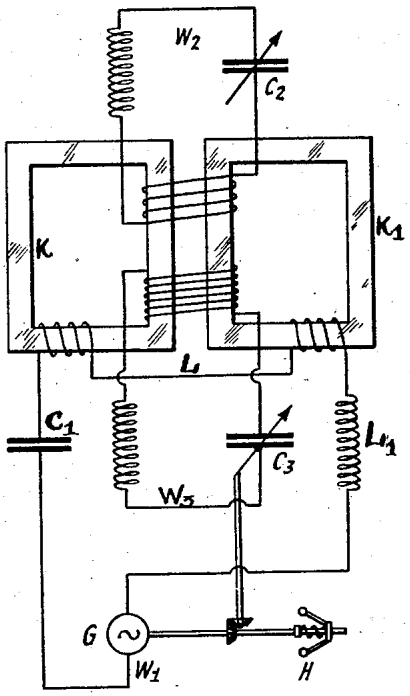
Aug. 23, 1927. 1,639,695

K. HEEGNER

ARRANGEMENT FOR THE REGULATION OF THE FREQUENCY IN FREQUENCY CHANGERS

Filed Oct. 23, 1925



INVENTOR
KURT HEEGNER
BY
ATTORNEY

Patented Aug. 23, 1927. 1,639,695

UNITED STATES PATENT OFFICE.

KURT HEEGNER, OF BERLIN, GERMANY, ASSIGNOR TO GESELLSCHAFT FUR DRAHTLOSE TELEGRAPHIE M. B. H., OF BERLIN, GERMANY, A CORPORATION OF GERMANY.

ARRANGEMENT FOR THE REGULATION OF THE FREQUENCY IN FREQUENCY CHANGERS.

Application filed October 23, 1925, Serial No. 64,321, and in Germany October 31, 1924.

The present invention relates to the regulation of the frequency of an oscillating circuit and is designed to produce a system for automatically maintaining the frequency of such a circuit substantially constant.

It is a well-known fact (see my copending application 51,000 filed August 18, 1925) that if several oscillation circuits be coupled to one or more iron cores, while the iron is magnetized by an alternating current supplied from an alternator, self-excited oscillations are set up in the oscillation circuits whenever the sum total of the natural frequencies of the oscillation circuits is equal to an even multiple of the alternator frequency. This method, as will be noted, is used for the production of frequencies higher or lower than the alternator frequency. One of the simplest forms of construction of such an arrangement for oscillation generation is obtained by connecting an iron-core to three circuits, one of which circuits has the generator frequency W_1, while the two others are oscillation circuits whose natural period is equal to W_2 and W_3. The tuning is so chosen that the three frequencies are related by the equation $2W_1=W_2+W_3$. It will be seen from this equation that the frequency of the oscillation arising in one of said circuits is dependent upon the generator frequency and the natural frequency of the other oscillation circuit, and that it is possible to obtain any desired continual change in the produced frequency in one of the circuits, which we will take to be the working frequency, by means of changing the natural frequency of the other circuit.

Now, the present invention consists in the application of this well-known effect as hereinbefore described for the purposes of frequency regulation in the frequency changer, in other words, for instance, for the object of maintaining the transmission frequency at a constant value. Now, the method of frequency regulation consists in that, upon the occurrence of variations in the generator frequency, the natural frequency of one of the oscillation circuits (i. e., of the circuit which does not carry the working frequency) is automatically varied in such a manner that the sum total of the working frequency and the natural frequency of the second oscillation circuit remains always equal to an even multiple of the generator frequency. This regulation can be accomplished by that the tuning means of the auxiliary circuit, which does not carry the useful or working frequency, is positively coupled with the generator, so that, upon the arising of variations in the generator corresponding changes are produced in the tuning of the auxiliary circuit.

The invention will be better understood from the following description when considered in connection with the accompanying drawing in which the single figure is a diagrammatic view of the apparatus.

