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SCANNING SYSTEM

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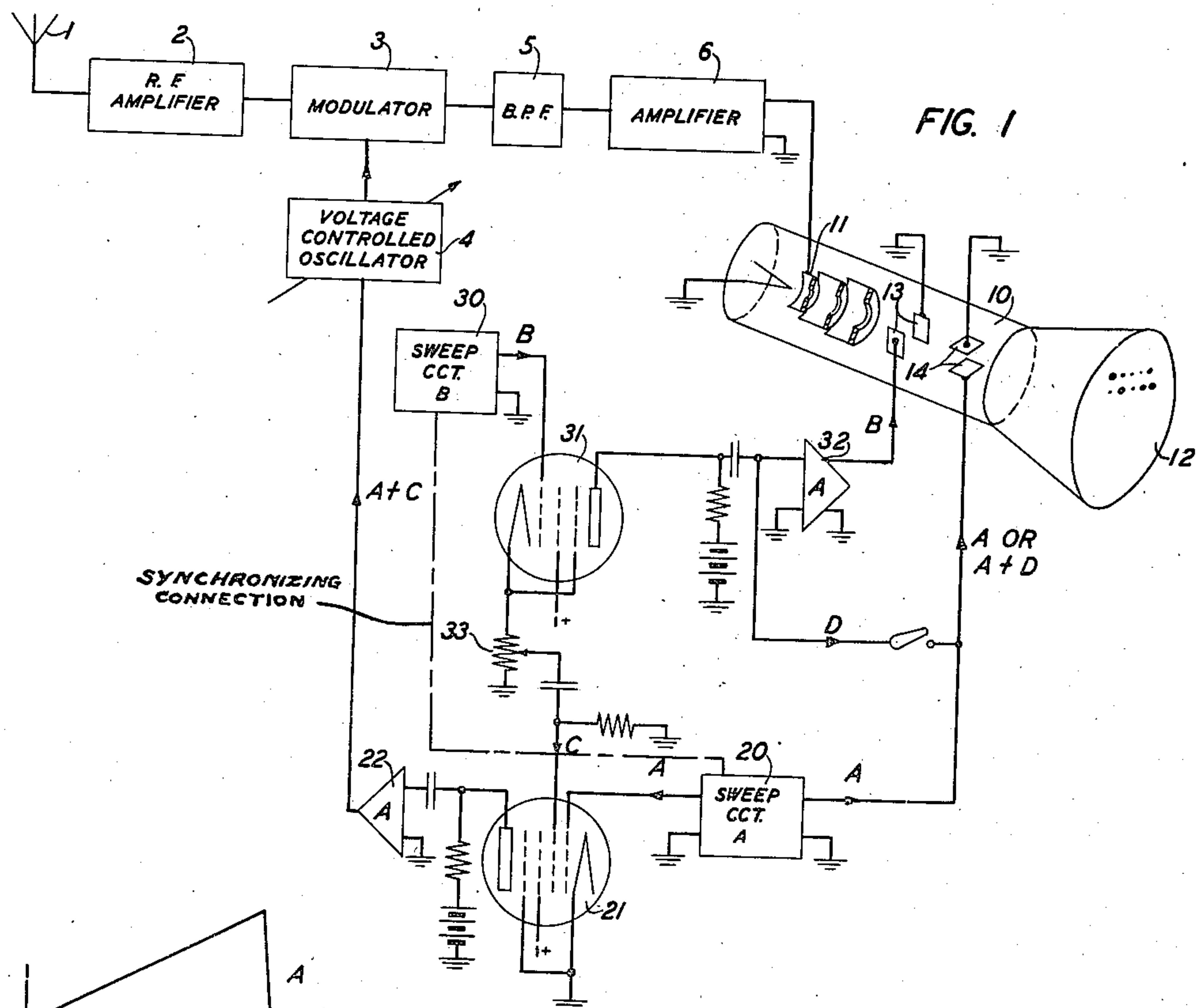


