

Aug. 10, 1948.

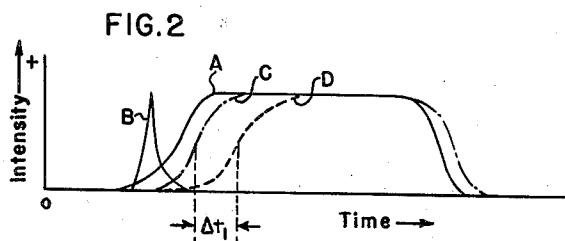
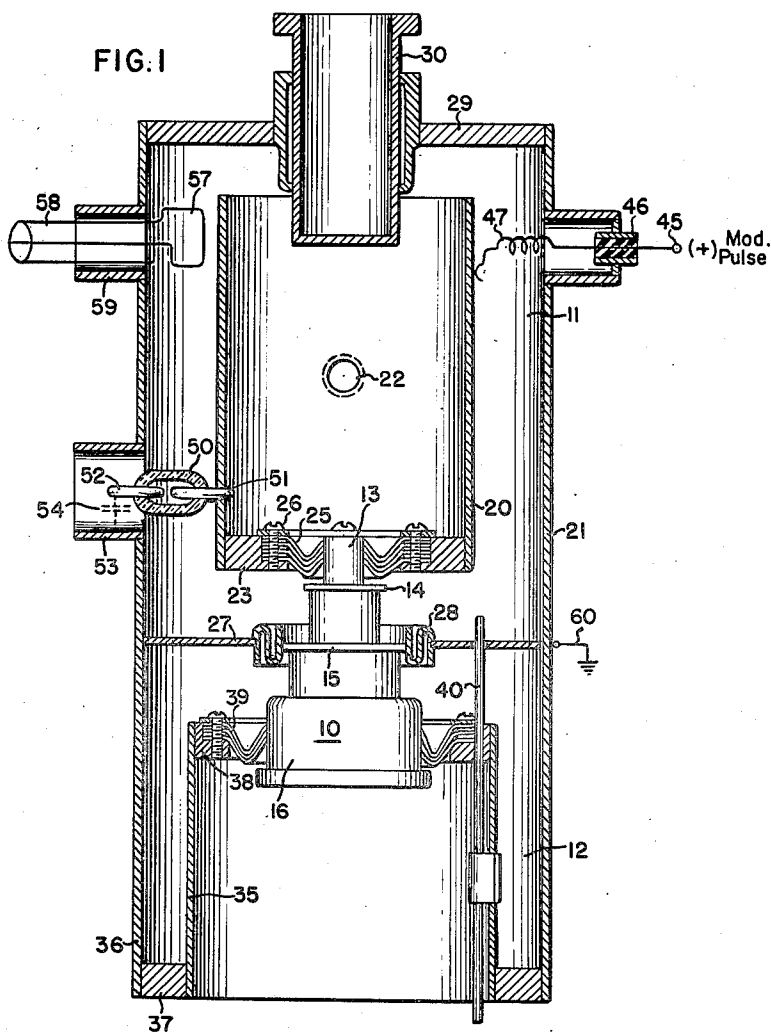
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2,446,829

