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BY A. P. C.

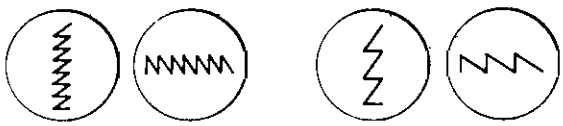
H. DE FRANCE

SYSTEMS FOR USE IN CONNECTION WITH TELEVISION AND THE LIKE

Filed Nov. 6, 1942

Serial No. 464,750

3 Sheets-Sheet 1



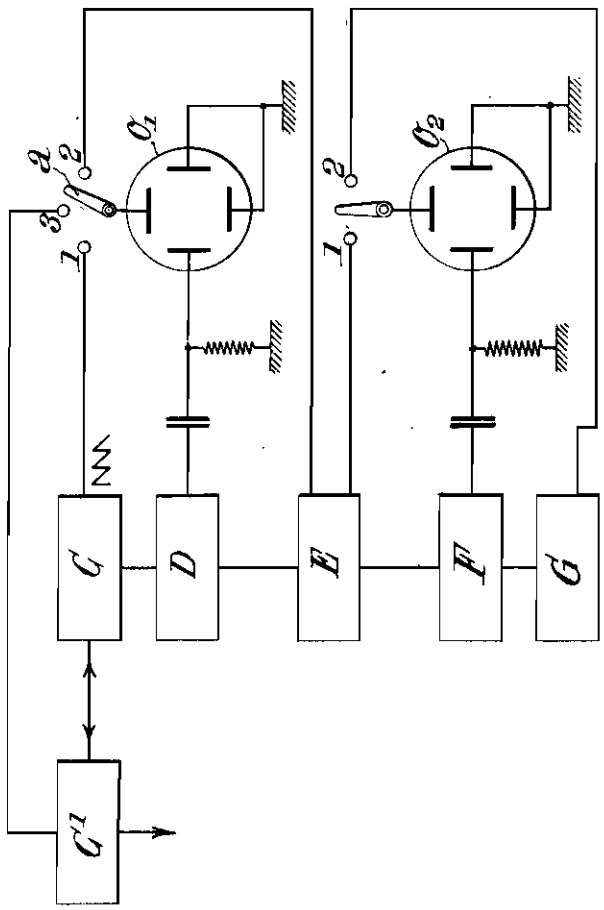


