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ELECTRIC WAVE TRANSMISSION SYSTEM

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FIG. 1

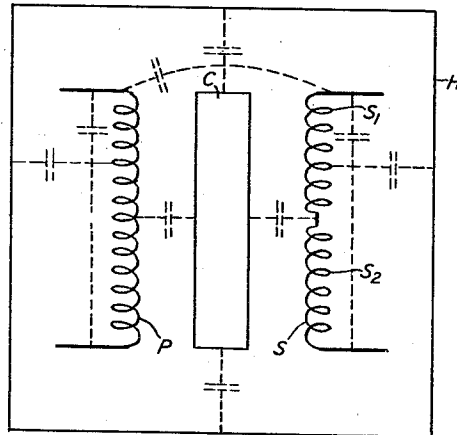
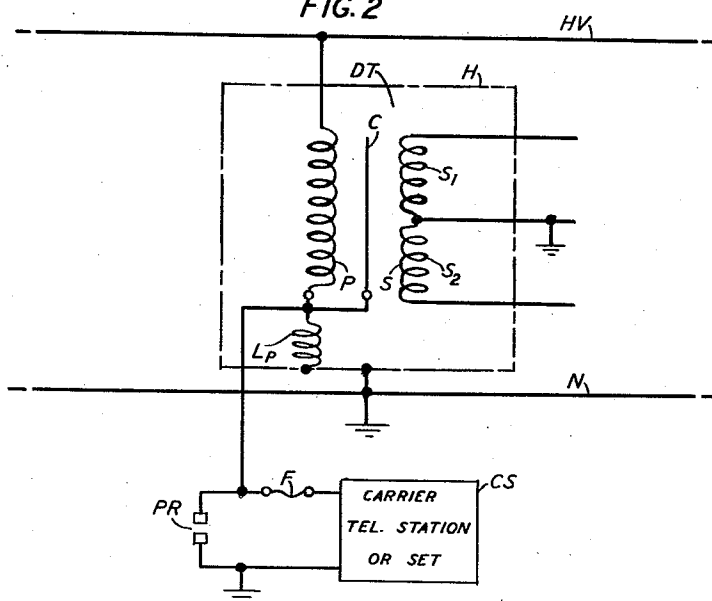


FIG. 2



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ELECTRIC WAVE TRANSMISSION SYSTEM

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Application October 5, 1940, Serial No. 359,873

4 Claims. (Cl. 179-2.5)

This invention relates to electric wave transmission systems and, more particularly, to carrier frequency telephony on power line and to an arrangement for coupling the carrier frequency telephone station or set to the power line.

Carrier frequency telephony over power lines, of course, is well known as are various expedients for coupling the telephone stations to the power line. The use of coupling condensers, of aerials or conductors in proximity to and extending along a section of the power lines, and of the distribution transformer coupling the power line to a tributary or power consumer's line have been proposed.

The usual practice is to transmit electric power over a main power line at low frequency and high voltage and to distribute it to tributary, subsidiary or power consumer's lines through distribution transformers that step down the voltage to a standard value, for example, 110 volts or 220 volts. Such a transformer generally comprises a primary and a secondary winding wound on a magnetic core and enclosed in a metallic case or housing, the housing being connected to ground and the core grounded on the housing. The distribution transformer embodies a number of distributed capacitances the most prominent of which are those between the windings and the case and the core and the case, the windings and the core, and the distributed capacitances of these windings.

Prior to this invention, it had been established that the carrier telephone set or station could be coupled to the power line through a circuit tuned to the carrier frequency, this circuit comprising the distributed capacitance of the transformer's primary winding and an inductive impedance connected in series with the primary winding, the carrier telephone set being connected in parallel or in series with the impedance. The distributed capacitance of the primary winding to the case, core and secondary winding is in shunt with the impedance of the primary winding, however, and is not tuned by this method.

An object of this invention is to improve this type of coupling and to enable additional of the available transformer capacitances to be utilized for carrier frequency coupling purposes.

This object is realized in accordance with this invention by insulating the core from the transformer case, connecting one end of the primary winding of the transformer to the core, and connecting the inductive impedance between the grounded case and the junction of the primary winding and core.

The invention will be described in greater detail with reference to the accompanying drawing, wherein:

Fig. 1 is a schematic of a typical power transformer; and

Fig. 2 shows a circuit arrangement embodying the invention and including a transformer of the type shown in Fig. 1.

The electric power distribution systems for rural areas are usually on a low frequency alternating current basis, either one, two or three phase. The power line may comprise two or more conductors and, in a three-phase system, would comprise at least three wires or conductors and a neutral wire. The consumer derives his power over a tributary or distribution line through a transformer coupling it to two phase wires, or to a phase wire and the neutral.