MODULATED SIGNAL GENERATOR

Filed Feb. 21, 1946

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

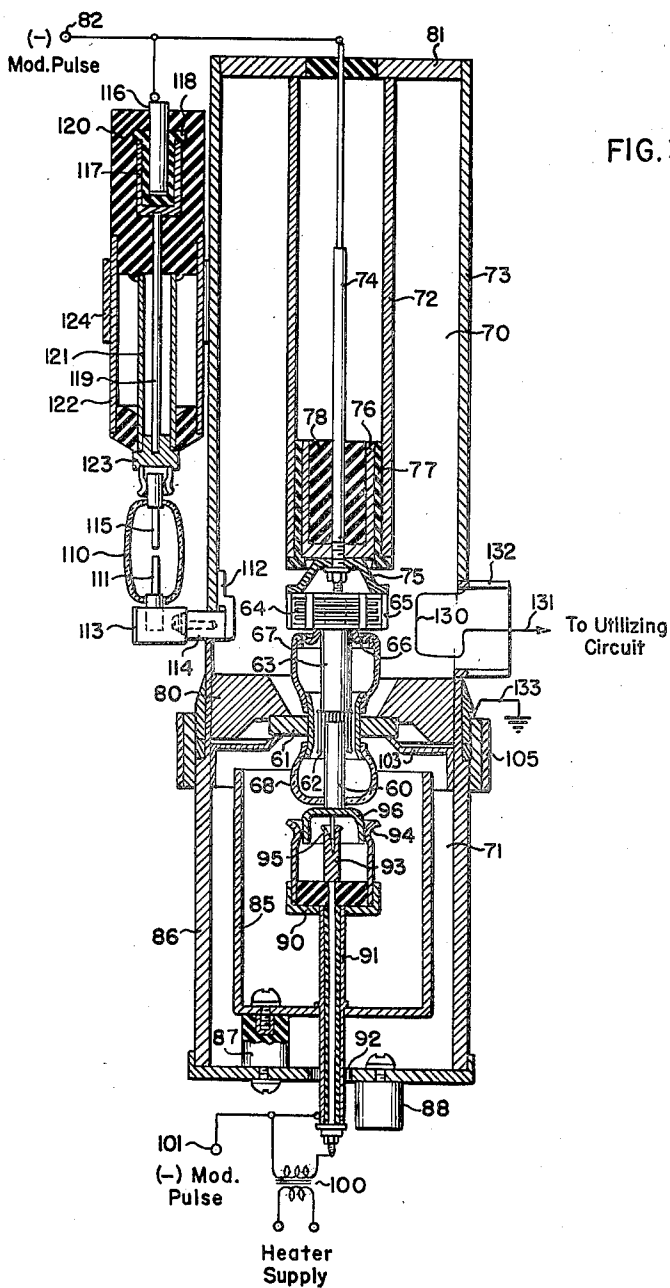


FIG. 3

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MODULATED SIGNAL GENERATOR

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3 Sheets-Sheet 3

FIG. 4

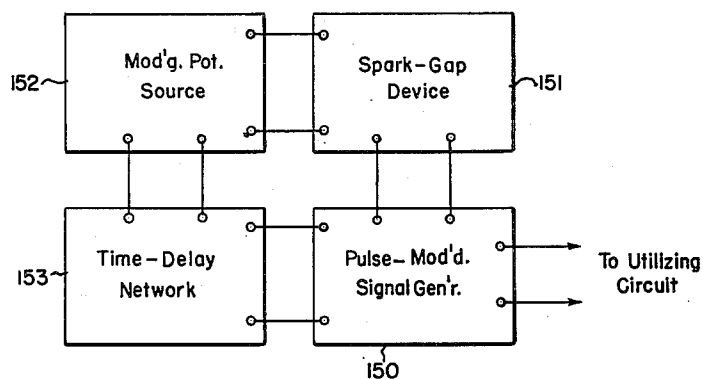
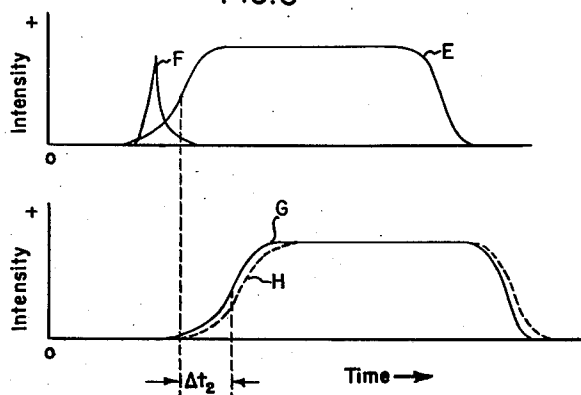


FIG. 5



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2,446,829

MODULATED-SIGNAL GENERATOR

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Application February 21, 1946, Serial No. 649,344

10 Claims. (Cl. 179—171.5)

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This invention relates, in general, to modulated-signal generators controlled by applied modulating potentials of step wave form. While the invention is subject to a variety of applications, it is especially suited for use in a pulse-modulated oscillation generator and will be particularly described in that connection.

One prior pulse-modulated oscillation generator comprises an oscillatory circuit normally maintained in a nonoscillatory condition in which the circuit exhibits positive conductance. A control arrangement is associated with the circuit for applying thereto a modulating potential of pulse wave form and predetermined duration to initiate and sustain oscillations therein in order to generate a modulated-carrier signal having a similar wave form. In operation, the modulating potential causes the circuit conductance to decrease to zero and then increase to a high negative value. The negative conductance causes oscillations to build up in an exponential manner from an initial value corresponding to the level of the inherent background disturbance of the oscillatory circuit which, for convenience, may be called the circuit noise signal. Usually, the modulating potential is sufficiently long in duration that the oscillations attain a maximum or saturation value. At the trailing edge of the modulating potential, the oscillations decay and the circuit is restored to its normal nonoscillatory condition.

It has been found that a finite time is required for the oscillations to build up to their maximum value. The build-up time is usually variable, being influenced by such factors as the level of the erratic noise signal at the start of the negative-conductance interval, the type oscillatory circuit employed, and the condition of the oscillator tubes. It represents an uncertain time delay between the leading edges of the modulating pulse and the generated signal and its effect may be considered as a shortening of the generated signal which, ideally, is intended to start and stop coincidentally with the modulating potential.

The build-up time or delay phenomenon referred to may become very objectionable in particular installations. Since it is generally a noncontrollable and variable effect, it introduces an undesired instability manifested by the generation of pulse signals of unequal pulse widths in response to modulating potentials of uniform duration. The instability is most pronounced in arrangements designed to produce output signals having a build-up time comparable with Q cycles of the oscillation, where Q is the ratio of reactance to resistance effective in the loaded oscillatory circuit. In such cases the delay in starting may constitute an appreciable part of the desired pulse period. Additionally, the build-up time impairs the efficiency of the oscillation generator be-

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cause during such time energy is supplied but no useful output signal is produced.

