

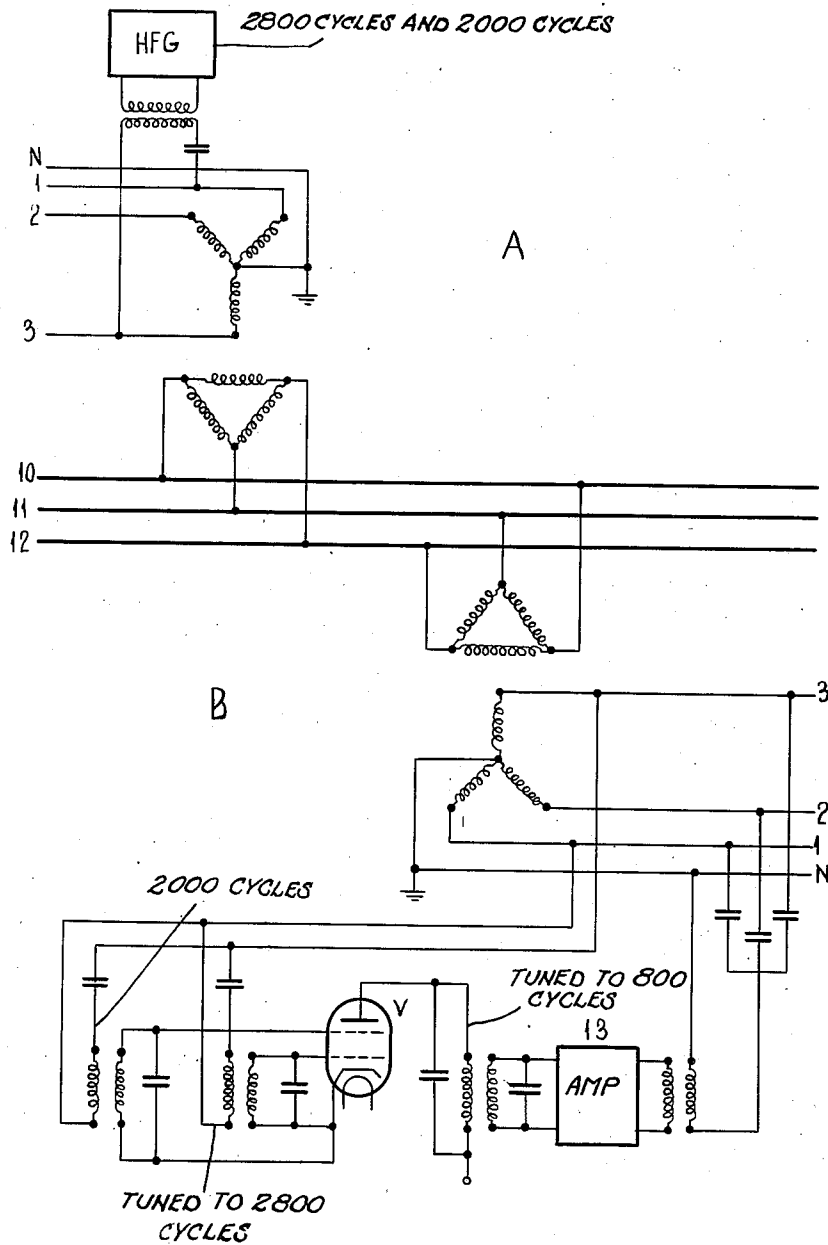
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ELECTRICAL SIGNALING SYSTEM

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ELECTRICAL SIGNALING SYSTEM

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The present invention relates to electrical signaling systems and is more particularly concerned with systems in which signaling is to be effected over alternating current electric supply networks by the use of currents of high frequency compared with the supply frequency which are extended via a high tension network to a plurality of low tension networks.

It has already been suggested in a system of this type to arrange for the high frequency (H. F.) signals to be generated at a controlling substation and applied to the low tension (L. T.) windings of the main HT/LT transformer. These signals then extend via the high tension conductors through the main transformers at each substation to each L. T. network to bring about operation of the H. F. responding devices connected thereto.

In practice it has been found that unless the signals propagated over the H. T. network have a frequency exceeding about 2000 cycles, the load on the various L. T. networks connected thereto will tend to constitute a leakage path. At the higher frequencies however penetration of the L. T. networks is interfered with due to the impedance of the conductors and the capacity losses which are higher than those obtaining on the H. T. network owing to the necessary differences of construction. In other words for efficient penetration of the L. T. networks the signal frequencies should be considerably less than 2000 cycles.

These two requirements are contradictory if the same frequency is used on both the high and low tension sides and it is the general object of the present invention to provide an improved signaling system of the above type in which the problem of efficient H. F. signal transmission is readily overcome by the use of different frequencies.

According to one feature of the invention in an electrical signaling system for the operation of control devices in response to high frequency currents transmitted over electric supply mains, one or more low tension networks are supplied with high frequency control currents by way of the high tension network supplying power to the low tension network, the frequencies of the control currents being different on the high and low tension networks to give transmission conditions most suitable for each network.