FIG. 1

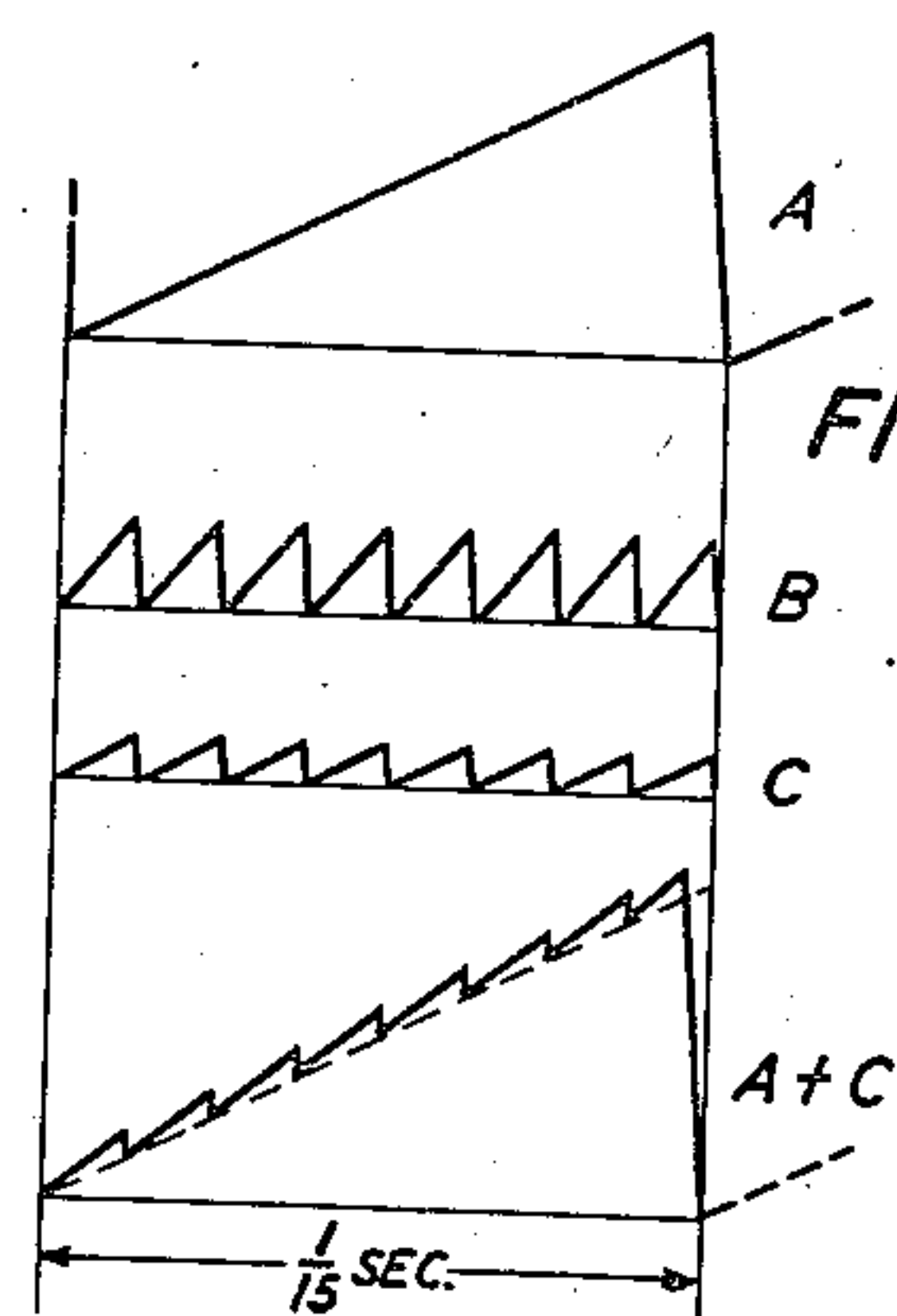


FIG. 3

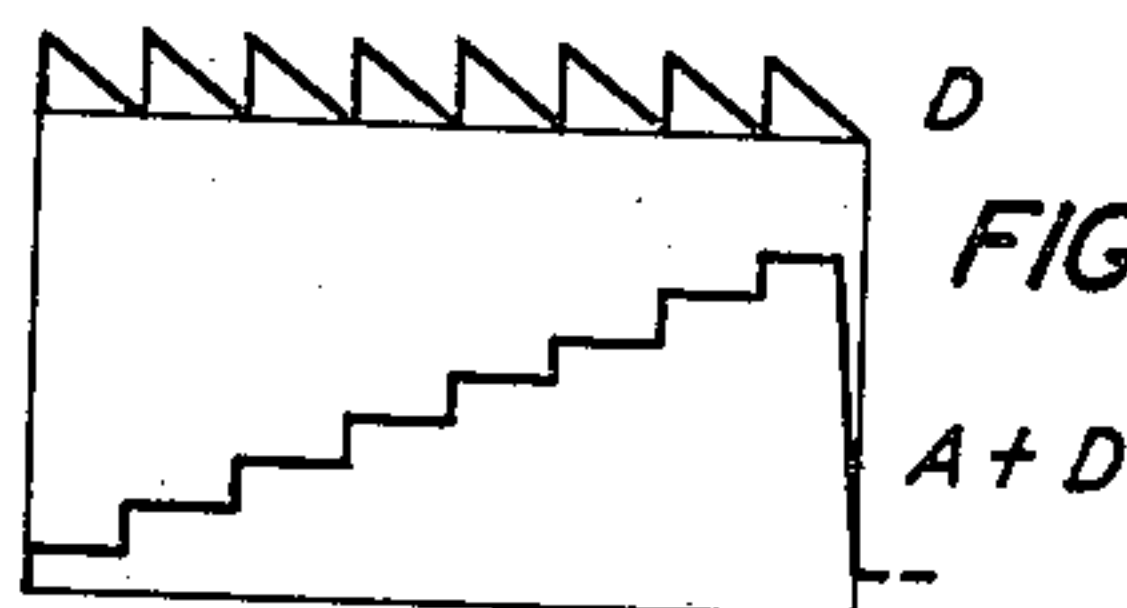


FIG. 4

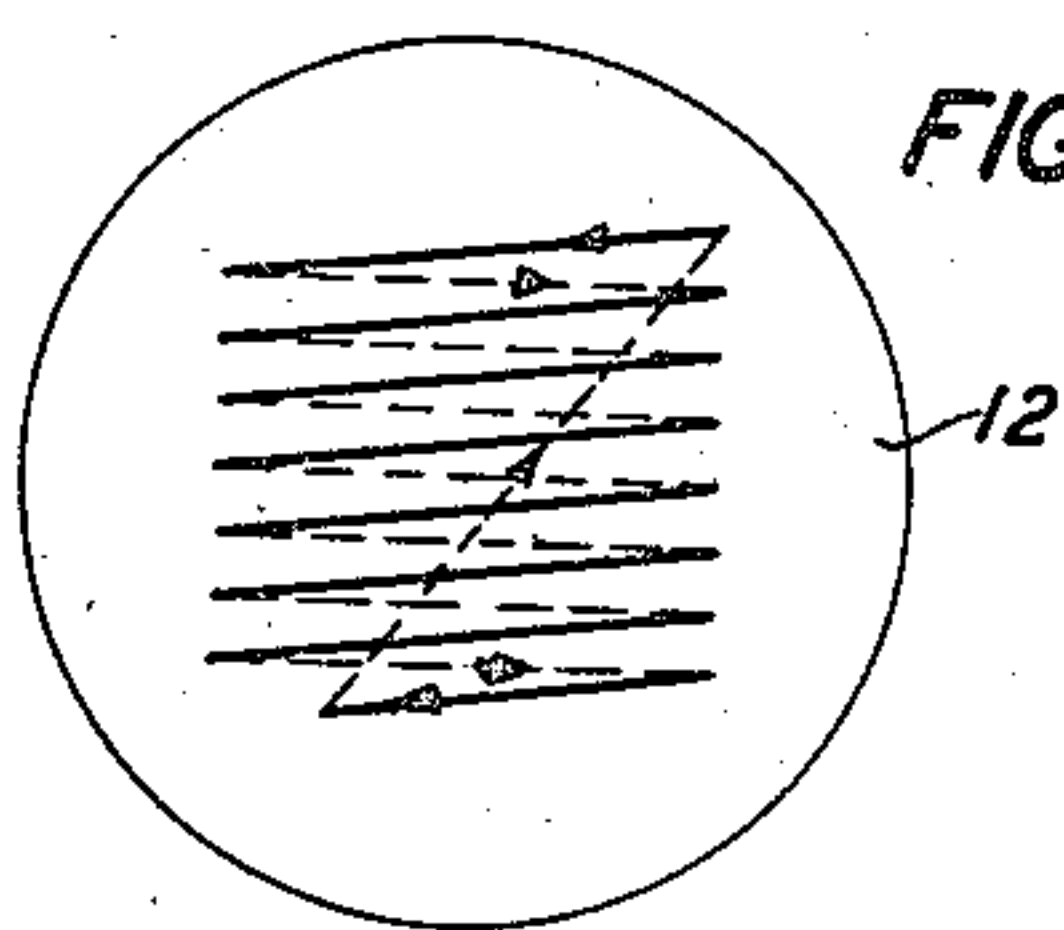


FIG. 2

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SCANNING SYSTEM

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12 Claims. (Cl. 250—20)