Referring to the drawing, K and K_1 are two iron cores which are magnetized by means of an alternating current generated at G, the said cores being embraced by a common winding included in the circuit of G. The windings are so chosen that no voltages of the fundamental frequency of the generator G are produced. The circuit of L and the alternating current source G is completed by means of the coil L_1 and condenser C_1. This circuit is tuned to have the normal frequency W_1. The generating tuned circuit including the variable condenser C_1 has the normal frequency W_1. Another tuned circuit including the condenser C_2 and having the frequency W_2 is provided. W_2 will be considered the working frequency. A third tuned circuit which may be termed a compensating circuit is also associated with the cores K and K_1. This circuit includes the condenser C_3 and is tuned to a frequency W_3.

The variable condenser C_3 is provided with some convenient mechanical speed responsive device such as the fly-ball governor H shown in the drawing, for varying the tuning of the circuit W_3 in accordance with the variations of the speed of the alternator G. Thus should the speed of the generator G be altered, the frequency of the circuit W_3 will be automatically altered to compensate for the first mentioned change. Referring to the equation governing the operation of the system, $2W_1=W_2+W_3$, it will be seen that the frequency W_2 will remain constant as the frequency W_1 changes. This is due, of course, to the compensating effect of the circuit W_3.

It will be understood that the specific form of the mechanical control for the variable condenser C_3 is not absolutely essential to

the operation of this invention but rather is included merely for the purpose of illustration, and any other equivalent mechanical means or electrical means might be substituted by anyone skilled in this art without departing from the spirit of this invention. For example, the tuning of the circuit W_3 might be changed by varying the self-inductance by means of a variometer in place of the variable condenser. Alternatively, an iron core coil may be used to change the self-inductance, and the variations may be obtained by means of a mechanical displacement of the iron core or by changing the magnetization of the iron core.

Having thus described my invention what I claim as new and desire to secure by Letters Patent of the United States is:

1. In a system for generating oscillations of a constant frequency, the combination of an alternating current generator, two iron cores adapted to be oppositely magnetized by said generator, a compensating oscillating circuit associated with said iron cores, a working oscillating circuit also associated with said iron cores, and means to vary the tuning of the compensating circuit in accordance with changes in the frequency of the generator whereby the tuning of the working circuit remains fixed.

2. In a system for generating oscillations of a constant frequency the combination of means for generating an alternating current, two iron cores constructed and arranged to be oppositely magnetized by said alternating current, two tuned circuits associated with said cores, the sum of the frequencies of the two tuned circuits being a multiple of the frequency of the alternating current generating means, means responsive to the variations of the frequency of the alternating current generating means to vary the frequency in one of the tuned circuits a corresponding amount, whereby the frequency of the other circuit remains constant.

3. In a system for generating oscillations of a constant frequency, a circuit including an alternating current generating means and a coil, two iron cores associated with said coil whereby the said cores are oppositely magnetized, a compensating tuned circuit associated with said cores, a working tuned circuit, the frequency of the said working circuit bearing a predetermined relation to the frequencies of the said compensating circuit and said alternating current generating circuit, and means responsive to a variation in one of said frequencies to automatically vary said other frequency, whereby the working frequency remains constant.

4. In a system for generating oscillations of a constant frequency the combination of an alternating current generator, two iron cores adapted to be magnetized by said generator, a tuned working circuit having a predetermined frequency, a compensating tuned circuit having a frequency which bears a predetermined relation to the frequency of the generator and the working tuned circuit, and automatic means governed by the generator to control the tuning of the compensating circuit thereby maintaining said relation constant.

5. In a system for generating oscillations of a constant frequency, the combination of an alternating current generator, two iron cores associated with said generator, a tuned working circuit associated with said cores, a compensating circuit associated with said cores, and automatic means governed by the generator to control the tuning of the compensating circuit whereby the tuning of the working circuit remains constant.

6. An arrangement for frequency changing comprising a pair of iron cores, a pair of coils associated therewith and adapted to be connected to a source of alternating currents for magnetizing said cores, a tuned working circuit associated with said cores, a second tuned circuit also associated with said cores, the sum or the difference of the tuning frequencies of said circuits being approximately equal to an even harmonic of the magnetizing frequency and means for compensating for changes in the magnetizing frequency comprising a connection between the magnetizing source and a tuning element of said second circuit whereby the tuning of the working circuit remains fixed.

KURT HEEGNER.