April 2, 1935. M. CHIROL 1,996,145

DEVICE FOR RECEIVING HIGH FREQUENCY CURRENTS SUPERIMPOSED ON ELECTRICAL POWER SUPPLY LINES

Filed Jan. 19, 1933

H.F. Generating Apparatus

Fig. 1.

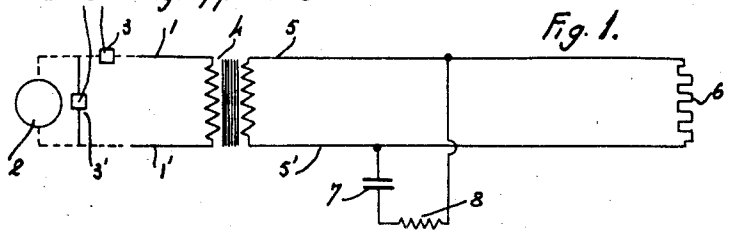


Fig. 2.

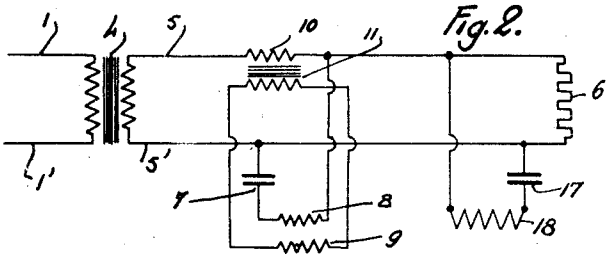


Fig. 3

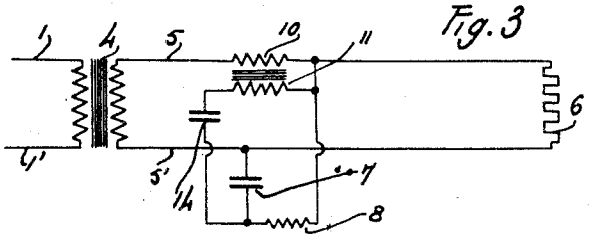


Fig. 4.

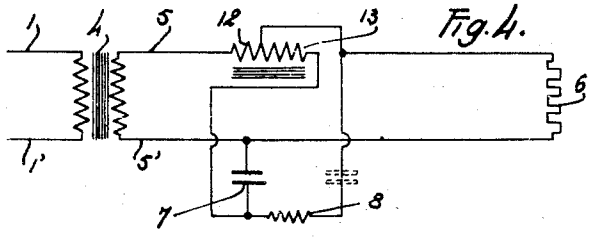
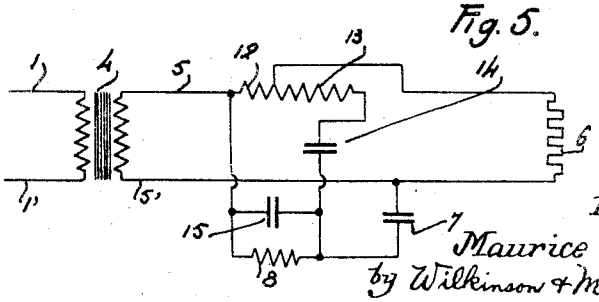


Fig. 5.



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1,996,145

DEVICE FOR RECEIVING HIGH FREQUENCY CURRENTS SUPERIMPOSED ON ELECTRICAL POWER SUPPLY LINES

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5 Claims. (Cl. 175—320)

It has already been proposed to superimpose high frequency currents, particularly currents the frequency of which corresponds to that of a musical note, on normal supply currents in electrical power supply systems, for actuating certain members or certain apparatus, usually relays, responsive to high frequencies and adapted to perform definite duties under the influence of such currents, for example the change of tariff in multiple tariff meters.

Such receiving members or apparatus which are usually located in the low tension portion of the system, (whereas the superimposed currents may be fed into the high tension portion thereof), are, in general, adapted to operate normally when the voltage of the superimposed currents varies within certain limits, so as to provide for the possible increases or drops in the voltage thereof; but such limits are necessarily narrow.

The object of this invention is to make said apparatus operate normally within considerably wider limits.

In the systems proposed hitherto, the superimposed currents act directly on the receiving member, which is usually a resonance relay connected across the supply circuit.

According to the invention, the addition of an auxiliary circuit enables any receiver of superimposed currents to respond to two influences simultaneously.

(*a*) To an influence dependent upon the voltage of such currents available at the input, as is normally the case;

(*b*) To an influence dependent upon the amperage of such currents in the low tension leads of the system, and due to the currents induced in the aforesaid auxiliary circuit.

As will be hereinafter explained, the action according to (*b*) increases as the terminal impedance of the low tension system decreases for the superimposed currents; it will also be seen that this is equivalent to saying: "The action according to (*b*) increases as the action according to (*a*) decreases."

Consequently, the auxiliary circuit according to the invention acts as an "auto-compounding circuit" for supplying the superimposed current receivers, and enables the total action of such currents to be maintained substantially constant, (i. e. substantially independent of the local conditions of the receiver).

A further object of the present invention is to prevent fraudulent tampering with a remotely controlled device for changing the tariff of a multiple tariff meter.

Embodiments of the invention have been illustrated in the accompanying drawing wherein:

Figure 1 is a diagrammatical illustration of the systems known hitherto.

Figure 2 shows one embodiment of the device according to the invention.

Figures 3, 4 and 5 are other embodiments of the invention.