According to another feature of the invention in an electrical signaling system for the operation of control devices in response to high frequency currents transmitted over electric sup-

ply mains and having control currents transmitted from one low tension network to one or more additional low tension networks by way of a common high tension network supplying power thereto, control currents of one frequency applied to the controlling low tension network are converted into currents of a beat frequency for transmission over one of the controlled low tension networks by a heterodyning action with currents of a different frequency.

A further feature of the invention is that in an electrical signaling system for the operation of control devices in response to high frequency currents transmitted over electric supply mains and having control currents transmitted from one low tension network to one or more additional low tension networks by way of a common high tension network supplying power thereto, control currents of two different frequencies are applied to the controlling low tension network and are transmitted over the high tension network to the other low tension network, arrangements being provided associated with said network to cause a heterodyning action so that currents of a beat frequency are transmitted over the control devices.

The invention will be better understood from the following description of one method of carrying it into effect, reference being had to the accompanying drawing. This shows circuit arrangements at two substations A and B which are both supplied from the H. T. feeders 10, 11 and 12 and each feed a separate low tension network. Substation A is assumed to be the controlling one and is provided with high frequency signal generator HFG, while substation B is provided with signal receiving and amplifying equipment connected to the supply conductors as shown.

The substations A and B are each assumed to feed 3 phase 4-wire alternating current networks of which the phase conductors in each case are designated 1, 2, 3 while the neutral conductors are designated N. Although only one substation such as B is shown, it will be understood that any number of substations similarly equipped may receive signals from substation A. A plurality of responding devices of any suitable H. F. responsive type will be connected to the supply conductors of each L. T. network.

Considering now the circuit operation, when it is desired to extend a control signal from substation A, the high frequency generator HFG is set in operation. This may be of either the thermionic valve or motor driven type depending on the size of the whole network and cost con-

siderations. For the purpose of the description it will be assumed that the high frequency signal generated comprises two frequencies of 2000 and 2800 cycles respectively which are simultaneously applied to the L. T. side of the main LT/HT transformer. These frequencies pass over the H. T. feeders and through the main transformers at each controlled substation into valve receiving and amplifying equipments connected to the supply conductors in the manner shown.

While the specification refers to two particular frequencies for transmission and the drawing is correspondingly marked, it should be understood that other time frequencies having approximately the same differences in frequencies as those indicated may be used without departing from the spirit of my invention.

Considering now the arrangement of this equipment at substation B, it will be seen that the input circuit from the supply conductors to the two grids of a frequency changing or so-called mixer valve V extends by way of coupled tuned circuits preferably of the sharply resonant filter type which are tuned to pass respectively only frequencies of 2000 and 2800 cycles. When a signal is received, the two frequencies which it comprises will pass to the two grids of the mixer valve from whose plate circuit will emerge a heterodyne frequency of 800 cycles. The received signal now at a lower single frequency of 800 cycles is passed through a tuned transformer to a valve amplifier 13 from the output of which it is re-applied in amplified form between the neutral and phase conductors of the L. T. network to operate the responding devices which may be connected between any of the phase conductors and the neutral or earth.

With arrangements of the type described the transmission of signals at a comparatively high frequency over the H. T. network and the subsequent changing to a lower frequency before amplification and application to the L. T. networks enables the attenuation of the signals over the whole HT/LT system to be kept at a minimum, thereby economising in generator and amplifier costs and generally providing a more efficient scheme.

Due to the use of the sharply resonant type input circuits there will be no possibility of the lower output frequency feeding back again to the mixer valve and bringing about self-oscillation.

Although in the system described it has been assumed that use is made of a signal of two different frequencies for transmission over the H. T. network, it will be readily appreciated that any

number of frequencies may be simultaneously transmitted and subsequently heterodyned together.

The setting of the various responding devices connected to the L. T. networks might be effected by successive applications of a single frequency signal thereto while if selective control of different sets of responding devices is required signals of differing frequency may be utilised. Alternatively responding devices employing both electrical and mechanical resonance arrangements could be utilised which would be operated in response to a high frequency signal interrupted at a slow rate. Selective control and on-off switching might then be carried out by interrupting the high frequency at differing rates.

I claim:

1. In an electric power supply network wherein a high tension network feeds a plurality of low tension networks through transformers, means in one of the low tension networks for transmitting a control frequency of approximately 2000 cycles from said last network via the high tension network to another low tension network, means connected to said second network responsive to said control frequency for converting it into a second frequency considerably less than 2000 cycles and impressing said second frequency upon said second low tension network, and means connected to said second network, at points remote from said last means, which is responsive to said second frequency.

2. In an electric power supply network including a high tension network feeding a plurality of low tension networks through transformers, a signaling system comprising means for impressing a plurality of control frequencies of approximately 2000 cycles or over upon one of the low tension networks and via said high tension network to the other low tension networks, receiving means connected to each of said other low tension networks having input circuits tuned to each of said control frequencies and responsive thereto to convert said control frequencies into another frequency considerably less than 2000 cycles and impressing it upon the associated low tension network, and means connected to said other low tension networks at points remote from the high tension network responsive to said other frequency.

3. A signaling system such as claimed in claim 2 in which said receiving means includes a mixing valve having its grid circuits connected to said tuned input circuits and producing said other frequency substantially equal in frequency to the difference between the control frequencies.

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