Fig.6

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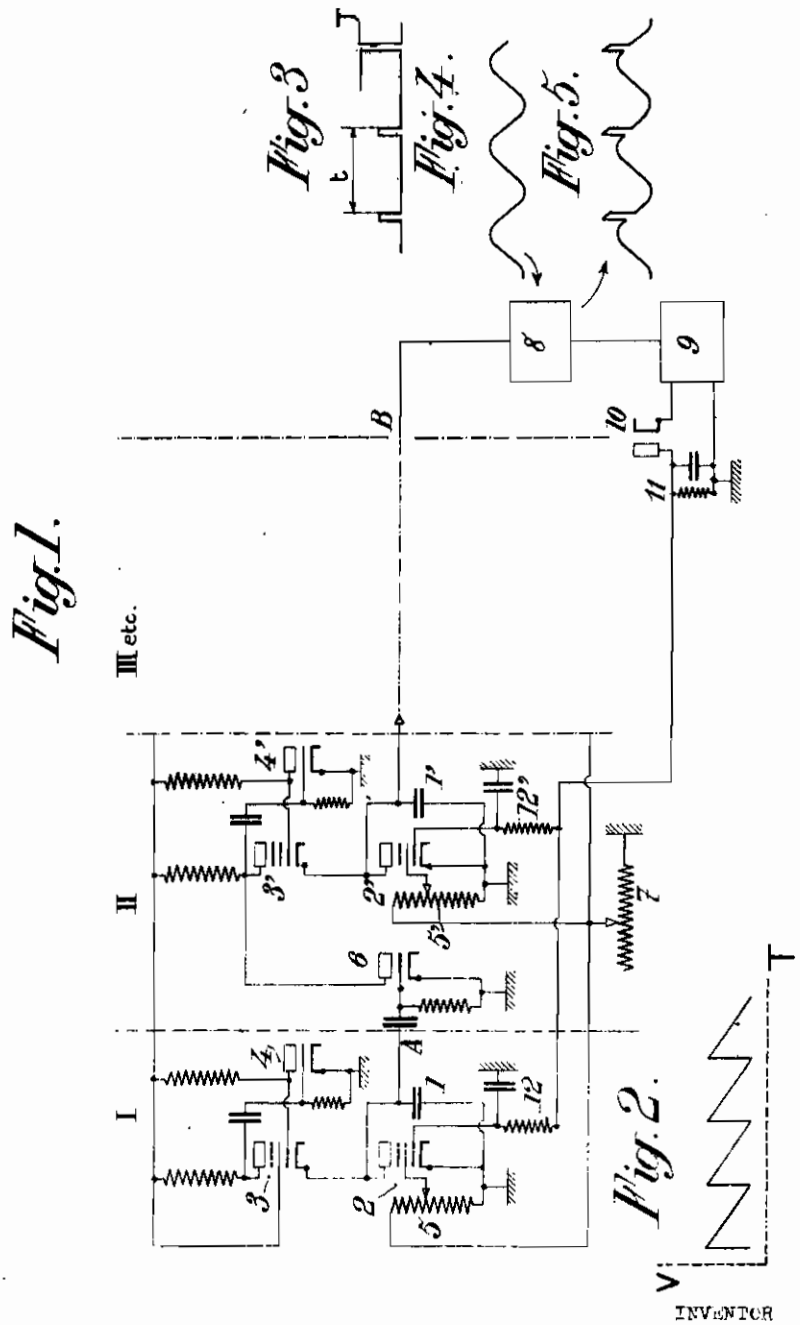

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Fig. 7

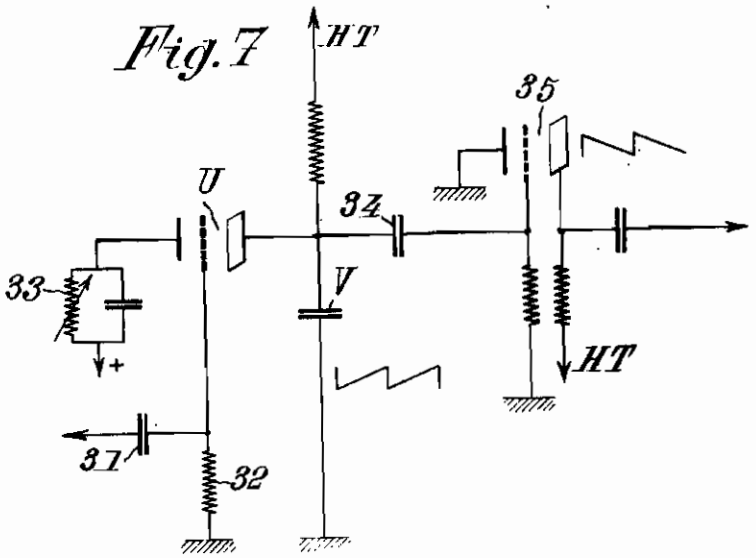
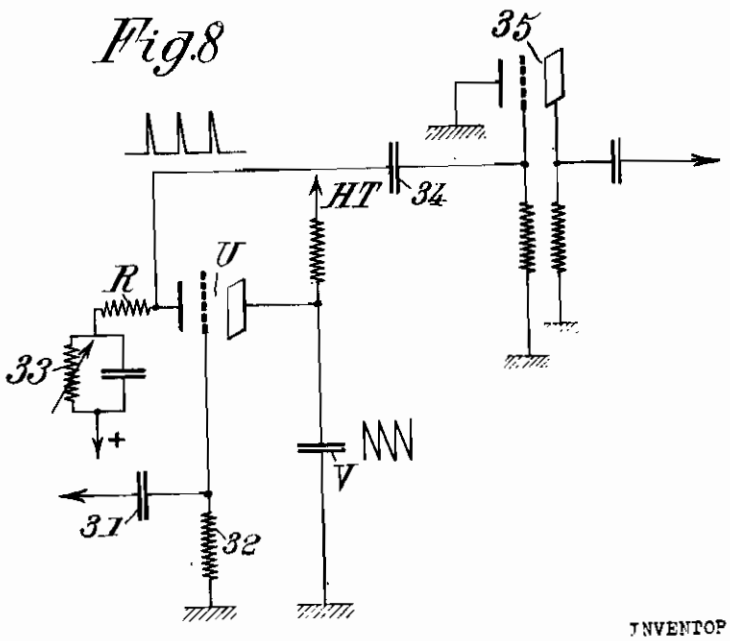