In the known device illustrated in Figure 1, 1 and 1′ are the two leads of a high tension line supplied by a source 2, 3 and 3′ are two devices for superimposing high frequency currents (for example, currents of the frequency of a musical note) placed in series with the line as at 3, or in parallel as at 3′, according to the method used for superimposing; 4 is a step down transformer by means of which the terminal impedance 6, which maybe of any kind, can be supplied with current by the source 2 through the low tension line 5 and 5′. 7 and 8 are respectively the condenser and the winding of a receiving relay, e. g. of the resonance type.

According to the present invention and as illustrated in Figure 2, there are added to the elements illustrated in Figure 1, an auxiliary circuit comprising a transformer, the primary winding 10 of which is in series with the low tension leads and the secondary winding of which supplies the supplementary winding 9 located on the receiving relay. The windings 8 and 9 of said relay have entirely separate magnetic circuits which do not react on each other and the currents passing through them act in the same direction, and are consequently additive in their action on the moving members of the relay.

In Figure 3, the auto compounding auxiliary circuit still comprises the transformer 10—11, but its secondary winding 11 supplies the coil 8 of the receiving relay directly, the additional coil 9 of Figure 2 being eliminated. A condenser 14 is inserted in this circuit, either to prevent the current from the mains from entering the receiver, or to tune the auxiliary circuit, or to bring into phase the superimposed current directly entering the coil 8, and the current supplied thereto by the transformer 10—11, or to carry out simultaneously all of the above enumerated duties, or finally for any other purpose which may be considered necessary.

According to Figure 4, the transformer 10—11 of the auxiliary auto compounding circuit is replaced by an auto-transformer 12—13, a portion of the winding of which aids in supplying the coil 8 of the receiving relay, the condenser 14 being retained or not.

Finally, in Figure 5 the transformer 10—11 is again replaced by an auto-transformer 12—13, the whole winding of which is, in this case, used to aid in supplying the coil 8 of the receiving relay, the condenser 14 being again retained or not, and a condenser 15 being added, if necessary, across the coil 8 in order to increase the voltage across the latter.

If the voltage of the superimposed currents across the coil 8 remains stationary or retains a mean value during a fairly restricted period of variations, the ordinary known device of Figure 1 is sufficient to ensure the correct operation of the receiving relay. But for a transformer 4 of given characteristics, account must be taken of the fact that the limits of the period of variations of the voltage of the superimposed currents are essentially dependent on the value and the nature of the terminal impedance 6 fed by said transformer. In particular, such impedance may retain a normal value for the supply currents which is in keeping with the power of the transformer 4, but at the same time if a disturbing circuit, illustrated in the drawing by the capacity 17 and inductance 18, is connected to the system accidentally or intentionally by the subscriber with fraudulent intent, i. e. to prevent the change tariff device associated with the meter from functioning, the said impedance may fall to a value far below that which is normally provided for the superimposed currents; in the latter case a considerable increase of such currents supplied by the transformer 4 occurs and, as a result thereof, a greater voltage drop across the reactance of said transformer and the impedance of the lines 5 and 5'; this finally causes a decrease in the voltage of the superimposed currents available across the coil 8 of the receiving relay. While the disturbing circuit 17—18 must have a very low impedance for the high frequency currents, it is evident that it must have a high impedance at the frequency of the supply currents, otherwise it would consume energy which would be registered by the meter, and the fraudulent introduction of this circuit would then defeat its own ends. But if, in accordance with the invention, the auxiliary auto compounding circuit hereinbefore described and shown in various forms in Figures 2 to 5, is added to the usual device of Figure 1, the superimposed currents which pass through either the primary winding 10 of the transformer 10—11, or the portion 12 of the winding of the auto transformer 12—13, induce, in said auxiliary circuit, currents, the value of which, for aiding in supplying the receiver, increases with the actual value of said currents, i. e., as the terminal impedance 6 decreases.

The invention can be applied to all signalling or controlling systems operated by superimposed currents of high frequency or of frequency producing a musical note (without any limitation being imposed as regards the value of the frequency or the extent of the band of frequencies of such currents), whether the oscillations are continuous or damped, or are modulated or not at the transmitting end, or detected or not at the receiving end, etc.

In general, any addition to an auxiliary circuit, whatever may be its form or its structure, placed either in the receiver or in the vicinity thereof, and the effect of which is to produce on the moving members of the latter, an action of superimposed currents which increases as the terminal impedance of the supply mains decreases for their frequency, will be considered to fall within the scope of the invention.

Furthermore, such an auxiliary or auto compounding circuit with respect to the receiver which is the object of the invention, will have no appreciable action on the normal supply currents.

I claim:

1. In a low frequency electric supply network comprising a high tension side on which currents of higher frequency are superimposed, a low tension side and a step-down transformer connecting said high to said low tension side, the combination with a relay including a winding shunted across said low tension side and responsive to said superimposed currents, of a second transformer having a primary winding mounted in series in the low tension side of said network and the secondary of which cooperates with the winding of said relay, said second transformer being adapted to induce in its secondary a current which increases proportionately to any decreases of the current flowing through said relay winding.

2. System according to claim 1 in combination with a winding connected to said second transformer secondary and cooperating with said relay winding to compensate the decrease of current flowing therethrough.

3. System according to claim 1 in combination with a capacity connecting said second transformer secondary to said relay winding.

4. System according to claim 1, wherein said second transformer is an auto-transformer.

5. System according to claim 1, wherein said secondary circuit of said second transformer has a high impedance at the low frequency of the supply current.

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