It is an object of the present invention, therefore, to provide an improved modulated-signal generator which avoids, at least in part, the aforementioned limitations of prior arrangements.

It is a further object of the invention to provide a modulated-signal generator having improved stability and efficiency characteristics.

It is a specific object of the invention to provide an improved modulated-signal generator controlled by a modulating potential of step wave form to produce an output signal of similar wave form having a leading portion occurring in substantial time coincidence with the corresponding portion of the modulating potential.

A modulated-signal generator in accordance with the invention comprises an oscillatory circuit including a cavity resonator normally maintained in a nonoscillatory condition and having an inherent background disturbance the amplitude of which is normally much less than a predetermined value. The generator has means for applying to the oscillatory circuit a pulse of modulating potential having a leading sloped portion to initiate therein oscillations of the aforesaid predetermined value. Additionally, it includes a transient-signal generator positioned at least in part within the cavity resonator and having an operating interval not exceeding the duration of the leading sloped portion of the modulating potential. Circuit connections are provided for exciting the transient-signal generator to introduce a signal into the cavity resonator to increase the amplitude of the background disturbance to a level much greater than its normal value. The background disturbance has this increased amplitude for an interval which occurs in approximate time coincidence with but of a duration not exceeding the leading sloped portion of the modulating potential, whereby the oscillations initiated in the oscillatory circuit build up to the aforesaid predetermined value rapidly to provide a modulated-carrier signal envelope with a leading sloped portion occurring in approximate time coincidence with the leading sloped portion of the modulating potential.

For a better understanding of the present invention, together with other and further objects thereof, reference is had to the following description taken in connection with the accompanying drawings, and its scope will be pointed out in the appended claims.

In the drawings, Fig. 1 represents a modulated-signal generator embodying the present invention in one form; Fig. 2 comprises curves utilized in explaining the operation of the Fig. 1 arrangement; Fig. 3 represents a signal generator including the invention in a modified form; Fig. 4 is a schematic representation of still another gen-

erator arrangement in accordance with the invention; and Fig. 5 includes graphs utilized in explaining the operation of the arrangement of Fig. 4.

Referring now more particularly to Fig. 1 of the drawings, there is represented a cross-sectional view of a modulated-signal generator constructed for ultra-short-wave operation and including the present invention in one form. This generator essentially comprises an oscillatory circuit normally maintained in a nonoscillatory condition and having an inherent background disturbance the amplitude of which is normally much less than a predetermined value. As illustrated, the oscillatory circuit is provided by an electron-discharge device 10, or vacuum tube of the triode type, and a pair of associated resonant cavities 11 and 12. Tube 10 is the so-called "lighthouse" tube having an anode 13, an anode ring 14, a control electrode ring 15 and a conductive shell 16 capacitively coupled to a cathode electrode (not shown). The tube also has conventional terminal prongs to facilitate making connections to a suitable source of heater voltage but, for the sake of simplicity, the prongs have been omitted from the drawing.

The first resonant cavity 11 includes a cylindrical hollow inner conductor 20 and a cylindrical hollow outer conductor 21 which are maintained in fixed concentric relationship by insulating spacers 22 secured between the conductors at points suitably spaced around the periphery thereof. One end of inner conductor 20 is open but its other end is closed by a disc 23. Disc 23 is centrally apertured to accommodate an electrical connector for yieldably engaging the anode 13 of tube 10. The connector is provided by a stack of resilient laminations 25 which may be secured to disc 23 by way of machine screws 26. The corresponding end of outer conductor 21 is likewise closed by a centrally apertured diaphragm 27. Within its aperture there is mounted an electrical connector 28 for yieldably engaging the control-electrode ring 15 of tube 10. The opposite end of outer conductor 21 is closed by a disc 29 which adjustably supports a cylindrical tuning plunger 30 in coaxial alignment with inner conductor 20. The plunger 30 has an appreciably smaller diameter than that of the inner conductor and forms a re-entrant portion of outer conductor 21 through which the operating wave length of the oscillatory circuit may be adjusted.

The second resonant cavity 12 is generally similar to that just described, including an inner hollow cylindrical conductor 35 and a concentrically disposed outer hollow conductor 36 which may constitute an extension of conductor 21. A conductive ring 37 maintains the desired space relationship of conductors 35 and 36. Another conductive ring (not shown) may be positioned above ring 37, having a slidable engagement with conductors 35 and 36 to tune resonant cavity 12. The end of conductor 35 adjacent diaphragm 27 is closed by a disc 38 arranged to accommodate a connector 39 constructed like connector 25 but proportioned yieldably to engage the cathode shell 16 of tube 10. An adjustable probe 40 projects through an aperture of diaphragm 27 and affords a feed-back path between resonant cavities 11 and 12, as required to sustain oscillations upon the application of suitable operating potentials to the oscillatory circuit.

