March 19, 1940. R. ANDRIEU ET AL 2,193,850

OSCILLATION GENERATOR

Filed Aug. 9, 1938 2 Sheets-Sheet 1

Fig. 1

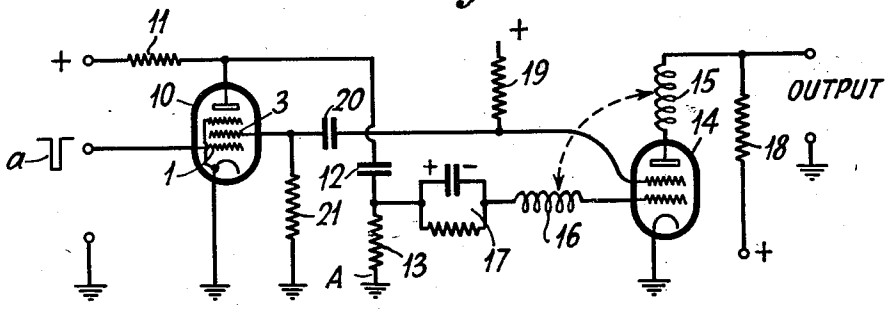

Fig. 2

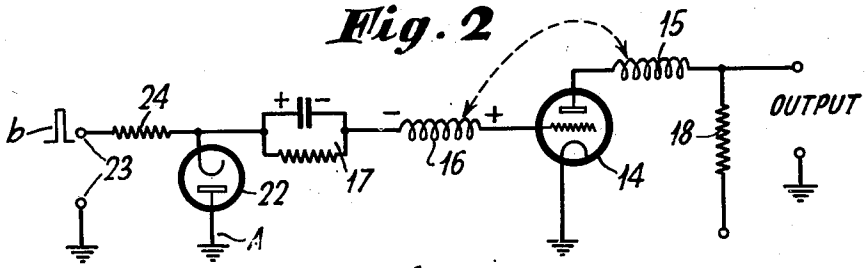

Fig. 3

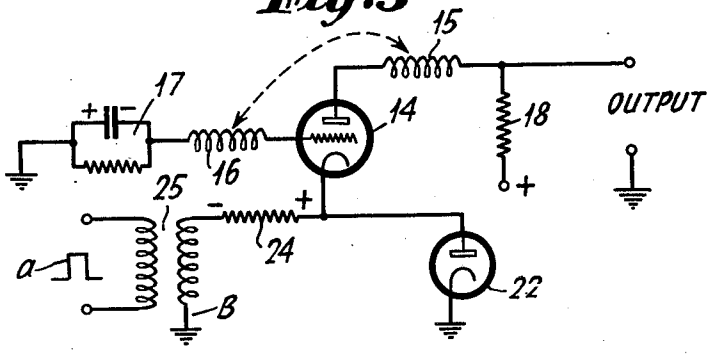

Fig. 4

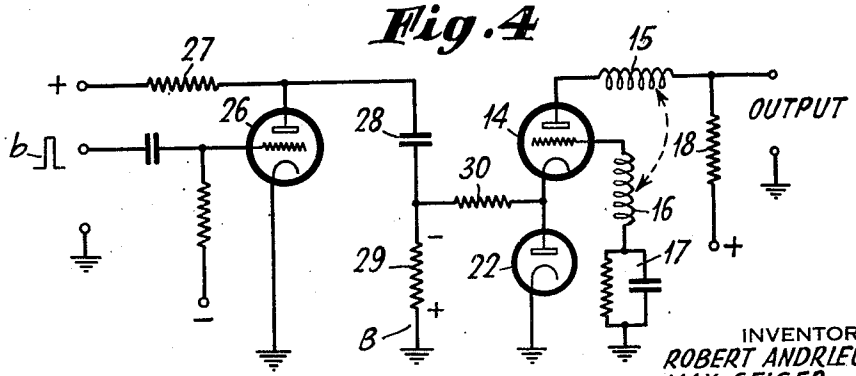

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Fig. 5

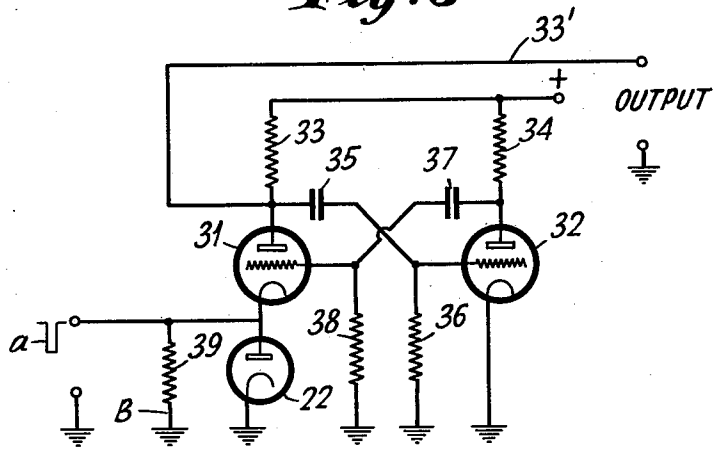


Fig. 6

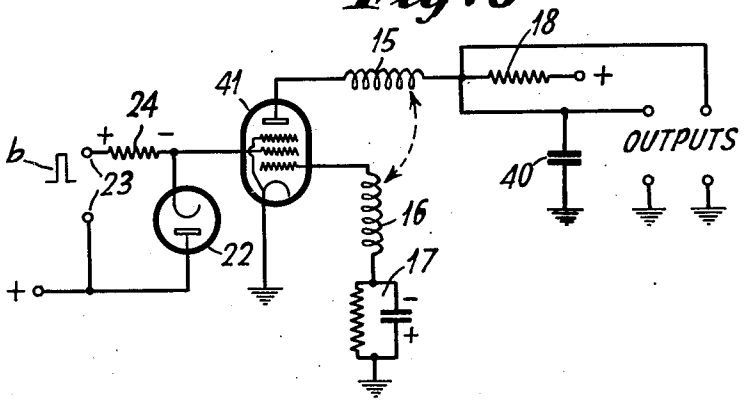
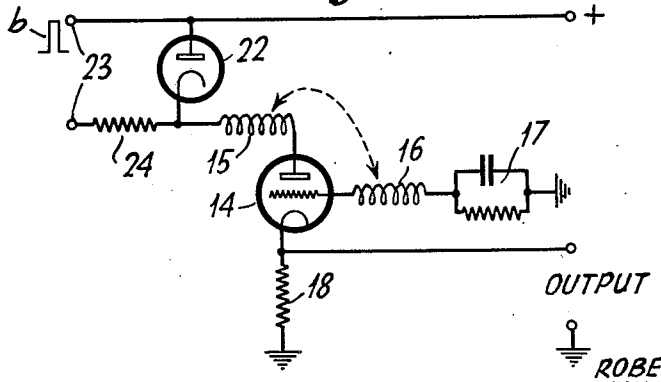


Fig. 7



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OSCILLATION GENERATOR

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3 Claims. (Cl. 250—36)

For a number of technical purposes, for instance, for oscillographic work with Braun cathode-ray tubes, and also in television work, it is necessary to produce a preferably periodically recurring current or potential wave by the aid of given control currents or control voltages and a time-base or sweep-circuit organization. To make matters clearer, what is here and further below meant by "sweep or time-base circuits" is a circuit organization in which, after each impulse produced by the control current or control potential, an identical current or voltage wave shape will be produced in a similar manner, or in which, in the absence of such control current or control potential, periodic current or voltage variations will arise. Typical instances of such circuit arrangements are embodied in the so-called self-blocking oscillator, the so-called multivibrator, and others. Now, in a great many cases arising in practice, on the one hand, the shape of the control current or the control voltage will not always be exactly the same, while, on the other hand, the demands to be made in practice regarding the constancy and stability of the current or voltage wave shape in such a sweep or time-base circuit organization are extremely severe. An instance is the synchronization of the line series change (vertical change) in television receivers which operate on what is known as the interlaced scanning method. The curve-shape of the current in the deflector coils or the curve-shape of the potential at the deflector plates for the slow picture co-ordinate must be extremely constant in order to prevent all risks and chances of a shift being caused in the two series of lines in relation to each other in the vertical sense. Other instances where the problem of producing an ever recurring uniformity of the shape of current and voltage is of similar importance and value shall be discussed in more detail further below.

Now, the basic idea of the invention is to devise ways and means which, in dependence upon the initiation of the current or voltage shape in the time-base circuits, will diminish or eliminate the further controlling effect of the control current or the control potential.

