

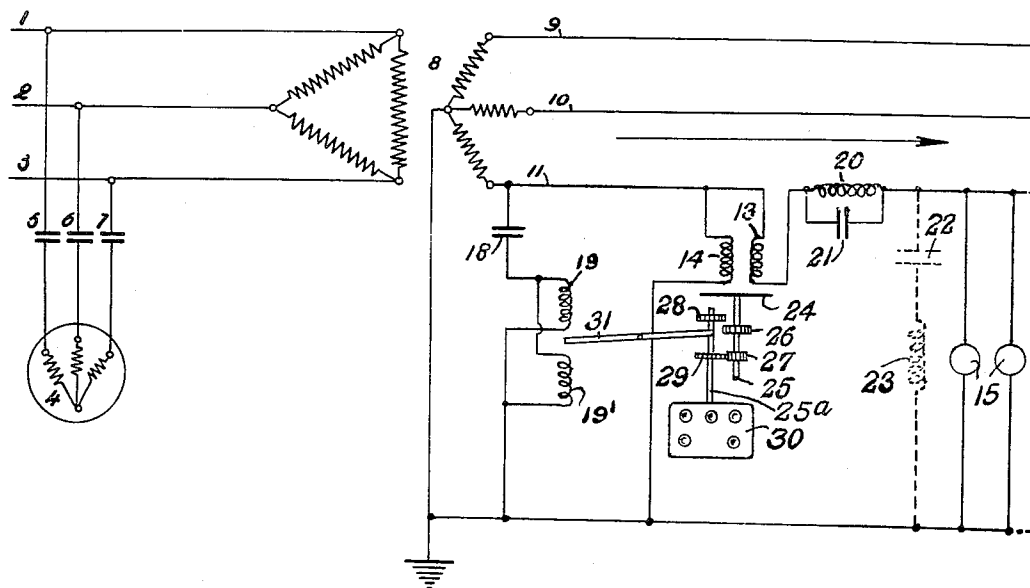
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MULTIPLE TARIFF METERING SYSTEM

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MULTIPLE TARIFF METERING SYSTEM

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It is old to superimpose on the supply current proper in electrical energy supply net-works, currents of high frequency for example and more generally of musical frequency, for the remote control of special apparatus, usually relays intended either for signalling or for the remote control of apparatus for measuring or metering the supply current proper.

The control of the mechanism for changing the tariff of multiple tariff meters may be cited as an example of the application of the high frequency superimposed current.

In the majority of cases, the superimposed currents are injected at certain points of the high tension portion of the net-work and must therefore flow through the step-down transformers when the apparatus they control are situated in the low tension portion of the net-work.

Consequently, the step-down transformers lower the voltage of said superimposed currents as well as that of the supply currents and generally in the same ratio as the latter. That is to say, the ratio between the tensions of the superimposed and supply currents is practically the same at all points on the net-work.

Thus, it is generally possible to adjust the sensitivity of the members controlled by the superimposed currents according to the theoretical value of their tension at each point of the net-work.

But certain peculiar circumstances may modify the ratio of the two tensions at a given point in the line, for example local resonance will increase said ratio, whereas damping will reduce it. An increase in this ratio offers no serious drawback, for it is always possible to remedy it either by creating an additional artificial damping for the superimposed currents, or, more simply, by adjusting the sensitivity of the receiving members (and this may be effected even when allowing a sufficiently large margin for the case in which the value of the above ratio is not fixed, but varies though within fairly restricted limits).

A decrease of ratio may, however, if unduly large, cause the receiving member to operate defectively.

The object of the present invention is to provide means for preventing, if not wholly at any rate sufficiently for practical requirements, any exaggerated local decrease in the tension of the superimposed currents. This means is particularly applicable to the case in which the reduction in the ratio tends to occur in the low tension portion of the net-work.

An exaggerated voltage drop of the high fre-

quency superimposed current may be due to divers causes; for instance, it may be due to the leakage reactance of the step-down transformers (the reactance varies according to the magnetic condition of the iron, that is to say, depending on the load of each transformer), the impedance of the low tension lines etc.

According to the present invention, the tension of the superimposed currents is prevented from falling in the neighborhood of the receiver by placing a circuit acting as a stopper to said currents in series in the line after said receiver (and preferably immediately after), but obviously forward of any local resonance or damping of another receiver. Thus, for example, if the superimposed currents control multiple tariff meters, the stopper circuit above-mentioned will be placed, according to the present invention, either in the meter itself or immediately to the rear thereof, but in any case always forward of that portion of the circuit which is accessible to the consumer.

Another object of the present invention is to prevent fraudulent tampering with a remotely controlled change tariff meter device.

An embodiment of the invention has been illustrated merely by way of example in the single figure of the accompanying drawing, which shows the application of the invention to superimposed high frequency currents for controlling apparatus for changing the tariff of multiple tariff meters.

In the figure, on the three high tension cables 1, 2, 3 of a three-phase supply system, are superimposed, through the medium of the condensers 5, 6, and 7, signalling currents of musical frequency, supplied by the source 4.