The generator, as thus far described, is similar to that disclosed and claimed in a copending

application of Harold A. Wheeler, entitled "Ultra-short-wave signal-translating device," Serial No. 565,828, filed November 30, 1944 and assigned to the same assignee as the present invention. Reference may be had to this copending application for a more detailed discussion of the mechanical and electrical properties of a generator of the type under consideration. As there described, however, the generator is energized to produce continuous oscillations whereas in the instant application pulse-modulated operation is contemplated. To this end, means are provided for applying to the oscillatory circuit a modulating potential of step wave form to initiate therein oscillations of a predetermined value, corresponding to saturation level. More specifically, a terminal 45 for receiving a modulating pulse of positive polarity is coupled by way of a bushing-type condenser 46 and a signal-frequency choke 47 to inner conductor 20 of resonant cavity 11.

In order that the generated oscillations may reach saturation level early in the period of the applied modulated pulse, means are included in the generator for effectively increasing the amplitude of its background disturbance or noise signal to a level much greater than its normal level for a short time interval, occurring in approximate time coincidence with but of a duration not exceeding the leading sloped portion of the applied pulse of modulating potential. This means includes an arc-discharge or spark-gap device 50 positioned within resonant cavity 11 and having a pair of electrodes 51 and 52 adjacent ends of which are sealed within a hydrogen-filled envelope. Electrode 51 is conductively connected with inner conductor 20 and may serve to support the spark-gap device within cavity resonator 11. Its other electrode 52 is capacitively coupled with a projecting or chimney-like portion 53 of outer conductor 21, this coupling being designated by a condenser 54 shown in broken-line construction since it comprises distributed rather than lumped capacitance. This simulated capacitance 54 is serially connected with spark-gap device 50 through inner conductor 20 to the modulating-pulse terminal 45.

The signal generated in the oscillatory circuit is derived through a pickup loop 57 and supplied to any suitable utilizing circuit through a coaxial-type cable 58. The cable and pickup loop may be positioned within resonant cavity 11 through a second chimney-like portion 59 of outer conductor 21. This conductor is grounded as indicated at 60.

In considering the operation of the Fig. 1 arrangement, the generator will be seen to comprise a triode vacuum tube 10 having a first resonant cavity 11 coupled to its anode and control electrodes and a second resonant cavity 12 coupled to its cathode and control electrodes with a feedback therebetween provided by probe 40. The first of these cavities determines the operating wave length of the generator. The second is proportioned so that the arrangement represents an oscillatory circuit similar to the well-known Colpitts oscillator, the operation of which is well understood in the art. The performance of the oscillator under the control of modulating potentials of step wave form is demonstrated by the curves of Fig. 2.

The applied modulating potential is represented by the full-line curve A. It is a pulse of excitation potential having stepped or sloped portions at both its leading and trailing edges. The application of this pulse to inner conductor 20

establishes a potential gradient across the gap electrodes 51 and 52. When this potential gradient exceeds the breakdown potential of the spark gap, device 50 is rendered conductive. Current then flows through the spark gap, as represented by curve B, being interrupted upon the charging of condenser 54. The charging time constant for the condenser is very small so that the conductive interval of the gap is short with reference to, but occurs within the duration of the leading sloped portion of, the modulating potential, as indicated by curves A and B.

The flow of current through the spark gap introduces a signal into resonant cavity 11 which causes the inherent background disturbance or noise level of the oscillator to be much greater than that encountered when the oscillator is blocked and the spark gap is nonconducting. Since this increased signal level occurs early in the duration of the leading sloped portion of the modulating potential, the resulting oscillations have a high initial value and build up to their maximum level rapidly, as indicated by dash-dot curve C. The spark current is, preferably, interrupted within the duration of the leading sloped portion of the modulating potential so that this maximum value corresponds with the saturation level. The oscillations are maintained throughout the duration of the modulating pulse and generate a modulated-carrier signal. At the end of the modulating pulse, condenser 54 discharges through device 50 and the generator is restored to its normal nonoscillatory condition. Curve C represents one-half of the envelope of the output signal derived by pickup loop 57. It has a leading sloped portion occurring in approximate time coincidence with the corresponding sloped portion of the modulating potential and, therefore, an approximately equal pulse duration.

The dotted curve D illustrates the circuit operation in the absence of the spark gap. In such a case, the generated oscillations have an initial value corresponding to that of the circuit background disturbance at the time the modulating pulse is applied. This initial level is much smaller than that occasioned by the breakdown of the spark-gap device and accordingly a greater time interval is required for the oscillations to attain saturation value. The improvement in build-up time attributable to spark-gap device 50 is indicated Δt_1 in Fig. 2. The decrease in build-up time increases the efficiency of the oscillator and causes the envelope of the generated pulse to conform more closely with the wave form of the modulating potential. Additionally, the spark-gap device improves the stability of the oscillator so that the generated signals obtained during succeeding modulating intervals are substantially uniform if the modulating pulse in each case has approximately the same wave form.