The invention may best be understood by referring to the drawings, wherein like reference characters represent like parts and wherein:

Figure 1 shows one form of an oscillation generator;

Figure 2 shows another form of an oscillation generator;

Figure 3 shows a modification of the oscillation generator shown in Figure 2;

Figure 4 shows still another form of a generator;

Figure 5 shows the control or synchronizing of a conventional multivibrator, and

Figures 6 and 7 show still further modifications of the present invention.

Referring to Figure 1, 10 is a pentode. The plate circuit of this tube includes a resistance 11. To the plate are connected a coupling condenser 12 and a resistance 13. These two circuit elements insure coupling relation with a tube 14 comprised in the blocking-oscillator circuit organization. The primary and secondary winding of the blocking oscillator have been designated by 15 and 16, respectively, while the resistance-condenser combination in its grid circuit bears the numeral 17. In the plate circuit of tube 14 is included a resistance 18, while the screen-grid circuit thereof contains a resistance 19. Associated with the screen grid of tube 14, through a coupling condenser 20, is the grid 3 of the pentode tube 10, the requisite grid leak being indicated at 21.

Now, an arrangement such as illustrated in Figure 1 operates in this manner that a given control potential is impressed upon the control grid 1 of tube 10 in the form of a negative impulse *a*. As a result, the plate current which has previously been flowing in the tube 10 is interrupted and cut off, and as a further result a rise of potential is caused at the anode end of the resistance 11. This rise of potential through the resistance-condenser coupling combination 13, 12 reaches the control grid of the blocking oscillator tube 14 which, up to that instant shall be assumed to have carried no plate current. In the circuit organization here shown the plate current is zero as long as across the resistance-condenser combination 17 in the grid circuit of the blocking oscillator there still prevails a sufficiently high potential acting in the sense of the plus and minus signs there indicated. But as a result of the rise of potential at the anode end of resistance 11, the control grid potential of tube 14 is raised to a point where plate current begins to flow. This current, by virtue of the feedback relation established through transformer 15, 16, results in the initiation of a grid current; and this current, as well known, causes the condenser of combination 17 to be charged more strongly in the sense of the plus and minus signs here indicated so that, upon termination of the plate-current impulse of tube 14 there pre-

vails a markedly negative potential across the resistance-condenser combination 17 which will preclude and block the flow of current in tube 14. As a result of the commencement of plate current flow in the tube 14, there is caused at the same time a decrease of potential at the lower terminal of resistance 19 in the screen-grid circuit so that a potential will come to act at the grid 3 of tube 10 which will block the plate current in this tube, regardless of the shape or development of the impulse *a* at its grid 1, as long as the current impulse in the blocking oscillator 14 persists.

In this manner an ever uniform and identical shape or trend of the plate current impulse in the blocking oscillator will be insured since, as explained, the controlling action of the impulse at the grid 1 of tube 10 upon the blocking oscillator tube is eliminated and suppressed once the plate current impulse has been initiated in tube 14. In order to cause discontinuance of the controlling action there is here used the influence which is exercised by the current-carrying screen-grid of tube 14 upon the discharge path of tube 10. In other words, at the top terminal of resistance 18 there is thus available a voltage impulse which is substantially entirely independent of the particular shape of impulse *a*.

Figure 2 illustrates another exemplified embodiment in which the grid circuit of a blocking oscillator tube 14 (connected, as to the rest, in a circuit organization similar to that shown in Figure 1) includes a rectifier (diode) 22, that is, in parallel relation to the terminals 23 upon which the control potential is impressed. Resistance 24 either is a separate resistance or else the inner resistance of the control-voltage source of supply.

The arrangement shown in Figure 2 operates in this manner that across the terminals 23 the control potential is supplied in the form of a positive impulse *b*, with the result that in the tube 14 which previously was still cut off or blocked by action of the residual potential prevailing across the resistance-condenser combination 17, a plate current commences to flow. This plate current, for reasons well known from the operation of blocking oscillators, leads inside an extremely brief interval of time, and by positive action, to the development of a grid current, for the reason that across the secondary winding 16 of the feedback or tickler transformer 15, 16 a potential will be set up in the sense of the plus and minus signs there indicated. This potential drives the grid current through the grid-cathode path of tube 14 and the plate-cathode path of rectifier 22. Inasmuch as the inner resistance of this rectifier path is low compared with the resistance 24, it follows that the control potential, from the very instant when the rectifier becomes conductive, practically prevails across resistance 24. Thus the influence of the control potential upon the shape of the plate current in the blocking oscillator is practically entirely precluded. In other words, also in this circuit organization the piloting or controlling effect of the control potential as a function of the initiation of the grid current flow and thus indirectly of the incipiency of the plate current of the blocking oscillator tube is practically excluded. The desired voltage impulse which will be independent of the development and form of the impulse *b* may again be taken off at the left-hand terminal of the resistance 18.