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This invention relates primarily to scanning systems and more particularly to oscillographic systems providing a definite time or reference axis along which scanned information of one character or another may be displayed.

An illustrative system of the kind described is a so-called panoramic radio receiving system comprising electrical scanning means for continuously traversing a predetermined radio frequency range and a cathode-ray oscilloscope for indicating simultaneously at preassigned respective points along a reference axis the frequencies at which radio activity is encountered. The reference axis may be in the form, for example, of a single line that is continuously scaled, in terms of frequency, from one end to the other. The presence of radio activity at any particular frequency may be indicated by a luminous spot or spike that is made to appear at the corresponding point along the frequency scale.

An object of the invention is to provide an improved oscillographic system in which the reference axis along which information is displayed comprises a multiplicity of separated portions. A more particular object is to insure that all of the collected information is displayed notwithstanding the finite time required for the cathode ray or the like to pass from the end of one portion of the reference axis to the beginning of another.

In a panoramic receiver embodying the present invention the frequency scale takes the form of a multiplicity of parallel lines on the screen of a cathode-ray oscilloscope. These lines are traversed in succession by the cathode ray while the frequency scanner once traverses the frequency range of interest. The operation of the frequency scanner is so controlled that its progression across the frequency range is effectively halted during those intervals in the scanning cycle when the cathode ray is passing from one of the scale portions to another.

The nature of the present invention will appear more fully from a consideration of the embodiment illustrated in the accompanying drawing, in which:

Fig. 1 illustrates a panoramic receiver in accordance with the invention; and

Figs. 2, 3 and 4 are diagrams illustrating the operation of certain of its components.

Referring more particularly now to Fig. 1, the panoramic receiving system shown schematically herein comprises a radio receiving antenna 1 and a radio frequency amplifier 2 through which all of the received waves lying within a predetermined frequency range are applied to the modu-

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lator 3 of a frequency scanner. The scanner includes also an oscillator 4 connected to supply beating oscillations to modulator 3, and a filter 5 that is connected to receive the wave output of modulator 3. The operating frequency of oscillator 4 is cyclically varied, in a manner to be described, between limits such that at the output of modulator 3 one of the sidebands derived from the applied radio frequency range is swept repeatedly, from one extremity to the other, across the pass frequency of filter 5. The pass band of filter 5 is made narrow enough to selectively transmit in succession all of the radio signals that may appear in the applied band. In effect, the frequency scanner repeatedly traverses the applied radio frequency range and during each traverse transmits momentarily and in succession the various radio signals that are encountered. The information collected by the frequency scanner is delivered at the output of filter 5 in the form of a succession of wave effects or wave pulses, and these are delivered through amplifier 6 to the control grid 11 of a cathode-ray tube 10.

Cathode-ray tube 10 comprises control grid 11 for controlling the intensity of the cathode ray, a luminescent screen 12 for the display of the collected information, means 13 for deflecting the cathode ray in the horizontal plane and means 14 for deflecting the ray in the vertical plane. The two deflecting means are shown as two pairs of deflecting plates although they could as well be two sets of magnetic deflecting coils. The cathode-ray tube 10 may be so biased, by means not shown, that the luminous spot or trace which the cathode ray tends to produce on screen 12 is just barely extinguished except when signal effects are applied to the control grid 11.

Deflecting plates 14 are connected to a sweep circuit 20 which applies to them a saw-toothed voltage wave as illustrated at A in Fig. 3. This causes the point of impingement of the cathode ray on screen 12 to move periodically in a vertical direction across screen 12 at a periodic rate fixed by the operating frequency of the saw-toothed wave source 20. The latter is the same as the repetitive rate of frequency scanning and may be, for example, 15 cycles per second. The shape of the saw-toothed wave A is such that the "spot" or point of impingement of the cathode ray moves relatively slowly from, say, top to bottom of screen 12 while the voltage A is rising, and returns relatively quickly while the voltage A is falling. During the latter period, the "flyback" or "retrace" period, the cathode ray may be suppressed in

known manner to prevent any mark being made on the screen.

