Dec. 16, 1941. R. J. KEMP 2,266,047

ELECTRICAL OSCILLATORS AND TIME BASE CIRCUITS

Filed June 25, 1938

Fig. 1

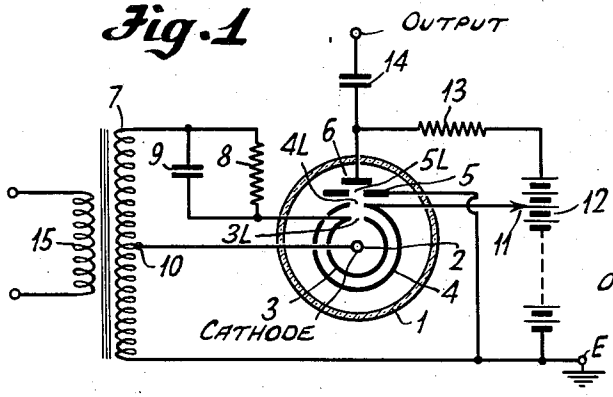


Fig. 3

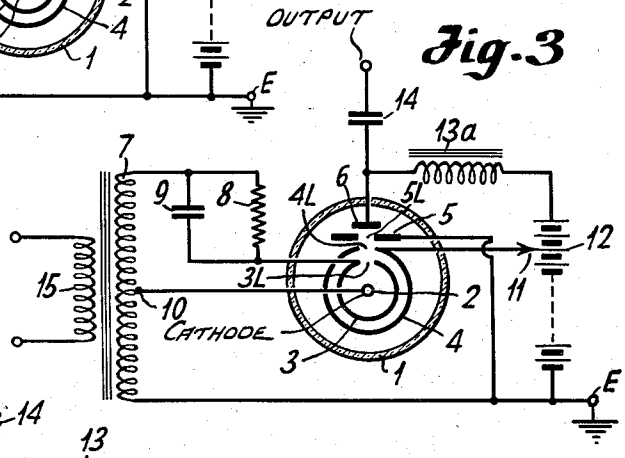


Fig. 5

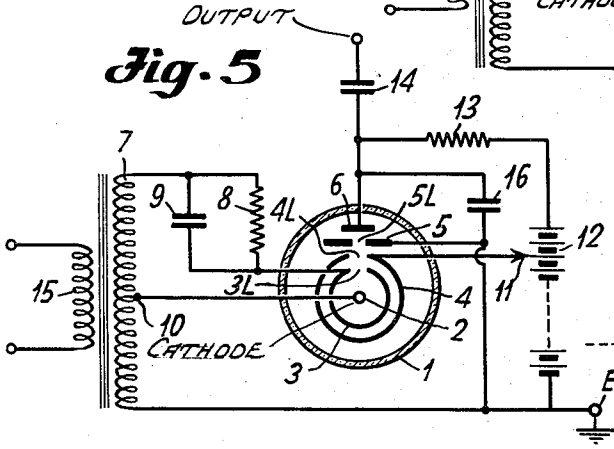


Fig. 2

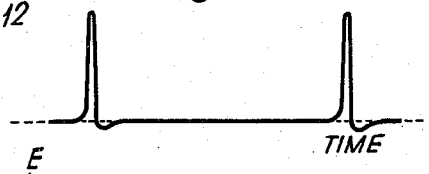


Fig. 4

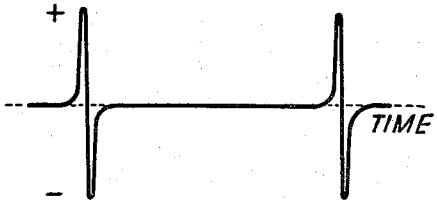
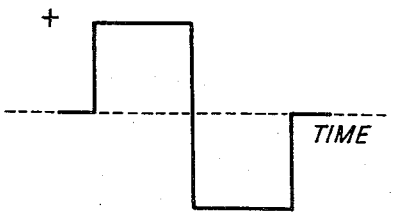


Fig. 6



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ELECTRICAL OSCILLATORS AND TIME BASE CIRCUITS

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5 Claims. (Cl. 250—36)

This invention relates to electrical oscillators and time base circuits and more particularly to electron discharge device oscillators of the so-called blocking oscillator type. The invention is of wide application and may be employed for low frequency as well as for comparatively high frequency. Among its applications are to provide time base circuits for scanning action in cathode ray tube television apparatus and to provide low frequency output for low frequency switching purposes, e. g. in radio direction finder systems.

