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ELECTRICAL OSCILLATION GENERATOR

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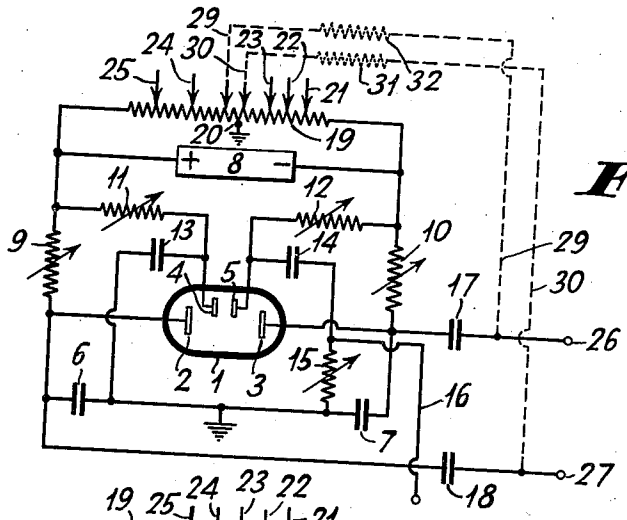



Fig. 1

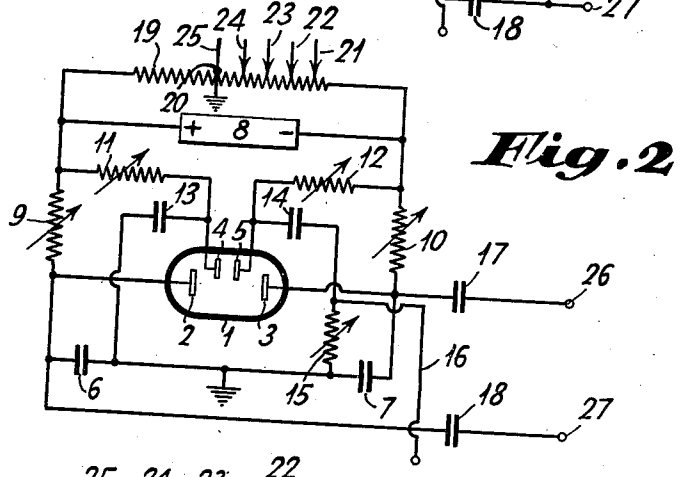



Fig. 2

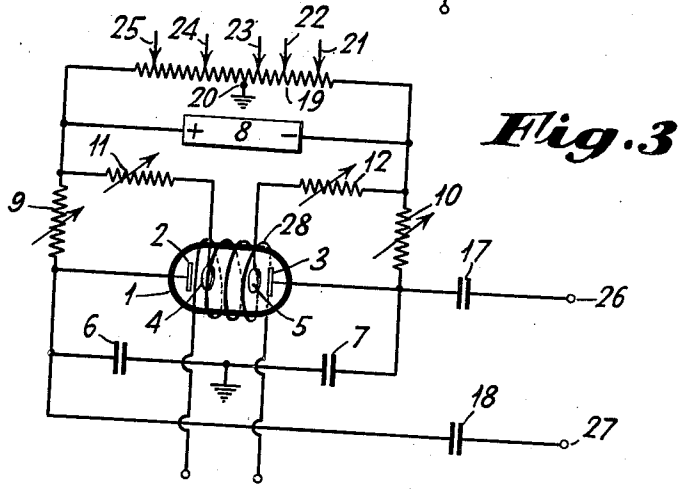



Fig. 3

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## ELECTRICAL OSCILLATION GENERATOR

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8 Claims. (Cl. 250—36)

This invention relates to electrical oscillation generators and more particularly to generators adapted to generate substantially sawtooth waves and suitable for use as time base circuits for controlling the scanning action in cathode ray tube television and like apparatus.

It is common present day practice in time base circuits for cathode ray tube television apparatus to employ sawtooth wave oscillators providing sawtooth waves of relatively small amplitude and then to amplify the waves thus produced by means of a so-called paraphrase amplifier the output from which is employed to control the scanning action. This practice has a number of disadvantages. Firstly, a well smoothed high tension supply of somewhere about 1,000 volts and 30 milliamperes is generally required for the paraphase amplifier; secondly, if ordinary commercially available valves of reasonably practical ratings are employed in the amplifier, they are necessarily somewhat overloaded and consequently have a short useful life; thirdly, commercially available valves do not present grid voltage-anode current characteristics of sufficient rectilinearity over the large range of grid volts involved and in consequence the amplifier introduced a certain amount of distortion in the sawtooth waves; and lastly great difficulties are experienced in amplifying without losing some of the higher harmonic frequencies involved in a sawtooth wave form of 10,000 cycles per second or thereabouts as employed in modern high fidelity television systems.