In one embodiment of the Fig. 1 arrangement, found to have practical utility, tube 10 was an R. M. A. No. 2C42 operated under the following conditions:

Repetition rate of modulating pulse.....	pulses per second...	500
Duration of the modulating potential.....	microsecond...	1
Peak potential of the modulating pulse.....	volts...	2,600
Time required for generated signal to reach one-half maximum value.....	microsecond...	0.13
Loaded Q of the oscillator.....		100-200

As in any gas-filled electron-discharge device, some time is required for the gap current to build up after the potential gradient across its electrodes reaches breakdown value. Preferably, this time should be less than that of one-quarter of a cycle at the operating wave length of the generator to ensure that the gap contains signal energy of this wave length. For many applications a gap of about 1 mil in an atmosphere of hydrogen is suitable.

The generator arrangement of Fig. 3 embodies the invention in modified form. This generator also includes a triode-type vacuum tube having a rod-type cathode 60, a ring-type anode 61 and a control electrode or grid 62. The grid is in the form of a cage interposed between the cathode and a longitudinal extension of the anode and is supported by a grid post 63. At one end of the grid there is a radiator 64, comprising a stack of spaced metallic discs. A plurality of straps 65 are secured across the discs of the radiator and provide a conductive path through a contact element 66 to the grid post 63. Glass portions 67 and 68, having metal-to-glass seals with grid member 66, the anode extension, and the cathode 60, complete the tube envelope.

As in the Fig. 1 arrangement, a pair of cavity resonators 70 and 71 are associated with the tube to constitute an oscillatory circuit. The first cavity 70 has a hollow cylindrical inner conductor 72 and a coaxially arranged hollow cylindrical outer conductor 73. A conductive rod 74 projects through inner conductor 72 and carries at one end a contact device 75 for yieldably engaging the grid radiator. This rod also supports a conductive cylinder 76 which is open at one end. The space between conductive cylinder 76, rod 74 and conductor 72 includes dielectric material 77 and 78. With this construction, cylinder 76 in conjunction with conductor 72 and the intervening dielectric 77 constitutes a blocking condenser for the grid. One end of outer conductor 73 is closed by a centrally apertured disc 80, apertured to accommodate the tube structure. Disc 80 engages anode ring 61 to couple the resonant cavity 70 therewith. The opposite end of outer conductor 73 is closed by a disc 81 which also closes the corresponding end of inner conductor 72. Grid rod 74 projects through and is insulated from disc 81 and is coupled to a terminal 82 to which a modulating pulse of negative polarity may be applied.

The other resonant cavity 71 also has a hollow cylindrical inner conductor 85 and a hollow cylindrical outer conductor 86. The ends of these conductors which are remote from the triode tube are closed as indicated, and insulating spacers 87 maintain the conductors in coaxial alignment. Other insulating spacers 88, projecting from the closed end of outer conductor 86, facilitate mounting the generator arrangement to any supporting structure. A resilient contact device 103 for engaging anode ring 61 of the tube is secured to outer conductor 86.

A socket arrangement 90 is supported on a cathode post 91 conductively connected with the closed end of inner conductor 85 and projecting through an aperture 92 in the closed end of outer conductor 86. The socket 90 has inner and outer coaxially aligned contact members 93 and 94, respectively, for receiving a heater prong 95 and a cathode contact element 96. The circuits of contact members 93 and 94 extend through cathode post 91 to a terminal end to which a heater supply 100 may be coupled, as indicated.

Also, a modulating-pulse input terminal 101 is coupled to cathode post 91 to permit the application of a modulating pulse of negative polarity to the cathode element.

The described resonant cavities 70 and 71 are separable to permit inserting the tube into operative relation with reference thereto. A mechanical locking arrangement, designated 105, couples the resonant cavities into one assemblage after the tube has been inserted.

The arrangement of Fig. 3 also includes a spark-gap device 110 coupled into resonant cavity 70. To this end, one of the spark-gap electrodes 111 is connected with a magnetic-type coupling device 112 positioned within resonant cavity 70. The connection between these elements is afforded by a fuse clip 113 engaging the terminal end of electrode 111, and a mounting stud 114 projecting through outer conductor 73 of the cavity and supporting both fuse clip 113 and coupling device 112. The modulating potential applied through terminal 82 to the grid structure of the oscillator is simultaneously applied to the spark-gap device through a serially connected condenser connected in circuit between terminal 82 and the other spark-gap electrode 115. This condenser is provided by a first conductive rod 116 and an associated conductive cylinder 117 closed at one end and spaced from rod 116 by a dielectric material 118. The condenser element 117 is conductively coupled to the terminal end of electrode 115 by means of a rod 119. The condenser elements are maintained in their desired spaced relation by an insulator 120, which may be molded thereabout. An additional pair of concentrically aligned cylinders 121 and 122 are supported by the insulator 120. The first of these is conductively connected with rod 119 through a conductive member 123. The other is conductively connected with resonant cavity 70 by means of a strap 124 which also mechanically secures the spark-gap device and its associated condenser structures to the generator. Elements 121 and 122 constitute an air-dielectric condenser which completes an alternating current path from the spark-gap electrodes through coupling device 112 and the outer conductor 73 of resonant cavity 70.