The so-called blocking oscillator is well known for television scanning control purposes and usually comprises a thermionic valve whose anode circuit is coupled to its grid through a suitable iron-cored transformer. A condenser-grid leak time constant circuit is employed and this is so dimensioned, and the degree of transformer coupling is so chosen, that the grid of the valve is maintained negative during the greater part of each cycle of the natural period of the circuit, but is driven positive for the remaining part with the result that an oscillatory output is obtained, said output having a wave form consisting of steep sided voltage impulses or "pips" each of which endures for only a fraction of a cycle. For television scanning purposes the oscillator frequency is synchronized by applying television synchronizing pulses to the grid circuit. The output from the oscillator is usually applied to a valve having heavy negative bias, the positive pulses from the oscillator being sufficient to drive the said valve into grid current with the result that the rapid rise of anode current in the said valve is sufficient to discharge a condenser which is connected across its anode-cathode circuit so that a sawtooth wave form is obtained. It is highly desirable that the pulses or "pips" provided by a blocking oscillator shall be as steep sides and as of short a duration as possible, and it is also highly desirable that the frequency of the oscillator shall be as free as possible from change due to the application of synchronizing impulses or due to the taking off of output.

The present invention seeks to employ improved blocking oscillator time base circuits wherein these requirements are satisfied to a high degree.

According to this invention a time base circuit of the blocking oscillator type comprises an electron discharge device including a cathode, a control electrode and an output anode; an auto-transformer having its larger winding portion connected in circuit with a time constant circuit between said control electrode and "earth" or "frame" and its smaller winding portion connected between said cathode and "earth" or "frame"; and an output circuit fed from the said output anode.

Preferably the electron discharge device employed is a so-called electron beam valve.

The invention is illustrated in and further explained in connection with the accompanying drawing in which Figs. 1, 3 and 5 show embodiments of my invention and in which Figs. 2, 4 and 6 show the form of the output wave produced by Figs. 1, 3 and a modification of Fig. 1 respectively.

Referring to Fig. 1 which shows diagrammatically one embodiment of the invention, 1 is an electron beam valve as known per se having within its evacuated envelope a cathode 2, a control electrode 3, an accelerator anode 4 which also acts as a screen, a suppressor electrode 5 which also acts as a screen and an output anode 6. The output anode 6 may be in the form of a plate and the suppressor electrode 5 may be in the form of an apertured or slitted plate placed in front of the output anode and having a longitudinal slit therein 5L, the cathode 2 being at the axis of a cylindrical electrode system comprising also the control electrode 3 and the accelerator anode 4, the last two electrodes being incomplete or slitted cylinders with their slits 3L, 4L, aligned with the cathode and with the slit 5L so that, in use, a ribbon-like jet of electrons passes from the cathode through the various aligned slits to the output anode. A valve structure of this nature is indicated in Fig. 1. An iron-cored auto-transformer has one end of its winding 7 connected to "earth" or "frame" E and the other end of its winding connected through a condenser shunted grid leak combination 8, 9, to the control electrode 3. An intermediate tap 10 on the winding is connected to the cathode 2. The suppressor electrode 5 is connected to "earth" or "frame" and the accelerator electrode 4 is connected to a suitable intermediate point 11 on a source of potential 12 whose negative terminal is connected to "earth" or "frame" and whose positive end is connected through an anode resistance 13 to the output anode 6. Output from this oscillator is taken from the output anode through a suitable coupling condenser 14. Synchronizing input may be applied by means of a relatively small coil 15 coupled to the winding 7 of the auto-transformer. Alternatively synchronizing input may be applied across a further resistance (not

shown) interposed between "earth" or "frame" and the adjacent end of the transformer winding 7.

With this arrangement, the wave form generated and the frequency will depend, inter alia, upon the position of the point on the transformer winding to which the cathode is connected, upon the values of grid leak and shunt condenser and upon the dynamic resistance of the auto-transformer.

