Sept. 9, 1930. M. OSNOS 1,775,210

ARRANGEMENT AND METHOD ADAPTED TO CONTROL HIGH FREQUENCY CIRCUITS

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Fig. 1

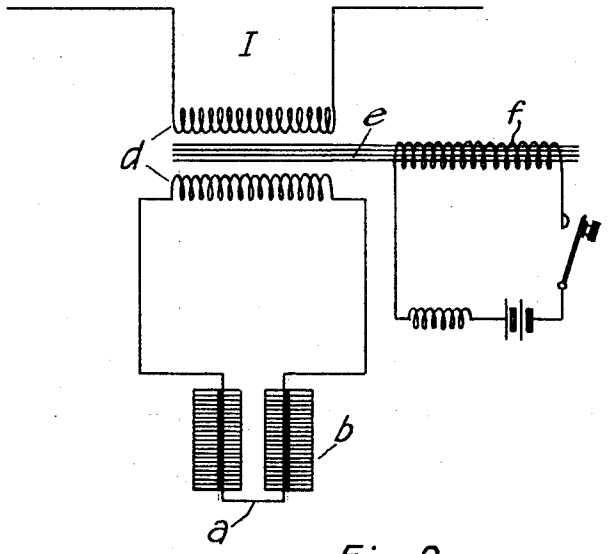
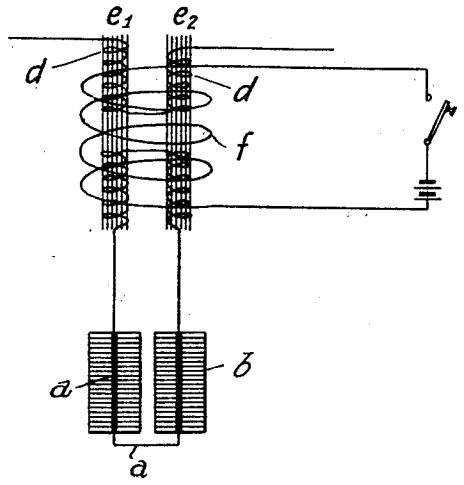


Fig. 2



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ARRANGEMENT AND METHOD ADAPTED TO CONTROL HIGH-FREQUENCY CIRCUITS

Application filed December 1, 1925, Serial No. 72,458, and in Germany December 4, 1924.

It is well-known that high-frequency circuits may be controlled by means of the variation of an ohmic resistance or an impedance, the changes in impedance being accomplished by variations of the magnetic properties of the controlling device, for instance, by the aid of the super-position of an auxiliary field.

However, in a great number of cases this is attended with a certain difficulty because the controlling currents, in order to effectively influence the permeability, must be chosen comparatively large. If a kind of construction is to be resorted to in which the controlling current is made to flow through a coil consisting of a great number of turns, there frequently arises another difficulty. The controller coil is often damaged by the heating of the iron body of the controller device.

It may be desirable to use for the control a device of the type disclosed in my co-pending application Serial No. 64,245, filed October 22, 1925. This consists of a conductor preferably made of copper which is surrounded by iron, and which consequently, may involve considerable self-inductance as well as a high ohmic resistance on account of the hysteresis and eddy-current losses set up in the iron.

By sufficient saturation in the iron by the aid of a superposed controlling field, it is possible to greatly vary both the inductive as well as the ohmic resistance of the device. If the same conductor that carries the high frequency current to be modulated is to be used as the conductor for the controlling current, it is necessary for the controlling currents in order to be effective to be of approximately the same order of magnitude as the high frequency currents. They will have to be relatively large, as a result of which the serious difficulty above referred to is encountered. But if a separate controlling coil conveniently disposed upon the iron of the apparatus is used for the controlling currents, the other difficulty above mentioned will arise and the coils become damaged by heating.

According to this invention the difficulties referred to are obviated by using a controlling impedance that is not inserted directly in the circuit to be controlled, but is in inductive coupling relationship therewith through an iron-cored transformer whose coupling capacity is variable within wide limits by the aid of an additional excitation. Hence, by changing the coupling it is possible to detract resistance from the circuit to be controlled, or add resistance thereto.

The coil carrying the controlling current is wound upon the coupling transformer and is independent of the controlling resistance used.

One form of construction of the idea underlying the invention is illustrated in the accompanying drawing in which:—

Fig. 1 shows my arrangement, and

Fig. 2 is a modification. Referring first to Fig. 1 of the drawings, I is the circuit to be controlled, *a b* the controlling impedance of the kind as above described, consisting of a conductor *a* and an iron coat or sheath *b*. *d d* are the coupling coils comprising a core of iron *e* conveniently closed upon itself, while *f* is the controller winding wrapped upon the same core. In order that no voltages of the high frequency to be modulated may be induced in the winding *f*, it is a good plan, as shown in Fig. 2, to arrange the high frequency winding *d* and the controlling winding *f* upon two iron cores e_1, e_2, preferably closed upon themselves in a way so as to act differentially with relation to one another.

Having thus described my invention, what I claim is:—

1. In combination, a high frequency circuit and controlling impedance coupled therewith, said coupling means including an iron core transformer, said impedance comprising a copper conductor surrounded by a plurality of thin magnetic disks for reducing hysteresis and eddy current losses, and a controlling circuit coupled with said high frequency circuit and said impedance through said iron core transformer, said controlling circuit being independent of said high frequency circuit and said controlling impedance, said controlling circuit being adapted to control the effect of said impedance upon said high frequency circuit by varying the degree of

coupling of said controlling circuit with said high frequency circuit.

2. In combination, a high frequency circuit and controlling impedance comprising a copper body surrounded by a magnetic layer, an iron core transformer for inductively coupling said high frequency circuit and said impedance, means for varying the saturation of said magnetic layer by varying the degree of coupling of said impedance with said high frequency circuit, a controlling circuit coupled with both said high frequency circuit and said impedance for controlling the effect of said impedance upon said high frequency circuit by varying the degree of coupling of said impedance with said high frequency circuit, and means provided by said iron core transformer for winding said high frequency circuit upon said transformer in a differential relationship whereby the effects of said high frequency are avoided in said controlling circuit.

3. In combination, a high frequency circuit, a controlling impedance comprising a copper conductor surrounded by a plurality of thin magnetic disks, an iron core transformer, means for coupling said high frequency circuit and said controlling impedance, a controlling circuit magnetically associated with both said high frequency circuit and said controlling impedance for controlling the effect of said impedance upon said high frequency circuit by controlling the degree of coupling between said impedance and said high frequency circuit, and means provided by splitting the high frequency portion of said transformer windings into two differentially wound portions for causing the voltages produced by the high frequency currents in the said windings to act differentially one upon the other and avoiding the effects of the high frequency in the said controlling circuit.

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