Sweep circuit 30 produces a saw-toothed voltage wave B that is of the same shape as voltage wave A but its frequency is a multiple thereof. It may be assumed by way of example that the frequency of the one is eight times that of the other, as illustrated in Fig. 3, and that this harmonic relation is maintained by any suitable synchronizing means. The output of sweep circuit 30 is applied through amplifying pentode 31 and amplifier 32 to deflecting plates 13 whereby the cathode ray is deflected horizontally across the screen 12 at a rate of 120 cycles per second. The bias and polarity may be assumed to be such that during each $\frac{1}{120}$ second the spot moves relatively slowly from right to left across the screen and returns relatively quickly during the flyback period pertaining to wave B. Disregarding the fact that the cathode ray or spot may be extinguished much of the time, the path traced on the screen 12 by the cathode ray as a result of the two components of displacement imparted to it is of the form illustrated in Fig. 2. It will be understood that this path is cyclically traversed fifteen times a second. The relatively slow movements of the spot are indicated by the solid lines in Fig. 12 while the relatively rapid "flyback" movements are represented by dotted lines.

Although the reference axis represented by the multiplicity of solid lines is discontinuous, it is an object of the invention to arrange that these separate lines or scale portions shall together provide a continuous frequency scale embracing all of the radio frequencies within the range traversed by the frequency scanner. In other words, it is desired that if the left-hand end of one line represents a certain radio frequency the right-hand end of the next line shall represent the next adjacent frequency, or that there shall be an overlap rather than an hiatus. One of the difficulties to be overcome in this connection is that while the cathode ray is moving from left to right during the interline flyback periods the frequency scanner would ordinarily continue its traverse across the radio frequency range during these periods, with the result that signals encountered in certain portions of the scanning cycle would be lost in so far as their indication on the frequency scale is concerned.

As indicated hereinbefore the present invention provides for effectively halting or suspending the progressive scanning operation during the interline flyback periods so that no radio frequencies are passed over by virtue of the scanner continuing to advance across the frequency range while the cathode ray is passing from the end of one scale portion to the beginning of the next. It is not essential that the scanner be completely stopped but rather that there be no net progression of the scanner during the interline flyback periods. In the Fig. 1 system the scanning operation is reversed rapidly at the beginning of each flyback period and immediately allowed to resume so that by the end of the flyback period the scanner has again reached, or at least not passed beyond, the frequency that it had reached before reversal of the direction of scanning. The circuit means provided for this operation are as follows.

The saw-toothed voltage wave A produced by sweep circuit 20 is applied to a control grid of the amplifying space discharge device 21 which may be of the pentagrid mixer type, and after further amplification in amplifier 22 it is applied with the

proper polarity to a voltage-responsive frequency-controlling portion of beating oscillator 4. Oscillators of the character described are well known in the art and it suffices to say that the applied voltage wave A varies the operating frequency between the necessary limits. The polarity may be such, for example, that during each cycle of the voltage wave A the operating frequency tends to increase relatively gradually from a lower extreme value to an upper extreme value and then to fall rapidly to the initial value during the flyback period associated with wave A. The frequency scanner tends to scan the applied radio frequency range in the same manner at the assumed rate of fifteen times per second, which is the periodic rate at which the cathode ray traverses the path described with reference to Fig. 2.

Saw-toothed voltage wave B, regulated to the proper amplitude and illustrated in exaggerated form at C in Fig. 3, is applied concurrently with voltage wave A to control the operating frequency of oscillator 4. This added component is, or may be, derived from sweep circuit 30 by way of a potential divider 33 that is interposed in the common grid-anode circuit of pentode 31, the potential divider being connected in turn to another control grid in the amplifying space discharge device 21. The resultant wave applied to oscillator 4 is illustrated at A+C in Fig. 3 with the serrations exaggerated to show more clearly the character of the wave shape.

