July 17, 1934. P. B. F. DAVID 1,966,616

GENERATING OSCILLATIONS DEVICE

Filed Nov. 5, 1930

Fig. 4

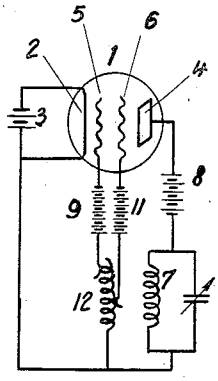


Fig. 5

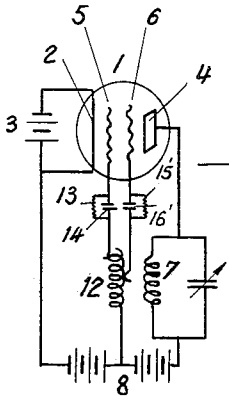


Fig. 1

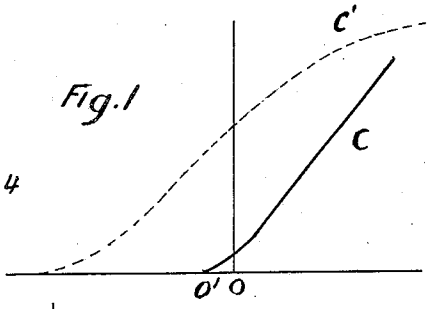


Fig. 3.

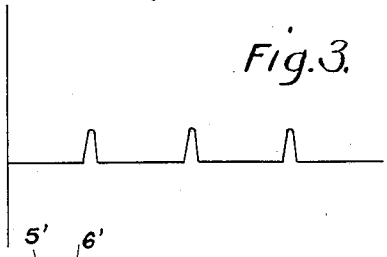


Fig. 6

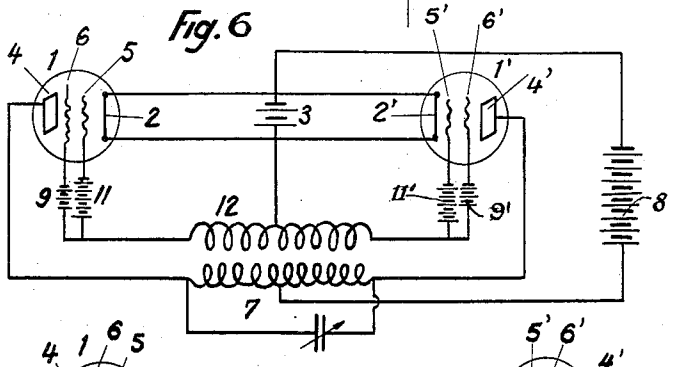


Fig. 7

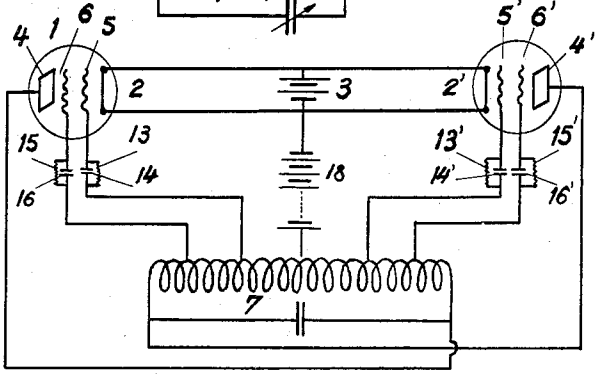
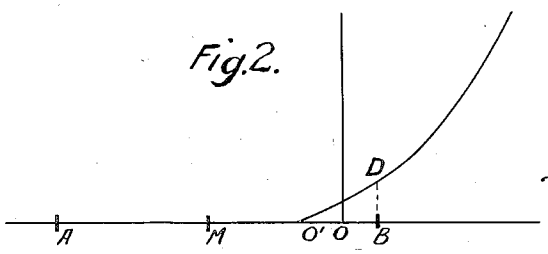


Fig. 2.



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GENERATING OSCILLATIONS DEVICE

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In France November 23, 1929

4 Claims. (Cl. 250—36)

A number of ways are known in which to connect three electrode valves in circuits including inductance and capacity for the purpose of generating oscillations.