Fig. 8



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ALIEN PROPERTY CUSTODIAN

SYSTEMS FOR USE IN CONNECTION WITH TELEVISION AND THE LIKE

Henri de France, Lyon, Rhone, France; vested in the Alien Property Custodian

Application filed November 6, 1942

The present invention relates to systems for use in connection with television and the like.

An object of the invention is to provide an oscillation generator systems, with means and methods for the adjustment thereof, to be more especially, although not exclusively, applied to the transmission of television picture and line signals, such a system being better adapted to meet the requirements of practice than those used for the same purpose up to the present time, and being in particular more stable.

With this object in view, according to a feature of the present invention, in systems of the frequency demultiplier kind, that is to say systems including a plurality of oscillators cooperating together so as to supply at least two utilization frequencies affording a given ratio of demultiplication or multiplication, I have recourse, in order to adjust the frequencies of the various oscillators, to means adapted to act simultaneously on those of their respective elements upon which the successive frequencies that are produced depend, so as imperatively to maintain the ratios of said frequencies, and, in particular, I impress perfectly determined and adjustable voltages upon said elements, for instance by means of a potentiometer common to the various oscillators.

According to another feature of the invention, relating to systems of the type above referred to, for producing at least one given frequency, especially those for television picture and line signals, I superpose to this frequency a standard frequency (for instance that of an alternating current distribution system), and I cause the resultant frequency to react (preferably after detection) on the elements of said system upon which depends the frequency to be produced.

Another object of the present invention is to provide a frequency demultiplier or multiplier which maintains the frequency conversion ratio in a more accurate manner than in the systems used for the same purpose up to the present time.

With this last mentioned object in view, according to a feature of my invention, I have recourse to a series of oscillators connected to one another according to multiples or sub-multiples of the fundamental frequency, the oscillations being preferably of the saw teeth type in order to increase the accuracy of the synchronism, and I combine with such an assembly means for controlling the frequency conversion ratio, these means including at least one oscillograph the series of plates of which can be coupled at will respectively with at least two of the oscillators, so as to bring into light the synchronism, according to the appearance of the resultant curve.

Other features of the present invention will result from the following detailed description of some specific embodiments thereof.

Preferred embodiments of the present invention will be hereinafter described with reference to the accompanying drawings, given merely by way of example, and in which:

Fig. 1 is a diagram of a system for the transmission of synchronisation signals for television, this system being made according to the invention;

Fig. 2 is a curve illustrating the saw-teeth voltage supplied by the first stage of the system of Fig. 1 and the frequency of which is to correspond to that of the line signals;

Fig. 3 is a curve similar to that of Fig. 1 illustrating the production of the picture synchronizing signals obtained at the output end of the systems;

Fig. 4 is a curve illustrating the voltage of an alternating current distribution system to be superposed, according to a feature of the invention, to the picture synchronizing signals produced by a system of the kind of Fig. 1;

Fig. 5 is a similar curve illustrating the result of this superposition of voltages;

Fig. 6 diagrammatically shows the whole of a line and picture frequency generating system for use in television, and of a device for the control of the frequencies, this arrangement being made according to the invention;

Fig. 7 diagrammatically shows the relaxation tubes which can advantageously be used in such a combined system according to the present invention;

Fig. 8 is a view, similar to Fig. 7, showing similar tubes made according to a modification.

