

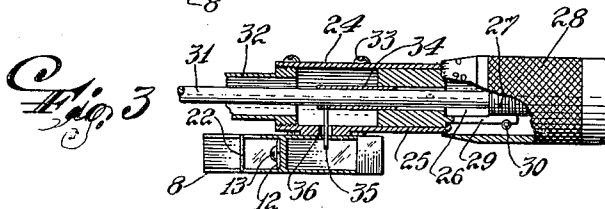
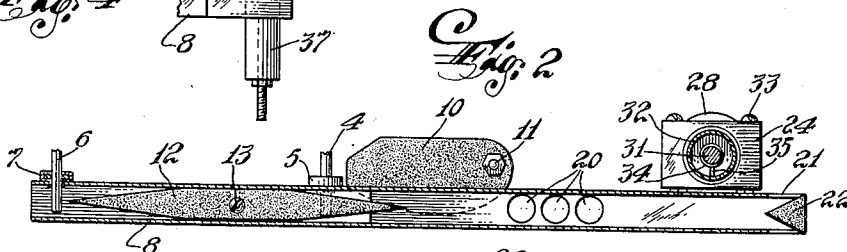
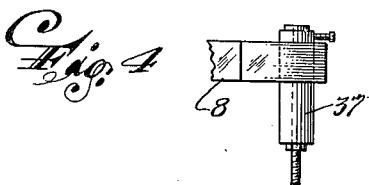
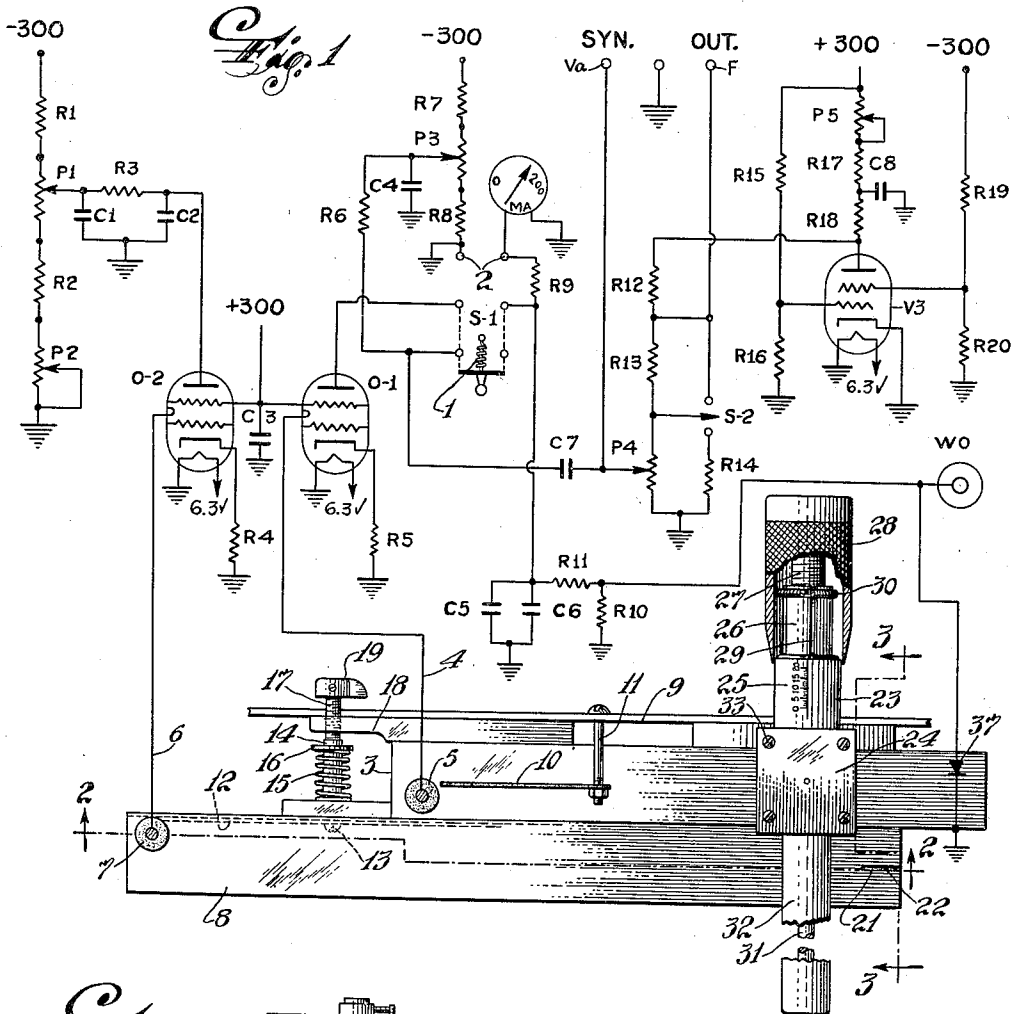
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2,498,076

WIDE-RANGE SWEEPING OSCILLATOR

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WIDE-RANGE SWEEPING OSCILLATOR

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This invention relates to means for obtaining a testing apparatus which can be used for various purposes such as servicing a standard A.-M. radio broadcast or a television receiver, video and other amplifiers or other equipment requiring the use of a frequency having a sweep much wider than anything heretofore used or available.

