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MEANS FOR VARYING THE PERIOD OF OSCILLATION OF TWO OSCILLATORY CIRCUITS.

APPLICATION FILED SEPT. 8, 1909.

1,014,722. Patented Jan. 16, 1912.

Fig.1.

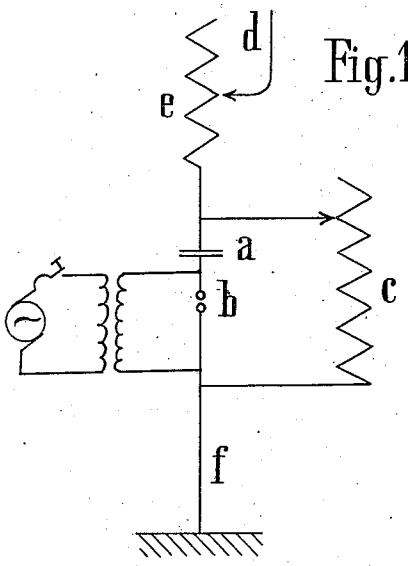


Fig.4.

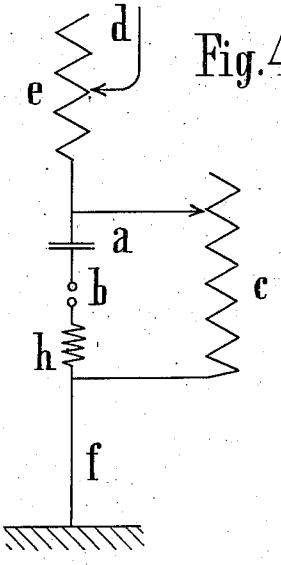
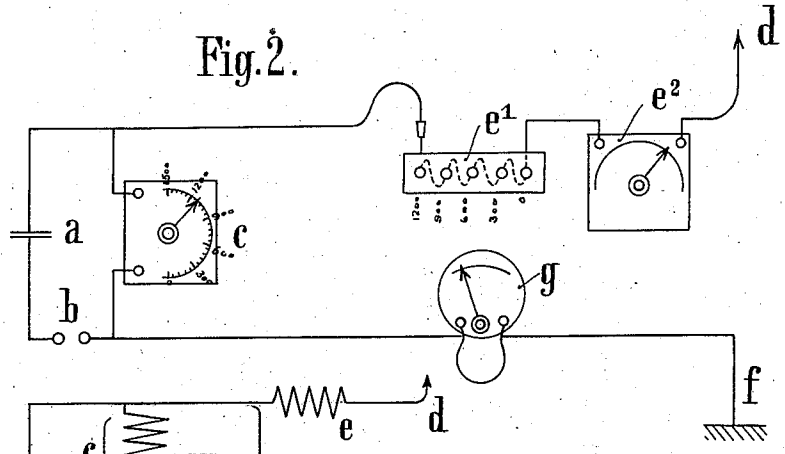


Fig.2.



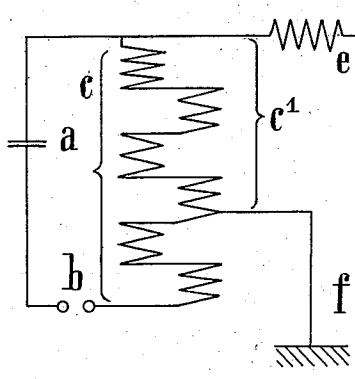


Fig.3.

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MEANS FOR VARYING THE PERIOD OF OSCILLATION OF TWO OSCILLATORY CIRCUITS.

1,014,722. Specification of Letters Patent. Patented Jan. 16, 1912.

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To all whom it may concern:

Be it known that I, RAGNAR HÄKAN RENDAHL, a subject of the King of Sweden, and residing at Stockholm, Sweden, have invented a certain new and useful Improved Means for Varying the Period of Oscillation of Two Oscillatory Circuits, of which the following is a specification.

The subject-matter of my invention comprises means for varying the period of oscillation of two oscillatory circuits tuned one to the other.

Recently almost all stations for wireless telegraphy and telephony have been so arranged that they can emit and receive oscillations of different wave-lengths. So long as they operate with simple transmitters and receivers the variation of the wave-length is brought about simply by altering the constants of the antennae, *e. g.* the capacity or self-induction. Conditions are different in case of a coupled system; for in this event when changing from one wave-length to another the tuning of all circuits of the station must be altered simultaneously. In general, this alteration is brought about for example at the transmitter by increasing or diminishing the self-induction of the aerial and corresponding variation of the capacity or self-induction of the primary circuit. Other methods have also been proposed; all have the common disadvantage, however, that when the wave-length changes the coupling between the different circuits is altered without following a definite law. Sometimes it becomes closer, sometimes looser, so that in coupled systems it is necessary to adjust the coupling in addition to altering the constants of the different oscillatory circuits.

Now the principal object of my invention is to do away with this drawback.