I will first describe a system according to the invention for the production of oscillations for transmitting synchronizing signals (corresponding to pictures and lines) for television.

First, it should be reminded that it is known in the art to make use, for this transmission, of a series of multi-vibrators or relaxation oscillators the first of which supplies the frequency which is to correspond to the scanning of the lines (for instance $441 \times 50 = 22050$, if it is desired to obtain 441 lines in each picture and 50 pictures per second) while the others are synchronized to frequencies which are sub-multiples of the first, so as finally to supply the frequency of the picture synchronizing signals, to wit 50 per second.

For instance, in a given arrangement, the system includes, after the first oscillator, tuned to the frequency of 22050 per second, four oscillators respectively synchronized to the following frequencies:

$$\frac{22050}{7}=3150;\ \frac{3150}{7}=450;\ \frac{450}{3}=150;\ \text{and}\ \frac{150}{3}=50$$

However, this kind of arrangement involves a certain number of disadvantages. In particular, if the frequency of the first oscillator varies by a value equal to $\frac{1}{7}$ of its value, due for instance to a voltage adjustment, the second oscillator suddenly ceases to correspond to the sub-harmonic of order 7 so as to correspond to the adjacent sub-harmonic of order 6 or 8, whereby the scanning is wholly modified.

In order to obviate these drawbacks, according to the invention, the respective oscillators are caused to coact with regulating means such that they imperatively maintain the ratios between the successive frequencies.

For instance, if the frequency of each of said oscillators depends upon the discharge speed of a condenser, as it is the case with oscillators or multi-vibrators of the relaxation type, this speed being itself a function of a voltage impressed, for instance, upon one of the electrodes of the tube or of one of the tubes of the corresponding oscillator, said means will consist in regulating the above mentioned voltages of the respective oscillators from a common device, such for instance as a potentiometer.

It goes without saying that such a result can be obtained in many different manners depending in particular upon the nature of the oscillators that are utilized.

In Fig. 1, I have shown a group of multi-vibrators or relaxation oscillators, of a type known in itself, the first two oscillators only being visible on the drawing.

Compartment I contains the main oscillator. Condenser 1 discharges slowly into pentode tube 2, and it is charged suddenly through tube 3 during the short time for which the latter is not fully blocked by its polarization. An auxiliary tube 4 may be provided, as it is known, for accelerating the beginning of the charge. Finally, the discharge speed, which determines the frequency, is initially regulated through any known means, for instance by adjusting the screen voltage of tube 2, which determines the value of the plate current. This adjustment is effected by means of a potentiometer 5 or through any other means.

Finally, I obtain, at the output end of the first compartment, at A, a voltage which has, for instance, the saw-teeth shape illustrated by Fig. 2 and which is utilized for the line synchronizing signals, its frequency having been suitably adjusted for this purpose.

Compartment II, which is connected to the first compartment through a capacity or other coupling, includes similar elements 1', 2', 3', 4', as the first compartment. However, the capacity of condenser 1' is greater in such manner as to supply a lower frequency, with the demultiplication ratio that has been chosen. Furthermore, in order to transmit the voltage of compartment I, there are provided means such as a tube 6 or the like for ensuring synchronizing, by frequency demultiplication, of compartment II with compartment I.

Compartments III, IV, etc. in turn supply demultiplied frequencies. The last one produces, at its output end, at B, a voltage at the frequency of the picture synchronizing signals, for instance 50 per second and in a form illustrated by the curve of Fig. 3.

Such a system having been provided, it is then combined, as above stated, with a common adjustment potentiometer, through which the individual potentiometers 5, 5', etc. are fed, instead of having them controlled, in the usual manner, by the high frequency of the station.

It will be readily understood that with this adjustment common to the various compartments, it is possible simultaneously to vary the respective discharge of condensers 1, 1', etc., by proportional amounts, which also ensures proportional displacements of all the intermediate frequencies of the system.