The object of the present invention is to provide apparatus whereby these disadvantages are avoided, the said invention seeking to provide a substantially sawtooth wave oscillator capable of producing substantially straight sided sawtooth wave oscillations of sufficient amplitude to be employed for scanning control purposes without further amplification. As will be seen later, an oscillator in accordance with this invention and employed in conjunction with a television or like cathode ray tube, may be arranged to be operated from the same high tension voltage supply source as is already provided for the cathode ray tube.

The present invention provides a substantially improved sawtooth wave oscillator of the kind wherein the capacity portion of a resistance capacity charging circuit is associated with a gas-filled electric discharge tube whch breaks down and thus discharges the condenser when, or just before, a predetermined voltage has been built up across said condenser and the said invention is characterized in that the said discharge tube comprises a main pair of electrodes between which the condenser discharging discharges occur, and an auxiliary pair of electrodes which are closer together than and positioned between the main pair of electrodes and between which an auxiliary discharge is set up. The auxiliary discharge may either be set up intermittently the arrangement being such that the setting up of the auxiliary discharge initiates the main discharge, or it may be a continuous discharge.

The invention is illustrated in and further explained in connection with the accompanying drawing.

Fig. 1 illustrates one embodiment of the invention.

Fig. 2 illustrates a second embodiment of the invention utilizing a high tension source.

Fig. 3 illustrates a third embodiment of the invention utilizing a magnetic coil for control purposes.

Referring to Fig. 1 which shows diagrammatically one way of carrying out the invention, there is employed a tube 1 filled with argon or similar inert gas at a suitable pressure and containing two pairs of electrode 2, 3; 4, 5, one pair 2, 3—hereinafter called the "main pair"—being spaced apart by a substantial distance, and the other pair 4, 5—hereinafter called the "auxiliary pair"—being more closely spaced and being situated between the main pair. To take a practical example the distance between the main pair 23 of electrodes may be such as to give a breakdown voltage of about 1,000 volts and that between the auxiliary pair 4, 5, may be such as to give a breakdown voltage of 150 volts. Each of the electrodes of the main pair is earthed through one of two similar condensers 6, 7. The main electrode 2 is connected to the positive terminal of a source 8 of supply through a resistance 9 and the other main electrode 3 is connected to the negative terminal of the said source through a resistance 10. These resistances 9 and 10 should be as nearly as possible identical and may be adjustable. The source 8 of potential may conveniently be the same source as that which supplies the cathode ray tube with which the oscillator is to be associated and may conveniently be a 6,000 volt source. The positive terminal of the source is connected to the auxiliary electrode 4 which is nearer to the positive main electrode 2, through a resistance 11, the negative terminal being connected to the other auxiliary electrode 5 through a further resistance 12. These two resistances 11, 12, also should be similar and may

be adjustable. The positive auxiliary electrode 4 is earthed through a condenser 13 and the negative auxiliary electrode is earthed through a second, similar condenser 14 which is preferably in series, as shown, with an adjustable resistance 15. A connection 16 for the application of synchronizing pulses is made to the junction of the condenser 14 and resistance 15. Sawtooth waves for application to a pair of deflector plates in the associated cathode ray tube are taken off at terminals 26, 27 through condensers 17, 18, from the main pair of plates 2, 3. In practice, a potentiometer resistance 19 with an earthed centre point 20 may be connected across the source of potential 8 and the various electrodes of the associated cathode ray tube (not shown)—the Wehnelt cylinder, the control electrode and the first, second, and third anodes—may be energized from individually adjustable tappings (21, 22, 23, 24 and 25 respectively) upon this potentiometer. This method of connection is normally quite practical, but in those cases in which the cathode ray tube forms part of a television receiver whose circuit is such that one pole of the high tension supply unit must be "earthy" the circuit above described may be modified by employing a high tension source whose total voltage is twice that required for the cathode ray tube and making the various cathode ray tube tappings to different points upon one half of the potentiometer resistance. This is represented diagrammatically in the accompanying Figure 2.