Resonant cavity 70 has an electrical length corresponding to substantially three-quarters of the operating wave length of the generator. The mounting strap 124 is secured thereto so that coupling device 112 is positioned in a portion of the cavity where the magnetic field has a maximum value. A further magnetic pickup device 130 is positioned in the same plane of resonant cavity 70 to derive the generated signal for application to a suitable utilizing circuit, as indicated by arrow 131. This output may be taken through a chimney-like projection 132 of the outer conductor 73.

The generator of Fig. 3 is similar to the well-known Colpitts oscillator. It is operated with the anode electrode of the triode vacuum tube maintained at ground potential, as indicated by the connection 133. The first resonant cavity 70 is coupled between the anode and control electrodes of the tube. It may be considered as the wave-length determining portion of the oscillator. The other resonant cavity 71 is coupled between the anode and cathode electrodes. It is constructed to represent a capacitive reactance. The feedback required to sustain oscillations is provided by the interelectrode capacitance of the grid and cathode elements of the tube. The

conductors included in cathode post 81 for extending the circuits of socket 80 to the heater supply 100 may have such electrical lengths as to provide the usual radio-frequency chokes in the heater circuit. The excitation potential for initiating oscillations in the generator is applied with negative polarity to modulating-pulse terminals 82 and 101 with such relative magnitudes that the grid is at a negative potential with reference to the cathode. The applied potential is also effective to excite spark gap 110 through series condenser 116—117—118.

The response of the generator to applied modulating potentials of pulse wave form is generally similar to that described in connection with Fig. 1. The spark-gap device 110 is rendered conductive for a short time interval occurring within the duration of the leading stepped portion of the applied modulating potential as determined by the breakdown potential of the gap and the time constant of the serially connected condenser 116—117—118. Its breakdown introduces a signal into resonant cavity 70 which greatly increases the inherent background disturbance thereof so that the generated oscillations have a high initial value and rapidly attain saturation value. In this manner a modulated-carrier signal envelope is produced having a leading sloped portion that occurs in approximate time coincidence with the corresponding portion of the modulating potential. Curves A, B and C of Fig. 2 also represent this operation of the Fig. 3 arrangement.

It will be apparent from the foregoing description and curves A and B of Fig. 2 that some time is required to provoke an arc discharge in the spark-gap device included in the generators of Figs. 1 and 3. This follows from the wave form of the modulating potential which, in most installations, has a finite leading slope and thus takes time to establish a potential across the spark gap equal to its breakdown potential. It is primarily for this reason that the generated signal represented by curve C lags the modulating potential by a very small interval. If desired, the spark-gap device may be controlled to cause the oscillatory circuit to have an increased background disturbance at the time of application of the modulating potential. An arrangement for accomplishing this result is represented in block diagram in Fig. 4. The signal generator is designated 150 and is influenced by the spark-gap device 151. These units may be constructed as illustrated in Fig. 3. A modulating-potential source 152 which may comprise a multivibrator for supplying pulses of unidirectional potential of approximately rectangular wave form is directly coupled with the spark-gap device and is coupled to the generator through a time-delay network 153. With this circuit arrangement, the spark gap 151 is excited by a modulating potential leading that applied to the oscillatory circuit.

The operation of the Fig. 4 embodiment is indicated by the curves of Fig. 5. Curve E represents the leading modulating pulse applied to spark-gap device 151 to produce spark-gap current shown by curve F. The modulating potential of curve G applied to the generator 150 has a time delay Δt_2 with respect to the potential of curve E. This time delay is such that the leading edge of the modulating pulse to generator 150 occurs at an instant when the spark gap has increased the background disturbance of the generator. The resulting modulated-car-

rier signal produced by the generator is shown by broken-line curve H. It has a substantial time coincidence with the applied modulating pulse G.

The grid structure of the oscillator of Fig. 3, especially its radiator, forms the subject matter of an application Serial No. 649,346, filed concurrently herewith in the name of Harold A. Wheeler, now Patent 2,439,641, issued April 13, 1948. Likewise an arrangement for coupling anode ring 61 to its associated resonators is disclosed and claimed in application Serial No. 649,345 filed concurrently herewith in the name of John A. Rado. Both the Wheeler and Rado applications are assigned to the same assignee as the present invention.

The invention has been explained in the light of modulating potentials of approximately rectangular wave form. However, it is useful in connection with other forms of modulating potentials having sloped leading edges relied upon to initiate the operation of an oscillation generator.

