

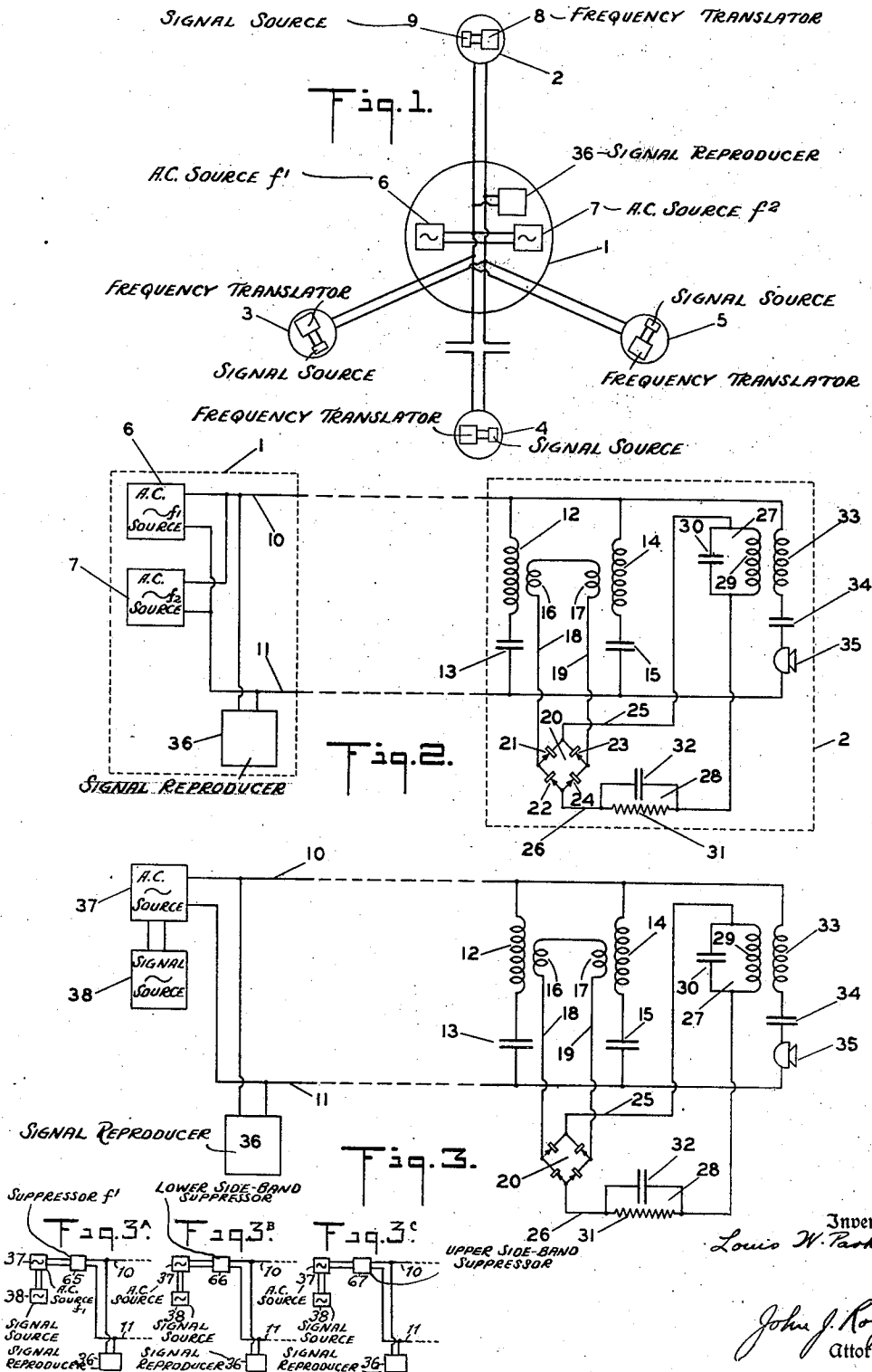
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INTERCOMMUNICATING SYSTEM

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INTERCOMMUNICATING SYSTEM

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This invention relates to intercommunicating systems and more particularly to an improved method of intercommunication between a central station and one or more distant stations.