In these circuits the frequency generated is in the neighbourhood of the frequency proper to the circuit but not exactly equal thereto. A slight difference exists between them, variable with the heating, the potential applied to the plate, the resistance of the circuit etc., which gives the emissions a certain very objectionable irregularity which may exceed the hundredth part of the frequency.

It is known to diminish this drawback somewhat by imparting a negative bias to the grid, either by means of a special battery or by inserting a high resistance in its circuit shunted by a condenser such as to allow the oscillations to pass. In effect, since the grid current becomes appreciable as soon as the grid is positive, the fall of potential across the resistance automatically lowers the mean potential of the grid.

Finally valves are known which have more than one grid and which in general fulfill different functions.

For example one of the grids receives the impulses to be amplified or detached whilst the other which is kept at a fixed potential acts on the space charge and diminishes the internal potential of the valve. Again one of the grids is connected to the aerial, whilst the other is connected to the plate to produce local oscillations which act with the oscillations received to produce a change in frequency.

Bearing these various points in mind the present invention has for its object to provide a method of connecting a two grid valve to generate particularly stable oscillations, that is to say so that the accidental variations of frequency resulting from variations in the potential supplied, or replacement of valve etc., are very considerably reduced in general to something of the order of one hundred thousandth of the frequency produced.

This method of connection consists in giving the same control function to both grids. Several elements are arranged in such manner that the electrons must traverse them successively in the path from the filament to the anode. This provides a regulating field which is not simply a surface but a volume.

The different elements are all coupled to the plate circuit and partake of the same variations of alternating potential, with different biases.

Without entering into the theory of valves of this kind which is doubtless very complicated, it is conceivable that the control effect exerted on the electronic current by a single grid should be strengthened and multiplied by traversing several grids in succession. If for example the characteristic is drawn for the plate of a valve so connected, it is found to be of the form C of Figure 1. By comparison with the curve C′ for an ordinary valve, it will be seen that the amplification is increased, since the curve rises more steeply, but above all that it is much more sharply bent and that the plate current commences only at considerably high grid potentials.

Similar observations could be made concerning the characteristics of the grid. As soon as the potential becomes positive the two grids which are connected take a considerable current which is evidently greater than is taken by a single grid.

Now very pronounced bends in the characteristic are extremely favourable to the stability of the frequency because they make the currents vary considerably from the sinusoidal form.

For example suppose AB is the amplitude of the alternating variation of the grid potential (Figure 2). Suppose a considerable resistance is inserted in the grid circuit. As soon as the instantaneous potential becomes positive a current passes and a potential drop is produced across the resistance. The mean potential decreases to approximately the value OM. The plate current is therefore strictly zero thoughout the greater portion of the period (distance AO′). Current passes only during a very short interval (distance O′B). Its form is therefore that indicated in Figure 3 having extremely short peaks. This is what is observed when examining the current by oscillograph.

The result of this is that the oscillations are generated by very short impulses applied to the oscillatory system and this is precisely the ideal condition required in order not to disturb the natural frequency, a condition that is always aimed at particularly in the case of pendulums. The arrangement herein disclosed enables this effect to be obtained in a very much more marked degree than the present arrangements, giving appreciable power at low potentials.

It is to be observed that similar phenomena can be produced with an ordinary valve having a simple grid, but if it is desired to impress a true impulse on the oscillating circuit it is necesscary to reduce the time during which the anode current I passes with the flattened form of the characteristic C′ (Fig. 1) and this necessitates maintaining the grid at a strongly negative mean

potential, and leads to this current's having such small maximum values that the oscillating current generated by the valve is of insignificant intensity. With the device according to the invention the sharply bent form of the characteristic C permits a considerable maximum value of the current I to be obtained even if the period of time corresponding to the length OB of Figure 2 is very small.

The system of connection according to the invention can be applied to different kinds of oscillators and particularly to "symmetrical" or "push pull" circuits which present advantages for very short waves, but are subjected to the same variations of frequency.

The following description and the accompanying drawing illustrate by way of example different ways of carrying out the invention.

Figures 1 to 3 are curves explaining the operation of the valve.

Figures 4 and 5 show two circuits for a two grid valve of which the grids are at different constant potentials.

Figures 6 and 7 show two circuits of the type known as "push pull".