The apparatus in general operates as follows: The condenser 6 is connected to the positive side of the source of potential 8 through a resistance 9 connected serially therewith. In turn, the condenser 6 is connected serially with condenser 7 and resistor 10, the latter being connected to the negative side of the potential supply 8. The common terminal of condensers 6 and 7 are connected to a point of reference potential or, in other words, grounded. The same is true of the midpoint of the potential supply 8, this being accomplished by grounding the center tap of resistor 19 which is shunted across the potential supply 8. The main electrode 2 is connected to the common terminal of resistor 9 and condenser 6, and the main electrode 3 is connected to the common terminal 10 and the resistor 7. Assuming a condition of no charge on condensers 6 and 7, the side of the condenser 6 which is connected to the resistance 9 will begin to charge up through the resistor 9 with a charge which leaves the condenser charged to a potential which gradually approaches the potential of the positive side of the potential supply 8. On the other hand, the potential of the side of the condenser which is connected to the resistor 10 will gradually pull down to approach a value of the negative side of the supply 8. Hence the two condensers will charge. These two condensers being connected serially, and the serial connection shunted across the main electrodes 2 and 3 will discharge across the space discharge path between the main electrodes 2 and 3 if the gaseous medium in the tube becomes conducting. The condenser 13 simultaneously begins to charge through the resistor 11 to approach the value of the positive terminal of the potential supply 8. Hence the plate 4 begins to assume a positive potential. On the other hand, the plate 5 will grow more negative in potential due to the charging of condenser 14 through resistor 12, the side of the condenser 14 which is connected to the resistor 12 being also connected to the electrode 5, and tending to gradually assume a negative value of the negative terminal of the supply source. Hence auxiliary electrodes 4 and 5 will tend to assume gradually a high negative value.

Now initiation of discharge across plates 4 and 5 may be accomplished either by the impressing of a synchronizing signal on one of the plates by way of the connection 16, or the plates 4 and 5 may gradually assume a positive and negative value relative to each other whereby the potential gradient in the discharge path between the elements 4 and 5 exceeds the ionization potential of the gaseous medium. However, once discharge has been initiated between elements 4 and 5, then the medium having been ionized will easily conduct between elements 2 and 3 or, in other words, 4 and 5 act as a trigger to cause conduction between the elements 2 and 3 and discharge condensers 6 and 7.

In the arrangements of Figures 1 and 2, the two time constant circuits (each consisting of a resistance and capacity 9, 6 or 10, 7 in series) associated with the main electrodes are practically of identifical time constant, and similarly the two time constant circuits 11, 13 and 12, 14, 15 associated with the auxiliary electrode are also of practically identical time constant. The time base constant circuits are so dimensioned that the potential between the main electrodes 2, 3, and the potential between the auxiliary electrodes 4, 5, reach their respective breakdown voltages at almost the same time so that the discharge between the auxiliary electrodes will take place just when the discharge between the main electrodes is ready to occur. Thus the auxiliary discharge initiates or triggers the main discharge. This action obviates the natural irregularity in the high voltage discharge between the main electrodes which would otherwise occur due to the wide spacing of these electrodes. Further, it will be seen that the auxiliary discharge may be initiated by the application of properly timed, properly polarized, synchronizing signals. Such signals which will maintain both discharges in synchronism may be of much smaller amplitude than would be necessary if the said signals were employed to initiate the main discharge directly.

As will be seen, the voltage upon one of the associated pair of deflector plates (not shown, but connected at 26, 27) in the cathode ray tube will rise (during the "long side" of a sawtooth wave) from approximately earth potential to some predetermined positive potential (say 500 volts) and the other deflecting plate will, during the same time, go from approximately earth potential to approximately the same potential negative. In order to maintain the "scan" central on the screen of the cathode ray tube, suitable bias voltages—for the figures just given 250 volts positive and negative—should be applied to the deflector plates with respect to the cathode ray tube anode. These bias potentials may be obtained from the potentiometer resistance 20 as indicated by the broken line leads 29, 30 of Figure 1, these leads containing resistances 31, 32. The resultant scanning action will be such as to avoid trapezium distortion.

The resistance 15 which is in series with the condenser 14 between the auxiliary electrode 5 and earth controls the time occupied by the auxiliary discharge, and the value of this resistance should be so chosen that the auxiliary discharge continues for a short time after the main discharge has been extinguished. The advantageous result of this is that when the potential between

the main electrodes falls below that between the auxiliary electrodes, ions, and electrons comprising the main discharge are attracted into the auxiliary discharge and accordingly the main discharge path rapidly becomes non-conducting.

