

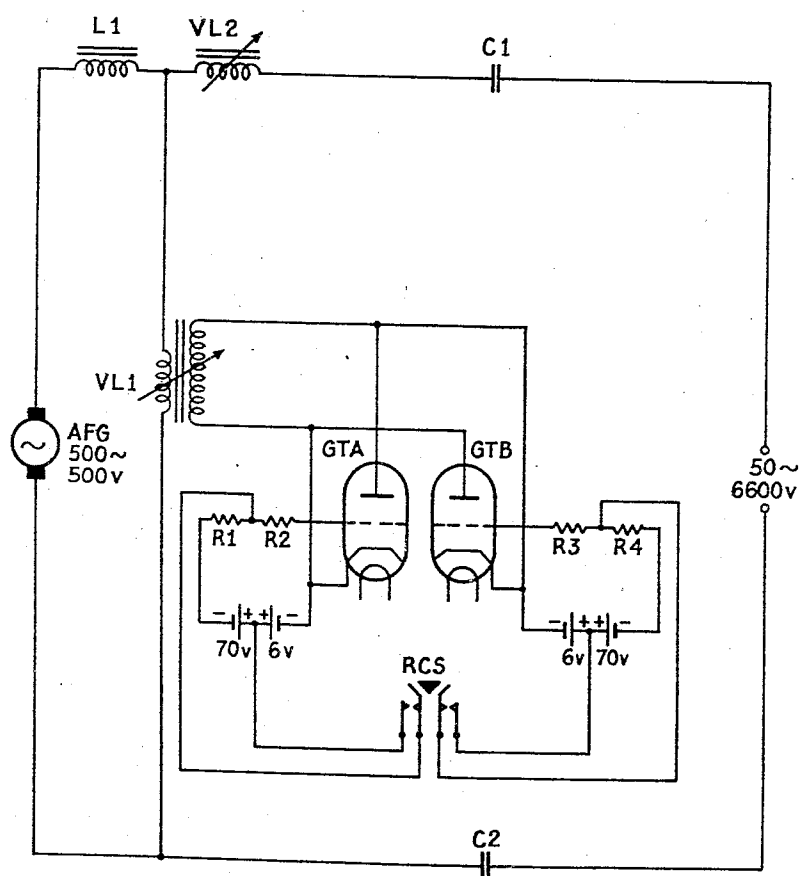
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ELECTRICAL SIGNALING SYSTEM

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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 effected over electric supply networks by the use of superimposed high frequency currents, such systems finding application to the centralised control of street lights, domestic water heaters, public warning signals, and the like. The invention is moreover particularly concerned with equipment for use at the controlling point in so-called cadence or rhythm signaling systems, that is to say, systems in which the superimposed currents are interrupted at regular intervals to form different cadences so that for any one signaling frequency a number of distinctive signals can be obtained depending upon the periodicities of the various cadences.

Hitherto, signaling in such systems has been effected by interrupting the connection of the high frequency generator to the network by means of electro-mechanical switches of heavy current-carrying capacity, but due to the inherent inertia of these switches a limitation is imposed on the number of distinctive cadence signals which can be made available with a signaling period of reasonable length. The object of the invention is to provide improved switching arrangements whereby the limitations of electro-mechanical switching means as regards speed and current carrying capacity will be avoided, thus improving the efficiency and scope of centralised control systems of the type in question.

According to one feature of the invention, in a signal transmitter for applying high frequency signaling currents to an electric supply network in the form of coded pulses, the high frequency generator is connected to the network throughout the signaling operation by way of a filter with a pass range including the signaling frequency and the coded signals are produced by altering the characteristics of the filter so that it no longer passes the signaling frequency.

According to another feature of the invention, in a signal transmitter for applying high frequency signaling currents to an electric supply network in the form of coded pulses, the application of the signaling currents is effected under the control of switching devices comprising grid-controlled gas discharge tubes whereby switches of small current-carrying capacity may be employed to control the transmission of considerable signaling currents interrupted at high speed.

A further feature of the invention is that in a signal transmitter for applying high frequency signaling currents to an electric supply network

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in the form of coded pulses, the high frequency generator is connected to the network throughout the signaling operation by way of a filter with a pass range including the signaling frequency but excluding the supply frequency, the flow of signaling current into the network being intermittently prevented by alteration of the characteristics of the filter by the shunting effect of the ionised anode-cathode path of a grid-controlled gas discharge tube to the grid of which variable control potentials are applied.