It is the principal object of my invention to provide an apparatus which will cover an enormous spectrum extending from just above the audio range to over 500 megacycles and by means of additional adjustments the spectrum may be extended to 1,000 megacycles or higher wherein at various parts of this spectrum a frequency sweep of 30 megacycles or over may be obtained.

A further object is to provide an apparatus having a sweep output that will cover successively each color television frequency band.

A still further object is to provide a megasweep apparatus for field as well as laboratory and research work use which is small, (the front panel with all regular adjustments available thereon being only 15" x 9") so it can be conveniently carried by one person.

Other objects will be discerned by one skilled in this particular field. In order to illustrate the manner in which the objects are obtained, reference is made to the annexed drawing wherein,

Figure 1 illustrates diagrammatically the circuit of my new and improved circuit together with a plan view of the wave guides and wave meter used in connection therewith and forming part of the circuit.

Figure 2 is a sectional view on the line 2—2 of one of the wave guides and also showing a cross section through the wave meter.

Figure 3 is a sectional view on the line 3—3 of Figure 1.

Figure 4 is a fragmentary view showing the crystal detector, which is only diagrammatically illustrated in Figure 1.

In Figure 1 the resistances used in the circuit are numbered R1 to R20, while the condensers are designated as C1 to C8, and the potentiometers are numbered P1 to P5. O1 and O2 are reflex oscillators of the Klystron type which are adapted to operate at approximately 10,000 megacycles. The tube V3 is one that is adapted to deliver a saw tooth wave form potential to the tube O1 by way of the potentiometer P4, condenser C7, and switch S1. While the voltage supplied by the tube V3 is used to vary the frequency of the oscillator O1 it also simultaneously supplies the voltage to the X axis of an oscilloscope which is connected

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to the terminals syn. and out. One of these terminals, Va may be a variable voltage supplied thereto by the potentiometer P4 or a fixed voltage supplied by way of switch S2, either voltage may be used to drive the X axis of the oscilloscope. The switch S1 is supplied with a toggle type spring 1 so that after the switch is thrown to the upper position into engagement with the contacts 2 and released, spring 1 will cause it to automatically return to the normal closed position as indicated. The function of the switch S1 will be later referred to.

The oscillator O1 is provided with a wave guide 3, and the output lead 4 of this tube extends a substantial distance by way of an insulator 5 into its wave guide as indicated in Figure 2. The output lead 6 of the oscillator tube O2 is positioned in an insulator 7 located in wave guide 8. The two wave guides 3 and 8 are preferably fastened together to a mounting panel 9 carrying the resistances, condensers, potentiometers, etc., making up the circuit. The upper part of the wave guide 3 has a slot therein to receive a relatively fixed or padding attenuator 10, which may be of suitable insulating material such as Bakelite, that is carried by a stud 11 fastened to the panel 9. The wave guide 8 carries within its interior an adjustable attenuator 12 which may be of any suitable material such as Bakelite, fastened by a screw 13 to an insulating stud 14. Around the stud 14 is positioned an expansible spring 15 held in place by a washer 16 that is held to the upper end of the stud 14 in a satisfactory manner as by a cotter pin. With this arrangement the spring 15 normally holds the attenuator 12 against the inner edge wall of the wave guide 8. An adjusting screw 17 carried by a support member 18 has an operating knob or holder 19 at one end so when it is turned the stud 14 is moved inwardly to cause the attenuator 12 to move away from the inner wall of the wave guide 8 for purposes which will be later referred to. Both of the adjacent walls of the wave guides 3 and 8 are provided with a plurality of holes 20 which act as a directional coupler means to which reference will be later made. The extremity of the wave guide 8 opposite the insulator 7 that receives the tube output lead 6 has a slot 21 therein to receive a triangularly shaped card 22 of insulating material therein. The attenuators 10, 12 and card 22 are treated on their surfaces with a thin layer of resistance material such as carbon for purposes which will be later described. Mounted on the wave guide 3 is a wave meter 23 which includes a block 24 having a graduated hub 25

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which supports a tubular member 26 that is internally threaded to receive a threaded stud 27 carried by an operating cylinder 28 which in turn is calibrated into a hundred divisions to cooperate with the calibrations on the hub 25. Preferably the member 26 has a plurality of slots 29 and a groove at one end to receive a spring 30 that applies a contracting force to the split ends of the member 26 so as to insure that the micrometer adjustment of the cylinder 28 will be positive and accurate. Extending from the threaded stud 27 is a rod 31 which forms a coaxial cavity tuning member with the tubular member 32 carried by the block 24 which is fastened by screws 33 through the top surface of the wave guide 3. Positioned within the block 24 is a tube 34 for receiving the rod 31 and near the inner end of the tube 34 is located a pin 35 that extends through a clearance hole 36 in the block 24 into the chamber of the wave guide 3. The purpose of this pin and other circuit parts will be later referred to in the operation of the structure.