Owing to the characteristics of an electron beam valve, and in particular to the almost complete isolation of the output anode of such a valve, the coupling between input and output circuits in the arrangement above described is almost exclusively electronic and uni-directional "pips" of either positive or negative polarity can be obtained from the output anode. These "pips" are very peaky and sharp sided in character and may be used to operate a time base electric discharge tube circuit (not shown). A typical output wave form obtainable with an arrangement as shown in Fig. 1 is represented in conventional graphical manner in Fig. 2. Owing to the high degree of isolation of the output anode from the transformer circuit—which is the oscillatory circuit—the frequency and wave form is practically unaffected by the coupling values. As is well known in television receiver technique a short "fly-back" to the usual sawtooth wave scanning impulses is desirable and the oscillator above described, since it will give an extremely sharp and peaky "pip" facilitates the obtaining of very rapid "fly-back."

Either of the above described circuits may be modified by replacing the anode resistance 13 by a choke 13a as shown in Fig. 3. This modification will result in a change in wave form in that each "pip" will now consist of two halves which follow one another without any substantial interval, and one of which is positive and the other negative. With this modified wave form (which is represented conventionally in Fig. 4) the time occupied by one half of a positive and negative "pip" is reduced as compared to the time occupied by the "pip" of corresponding polarity obtained with the arrangements first described. Furthermore, the peak voltage of the "pip" is increased so that with a suitable choice of negative bias on a time base electric discharge tube following the generator, its anode resistance may be lowered for very short periods only, and this again conduces to the obtaining of short "fly-back" time.

In a still further modification (shown in Fig. 5) of the first described arrangements an additional condenser 16 is connected between the output anode 6 and "earth" or "frame" E. With such a condenser connected in circuit, the arrangement operates as a sawtooth wave generator. The voltage "pips" developed at the grid are in a positive direction which increases anode current to a considerable value, thus reducing the anode cathode resistance and discharging the additional condenser 16. Following the completion of a "pip" the anode current is cut off by the negative charge held by the grid leak and condenser combination 8, 9, and this cutting off of anode current enables the additional condenser 16 to be charged in a substantially rectilinear manner through the anode resistance 13 (the resistance should be of high value) thus giving the long sloping side to the sawtooth wave. At the end of this charging period the voltage across the additional condenser is very rapidly reduced to a datum level by the next positive grid "pip" thus giving an almost vertical shorter sawtooth side.

By choosing the intermediate point 10 on the transformer winding 7 to which the cathode is tapped near the grid end of the said transformer winding, the circuit of Fig. 1 may be caused to give substantially or approximately rectangular or square topped wave form output approximately as represented in Fig. 6. Such a wave form is often required for various purposes, for example in certain types of radio direction finders.

What I claim is:

1. A time base circuit of the blocking oscillator type comprising an electron discharge device including a cathode, at least one control electrode and an anode, a point of reference potential, a time constant circuit, an auto-transformer having its larger winding portion serially connected with said time constant circuit between said control electrode and the point of reference potential, and its smaller winding portion connected between said cathode and the point of reference potential, means for biasing said anode positively with respect to the point of reference potential, resistive means connected serially with said biasing means, capacitive means connected substantially in parallel with said resistive means and said biasing means, and an output circuit fed from said anode-cathode circuit.

2. Apparatus in accordance with claim 1 wherein the electron discharge device is an electron beam valve.

3. A time base circuit of the blocking oscillator type comprising an electron beam tube including a cathode, at least one control electrode and an anode, a point of reference potential, a time constant circuit connected in the control electrode-cathode path of said tube, an auto-transformer having its larger winding portion connected serially with said time constant circuit between said control electrode and said point of reference potential, and its small winding portion connected between said cathode and said point of reference potential, means for biasing said anode positively with respect to the point of reference potential, an output circuit fed from said anode-cathode circuit, and means for impressing synchronizing signals from a source external to said oscillator onto the auto-transformer.

4. A time base circuit of the blocking oscillator type comprising an electron discharge device including a cathode, an anode and at least one control electrode, a point of reference potential, a time constant circuit, an auto-transformer having its larger winding portion connected serially with said time constant circuit between said control electrode and said point of reference potential, and its smaller winding portion connected between said cathode and said point of reference potential, means for biasing said anode positively with respect to the cathode and the point of reference potential, means for impressing synchronising signals from a source external to said oscillator onto the auto-transformer, and an output circuit fed from said anode-cathode circuit.

5. Apparatus in accordance with claim 4, wherein there is provided in addition inductive means connected serially with the anode biasing means in the anode-cathode path of said tube.

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