While there have been described what are at present considered to be the preferred embodiments of this invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention, and it is, therefore, aimed in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. A modulated-signal generator comprising, an oscillatory circuit including a cavity resonator normally maintained in a nonoscillatory condition and having an inherent background disturbance the amplitude of which is normally much less than a predetermined value, means for applying to said oscillatory circuit a pulse of modulating potential having a leading sloped portion to initiate therein oscillations of said predetermined value, a transient-signal generator positioned at least in part within said cavity resonator and having an operating interval not exceeding the duration of said leading sloped portion of said modulating potential, and circuit connections for exciting said transient-signal generator to introduce a signal into said cavity resonator effectively to increase the amplitude of said background disturbance to a level much greater than its normal value for an interval which occurs in approximate time coincidence with but of a duration not exceeding said leading sloped portion of said modulating potential, whereby the oscillations initiated in said circuit build up to said predetermined value rapidly to produce a modulated-carrier signal envelope with a leading sloped portion occurring in approximate time coincidence with said sloped portion of said modulating potential.

2. A modulated-signal generator comprising, an oscillatory circuit including a cavity resonator normally maintained in a nonoscillatory condition and having an inherent background disturbance the amplitude of which is normally much less than a predetermined value, means for applying to said oscillatory circuit a pulse of modulating potential having a leading sloped portion to initiate therein oscillations of said predetermined value, a transient-signal generator including a spark-gap device positioned within said cavity resonator and having an operating interval not exceeding the duration of said leading sloped portion of said modulating potential, and circuit connections for exciting said tran-

sient-signal generator effectively to increase the amplitude of said background disturbance to a level much greater than its normal value for an interval which occurs in approximate time coincidence with but of a duration not exceeding said leading sloped portion of said modulating potential, whereby the oscillations initiated in said circuit build up to said predetermined value rapidly to produce a modulated-carrier signal envelope with a leading sloped portion occurring in approximate time coincidence with said sloped portion of said modulating potential.

3. A modulated-signal generator comprising, an oscillatory circuit including a cavity resonator having an inner conductor and a concentrically arranged outer conductor, said oscillatory circuit being normally maintained in a nonoscillatory condition and having an inherent background disturbance the amplitude of which is normally much less than a predetermined value, means for applying to one of said conductors of said oscillatory circuit a pulse of modulating potential having a leading sloped portion to initiate therein oscillations of said predetermined value, and a transient-signal generator having an operating interval not exceeding the duration of said leading sloped portion of said modulating potential, said transient-signal generator comprising a spark-gap device positioned within said cavity resonator with one electrode conductively connected to said one conductor and responsive to said modulating potential effectively to increase the amplitude of said background disturbance to a level much greater than its normal value for an interval which occurs in approximate time coincidence with but of a duration not exceeding said leading sloped portion of said modulating potential, whereby the oscillations initiated in said circuit build up to said predetermined value rapidly to produce a modulated-carrier signal envelope with a leading sloped portion occurring in approximate time coincidence with said sloped portion of said modulating potential.

4. A modulated-signal generator comprising, an oscillatory circuit including a cavity resonator having an inner conductor and a concentrically arranged outer conductor, said oscillatory circuit being normally maintained in a nonoscillatory condition and having an inherent background disturbance the amplitude of which is normally much less than a predetermined value, means for applying to one of said conductors of said oscillatory circuit a pulse of modulating potential having a leading sloped portion to initiate therein oscillations of said predetermined value, and a transient-signal generator having an operating interval not exceeding the duration of said leading sloped portion of said modulating potential, said transient-signal generator comprising a spark-gap device positioned within said cavity resonator with one electrode conductively connected to said one conductor, with a second electrode capacitively coupled to the other of said conductors and responsive to said modulating potential effectively to increase the amplitude of said background disturbance to a level much greater than its normal value for an interval which occurs in approximate time coincidence with but of a duration not exceeding said leading sloped portion of said modulating potential, whereby the oscillations initiated in said circuit build up to said predetermined value rapidly to produce a modulated-carrier signal envelope with a leading sloped portion occurring in approximate

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time coincidence with said sloped portion of said modulating potential.

5. A modulated-signal generator comprising, an oscillatory circuit including a cavity resonator having an inner conductor and a concentrically arranged outer conductor, said oscillatory circuit being normally maintained in a nonoscillatory condition and having an inherent background disturbance the amplitude of which is normally much less than a predetermined value, means for applying to said inner conductor of said oscillatory circuit a pulse of modulating potential having a leading sloped portion to initiate therein oscillations of said predetermined value, and a transient-signal generator having an operating interval not exceeding the duration of said leading sloped portion of said modulating potential, said transient-signal generator comprising a spark-gap device positioned within said cavity resonator with one electrode conductively connected to said inner conductor, with a second electrode capacitively coupled to said outer conductor and responsive to said modulating potential effectively to increase the amplitude of said background disturbance to a level much greater than its normal value for an interval which occurs in approximate time coincidence with but of a duration not exceeding said leading sloped portion of said modulating potential, whereby the oscillations initiated in said circuit build up to said predetermined value rapidly to produce a modulated-carrier signal envelope with a leading sloped portion occurring in approximate time coincidence with said sloped portion of said modulating potential.