The step-down transformer 8 enables the high tension cables 1, 2, 3 to feed the low tension cables 9, 10, 11 and 12. A subscriber's meter has been illustrated, by way of example, in the form of a single phase induction apparatus comprising a current coil 13, a voltage coil 14 and a rotatable disc 24. The disc 24 is mounted on the spindle 25 on which pinions 26 and 27 are mounted fast. The pinion 26 can gear with a toothed wheel 28 and the pinion 27 can gear with a toothed wheel 29 of the counter mechanism 30 of the meter. The toothed wheels 28 and 29 are mounted on the register shaft 25^a. Depending on whether the pinion 26 gears with the toothed wheel 28 or the pinion 27 gears with the toothed wheel 29, the counter mechanism of the meter will be driven at different speeds. To control the changing over from one speed to the other of the counter mech-

anism of the meter and hence from one meter tariff to the other, there is provided a relay tuned to the musical frequency currents and comprising a condenser 18 and coils 19 and 19'. Said coils 19 and 19' are tuned to different frequencies f and f' and are adapted to attract a lever 31 secured at one end to the register shaft 25^a in order to shift same, whereby engagement of the pinions 26 and 28 or of the pinions 27 and 29 is brought about. 16 and 17 are the outlet terminals of the meter or at any rate, the terminals to the right of which, in the direction of the arrow, the circuit 11—12 is entirely accessible to the subscriber. In the line 11 is mounted a stopper circuit tuned to the frequency of the superimposed currents and comprising the reactance 20 and condenser 21, said stopper circuit being mounted forward of the terminal 16, that is to say, in the portion of the conductor 11, which is not accessible to the subscriber.

A disturbing circuit has been illustrated in dotted lines and comprises the condenser 22 in series with the reactance 23. Such disturbing circuit is shunted across the conductors 11—12 in the subscriber's circuit and may be placed therein by the subscriber himself with fraudulent intent, i. e. in order to render inoperative the relay 18—19—19' when the latter is energized with a view to changing over the meter registration to the higher tariff.

It is evident that in order to be effective the disturbing circuit 22—23 must act as a short circuit at the frequency of the superimposed currents in order to lower as much as possible the voltage at the terminals of the relay 18—19—19'. But it is also evident that such disturbing circuit must possess a high impedance at the frequency of the supply current, otherwise it will consume energy which will be registered by the meter 13—14.

Under these conditions, it will be readily understood that, in order to be effective, the disturbing circuit must be reducible to a circuit tuned to the frequency f or f' having a low capacity 22 and a high inductance 23.

To understand the invention, the circuit illustrated will be considered first of all, without the stopper circuit 20—21 and the impedance 22—23.

A current of musical frequency superimposed on the normal supply current at a suitable voltage in the high tension portion of the network is introduced on the low tension side under reduced voltage by the step-down transformer 8 and the relay 18—19 adjusted to this reduced voltage, will operate responsive to the current.

If now the impedance 22—23 be introduced in the low tension lines, said impedance will have a high value at the frequency of the supply current and will therefore not increase the flow of said current, while, on the contrary, the value of said impedance is much lower at the frequency of the superimposed currents and the intensity of said superimposed currents in the low tension circuit will increase appreciably and will produce a considerable voltage drop across the leakage reactance of the transformer 8 and possibly across the impedance of the lines 11—12. In certain cases, the voltage drop thus produced by the introduction of the impedance 22—23 becomes such that the tension of the superimposed currents across the terminals of the control relay

18—19—19' is insufficient to operate the same.

According to the invention, the introduction of the stopper circuit 20—21 offers a resistance to the flow of the superimposed currents in the impedance 22—23 and thus prevents any appreciable increase of said currents and thus renders the disturbing impedance 22—23 inoperative.

Without departing from the spirit of the invention, either as many stopper circuits as there are different frequencies of superimposed currents may be used, or a circuit may be used which acts as a stopper for a more or less large and predetermined range of frequencies.

In any case, the stopper circuit or circuits will not appreciably affect the supply currents.

The present invention applies indifferently to all signalling systems or remote control systems using high or musical frequency superimposed currents (without any restriction however, as regards the frequencies utilized), whether such currents are modulated or not at the sending end and detected or not at the receiving end.

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, to which may be connected a circuit having a low impedance at the frequency of said superimposed current, and a step-down transformer connecting said high to said low tension side, the combination with apparatus mounted in said low tension side of said network, and operated by the superimposed current delivered to said low tension side by said transformer, of a stopper circuit mounted in said low tension side of said network forward of said first mentioned circuit, but after said apparatus, for preventing an undue increase of intensity of the superimposed current when said first mentioned circuit is connected to said supply network.

2. In a low frequency electric supply network comprising a high tension side on which currents of higher frequency are superimposed, a low tension side to which may be connected a circuit having a low impedance at the frequency of said superimposed current, and a step-down transformer connecting said high to said low tension side, the combination with apparatus mounted in said low tension side of said network, and operated by the superimposed current delivered to said low tension side by said transformer, of a capacity and an inductance mounted in said low tension side of said network forward of said first mentioned circuit, but after said apparatus, said inductance and capacity forming a stopper circuit for preventing an undue increase of intensity of the superimposed current when said first mentioned circuit is connected to said supply network.

3. In a low frequency electric supply network comprising a high tension side on which currents of higher frequency are superimposed, a low tension side to which may be connected a circuit having a low impedance at the frequency of said superimposed current, and a step-down transformer connecting said high to said low tension side, the combination with a multiple tariff meter mounted in said low tension side of said network and means, including a relay likewise mounted in said low tension side, for changing the tariff of said meter, of a stopper circuit mounted in said low tension side of said network forward of said first mentioned circuit but after said relay, for preventing an undue increase of intensity of the superimposed current when said

first mentioned circuit is connected to said supply network.

4. In a low frequency electric supply network comprising a high tension side on which currents of higher frequency are superimposed, a low tension side to which may be connected a circuit having a low impedance at the frequency of said superimposed current, and a step-down transformer connecting said high to said low tension side, the combination with a multiple tariff meter mounted in said low tension side of said network

and means, including a relay likewise mounted in said low tension side, for changing the tariff of said meter, of a capacity and an inductance mounted in said low tension side of said network forward of said first mentioned circuit but after said relay, for preventing an undue increase of intensity of the superimposed current when said first mentioned circuit is connected to said supply network.

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