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METHOD OF PRODUCING CARRIER FREQUENCIES

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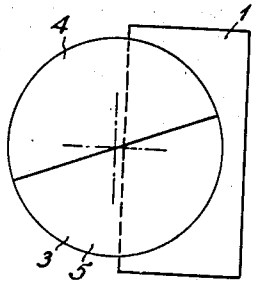


Fig. 1.

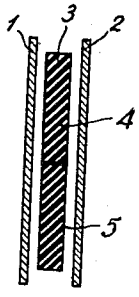


Fig. 2.

Inventor:
Heinrich Hornung
by R. C. Hofgood
Attorney

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METHOD OF PRODUCING CARRIER FREQUENCIES

Heinrich Hornung, Berlin-Tempelhof, Germany, assignor to C. Lorenz Aktiengesellschaft, Berlin-Tempelhof (Germany), Lorenzweg

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3 Claims. (Cl. 175—41.5)

In order to produce an electric carrier frequency two frequencies may be caused to interfere with each other so as to generate a so-called beat frequency, or a frequency may be modulated with another and either the lower side band or the upper may be used as the carrier. In the latter method the frequency generator whose frequency is modulated is controlled mechanically, as by a quartz, for example, whilst the frequency generator whose frequency serves for the modulation has no such mechanical control. The frequency of this generator on the one hand is variable while on the other hand it is as far as possible maintained constant by additional means, such as oscillatory circuits independent of temperature, or by arranging casings dependent upon temperature, or also by keeping constant the anode voltage in the case of indirect heating, etc.

The invention has for its object to obviate frequency variations which are due to variations of temperature. In accordance with the invention this problem can be solved by so choosing the temperature coefficients of the frequency generators, that is, the temperature coefficients determining the frequency, as to compensate for frequency variations caused by differences of temperature. In the beat method the temperature coefficients must be of the same sign and the frequency variations must be of the same magnitude. In the modulation method the temperature coefficients must be of the same magnitude but of different sign if the upper side band is used. If, however, the lower side band is used then the temperature coefficients must be equal to one another in magnitude and sign. Frequency variations can thus be avoided in a simple manner even if the temperature differences are great for the following reasons:

If f denotes the desired frequency, f_1 the frequency of the first generator, f_2 that of the second generator then in the case of the beat method there is the relation

$$f=(f_1+\Delta f_1)-(f_2+\Delta f_2).$$

If the values Δf_1 and Δf_2 are made equal to each other they cancel out if the brackets in this expression are solved. The desired frequency f is the same at all temperatures. Such is the case if the temperature coefficients are of the same sign and if the frequency variation is of the same magnitude.

If, however, the modulation method is adopted the following considerations apply.

If f_Q is the frequency of the mechanically controlled generator, f_V the frequency of the variable generator, t the temperature, and if α, β are the temparture coefficients, then the relation

$$f=f_Q(1\pm\alpha t)+f_V(1\mp\beta t)$$

is valid if the upper side band is used as the carrier.

If the frequency is required to be constant at all temperatures then $f_Q\alpha t$ and $f_V\beta t$ must cancel each other.

When using the lower side band the relation is as follows:

$$f=f_Q(1\pm\alpha t)-f_V(1\pm\beta t).$$

The generation of one frequency by means of two separate generators is known in the art whereby the frequency determining elements are selected so as to mutually compensate for frequency variations. These frequency determining elements of the oscillating circuits may then be subjected to temperature variations without providing any means for the purpose of maintaining the temperature constant. The condition for an unobjectionable functioning of this arrangement, however, necessarily requires the selection of the temperature coefficient in such a manner that the frequency variations of both oscillators are of equal magnitude, and that the frequency determining elements of both oscillators present at any instant the same temperature.

From the two frequencies generated by said oscillators, a third desired frequency may be derived according to different methods, viz. as a difference between the two frequencies, as the sum of these frequencies or as a modulation product from one of these frequencies and another frequency, whereby either the upper or the lower side frequency is utilized.

In order to effect the novel method the temperature coefficients are regulated with the aid of certain means. For instance, tuning elements variable by bimetallic arrangements, or condensers with regulable temperature coefficient are suitable for this purpose. Such condensers have two metallic coatings opposite each other and a dielectric which for example is a disc having in part a positive and in part a negative temperature coefficient. According to whether more of the dielectric having the one temperature coefficient or more of the material having the other temperature coefficient is turned into the space between the condenser coatings a temperature coefficient will be obtained which is more or less in one sense or the other. The two oscillation generators of this construction are subjected to the same temperature differences, that is to say, are disposed in the same room in order that in the event

of temperature variations both generators shall be influenced by the same variations of temperature.

Figs. 1 and 2 show, respectively, a side elevation and a vertical cross-section of embodiments of the invention. Reference numerals 1 and 2 indicate the plates of a condenser between which a disc 3 of dielectric material is rotatably arranged. The disc 3 consists of two different dielectric materials which present opposite temperature coefficients. The portion 4 may for instance consist of a ceramic material known as "Condensa N" which presents a negative temperature coefficient, while the portion 5 may consist of a ceramic material known as "Tempa S" and which has a positive temperature coefficient. The temperature coefficient of the dielectric is defined by the following formula:

$$\frac{d\epsilon}{dt}\cdot\frac{1}{\epsilon}$$

in which ϵ denotes the dielectric constant and $d\epsilon$ indicates the change of the dielectric constant in relation to the temperature change dt. Since the capacity of a condenser having a dielectric material interposed between the plates is proportional to the dielectric constant of this material and since the dielectric constant presents the above stated relationship to temperature, the capacity of the condenser also changes in proportion to the dielectric constant and is thus dependent on temperature. For instance, the more the dielectric with positive temperature coefficient is extended within the space between the condenser plates, the more positive the temperature coefficient of the condenser is made. In the reversed sense, the temperature coefficient of the condenser gets more negative, the more the dielectric having a negative temperature coefficient is prevailing within the space between the condenser plates.

The invention allows of employing simple transmission arrangements. All that is necessary to such end is that the two oscillation generators have the stated properties.

What is claimed is:

1. A condenser comprising two metallic coatings and a plural part dielectric means movable therebetween to different extents to adjust the temperature coefficient of said condenser, said parts having different temperature coefficients.

2. A condenser according to claim 1 wherein said dielectric means comprises a rotatably mounted disc having in part a positive and in part a negative temperature coefficient.

3. A condenser comprising two metallic coatings and a dielectric having a part of positive temperature coefficient and a part of negative temperature coefficient, said dielectric being adjustably positioned so that the proportion of positive to negative temperature coefficient material between said coatings may be varied to give the condenser a desired temperature coefficient.

HEINRICH HORNUNG.