The latter illustration will serve to illustrate also the variations in the frequency of oscillator 4 and the progression of the frequency scanner across the applied radio frequency range. Thus at the beginning of a cycle while the cathode ray traverses the uppermost scale portion the frequency scanner traverses progressively the corresponding portion of the radio frequency range. At the beginning of the interline flyback period the scanner is quickly set back a certain amount and then resumes its relatively gradual progression in the initial direction across the frequency range. The amplitude of voltage wave C is so adjusted by means of potential divider 33 that by the end of the interline flyback period the scanner has again just reached the radio frequency that was reached at the beginning of the flyback period, so that the beginning of the second scale portion coincides with the end of the first scale portion and the two taken in succession afford a continuous frequency scale. The scanner continues its progression while the cathode ray traverses the second scale portion, until the beginning of the next flyback period is reached and the scanner is again momentarily set back or temporarily reversed. This process is repeated until in slightly less than one-fifteenth second all of the scale portions have been traversed in succession and the flyback associated with voltage wave A begins. During the latter flyback period the spot returns to the beginning of the first scale portion and the scanner returns to its initial position in the radio frequency spectrum.

It will be understood that whenever the scanner encounters radio activity in its progression across the frequency range the cathode ray produces a luminous spot at the corresponding frequency position on the screen 12. It will be understood too that the visual indication representing a particular radio transmitter may be split, part appearing at the left-hand extremity of one scale portion and part at the right-hand extremity of the next scale portion. If a certain overlap be allowed as suggested hereinbefore, stations rep-

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resented at or near the left-hand end of one scale portion will be duplicated at or near the right-hand end of the next, but none will be omitted. In the latter case, one or the other of the duplicate scale portions may be disregarded or covered over if desired. A few of the transmission-indicating spots are shown in Fig. 1. Although the screen 12 may have a frequency scale inscribed on it along the scale portions illustrated in Fig. 2, such a scale may instead be inscribed on a removable transparency, or electrical auxiliaries known in the art may be employed for indicating or determining the radio frequency represented by any particular luminous spot. In any case, the several scale portions collectively cover the entire radio frequency range of interest.

Whereas the several scale portions are inclined as illustrated in Fig. 2, they may be made horizontal if desired by applying to the deflecting plates 14 a saw-toothed voltage wave having the shape illustrated at D in Fig. 4. This wave may be derived from sweep circuit 30, through a switch connected to the output circuit of pentode 31, as indicated in Fig. 1. The amplitude of the wave D is such that combined with the saw-toothed voltage wave A it produces a horizontally stepped voltage wave A+D as shown in Fig. 4. The net result is that the somewhat trapezoidal portion of Fig. 2 becomes strictly rectangular. In other respects the operation of the system is as hereinbefore described.

Although the present invention has been described largely with reference to a specific embodiment it will be understood that the invention may be embodied in various other forms within the spirit and scope of the appended claims.

What is claimed is:

1. An oscilloscopic system comprising, in combination, selective means for cyclically scanning a predetermined subject and selecting in succession in the course of each cycle effects appearing at various points therein, oscilloscopic means for marking the selected effects individually along a multiplicity of separated reference lines constituting an extended time base, said oscilloscopic means including means for driving said marking means along said reference lines in cyclically repeated succession, and means for interrupting the said scanning during the periods within each scanning cycle during which said marking means passes from one of said lines to another of said lines representing a subsequent portion of said extended time base.

2. In combination, selective means for cyclically scanning a predetermined subject and selecting in succession effects appearing at different points therein, oscilloscopic means for cyclically traversing a predetermined path and visually indicating the selected effects at respectively corresponding points along said path, said path comprising a multiplicity of separated portions along which all of the selected effects are to be indicated, and scanning control means for preventing any net progression of said selective means relative to said subject in the periods during which the path between said separated path portions is being traversed.

3. In combination, selective means for cyclically scanning a predetermined subject and selecting in succession effects appearing at different points therein, oscilloscopic means for cyclically traversing a predetermined path and visually indicating the selected effects at respectively corresponding points along said path, said

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path comprising a multiplicity of separated portions along which all of the selected effects are to be indicated, and scanning control means for preventing any net progression of said selective means through said subject in the periods during which the path between said separated path portions is being traversed, said scanning control means comprising means for temporarily reversing the direction of progression of said selective means through said subject within the said periods.