Thus is ensured the maintaining of the ratio of the extreme frequencies, but it should be well understood that all other assemblies giving the desired result might as well be employed according to the invention.

Such a system can be employed such as above explained, but, advantageously, I further make use of other features such as the following, which might eventually be employed separately.

According to one of these features, which will be supposed to be applied to a system of the type above described, I have recourse, for stabilizing the frequencies generated by said system, to means utilizing the superposition of a standard frequency for reacting, in a suitable manner, upon the elements upon which depends the value of said frequencies.

Thus, considering the voltage of the picture synchronizing signals, obtained at the output end of the system at B, which, in the example that has been chosen, varies at a frequency which is supposed to be of 50 periods,

a. there is superposed to this voltage, by means of a suitable mixing device 8 of a known type, the alternating sinusoidal voltage of a distribution system of 50 periods frequency (Fig. 3), this superposition giving rise to a combined voltage as illustrated by Fig. 4;

b. there is effected, through any suitable means, a detection of the tops of the curve of this resultant voltage which detection is to produce a constant rectified continuous voltage, if both of the component frequencies remain the same, but, on the contrary, a variable voltage if dephasings take place due to variations between these two frequencies, and

c. the voltage that is obtained is caused to act upon at least one of compartments I, II, etc. or upon each of these compartments, and that through one of the elements upon which the frequency depends, for instance the control grids of tubes 1, 1', etc., as shown by the drawing.

In the example illustrated by the drawing, it has been supposed that detector 9 includes a diode tube 10 and that the negative rectified voltage 11 is utilized for polarizing, with suitable couplings shown at 12, 12', etc., said control grids, the whole being arranged in such manner that an action is obtained upon the discharge speed of condensers 1, 1', etc. in a correcting direction, that is to say in such manner as to bring the final frequency of signal B to a value equal to that of the distribution system.

In order to obtain this result, it suffices that, if the signals succeed one another at time intervals shorter than it is desired, the discharge speed of I should be reduced, which corresponds to tube 2 being more polarized, that is to say the absolute value of negative voltage 11 being in-

creased. Now, an examination of Fig. 4 shows that this is what takes place when the signals tend to move toward the left, since the maximum ordinate of their tops then tends to increase.

Whatever be the particular arrangement that is chosen, I obtain a system the operation of which results sufficiently clearly from the preceding explanations for making it unnecessary further to describe it. This system has, over those existing at the present time, many advantages, and in particular that of ensuring a better stability of the frequency.

On the other hand, it is known that, in a television system, it is necessary to obtain a very sharp synchronism relation between the two extreme frequencies, that is to say, in particular, the frequency of the lines and the frequency of the pictures, the second of which must be, very accurately, a sub-multiple of the first. The degree of synchronism that is required is especially important with the interlacing method, the efficiency of which is wholly nullified if the end of a picture, for instance, is not obtained for exactly the same position of a line of a given number.

According to a feature of the present invention, in order to obtain the desired result, the whole of the oscillator system is first arranged in such manner as to include a fundamental generator coupled with a series of generators of respective sub-multiple frequencies, which are interrelated to one another, as precedingly described.

These generators are preferably such that they supply a saw-teeth curve because such an arrangement permits of increasing the accuracy and the stability of the interrelation between the generators, and therefore the synchronism.

It suffices to utilize for this purpose any known device, of the relaxation or other type with ordinary tubes mounted as multivibrators or tyratrons.

If it is supposed, by way of example, that it is desired to obtain, in the interlacing method, an analysis corresponding to 441 lines and 50 half pictures per second (therefore 25 complete pictures per second) I may make use of a fundamental generator C (Fig. 6) giving a frequency of:

$$f=441\times 50=22.050 \text{ cycles}$$

and to which are successively connected generators D, E, F, G; giving the following sub-multiple frequencies:

$$\frac{22050}{7}=3150$$

$$\frac{3150}{7}=450$$

$$\frac{450}{3}=150$$

$$\frac{150}{3}=50$$

the last one giving the picture frequency.