Mounted adjacent the wave meter, and at the extremity of the wave guide 3 is a detector 37, preferably of the crystal type and shown in assembled position in Figure 4 and diagrammatically in Figure 1. The detector is connected to the wave output terminal WO and also to a decoupling monitor circuit including the resistors R10 and R11 and condensers C5 and C6 which are connected through a resistor R9 to a D. C. microampere meter MA which serves to indicate the arrival of energy at the detector, as well as at the output terminal WO, it being understood that the monitor circuit picks up a D. C. component out of the detector circuit. In the operation of the mega-sweep apparatus after current has been turned on, it energizes the circuits; the potentiometer P4 is adjusted to one of its maximum positions and the attenuator 12 is set to its minimum position, i. e., with all the spring tension on the stud 14 at a minimum. Then, the switch S1 is turned to engage the contacts 2, and the potentiometer P1 is given a "peaking" adjustment until the current in the meter MA reaches the maximum. This peaking assures that the repeller voltage of oscillator O2 is set for operation in the proper manner. While the switch S1 is held in engagement with the contacts 2 it short circuits the resistance R9. The micrometer or cylinder 28 on the wavemeter is adjusted until there is a dip in the current reading on the ammeter MA. This reading is a measure of the frequency of the oscillator O2.

Oscillator O1 is set by first peaking the D. C. current from the detector by means of the peaking potentiometer P3. Small frequency shifts may also be made by the potentiometer P2.

The output frequency on the sweep circuit is determined by the difference in frequency between the two oscillators O2 and O1. This difference in frequency may be set at any desired value by obtaining the immediate reading associated with oscillator O2 as described, and setting oscillator O1 to a frequency which would give a dip on the meter with a micrometer reading which corresponds to the desired frequency.

The complete tuning procedure briefly outlined above is necessary only when the sweep apparatus is shifted to a new frequency region in the carrier band.

The energy from the signal oscillator O2 is passed to wave guide 3 and past the adjustable or variable attenuator 12 which absorbs, more or less, energy depending on its adjustment in

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its wave guide. After passing the attenuator 12 the energy passes through the directional coupler comprising one or more holes 20, into the wave guide 3. Any energy that is not passed through the coupler 20 is received and dissipated on the card terminator 22 which as heretofore explained is covered with an energy absorption material such as finely powdered carbon, so that these waves of energy are not thrown back in the wave guide so they will not interfere with the passage of the waves through the coupler 20.

The energy from the oscillator O1 which is passed through the lead 4 and the wave guide 3, is frequency modulated by a variable voltage from the saw tooth type tube V3 that is applied to the repeller member of the tube O1. The energy is passed from the lead 4 past the relatively fixed or padding attenuator 10 onto the detector 37, being mixed with the waves coming from the wave guide 3.

Since the wave meter 23 is positioned directly before the detector the frequency of both oscillators is measured by this co-axial cavity type absorption wave meter. It is well understood that when two different frequencies are mixed in a non-linear device such as a crystal detector the frequency difference is obtained and this difference is what is passed on to the wave output WO. It is important to keep in mind that in order to obtain a constant signal output, the larger signal, which in this case comes from the oscillator O1 is the one that is frequency modulated, even though its output may vary in amplitude the output signal will not vary, due to the fact that as in most detectors the output amplitude depends on the small signal. Also, when the local oscillator is frequency modulated an undesired result of this is that amplitude modulation is obtained. This is the reason that the output voltage amplitude is made dependent upon the signal oscillator.

By the use of the circuits and apparatus described I have obtained a mega-sweep means for obtaining the objects heretofore set forth as well as others all of which I have found from practical experience to be highly useful.

I prefer to have an apparatus that will deliver substantially a constant output which will only give a true response of an electrical network or amplifier. In some special cases in order to obtain a greater frequency sweep both the tubes O1 and O2 may be frequency modulated. But, so far as present day equipment is concerned I prefer to only modulate one oscillator in order to obtain a substantially constant current output.

I claim:

1. A radio structure including two ultra-high frequency oscillators, a wave guide for each oscillator with means for taking the energy output of each oscillator to its guide, means for passing the energy of certain of the waves from one guide into the other, a detector preferably of the crystal type located in said other guide and acting to take energy from the two waves passed into said guide and producing a signal current capable of being varied over a wide frequency range.