6. A modulated-signal generator comprising, an oscillatory circuit including a cavity resonator normally maintained in a nonoscillatory condition and having an inherent background disturbance the amplitude of which is normally much less than a predetermined value, means for applying to said oscillatory circuit a pulse of modulating potential having a leading sloped portion to initiate therein oscillations of said predetermined value, a spark-gap device supported within said cavity resonator, and a condenser serially connected with said spark-gap device for applying said modulating potential thereto and comprising therewith a transient-signal generator having an operating interval not exceeding the duration of said leading sloped portion of said modulating potential for introducing a signal into said cavity resonator effectively to increase the amplitude of said background disturbance to a level much greater than its normal value for an interval which occurs in approximate time coincidence with but of a duration not exceeding said leading sloped portion of said modulating potential, whereby the oscillations initiated in said circuit build up to said predetermined value rapidly to produce a modulated-carrier signal envelope with a leading sloped portion occurring in approximate time coincidence with said sloped portion of said modulating potential.

7. A modulated-signal generator comprising, an oscillatory circuit including a cavity resonator normally maintained in a nonoscillatory condition and having an inherent background disturbance the amplitude of which is normally much less than a predetermined value, means for applying to said oscillatory circuit a pulse of modulating potential having a leading sloped portion to initiate therein oscillations of said predetermined value, a spark-gap device at least partially positioned within said cavity resonator,

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and a condenser serially connected with said spark-gap device for simultaneously applying said modulating potential thereto and comprising therewith a transient-signal generator having an operating interval not exceeding the duration of said leading sloped portion of said modulating potential for introducing a signal into said cavity resonator effectively to increase the amplitude of said background disturbance to a level much greater than its normal value for an interval which occurs in approximate time coincidence with but of a duration not exceeding said leading sloped portion of said modulating potential, whereby the oscillations initiated in said circuit build up to said predetermined value rapidly to produce a modulated-carrier signal envelope with a leading sloped portion occurring in approximate time coincidence with said sloped portion of said modulating potential.

8. A modulated-signal generator comprising, an oscillatory circuit including a cavity resonator normally maintained in a nonoscillatory condition and having an inherent background disturbance the amplitude of which is normally much less than a predetermined value, means for applying to said oscillatory circuit a pulse of modulating potential having a leading sloped portion to initiate therein oscillations of said predetermined value, a spark-gap device having a pair of electrodes, a coupling device positioned within said cavity resonator and connected with one electrode of said spark-gap device, and a condenser serially connected with the other electrode of said spark-gap device for applying said modulating potential thereto and comprising therewith a transient-signal generator having an operating interval not exceeding the duration of said leading sloped portion of said modulating potential for introducing a signal into said cavity resonator effectively to increase the amplitude of said background disturbance to a level much greater than its normal value for an interval which occurs in approximate time coincidence with but of a duration not exceeding said leading sloped portion of said modulating potential, whereby the oscillations initiated in said circuit build up to said predetermined value rapidly to produce a modulated-carrier signal envelope with a leading sloped portion occurring in approximate time coincidence with said sloped portion of said modulating potential.

9. A modulated-signal generator comprising, an oscillatory circuit normally maintained in a nonoscillatory condition and having an inherent background disturbance the amplitude of which is normally much less than a predetermined value, means for applying to said oscillatory circuit a pulse of modulating potential having a leading sloped portion to initiate therein oscillations of said predetermined value, a transient-signal generator having a given starting time for effectively increasing the amplitude of said background disturbance to a level much greater than its normal value for an interval not exceeding the duration of said leading sloped portion of said modulating potential, and means for exciting said transient-signal generator earlier than said oscillatory circuit by an amount substantially equal to said starting time so that said background disturbance has its increased amplitude level at the time of application of said modulating potential to said oscillatory circuit, whereby the oscillations initiated in said circuit build up to said predetermined value rapidly to produce a modulated-carrier signal envelope with a leading sloped

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portion occurring in substantial time coincidence with said sloped portion of said modulating potential.

10. A modulated-signal generator comprising, an oscillatory circuit normally maintained in a nonoscillatory condition and having an inherent background disturbance the amplitude of which is normally much less than a predetermined value, means for applying to said oscillatory circuit a pulse of modulating potential having a leading sloped portion to initiate therein oscillations of said predetermined value, a transient-signal generator including a spark-gap device having a given breakdown time for effectively increasing the amplitude of said background disturbance to a level much greater than its normal value for an interval not exceeding the duration of said leading sloped portion of said modulating potential, and means for exciting said spark-gap device earlier than said oscillatory circuit by an amount substantially equal to said breakdown

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time so that said background disturbance has its increased amplitude level at the time of application of said modulating potential to said oscillatory circuit, whereby the oscillations initiated in said circuit build up to said predetermined value rapidly to produce a modulated-carrier signal envelope with a leading sloped portion occurring in substantial time coincidence with said sloped portion of said modulating potential.

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