It should be explained that the reference to the signaling currents as "high frequency currents" is intended to mean that they are of a frequency which is high compared with the supply frequency; in practice the frequency employed will probably be within the audio range as in the example about to be described.

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 which shows circuits of a simplified scheme of single-phase audio-frequency injection to a single-phase electric supply network and in which the cadence control is effected by a pair of gas discharge tubes. The construction and method of operation of a typical signal responding unit is disclosed in British specification No. 518,877.

500 cycle audio frequency currents at a voltage of the order of 500 volts are derived from a generator AFG and are applied to a 6600 volts 50 cycle electric supply network via a filter circuit which comprises inductor L1, variable inductors VL1 and VL2, and condensers C1 and C2, and which resonates at the audio frequency concerned so as to offer a low impedance to the forward passage of audio frequency currents and a high impedance to any backward passage of supply frequency currents.

Inductor VL1 has a secondary winding which is periodically short-circuited by gas discharge tubes GTA and GTB when the rhythm control switch RCS is operated at the appropriate intervals. Each time the secondary winding is short-circuited, the impedance of the primary winding is lowered accordingly, and the resultant shunt which is imposed on the audio frequency injection circuit throws this circuit out of tune and so imposes a high impedance to the passage of superimposed currents through to the supply network, and at the same time offers a shunt path for the audio frequency energy from generator AFG.

When the switch RCS is in its normal position

as shown, alternate half waves of the 500 cycle audio frequency current are applied to the two gas discharge tubes in turn, the required anode potential being obtained by providing a suitable high ratio step-up between the primary and secondary windings of inductor VL1. The tube control grids are normally biased 64 volts negatively with respect to their cathodes, there being provided for each valve two grid biasing batteries, or their equivalents incorporating electrical rectification from the mains supply, which are normally in opposition and which are designated 70 volts and 6 volts respectively. The heavy standing negative bias on the control grids prevents the tubes from coming into operation so that there will not be any interference with the band pass filter effect permitting the audio frequency currents from generator AFC to pass into the supply network.

When switch RCS is operated, however, the 70 volt negative bias voltage source for each valve will be shunted by the high value current limiting resistances R1 and R4, and the control grids will thus be rendered 6 volts positive with respect to their cathodes, resistances R2 and R3 serving in known manner for grid current limiting purposes under these conditions. On one half cycle of the audio frequency current when the upper end of the secondary winding of inductor VL1 becomes positive with respect to the lower end, tube GTA will strike and will impose a low resistance shunt on this secondary winding. On the succeeding half cycle the lower end of the secondary winding will become positive with respect to the upper end, whereupon tube GTB will strike and will produce the same effect as tube GTA. By this time tube GTA will have been extinguished and will be awaiting the next half cycle and so on. So long as switch RCS remains operated, tubes GTA and GTB continue to flash on alternate half cycles and thus to reduce the value of the audio frequency current injected into the supply network to negligible proportions, since owing to the alteration of the value of one component of the filter, it no longer passes the audio frequency current.

The currents to be carried by the contacts of the control switch RCS will be very small and in practice these contacts would be arranged to be opened and closed at regular intervals by motor-driven cams, the rate of interruption being adjusted in accordance with the particular signal which is required to be transmitted.

When injection is to be made on polyphase electric supply networks, use will preferably be made of a polyphase audio frequency generator, and a pair of gas discharge tubes and associated tuned circuit equipment will be provided for each phase concerned. Each pair of gas discharge tubes will, on the operation of the rhythm control switch or its equivalent, come into operation in turn under control of the polyphase audio frequency voltages in order to control the injection of the audio frequencies on to the electric supply network.

It will be understood that the invention is not limited to the use of gas discharge tubes as any switching device having the necessary current carrying capacity might be employed though static switching devices have obvious advantages. Moreover, instead of the form of gas discharge tube shown, use might also be made of mercury arc rectifiers of the type in which an arc is started by means of a special igniter. Such devices have

an advantage in some circumstances in that they are operable at comparatively low potentials.