Another embodiment in which the control potential is supplied to the cathode of a blocking oscillator tube, and in which the control or piloting effect is also discontinued and cut off by the aid of a rectifier is illustrated in Figure 3. In this illustration, reference numerals 14—18 denote a blocking oscillator circuit organization of the same nature as in Figure 2. A transformer which furnishes an impulse *a* is designated by 25, the rectifier again bears numeral 22, while a series resistance or else the inner resistance of transformer is designated by 24.

The circuit organization in Figure 3 operates in this manner that, as soon as the impulse *a* is initiated, the bias potential of tube 14 which shall be assumed to be still blocked by the residual charge across the resistance-condenser combination 17 is reduced so that a plate current starts to flow. This results in a drop of potential in the sense of the indicated plus and minus signs across resistance 24 so that the rectifier 22 becomes conductive for current. Thereafter, a practically constant potential prevails at the cathode of tube 14 since the pilot potential *a*, for reasons of the low inner resistance of the rectifier 22 in contrast to the series or inner resistance 24, will come to prevail practically completely across this resistance 24. The result is that the plate-current impulse of the blocking oscillator also in this instance has a shape that is practically independent of the form of the control or piloting potential *a* as soon as the rectifier 22 becomes conductive. The desired constant voltage impulse again is taken off at the left-hand terminal of resistance 18.

Figure 4 illustrates a circuit organization in which the control potential is fed to the cathode of a blocking oscillator tube by the direct or conductive way. Reference numerals 14 to 18 and 22 have the same denotations as in Figure 3. A tube connected below the blocking oscillator is designated by 26, its plate resistance is indicated at 27, while a resistance and condenser which serve to establish plate coupling is indicated at 28, 29. Between the elements 28, 29 and the cathode of tube 14 is a series resistance 30.

The organization shown in Figure 4 operates in this manner that the control grid of tube 26 is impressed with a positive pilot potential. Up to the time where the said potential arises, tube 26 carries no current, while after the occurrence of the pilot pulse its plate potential suffers a decrease. Across the resistance 29 there will thus arise a voltage in the sense of the plus and minus signs here indicated so that also the cathode potential of tube 14 is lowered. This leads to the initiation of plate current in the blocking oscillator 17 which from its plate first flows through the resistance 30 and resistance 29 to ground. The fall of voltage which thus results across resistance 30 which is high compared with resistance 29 occasions the opening of rectifier 22 so that the plate current of the blocking oscillator will then flow by way of the said rectifier which at the same time, in conjunction with resistance 30, practically short-circuits the pilot potential at resistance 29. The desired stable voltage impulses again are taken off at the left-hand end of resistance 18.

The circuit organization illustrated in Figure 5 relates to the control or synchronization of a multivibrator which, as known in the prior art, comprises two tubes 31, 32 with the corresponding plate resistances 33, 34 and coupling resistance-condenser meshes 35, 36, and 37, 38 respectively. Rectifier 22 is included in the cathode lead of tube 31. 39 designates a high resistance.

The operation of the arrangement shown in Figure 5 shall be explained while the presupposition is made that the tube 31 carries no current and that tube 32 conducts a current. Across the resistance 39 the control potential arises in the shape of a negative voltage impulse *a*. This impulse lowers the cathode potential of tube 31 so that a plate current begins to flow in the tube 31. As a result of the coupling of the control grid of tube 32 with the anode of tube 31, the current flowing through the tube 32 is thus caused to discontinue its flow as known in the art. The rapidly rising plate current of tube 31 occasions across the resistance 39 a drop of potential which will render the rectifier 22 conducting. Inasmuch as the inner resistance of the same is low in contrast with resistance 39, it follows that the control potential impulse *a* thereafter will be practically short-circuited so that at the plate of tube 31 the desired constant voltage impulse may be taken off through lead 33'. The end of this voltage impulse, as well known in the art, is governed by the disappearance of the potential across the condenser 35 and the incipient current flow thereby occasioned in tube 32.

