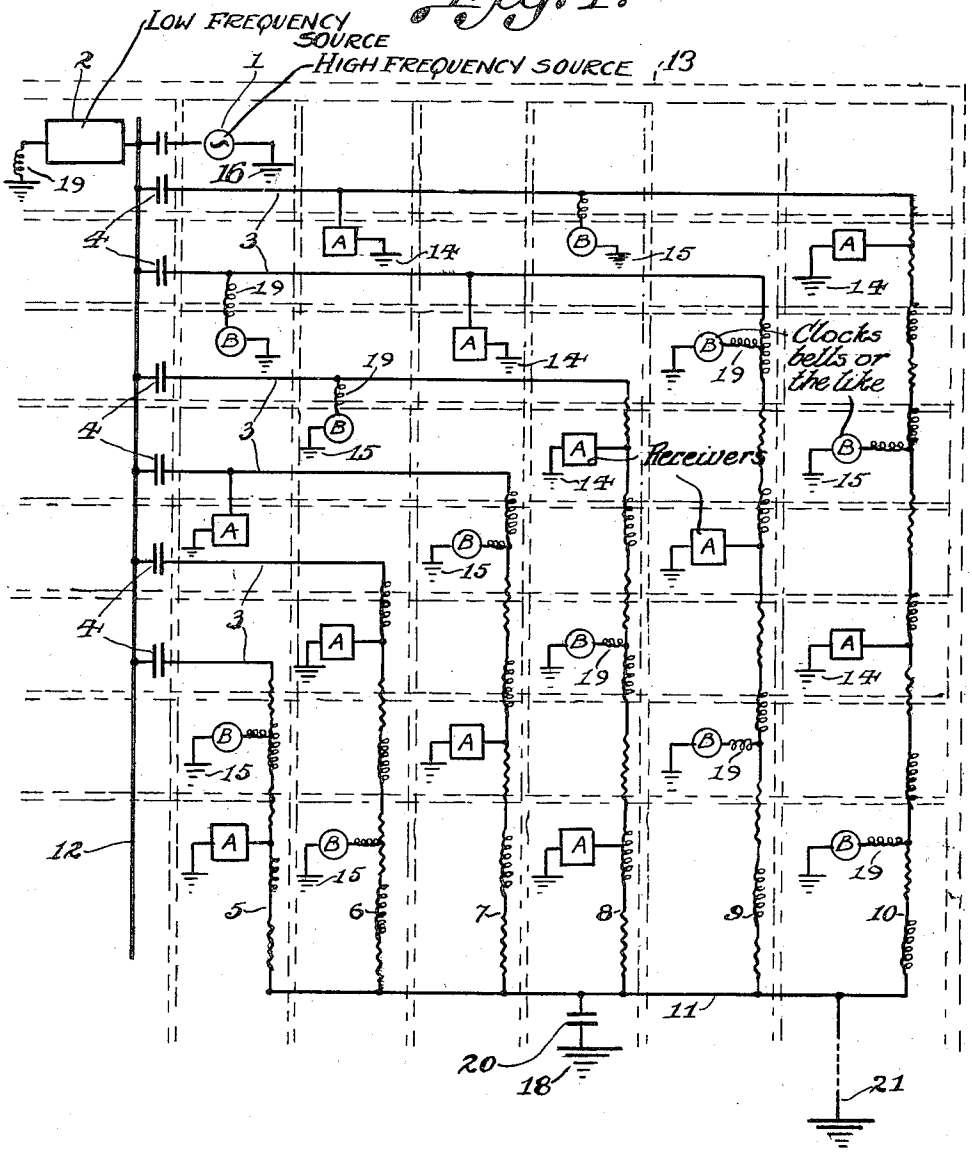
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METHOD AND MEANS FOR DISTRIBUTING ALTERNATING CURRENTS

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Fig. 1.