The distribution transformer as shown in schematic in Fig. 1 usually comprises a metallic case or housing H, a magnetic core C usually connected directly to the case, a primary winding P and a secondary winding S. Although there does not appear to be any standard voltage for the power line, consumer's line voltage is generally 110 volts. The secondary winding may comprise a single winding across which such voltage would be developed, or, as shown in Fig. 1, may comprise two sections S₁, S₂, with their junction or common terminal adapted to be connected to ground or to a ground wire extending into the consumer's premises, 110 volts being developed across each secondary section.

There are many effective capacitances present in such a transformer. The most prominent are those existing between the primary winding and the case, the secondary winding and the case and the core and the case, between the primary winding and the core and the secondary winding and the core, and between the primary and the secondary windings and involving the primary and the secondary windings. Although these are distributed capacitances, for clarity of showing they are indicated in Fig. 1, by the conventional symbol, as lumped capacitances.

As already indicated, prior to this invention it had been established that by connecting a suitably proportioned inductance in series with the primary winding of such a transformer, the primary winding's distributed capacitance could be tuned with the inductance to a carrier frequency used for transmission of telephonic signals over the power line, and that the carrier telephone set, station or equipment could then be connected in parallel or in series with the inductance.

Such arrangement, inter alia, is disclosed and claimed in L. K. Swart application Serial No. 359,879, filed October 5, 1940.

With the present invention, as shown in Fig. 2, additional of the transformer's effective capacitances are made available for carrier frequency tuning purposes. The primary winding P of the distribution transformer DT is connected between a high voltage wire HV and the neutral wire N, with an inductance L connected between the primary winding's low potential end or terminal and the transformer housing which is connected to ground, as is the neutral wire. The core is insulated from the housing, and is connected to the low potential end of the primary winding. The carrier frequency transmitting and receiving set or equipment CS is connected across the inductance L and may be safeguarded against the hazard of high voltage end current arising on the power line by a suitable fuse F and protector PR. With this arrangement, the capacitances between the primary winding and the case, core and secondary windings are available for tuning with the inductance L to the frequency of the carrier wave being used in the system for telephonic transmission.

Although the invention has been disclosed with reference to a single embodiment, it will be understood that it is not limited thereto but by the appended claims only.

What is claimed is:

1. In combination, a transmission line for distribution of electric power and for transmission of telephonic signals on carrier wave, a subsidiary line, a power transformer coupling said subsidiary line to said transmission line, said transformer comprising a metallic case containing a magnetic core and a plurality of windings, one of said windings being connected with said transmission line and a second of said windings being connected with said subsidiary line, said core being insulated from said case, and a carrier frequency telephone station coupled to the transmission line, the station coupling means including the transformer winding connected with said transmission line and an inductive impedance for tuning transformer effective capacitances to the carrier wave.

2. In combination, a transmission line for distribution of electric power and for transmission of telephonic signals on carrier wave, a subsidiary line, a transformer coupling said subsidiary

line and said transmission line, said transformer comprising a case containing a magnetic core, a primary winding and a secondary winding, said primary winding being connected with said transmission line and said secondary winding being connected with said subsidiary line and said core being insulated from said case and connected to one end of the primary winding, and a carrier frequency telephone station coupled to said transmission line, the station coupling means including transformer capacitances and an inductance coil connected with said primary winding and said core for tuning said capacitances to the carrier wave.

3. In combination, a transmission line for distribution of electric power and for transmission of telephonic signals on carrier wave, a subsidiary line, a power transformer coupling said subsidiary line and said transmission line, said transformer comprising a case containing a magnetic core, a primary winding connected with said transmission line and a secondary winding connected with said subsidiary line, said core being insulated from said case and connected to one end of the primary winding, and a carrier frequency telephone station coupled to said transmission line, the station coupling means including transformer capacitances and an inductance coil for tuning said capacitances to the carrier wave, said inductance coil being connected between said case and the junction of said primary winding and said core.

4. In combination, a transmission line for distribution of electric power and for transmission of telephone signals on carrier wave, a subsidiary line, a power transformer coupling said subsidiary line and said transmission line, said transformer comprising a grounded case containing a magnetic core, a primary winding and a secondary winding, said primary winding being connected with said transmission line and said core being insulated from said case and connected to one end of the primary winding, and a carrier frequency telephone station coupled to said transmission line, the station coupling means including transformer capacitances and an inductance coil for tuning said capacitances to the carrier wave, said inductance coil being connected between said case and the junction of said primary winding and said core.

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