The embodiment shown in Figure 6 in which the condenser 40 is disregarded, for the time being, comprises the use of a rectifier arrangement of the kind illustrated in Figures 2 to 5 in the screen-grid circuit of a blocking oscillator tube 41. The reference numerals 15 to 18 have the same denotations as in Figures 1 to 5. The rectifier is designated by 22, the terminals for the leads of the control or pilot potential by 23, while the series or inner resistance of the control-potential source are indicated by 24.

The circuit organization shown in Figure 6 operates in this manner that upon rise of control voltage *b* the screen-grid potential of tube 41 which up to that instant shall be taken to be blocked by virtue of the action of a residual potential or charge at the resistance-condenser mesh 17, is raised so that a plate current starts to flow. This current is related to a screen-grid current which across the resistance 24 causes a drop of potential in the sense of the legended plus and minus signs. As a result the rectifier 22 is rendered conducting so that the pilot potential comes to act almost entirely at the resistance 24, while at the screen grid there prevails a practically constant potential regardless of the further development or trend of the pilot potential through the rectifier 22. The plate-current impulse, therefore, from the very beginning of current flow in the rectifier 22, will develop almost wholly independently of the control voltage pulse *b*. The desired constant voltage impulse again is collected at the left-hand terminal of the resistance 18.

Figure 7 shows a circuit organization in which the control potential for a blocking oscillator is fed to the plate. The rectifier 22 is inserted between the positive plate potential terminal and the primary coil 15, while resistance 18 is included in the cathode lead of the blocking oscillator 14. The circuit arrangement of this tube resembles the organizations shown and described in the previous embodiments. Terminals 23 for the supply of the control potential and resistance 24 also are related to the rectifier so far as their position or connection is concerned in a way as before described.

The arrangement Figure 7 works in this manner that across the terminals 23 a positive potential impulse *b* is impressed which renders conductive the tube 14 (which previously had been blocked because of the residual charge of the resistance-condenser mesh 17) by virtue of the fact that the plate potential is raised. The ensuing plate current occasions across the resistance 24 a drop of voltage in the sense of the indicated plus and minus signs so that the rectifier 22 also begins to conduct current. From that instant, the rectifier 22 practically short-circuits the pilot potential *b*, and the plate current flows through the rectifier 22. At the cathode of tube 14, from the very instant when rectifier 22 begins to carry current, there may thus be taken off a potential impulse which is practically independent of the shape of the voltage pulse *b*.

As shown in Figures 1 to 7 all time-base organizations are so chosen that they will experience and produce saw-tooth waves even in case of a failure of the pilot potential pulse. In the practical use of time-base circuit organizations it is usual occasionally to employ a somewhat working method, that is, a method in which the time base circuits are subject to such a biasing voltage that they will go through a sweep cycle only upon the arrival of a control or piloting impulse, while staying quiescent permanently upon the failure of such an impulse to arrive. It will be understood that the invention may be readily applied also to this latter instance. In fact, all that is necessary to this end is that the point marked A, in Figures 1 and 2, should be connected with a constant negative potential to ground, while in Figures 3 to 5 terminal B is connected to a positive potential to ground. As to the rest the operation of the circuit organizations remain unaltered.

As also pointed out above, the invention is not restricted to the control or piloting of blocking oscillators or multi-vibrators. On the contrary, all time-base organizations with features as set forth at the outset may be run on the principle hereinbefore described. In fact, it would also be feasible to control also time-base circuits comprising grid-controlled gas or vapor-filled discharge vessels working with an arc-like discharge ("Thyratrons") by the principle here disclosed. In fact, it will be noted that circuit organizations of a kind shown in Figures 3, 4 and 7 are readily adaptable to time-base arrangements comprising such discharge tubes.

As already pointed out, above circuit arrangements of the described nature are to be used particularly for the synchronization of line series change in television receivers which are operated by the interlace-scan method. The deflection in the direction of the slow (or low-frequency) coordinate of the image may be effected by the aid of a saw-tooth generator which requires a negative impulse for starting. All that is necessary is to connect the input terminal in question to the anode end of the resistance 18 in Figures 1 to 4 and Figure 6 or of resistance 33, Figure 5. Also saw-tooth generators which require a positive synchronizing impulse, for instance, by the aid of a reversing stage, may be operated by the use of circuit organizations shown in Figures 1 to 6. However, it would also be possible to use a circuit arrangement as shown in Figure 7, with the synchronizing impulse being taken off at the cathode end of resistance 18.