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METHOD AND MEANS FOR DISTRIBUTING ALTERNATING CURRENTS

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This invention relates to distributing electric current systems of high or low frequencies and with particularity to modulated high frequency oscillatory currents for the purpose of distributing radio messages and programs, and modulated audio frequency currents emanating from a microphone transmitter, or phonographic pick-up, or output from a radio receiving set, and unmodulated single frequencies for the actuation of relays at remote points for the operation of various mechanical and electrical devices.

An object of this invention is to limit the distribution of such current to an approximately circumscribed volumetric unit of space.

A further object of this invention is to utilize existing metallic building materials and structural members or adjuncts thereto, to serve as conducting media for distributing currents within a given building or structure, steamship or other vessel, vehicles of all kinds, air-craft, and in mines, tunnels or other excavation or construction work.

The terms "structural media", or "distributing media", or "network system", or "metallic or structural components", or "adjuncts thereto", as herein used, are to be construed as including any metallic integral part of a building or other structure, or steamship or other vessel, or vehicles of all kinds, or air-craft, or in mines, tunnels or other construction or excavation work; such as steel girders or frame-work, water, gas, steam, oil or waste piping, pneumatic tubes or pipes, sprinkler systems, conduits, ventilating or exhaust flues, lightning rods, rails, or other metallic material permanently forming an integral part of a structural whole; all wiring systems such as electric light and power service lines, call bells, annunciator, telautograph, fire or burglar alarms, synchronized clock systems, telephone or telegraph systems, and other wiring permanently installed.

A feature of this invention is the approximate circumscribing of a definite unit of space by the network extension distribution of the metallic conducting media forming part of an integral structure or individual construction unit.

Another object of this invention is to unite the various conducting media, such as for example the several neutral power supply risers, but it is understood that other metallic media may be used, by a common bus wire to ground in the basement or lower or remote part of a given structure, thus extending the distributing media to a homogeneous and continuous network system extending throughout any given structure.

A still further object of this invention is to tap off from the several conducting media, as again from the plurality of neutral power supply risers and to extend such tap, preferably at its highest point through a condenser to another conducting medium herein designated the "feeder line", and which may consist of an existing metallic conductor, or may be a wire installed for the purpose and extending from the top of the structure downward but which must essentially not be connected to ground at any point except through the various network taps and the intervening condensers. This network of conducting media through its inherent characteristics becomes an impedance possessing both inductance and resistance, and it will be clear to any one conversant with the art that if a source of high or low frequency alternating electric current be impressed upon this distributing system at a relatively high point and a voltage measuring instrument be connected at any intermediate point in the network system to ground that a potential drop will be indicated.

It is therefore a further object of this invention to make use of the existing voltage drop as a means of transmitting oscillatory currents of high or low frequency by providing devices to be connected at any intermediate point of the network system at will throughout the structures fed by this network of conducting media, and to ground these devices to reproduce or detect by any well known means the original modulated or unmodulated impressed signals.

It is to be understood that the ground to which the receiving devices are connected in addition to the network system, may be of any other existing conductive medium such as a steam pipe system or a water pipe system that is inherently connected to ground.

A further feature of this invention is the impressing of a plurality of signal frequencies upon the feeder line supplying the network system simultaneously, thereby permitting the operation of selective devices for the reproducing of the various frequencies at one and the same time in a plurality of remote points throughout the building or other structure served by the network system formed by the conducting media.

Fig. 1 of the drawing is a diagrammatic illustration of a system in accordance with this invention as applied to a building.

For the purpose of illustrating one phase of this invention there is shown in the figure a schematic representation of a building having a plurality of radio sets distributed in various rooms throughout the building and a plurality of other devices for the reproduction and the operation

of audio signals, such as loud speakers, time clocks, thermal control devices or other mechanical or electrical contrivances, all distributed throughout the building and fed from the same network of conducting media. In the same building is shown located on the top floor, a source of high frequency oscillatory modulated currents, as for example the output of an oscillator modulated by the output of a master radio receiving set that is picking up broadcast programs from outside the building. The output of the oscillator is shown impressed on the feeder line connected to all the neutral wires of the service electric light and power lines through a series of condensers one in each tap from the neutral riser to the feeder line. One side of the oscillator is grounded at the oscillator or at any other suitable point, either directly or through a suitable impedance.