It will also be appreciated that the invention is not limited to the particular electrical connections of the inductors and capacitors shown comprising a form of band pass filter. Use could also be made of a single condenser and inductor arranged as a simple acceptor circuit and thus forming in effect a high pass filter. In this case the inductor would preferably be provided in two parts, only one of which would carry a secondary winding adapted to be shunted by the switching device.

According to the invention therefore the usefulness of centralised control systems of the type in question is extended and their cost reduced by the possibility of using simpler and cheaper switchgear capable of satisfactory repeated operation at higher speeds.

What we claim as new and desire to secure by Letters Patent is:

1. A signal transmitter for applying high frequency signaling current to a signaling channel comprising a fixed frequency signal current generator, a filter having a variable pass range normally including the signaling frequency connecting said generator to the channel, a pair of normally non-conductive gaseous discharge tubes each associated with said filter so as to individually control the pass range thereof, and means for transmitting coded signals over the channel by intermittently rendering said tubes alternately conductive to thereby intermittently alter the pass range of said filter so as to exclude the signaling frequency.

2. A signal transmitter for applying high frequency signaling currents to an electric supply network comprising a fixed frequency signal current generator, a filter having a variable pass range normally including the signaling frequency connecting said generator to the network, a pair of normally non-conductive grid-controlled gas discharge tubes each associated with said filter so as to individually control the pass range thereof, and means for applying variable control potentials to the grids of said gas discharge tubes so as to intermittently render them alternately conductive to thereby intermittently prevent the flow of signaling currents into the network by alteration of the pass range of said filter.

3. A signal transmitter as claimed in claim 2 in which an inductance element of said filter is formed by the primary winding of a transformer, and said gas discharge tubes are operative to short-circuit the secondary winding of said transformer to thereby alter the pass range of said filter.

4. A signal transmitter as claimed in claim 2 in which an inductance element of said filter is formed by the primary winding of a transformer having a high step-up ratio, and said gas discharge tubes are operative to short-circuit the secondary of said transformer to thereby alter the pass range of said filter.

5. A signal transmitter for applying high frequency signaling current to an electric supply network comprising a source of high frequency current, a filter having a variable pass range normally including the signaling frequency connecting said source to the network, a variable impedance element forming a shunt leg of said filter, a pair of gaseous discharge tubes each coupled to said element so as to individually control the impedance thereof, and means for intermittently preventing the flow of signaling current to the

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network by intermittently rendering said tubes alternately conductive to vary the impedance of said element, whereby a low impedance shunt path is formed for the signaling current and the frequency characteristics of said filter are altered so as to offer a high impedance to the flow of signaling current therethrough.

6. In a signaling system, a source of fixed frequency alternating current, a signaling channel, a filter having a pass range including said fixed frequency connected therebetween, an inductance consisting of the primary winding of a transformer forming a part of said filter, a pair of grid-controlled gas discharge tubes connected to a secondary winding of said transformer so as to be operative on alternate half-cycles of the alternating current wave, and means for transmitting signals over said channel by applying control potentials to the grids of said discharge tubes so as to alter the value of said inductance to thereby cause said filter to offer varying degrees of attenuation to said alternating current.

7. A signal transmitter for applying high frequency signaling currents to an electric supply network comprising a fixed frequency generator, a filter having a pass range including the signaling frequency connecting said generator to the

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network, a grid-controlled gas discharge tube associated with said filter, the grid of said gas discharge tube being normally maintained at a high negative potential with respect to the cathode by two different valued voltage sources serially connected therebetween, and means operated to shunt one of said voltage sources to cause the tube to strike and thereby alter the frequency characteristics of said filter so as to prevent the flow of signaling currents into the network.

8. In a signaling system, a source of fixed frequency alternating current, a signaling channel, a filter having a pass range including said fixed frequency connected therebetween, an inductance element forming a part of said filter, a pair of grid-controlled gaseous discharge tubes coupled to said element so as to be operative on alternate half-cycles of the alternating current wave to effectively shunt the same, and means operated to transmit signals over said channel by applying control potentials to the grids of said discharge tubes so as to cause them to fire alternately and effectively shunt said inductance element, thereby causing said filter to offer varying degrees of attenuation to said alternating current.

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