2. A radio structure as set forth in claim 1 further characterized in that each wave guide has at least one attenuator located therein and further characterized in that a co-axial wave meter is coupled into the guide carrying the detector.

3. A radio structure as set forth in claim 1 further characterized in that each wave guide has

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an attenuator located therein, the attenuator on said other wave guide being mounted in a relatively fixed position while the other attenuator is mounted for quick adjustment in the said one wave guide.

4. A radio structure as set forth in claim 1 further characterized in that said means for passing waves from one wave guide into the other, comprises a directional coupler consisting of at least one opening through the adjacent side walls of the guides.

5. A radio structure as set forth in claim 1 further characterized in that each wave guide has an attenuator located therein, the attenuator on said other wave guide being mounted in a relatively fixed position while the other attenuator is mounted for quick adjustment in said one wave guide, said means for passing waves from one wave guide into the other comprising a directional coupler consisting of at least one opening through the adjacent side walls of the guides and means located at the end of the wave guide having the quick adjustable attenuator and opposite thereto for absorbing the energy waves that do not pass through the directional coupler.

6. A radio structure as set forth in claim 1 further characterized in that each wave guide has an attenuator located therein, the attenuator on said other wave guide being mounted in a relatively fixed position while the other attenuator is mounted for quick adjustment in said one wave guide, said means for passing waves from one wave guide into the other comprising a directional coupler consisting of at least one opening through the adjacent side walls of the guides and a triangularly shaped termination card having energy absorption material thereon located in a slot in the end of the wave guide having the quick adjustable attenuator and opposite thereto, one apex of the triangularly shaped card being pointed toward the adjustable attenuator.

7. A radio structure having an output terminal and including a signal oscillator and a variable voltage frequency modulated oscillator, a wave guide for each oscillator with means for connecting the output terminal of each oscillator into one end of its wave guide, a detector preferably of the crystal type positioned at the opposite end of the guide having the output terminal of the modulated oscillator, an attenuator in this guide between the said terminal and the detector, an adjustable attenuator in the other wave guide near the signal oscillator terminal; a directional coupler between the two wave guides on similar sides of their attenuators, and a wave meter having members forming a co-axial cavity carried by the guide having the detector, a pick up pin extending from the inner member of the co-axial cavity into the wave guide.

8. A radio structure as set forth in claim 7 further characterized in that a decoupling monitor circuit is connected to the detector for taking a direct current component from the detector circuit and a direct current micro-ampere meter is used for utilizing the direct current component to indicate the arrival of energy at the crystal and output terminal of the structure.

9. A wide-range sweeping apparatus including two ultra high frequency oscillators with means for giving each an adjustment for maximum out-

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put energy, a wave guide for each oscillator and each guide having a terminal to receive the output of its associated oscillator, means for applying a saw tooth type voltage to one of said oscillators for modulating its frequency, the guide connected to the modulated oscillator having a detector preferably of the crystal type and also carrying thereon a co-axial wave meter located directly before the detector, wave coupler means common to both guides, an attenuator for each guide, the one in the guide associated with the non-modulated oscillator being adjustable.

10. A wide-range sweeping apparatus including two ultra high frequency reflex oscillators, a wave guide connected to each oscillator with their output terminals positioned in one end of their respective guides, means for frequency modulating the output of one of said oscillators, a detector located in the wave guide receiving the modulated output at the end opposite the wave receiving end, a cavity type wave meter positioned over the guide carrying the detector and having a reception pin located so as to absorb energy from said wave guide carrying the detector, the two wave guides being interconnected by wave coupling means and attenuator devices for both wave guides.

11. A wide-range sweeping apparatus including two ultra high frequency reflex oscillators, a wave guide connected to each oscillator with their output terminals positioned in one end of their respective guides, means for frequency modulating the energy of at least one of said oscillators, a detector located in one of the wave guides that receives the frequency modulated energy, the detector being located at the end of the guide opposite the energy receiving end, and a cavity type wave meter positioned on the guide carrying the detector and having means for absorbing energy from said guide, the two wave guides being interconnected by wave coupling means.

12. A wide range sweeping oscillating apparatus including two ultra high frequency oscillators with means for controlling the action thereof, said means including impedance devices, at least some of which are adjustable and also including an electron tube which will deliver a characteristic voltage to one of said oscillators to vary its output frequency, a wave guide connected to the output terminal of this one oscillator, a wave guide connected to the output terminal of the other oscillator, a directional coupler means for passing the waves from the last mentioned guide into the first mentioned guide, a detector carried by this first guide and connected to the wave output terminal of the apparatus and an adjustable wave meter also carried by the first guide for the purpose described.

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