In the same diagram is shown a source of low frequency oscillatory currents, as for example a microphone and amplifier, or it may be a master clock, or again it may be the output from a phonographic pick-up, or the direct audio output of a radio receiving set. This source of low frequency oscillations is also located on the top floor and is shown in the schematic diagram as connected to the same feeder and network system as is supplying the radio distribution, and to ground.

Referring particularly to the figure, the source of radio frequency oscillations is shown by the numeral 1, connected to the feeder line 12, and grounded. The source of low frequency oscillations 2 is shown also connected to the feeder line 12 and to ground. A plurality of neutral wire risers, 5, 6, 7, 8, 9 and 10 forming part of the electric light and power distribution system of the building 13 are connected by taps 3 through condensers 4 to the feeder line 12. All the lower ends of the neutral risers 5, 6, 7, 8, 9 and 10 are shown connected by a common bus 11 to local ground 18 through condenser 20. In the diagram, 21 represents the power feeder line which may be grounded either in the building or at the power house.

Special radio receiving sets "A" are shown distributed throughout the building and connected to the nearest neutral wire, either 5, 6, 7, 8, 9 or 10, and to ground 14 which may be the radiator forming part of the steam pipe service of the building. The connection to the neutral electric wire becomes automatic when plugging in radio set "A" to the electric light outlet located in the individual rooms. Loud speakers or other devices controlled by low frequency signals, such as secondary clocks in a master clock system, or bells are shown located in a plurality of rooms within the building by the letter "B" and each such device is shown connected through a suitable choke coil or filter 19 to its nearest neutral riser, either 5, 6, 7, 8, 9 or 10, and ground 15 which may be the same as 14 or may be a connection to the water pipe system or other available ground. The purpose of the chokes or filters 19 is to prevent interaction between the high and low frequency transmission when both are used simultaneously. Any well known manner of coupling the various devices 1, 2, A, B, etc. to the feeders may be employed, and while the drawing shows a conductive coupling, it will be understood that other forms of coupling may be employed.

From the above description of the figure, it will become apparent to any one skilled in the art, that the potential drop between neutral risers 5, 6, 7, 8, 9 or 10, and ground 14 or 15 when utilized in connection with device "A" or "B" are used for the reproductions of signals emanating from the sources of high and low frequency oscillations 1 and 2.

It will also be seen from the above that this distribution system will be operative with no appreciable attenuation loss within the structure 13 served by the neutral risers 5, 6, 7, 8, 9 and 10 and the feeder line 12 and grounds 14, 15, 16 and 17, and that the external surfaces of the building 13 may be said to circumscribe the definite volumetric unit of space within the said building 13, and if devices "A" or "B" were located in an adjacent building and not connected to the network system within the building 13, but to the corresponding wiring and ground systems within the adjacent building, then these devices would be unaffected since the attenuation loss would be substantially infinite.

While specific apparatus and devices have been mentioned and described for carrying out this invention, it will be understood that in its broad aspects the invention is not limited thereto, the main objects being the provision of a distributing system for high and low frequency oscillations in hotels, apartment houses, schools, factories, clubs or other buildings, or steamships or other vessels, or vehicles or aircraft, or in mines, tunnels or other excavation projects and construction work, utilizing existing conducting media with a minimum of installation wiring and providing means for reproducing or detecting or detecting transmitted signals in remote points within any given volumetric unit of space with a minimum amount of power transmission giving maximum power transference with negligible attenuation loss and employing inexpensive reproducing apparatus and equipment.

In other words the invention has for one of its principal objects the utilization, for conductively distributing signals or messages, of the elements or components which are primarily designed and arranged for a totally different purpose for example components ordinarily employed in buildings, or other unitary structures, some of which are specifically set forth hereinabove. It will be understood that while the drawing represents the network as comprising single wire risers (neutral wire) this is entirely schematic and the invention may equally well be applied to ordinary two-wire systems, using either or both of the power wires as risers.