In the modification shown in Fig. 3, the condenser 13 of Figures 1 and 2 and the series combination of condenser 14 and resistance 15 of the same figures are omitted and the auxiliary electrode is connected to the positive or negative terminal (as the case may be) of the supply source through a similar adjustable resistance 11 or 12 and the whole arrangement is such that the auxiliary discharge is continuous. In this arrangement, the auxiliary electrodes preferably consist as shown of two rings disposed on a common axis extending between the main electrodes or one auxiliary electrode may be a ring and the other may be of point form. The time constant circuits associated with the main electrodes are so chosen that the discharge between the said main electrodes can readily be initiated by energy derived from a synchronizing signal energy being applied by means of a coil 28 (or coils) suitably disposed about the discharge tube and arranged either to deflect or to concentrate the discharge between the auxiliary electrodes along the axis which constitutes the shortest path between the main electrodes. This arrangement has the advantage that by controlling the potential difference between the auxiliary electrode, the amplitude of the sawtooth wave obtained can be controlled since the potential difference between the main electrode can never fall below that between the auxiliary electrodes. Instead of using synchronizing signals direct in the manner just described, they can be employed to "trigger" a small power high frequency oscillator to produce short bursts of high frequency oscillations which are applied to the coil 28 disposed about the discharge tube so as to initiate the main discharge. This arrangement gives a further control of sawtooth wave amplitude since it enables the main discharge to be initiated before the natural breakdown voltage is reached.

It is obviously of advantage to use as high a value of high tension supply voltage as possible (consistent with other practical requirements) for the higher the supply voltage in relation to the breakdown voltage the better the rectilinearity. Quite good rectilinearity can be obtained with a ratio of high tension voltage to breakdown voltage of about 5:1 and a ratio of 8:1 (which, of course, gives better rectilinearity) is readily achieved.

What is claimed is:

1. A sawtooth wave oscillator comprising a pair of main electrodes, a pair of auxiliary electrodes adjacent said main electrodes, said auxiliary electrodes and said main electrodes being surrounded by an ionizable gaseous medium, a source of potential having positive and negative terminals, at least one time constant circuit connected serially with said source of potential, said main electrodes being connected substantially in parallel with the capacitive element of said time constant circuit, and means for initiating ionization between said auxiliary electrodes to cause ionization and conduction of said medium between said main electrodes whereby the condenser element in said time constant circuit is at least partially discharged.

2. Apparatus in accordance with claim 1, wherein the discharge between said auxiliary electrodes is initiated intermittently from a signal received from an external source.

3. A sawtooth wave oscillator comprising at least one pair of main electrodes and one pair of auxiliary electrodes, said main electrodes and said auxiliary electrodes being surrounded by an ionizable gaseous medium, a source of potential having positive and negative terminals, a point of reference potential, resistive means shunted substantially in parallel with said source of potential and having a tap thereon connected to said point of reference potential, a first time constant circuit comprising a resistance and a condenser connected serially to the positive terminal of said source of potential and to the point of reference potential, means electrically connecting one of said main electrodes to the common terminal of the resistance and condenser forming said first time constant circuit, a second time constant circuit comprising a resistance and a condenser serially connected with each other to the negative terminal of the source of potential and to the point of reference potential, means electrically connecting the other of said main electrodes to the common terminal of the resistance and condenser forming said second time constant circuit, and means for initiating a discharge between said auxiliary electrodes whereby ionization occurs between said main electrodes and the charge on the condensers included in said first and second time constant circuits are at least partially discharged.

4. Apparatus in accordance with claim 3 wherein there is provided, in addition, an additional time constant circuit shunted in parallel with said first time constant circuit and having the common terminal of the resistance and condenser forming said additional time constant circuit electrically connected to one of said auxiliary electrodes, and a second additional time constant circuit shunted substantially in parallel with said second time constant circuit and having the common terminal of the resistance and condenser forming said second additional time constant circuit electrically connected to the other of said auxiliary electrodes.

5. Apparatus in accordance with claim 3 wherein initiation of discharge between the auxiliary electrodes occurs intermittently in response to signals from a source external to said apparatus which are impressed on at least one of said auxiliary electrodes.

6. Apparatus in accordance with claim 1 wherein said time constant circuit is variable.

7. Apparatus in accordance with claim 3 wherein said time constant circuits are variable.

8. Apparatus in accordance with claim 3 wherein the means for initiating discharge between said auxiliary electrodes comprises an electromagnetic means positioned adjacent said auxiliary electrodes, ionization occurring when said electromagnetic means is energized.

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