4. In combination, cathode-ray oscilloscopic means, sweep circuit means adapted to drive the cathode ray cyclically along a predetermined path comprising a multiplicity of disconnected path portions, frequency scanning means for cyclically scanning a predetermined wave frequency range and selecting in succession wave effects of different frequencies appearing in said range, said scanning means having a cyclical rate such that it progresses once across said frequency range while said cathode ray covers said multiplicity of path portions, means operative on said scanning means for preventing any net progression of the said scanning means across said frequency range in the periods within each scanning cycle during which the cathode ray passes from one of said path portions to the next, and means for varying said cathode ray under the control of the wave effects selected by said scanning means.

5. In combination, frequency translating means having wave input means for the simultaneous application of any waves lying within a predetermined frequency range and wave output means, voltage-responsive means for varying the extent of translation effected by said frequency translating means, means for applying to said responsive means a periodically varying voltage which throughout a substantial part of each period of its variation changes substantially continuously and progressively in the same sense of change with relatively brief intermittent changes in the opposite sense, means for visually indicating the waves present in said range comprising an oscilloscope and frequency selective means connecting said oscilloscope and said wave output means.

6. In combination, selective means for cyclically scanning a predetermined subject and during each cycle selecting in succession effects appearing at discrete points therein, voltage-responsive means for controlling the progression of said scanning means through said subject, means for effectively halting the said progression of said scanning means repeatedly during each cycle comprising means for applying a periodic voltage wave to said voltage-responsive means, a cathode-ray tube, cathode-ray directing means adapted to drive the cathode ray around a predetermined path periodically in isochronism with the cyclical scanning, and ray controlling means responsive to the effects successively selected by said scanning means.

7. In combination, selective means for scanning a predetermined subject and selecting in succession effects that may appear at various points therein, voltage-responsive means for controlling the progression of said scanning means through said subject, a cathode-ray tube comprising two deflecting means for variably deflecting the cathode ray in respectively different directions, means for applying a periodic substantially saw-toothed wave to one of said deflecting means, means for applying to the other of said deflecting means a periodic substantially saw-toothed wave that is harmonically related to the

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first-mentioned wave, means for applying both of said waves to said voltage-responsive means with such relative polarity that the progression of said scanning means during the period of said first-mentioned wave is momentarily interrupted at the periodic rate of the second-mentioned wave, and means for representing all of the said effects at respective points along said path comprising cathode-ray controlling means actuated by the selected effects.

8. A panoramic receiver comprising a modulator having input means for receiving signals of different frequencies, a variable-frequency oscillator connected to supply beating oscillations to said modulator, the frequency of said oscillator being dependent on the magnitude of a control voltage supplied thereto, means for supplying to said oscillator a periodic control voltage which throughout a plurality of separated parts of its period changes in value in the same direction, the initial value in each said part except the first being substantially equal to the final value in the next preceding part and the interval separating said parts being small in comparison with the lengths thereof, filter means connected to the output of said modulator for selecting the received signals in periodically repeated succession, a cathode ray tube, ray deflecting means for driving the cathode ray along a multiplicity of separated path portions in succession in such timed relation with the changes in said periodic voltage that the ray passes from the end of one path portion to the beginning of the next substantially wholly within the interval separating respectively corresponding parts of the control voltage period, and ray controlling means responsive to the signals selected by said filter means for separately indicating the several signals along said path portions.

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9. A panoramic receiver in accordance with claim 8 in which the said intervals separating said parts of the control voltage period are at least several in number.

10. A panoramic receiver in accordance with claim 8 in which said means for supplying said periodic control voltage comprises a periodic saw-toothed voltage wave generator and means synchronized therewith for generating a periodic voltage wave the frequency of which is a multiple of the frequency of said saw-toothed voltage wave.

11. A panoramic receiver in accordance with claim 8 in which said means for supplying said periodic control voltage comprises two saw-toothed voltage wave generators the frequencies of which are harmonically related, and in which said ray deflecting means includes means for deflecting the ray under the joint control of the two saw-toothed voltage waves.

12. A panoramic receiver in accordance with claim 8 comprising means for generating two harmonically related saw-toothed voltage waves one of which has a frequency at least several times that of the other, means for combining said two waves to form a resultant saw-toothed wave having a flank that slopes substantially continuously in one direction with periodically repeated excursions that are opposite in direction of slope and of relatively small extent and duration, said resultant constituting said periodic control voltage, said ray deflecting means including two ray deflectors for deflecting the ray in respective mutually perpendicular planes, and means for applying each of said harmonically related waves to a respective one of said deflectors.

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