The valve (Figure 4) comprises an envelope 1 in which is a filament 2 heated by current from a battery 3, a plate 4 and two grids 5 and 6. The plate is connected to the filament through an oscillatory circuit 7 and a battery 8. The grids are connected to the filament in different ways through inductances 12 connected to the oscillatory circuit 7. According to the arrangement shown in Figure 4, each of the grids is maintained at a negative potential relative to the filament by means of special batteries 9 and 11, the positive poles of these being connected to two different variable points along the inductance and thence to the oscillatory circuit 7, the inductance 12 being connected directly to the filament.

Figure 5 shows a modification of the above described circuit in which the inductance 12 is connected to an intermediate point of a battery 8 and in which the batteries 9 and 11 are replaced by resistances 13 and 15' shunted by condensers 14 and 16' for lowering the potential of the grids.

As long as no oscillation is generated, the grids have potentials which are positive relatively to the filament, but by giving a great enough value to the resistances 13 and 15', it is possible to cause the oscillating potentials of the grids to keep negative mean values.

Figures 6 and 7 show how a two grid valve may be employed in a push pull circuit.

In Figure 6, the two grid valves 1, 1' have the grids polarized by batteries 9, 11 and 9', 11', respectively. The grids of each valve are connected at the extremities of the coil 12, the middle of which is connected to the filaments and which is coupled to the circuit 7 connecting the two plates and connected by the mid-point of the inductance to the anode battery 8.

Figure 7 shows a modification of the same circuit. The coil 12 is omitted and the grids are connected to different points of the inductance of the circuit 7. The negative bias or polarizing batteries are omitted and replaced by resistances 13, 15, 13', 15' shunted by condensers 14, 16, 14', 16'.

This arrangement has the advantages that it requires only one inductance coil.

The last two arrangements to be described are particularly suited for short waves.

I claim:—

1. An oscillations generating device of the type wherein an oscillatory circuit is excited by short impulses of current, comprising a vacuum tube, inside said tube a heated filament, a plate, and two grids arranged between said filament and said plate, an electric potential supply, means for connecting the negative pole of said supply with said filament, and the positive one with said plate, circuits connecting said two grids to said filament, an oscillatory circuit in the plate circuit, means for coupling this oscillatory plate-circuit to the two grid-circuits in such a manner that this coupling is sufficient to set up and maintain steady oscillations, means for applying to both grids different biasses, the mean values of which are constant and negative during oscillation.

2. An oscillations generating device of the type wherein an oscillatory circuit is excited by short impulses of current, comprising a vacuum tube, inside said tube a heated filament, a plate, and two grids arranged between said filament and said plate, an electric potential supply, means for connecting the negative pole of said supply with the filament, and the positive one with the plate, circuits connecting said two grids to said filament of an oscillatory circuit in the plate-circuit, means for coupling this oscillatory plate-circuit to the two grid circuits in such a manner that this coupling is sufficient to set up and maintain steady oscillations, two batteries arranged for applying to both grids different biassing potentials, the mean values of which are constant and negative during oscillation.

3. An oscillations generating device of the type wherein an oscillatory circuit is excited by short impulses of current, comprising a vacuum tube, inside said tube a heated filament, a plate, and two grids arranged between said filament and said plate, an electric potential supply, means for connecting the negative pole of said supply with the filament, and the positive one with the plate, circuits connecting said two grids to said filament, an oscillatory circuit in the plate circuit, means for coupling this oscillatory plate-circuit to the two grid circuits in such a manner that this coupling is sufficient to set up and maintain steady oscillations, between each grid and the said filament a condenser shunted by a resistance, the values of these elements being such that during oscillation the mean values of the two grid potentials are constant, negative and different one from the other.

4. A push-pull oscillations generating device comprising two vacuum tubes having each a heated filament, a plate, and two grids arranged between said filament and said plate, an oscillatory circuit comprising an inductance coil and a condenser connected in parallel, means to insert said circuit between the plates of said vacuum tubes, means for connecting the filaments to the middle point of the inductance coil, means for connecting the grids with different points of said induction coil, and means for maintaining during oscillation the potentials of both grids of each tube at negative mean values, which are constant and different one from the other.

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