Referring to Figure 6 it is shown in what way the time-base organization could be united with a saw-tooth generator of known type. Between the left-hand terminal of resistance 18 and the

ground is inserted the condenser 40. As long as the tube 41 carries no current, condenser 40 is charged through the resistance 18, and the potential prevailing at its upper plate rises in accordance with an *e*-function. As soon as the impulse *b* arises, the condenser is again discharged through the cathode-anode path of tube 41 so that the potential at its upper plate will rapidly decrease again. When the time constant of the circuit comprising the resistance 18 and condenser 40 is high enough, the shape of the potential at the upper plate of the condenser 40 will follow a saw-tooth curve. This potential variation through the line may then be fed, for instance, to a push-pull amplifier for the purpose of rendering the saw-tooth curve symmetric or it may be used in any other suitable manner.

For the synchronization of line series changes in the interlace method the present invention will be found of particular value and importance for the reason that it satisfies to perfection the requirement of insuring a return or flyback amplitude of definite size in a sawtooth potential (that is, the drooping high-speed flank of the saw-tooth curve). It will be remembered that this requirement, for a linear form of the upstroke of feeble inclination or slope, is the only one to be satisfied if the mutual shifting of the series of lines known as pairing and its marked disturbing action is to be avoided, while the exact timing of the initiation of return or down-stroke is rather immaterial. This latter fact has the result that when using a circuit organization of the kind here disclosed, under certain circumstances, all such ways and means of an auxiliary nature may be dispensed with in the transmitter as have heretofore been regarded as necessary in order to insure uniformity in the antecedents of the synchronizing impulse for line series change.

Circuit organizations of the kind here disclosed are advantageously serviceable, for instance, also in the case where by the aid of a perforated disc and a photo-electric cell a series of impulses is to be produced in which each individual impulse has exactly the same form. In practice the fulfillment of this demand is occasionally attended with difficulties where a perforated disc is used, for the reason that the holes are not always of exactly the same size from the outset or that they may be partly clogged by dust and dirt. These irregularities may be almost completely eliminated by a circuit organization as here disclosed, for the reason that the curve-shape of the control potential plays no longer any essential part in the present invention.

The invention is useful, for instance, also for the synchronization of line change in those television methods known in the prior art in which the synchronizing impulse for the slow picture co-ordinate is subject to interruptions such that the line deflection generator is constantly kept in step. In describing this method it is stated that the synchronizing impulse for the slow picture co-ordinate consists of a number of extended line impulses. These extended line impulses which are there necessary for the synchronization of the slow frame or picture co-ordinate may be readily converted for the synchronization of the line co-ordinate with a circuit organization of the invention into impulses which will have a shape and development exactly the same as the normal line impulses. The operation of the line deflection generator also during the synchronization of the generator for the slow co-ordinate will therefore be the very same as during the arrival of the ordinary line impulses.

We claim:

1. A system for generating voltages of saw-tooth wave form comprising a discharge tube having a cathode, a control electrode and an anode, circuit means for maintaining said anode positive with respect to said cathode, means for electro-magnetically coupling the control electrode to the anode circuit, a diode including cathode and anode electrodes, means for connecting the control electrode of said discharge tube to the cathode of said diode comprising a parallel resistance-condenser combination, means for connecting the anode of said diode to the cathode of said discharge tube, and means for applying potential impulses to the electrodes of said diode.

2. A system for generating voltages of saw-tooth wave form comprising a discharge tube having a cathode, a control electrode and an anode, circuit means for maintaining said anode positive with respect to said cathode, means for electro-magnetically coupling the control electrode to the anode circuit, a diode including cathode and anode electrodes, means for connecting the anode of said diode to the cathode of said discharge tube, means for connecting the control electrode of said discharge tube to the cathode of said diode comprising a parallel resistance-condenser combination, and means including a resistance for applying potential impulses to the electrodes of said diode.

3. A system for generating voltages of saw-tooth wave form comprising a discharge tube having a cathode, a control electrode and an anode, circuit means for maintaining said anode positive with respect to said cathode, means for electro-magnetically coupling the control electrode to the anode circuit, a diode including cathode and anode electrodes, means for connecting the anode of said diode to the cathode of said discharge tube, means for connecting the control electrode of said discharge tube to the cathode of said diode comprising a parallel resistance-condenser combination, and means for applying potential impulses to the electrodes of said didode, said last named means including an additional electron discharge device.

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