Instead of making use of a fundamental generator of a frequency equal to f, I might make use of another generator of different frequency, for instance

$$\frac{f}{2}$$

as shown at C' on Fig. 6.

In Figs. 7 and 8, I have shown, merely by way of example, two mountings corresponding to the use of tyratrons.

According to the embodiment of Fig. 7, the synchronizing signals coming from the preceding generator are applied to the grid of tyratron U through a condenser **31**. The leak resistance is shown at **32** and adjustment resistance at **33**. The plate of the tyratron which is connected with high voltage HT through an adjustment resistance, returns to the mass through a condenser V. The cathode circuit is positively polarized. The saw-teeth signals coming from said plate (and diagrammatically shown on the drawing) are then transmitted through a condenser **34** to the grate of a tube **35** which feeds, with the usual phase difference of 180°, a saw-teeth current (also shown by the drawing). These signals are finally transmitted to the next generator and so on.

Fig. 8 shows an analogous system in which the same reference numerals designate the same elements. The only difference lies in the fact that the signals, indicated on the drawing result from the practically instantaneous charge and discharge of cathode U. By using preferably in the cathode circuit a resistance R, I obtain in said circuit very short signals (top of Fig. 8) corresponding to the successive discharges of condenser V; these signals are utilized for synchronizing the next generator.

Such systems produce saw-teeth curves of very sharp shape which are well adapted to the desired purpose.

With a series of such generators or any analogous arrangement, I combine means for checking the accuracy of the synchronism, that is to say the demultiplication, which means are constituted by at least one cathode oscillograph the plates or series of plates of which may be coupled at will with at least two of the various generators. I can thus bring into light the synchronism that is obtained, in accordance with the aspect of the resultant curve visible in said oscillograph.

For instance, considering such an oscillograph O^1 (Fig. 6) and supposing (also by way of example) that two of the plates of said oscillograph are earthed, it will be seen that if the two other plates are respectively connected to generators C and D, I obtain on the screen of the oscillograph a Lissajou curve which, when the demultiplication 1/7 is ensured in an exact manner, must be constituted by seven teeth, for instance, in the horizontal direction (that is to say with sharp vertical ridges).

If now, without modifying the connection between generator D and the corresponding deviating plate, I connect the other plate to generator E, I must obtain, under the same conditions, a resultant curve having seven teeth, in the vertical direction.

Of course, it is advantageous, in order to permit of working quickly, to make use of a switch such as a, including a suitable number of contact studs, for instance three, if it is desired to be able to check the synchronism between C and C', when a generator such as C' has been provided.

The same checking operation can be performed with the following generators such as E, F, G, and this either with another oscillograph O^2 as shown, or by means of the same oscillograph O^1 associated with the switch a including a suitable number of contact studs.

Anyway, whatever be the particular embodiment that is finally chosen, I obtain a system the operation of which results sufficiently clearly from the preceding operations for making it unnecessary to enter into further details.

This system has over prior systems used for the same purpose, the following advantages:

(a) it ensures an easy, quick and very exact checking of the demultiplication ratio, that is to say of the synchronism; and

(b) it renders that synchronism more effective, owing to the saw-teeth shape of the oscillations, which permits of connecting the various generators with one another in a safe number.

Of course, I may utilize supplementary synchronizing means, for instance such as described in Figs. 1 to 6.

In a general manner, while I have, in the above description, disclosed what I deem to be practical and efficient embodiments of the present invention, it should be well understood that I do not wish to be limited thereto as there might be changes made in the arrangement, disposition and form of the parts without departing from the principle of the present invention.

HENRI DE FRANCE.

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Of course, I may utilize supplementary synchronizing means, for instance such as described in Figs. 1 to 6.

In a general manner, while I have, in the above description, disclosed what I deem to be practical and efficient embodiments of the present invention, it should be well understood that I do not wish to be limited thereto as there might be changes made in the arrangement, disposition and form of the parts without departing from the principle of the present invention.

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