According to my invention the capacity of the two circuits is made constant, the two circuits are coupled directly, and the part of the self-induction of the circuit having the greater capacity, which serves for coupling, forms a previously determined percentage of the entire self-induction of this circuit. This percentage is the same for all wave-lengths when the coupling coefficient is to be constant. Consequently it is most convenient in practice to make use of the total self-induction of the circuit which has the greatest capacity for coupling, whereas the remaining portion of the self-induction of the circuit having the smaller capacity is not used for coupling. In this case the coupling coefficient is determined theoretically by the simple formula

$$K = \sqrt{\frac{c_1}{c_2}}$$

when c_1 and c_2 are the capacities. If, however, it is not desired to keep the coupling coefficient constant, but to increase it, *e. g.*, gradually with the wave-length in such manner that for short waves the coupling becomes loose and for long waves close, it suffices when a portion of the self-induction of the circuit having the large capacity is not used for coupling.

In order that my invention may be clearly understood reference will now be made to the accompanying drawings in which various embodiments are diagrammatically represented.

In said drawings: Figure 1 shows a constructional form for a constant coupling using the entire self-induction and the primary circuit, whereas Fig. 2 shows diagrammatically apparatus arranged according to my invention, and Fig. 3 shows the same arrangement when the entire self-induction of the primary circuit is not to be made use of for coupling but only a part of the same; Fig. 4 shows diagrammatically an arrangement in which the coupling for short waves is looser than for long waves.

Similar reference characters designate like parts in all views.

Referring to the drawings and firstly to Fig. 1, *a* designates a fixed condenser, *b* a spark-gap, *c* a variable self-induction, *d* an aerial, *e* a variable self-induction, *f* an earth connection. The variable self-inductions *c* and *e* must be arranged relatively to one another in such manner that they do not influence the coupling.

In Fig. 2 the self-induction *c* consists of two coils which can be rotated relatively to one another, so that the self-induction can be gradually varied. Preferably the circuit *a*, *b*, *c* is calibrated in wave-lengths. The self-induction of the aerial is represented by the coil e_1 which can be varied step by step and the gradually variable self-induction e_2. Preferably the coil e_1 is also calibrated. *g* designates a hot-wire ammeter or other suitable measuring or indicating instrument. In this arrangement the change

from one wave-length to another is effected simply by the variable self-induction c being adjusted to the desired wave-length; the coil e_1 is adjusted similarly, whereas the gradually variable self-induction e_2 is altered until the instrument g indicates the maximum energy. At this moment the two circuits are tuned to the wave-length which the needle in the variometer e indicates. The coupling remains the same for all the wave-lengths which are to be made with this arrangement. It is preferable to give the positions of the variometer e and the coil e_1 which correspond to one another a like color, or to connect them positively one with the other in such manner that incorrect adjustment is avoided as much as possible.

In Fig. 3 the coil c is represented by a series of variometers which are positively connected one with another. Of these variometers only a part c_1 is used for coupling. The proportion of c_1 to c, however, remains constant and consequently the coupling coefficient also.

Fig. 4 is identical with Fig. 1 except that the fixed self-induction h is provided here which causes the coupling between the primary circuit and aerial to become closer as the wave-length increases.

I claim:

1. The combination of two oscillatory circuits having constant capacity, variable self-induction and being galvanically coupled with and tuned one to the other, connections arranged so that the variations of the self-induction results in the coupling self-induction being for all wave-lengths a previously determined percentage of the total self-induction of the circuit which has the greater capacity.

2. The combination of two oscillatory circuits having constant capacity, variable self-induction and being galvanically coupled with and tuned one to the other, connections arranged so that the variations of the self-induction results in the coupling self-induction being for all wave-lengths an equal previously determined percentage of the total self-induction of the circuit which has the greater capacity.

3. The combination of two oscillatory circuits having constant capacity, and being galvanically coupled with and tuned one to the other, a self-induction being common to the coupled circuits and being arranged in a variometer, the self-induction of the secondary circuit not participating on the coupling being arranged in a coil variable by degrees and a fine tuning means connected therewith, connections arranged so that the variations of the self-induction results in the coupling self-induction being for all wave-lengths a previously determined percentage of the total self-induction of the circuit which has the greater capacity.

4. The combination of two oscillatory circuits having constant capacity and being galvanically coupled with and tuned one to the other, a series of variometers connected in series and being mechanically connected one with another to cause their simultaneous mechanical operation to the same angular degree, a part of these variometers being simultaneously electrically connected with the secondary circuit, the coupling self-induction being for all wave-lengths a previously determined portion of said series of variometers.

5. The combination of two oscillatory circuits having constant capacity, variable self-induction and being galvanically coupled with and tuned one to the other, connections arranged so that the variation of the self-inductions results in the coupling self-induction being for all wave-lengths a previously determined percentage of the total self-induction of the circuit which has the greater capacity, the latter circuit containing a constant self-induction.

In testimony whereof, I affix my signature in the presence of two witnesses.

RAGNAR HÄKAN RENDAHL.

Witnesses:
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