It has been actually found that the hereinabove described system of conductively distributing messages or signals through existing structural components enables a high degree of efficiency to be reached in the signal reproduction and at a minimum cost. Thus in the case of radio or audio programs or messages it has been found that the simplest radio set may be employed. In one very large building in which the system has been in operation, an oscillator having a maximum output of the order of one watt has been sufficient to enable a single-tube set to be employed in each of the rooms for loud-speaker reproduction. Thus one set that is now used with the highest degree of faithfulness in reproduction employs a single ordinary amplifier tube which is also capable of acting as a detector.

What is claimed is:

1. In a system for distributing alternating signal currents to any number of points within a circumscribed unit of space within a structure, the

combination of a plurality of existing metallic elements within the structure, means for grounding all of said elements, a common feeder connected to all of said elements, the points of connection of said feeder to each of said elements being electrically remote from the common ground, grounded means connected to said feeder for impressing a plurality of alternating signal currents on said feeder, whereby a closed conductive network having distributed impedance is formed, and a plurality of grounded signal devices selectively responsive connected to said network at distributed points exclusive of the point of connection of said grounding means, all of said distributive points having inherently different potentials with respect to ground.

2. In a system as described the combination comprising a network composed of conducting members within a structure, said members having inherent, distributed impedance, means for grounding all of said members, a plurality of grounded sources of alternating current signal energy, means for connecting the high potential terminals of said sources to the network at a point electrically remote from the network grounding means, whereby a closed conductive network having distributed impedance is formed, the signal energy from said sources producing in the inherent impedance of said network potential differences, and a plurality of grounded selective signal responsive devices connected to said network at distributed points exclusive of said grounding means.

3. In a system as described the combination comprising a network composed of conducting members within a structure, said members having inherent, distributed impedance, means for grounding all of said members, a grounded source of alternating current signal energy, means for connecting the high potential terminal of said source to the network at a point electrically remote from the network grounding means, whereby a closed conductive network having distributed impedance is formed, the signal energy from said source producing in the inherent impedance of said network potential differences, and a grounded selective signal responsive device connected to said network at a point other than said grounding means.

4. In a system as described the combination comprising a network composed of existing metallic elements within a structure, the elements having inherent impedance, means for providing a common ground to all said members, a grounded source of alternating current signal energy, means for connecting the high potential terminal of said source to the network at a point electrically remote from the point of grounding of the network whereby a closed network is formed, the signal energy from said source producing in the inherent impedance of the network potential differences, a plurality of selective grounded signal responsive devices, and means for connecting the high potential terminals of said devices to said network at distributed points exclusive of said point of common ground, whereby the responsive signal devices are subjected to the potential differences developed in the inherent impedance of the network.

5. The method of transmitting electric signal energy within a structure having therein a closed conductive network having distributed impedance while substantially confining the signal energy within the volumetric space defined by the structure, the network including a grounded source of electric signal energy and the network having a second ground remote from the point of connection of the signal source to the network, which comprises impressing alternating electric signal energy upon the network from the source to produce potential differences therein in accordance with the distributed impedance of the network, and utilizing the potential difference variations in the network at points between the remote ground and the point at which the signals are impressed to operate a grounded electric signal responsive device.

6. The method of distributing alternating current electric signal energy within the volumetric space defined by a structure having a grounded conductive network having inherent distributed impedance, a grounded source of alternating current electric signal energy connected to said network at a point remote from the point of grounding of the network and forming therewith a closed network and a plurality of grounded signal responsive devices connected to the network at spaced points between the points of connection of the source to the network and grounding of the network, comprising impressing alternating current signal energy from the source upon the network to produce in the distributed impedance of the network potential drops corresponding to said energy and impressing the potential drops upon the responsive signal devices to operate them.

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