5 A principal object of the invention is to provide a system of intercommunication between a central station and one or more outlying stations wherein the signalling energy generating equip-
10 ment is located entirely at the central station. As a result of this it is possible to provide satisfactory communication from outlying points to a central station in situations where it would be impossible or impractical to locate the usual signal energy generating devices at the outlying
15 points. The upkeep and surveillance of the signal energy generating equipment is therefore confined to the central station. Such a system can be used for example to provide intercommuni-
20 cation between the bridge of a vessel and a plurality of outlying points on the vessels, e. g., engine room, life-boat stations, wheel-house, etc., even though the usual ship's generator should fail. Furthermore the communication can be
25 achieved in any emergency over the existing metallic media of the ship, thus obviating the running of special signal conductors to all the important points of the vessel.

Another object of the invention is to provide a system of selective signalling between a plurality
30 of outlying stations and a central station, by employing different signal frequencies but without requiring the relatively complicated wiring connections and apparatus usually employed for this purpose.

35 A feature of the invention relates to a central station intercommunicating system wherein a sustained alternating current of a given frequency or frequencies, is transmitted from the central station to one or more outlying stations
40 where it is translated into an alternating current of a different frequency to serve as a carrier of signals back from the outlying stations to the central station.

Another feature relates to a system of inter-
45 communication between an outlying station and a central station whereby at the outlying station a signal modulated carrier frequency current may be transmitted to the central station employing not moving generating equipment, oscillator gen-
50 erators or the like at the outlying station.

Another feature relates to novel circuit ar-
rangements at a distant station for receiving
signal energy of one frequency from a central
station and converting it locally at the distant
55 station into signal energy of a different fre-

quency for retransmission back to the central station.

A further feature relates to a system of inter-communication which is well adapted to provide
5 two-way communication between a central point and a plurality of outlying points which may or may not be mobile, e. g., between an executive's office and various departments in a factory, office building, school, hospital or the like; or in construction operations between headquarters and
10 various points of operation which are mobile or semi-permanent in character, such as elevators or supply trains, and without the necessity of running special signal conductors to the various
15 points. It will be seen also that this system is particularly well-suited to provide communication between a director's booth and the various points on a "movie location."

A still further feature relates to the novel organization, arrangement and relative connection
20 of parts which go to make up a reliable, simple and efficient system of communication between a plurality of outlying stations and a central station.

Other features and advantages not specifically
25 enumerated will be apparent after a consideration of the following detailed descriptions and the appended claims.

While the invention will be disclosed herein as applied to one form of intercommunicating sys-
30 tem it will be understood that this is done merely for purposes of explaining the inventive concept and not by way of limitation. Likewise while the various methods are shown in diagrammatic or schematic form, only sufficient apparatus is dis-
35 closed in detail as to enable a thorough and complete understanding of the invention to be attained. It will be clear to those familiar with the art of intercommunication that various changes in the type and details of the various
40 parts and apparatus represented schematically may be made without departing from the spirit and scope of the invention. Accordingly in the drawing,

Fig. 1 is a schematic diagram of a typical inter-
45 communicating system for purposes of explaining the invention, and which is separately covered in application Serial No. 106,789, filed October 21, 1936.

Fig. 2 is a schematic wiring diagram showing the details of one of the outlying stations of Fig. 1.

Fig. 3 is a modification of Fig. 2, forming the subject matter of the present application.

Fig. 3A is a modification of Fig. 3 using only
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the upper and lower side bands of a modulated carrier.

Fig. 3^B is another modification using only the fundamental and an upper side band of the carrier.

Fig. 3^C is another modification using only the fundamental and lower side band of the carrier. Referring to Fig. 1 the numeral 1 represents any suitable central station such as a ship's bridge, a director's office or the like. The numerals 2, 3, 4 and 5 represent a plurality of distant stations or points from which communication is to be had with the central station. The stations 2, 3 and 5 are shown connected with the central station by a two-wire line, such as a telephone line, a telegraph line or the like, while station 4 is coupled to the central station by a space inductive link such as radio antennae or the like. The invention is not necessarily limited to the use of special signalling lines such as telegraph or telephone lines for connecting the various stations and therefore the two conductors shown connecting the stations in Fig. 1 may be the existing metallic media or adjuncts of a building structure or they may represent any known form of signalling channel either wires or wireless. For example one conductor may be the neutral wire of a three-wire electric light or power system, and the other conductor may be the grounded framework of the building in which the central station and the various outlying stations are located.

At the central station 1 there are located two sources 6, 7 each source being designed to generate an alternating electric current of a frequency different from that generated by the other. Preferably the sources 6 and 7 generate high frequency electric currents of sustained sinusoidal wave form, and preferably, although not necessarily the two sources are connected in parallel. The outputs of the two sources 6 and 7 are applied to the transmission networks or links leading to the various outlying stations. At each of the outlying stations there is provided a pick-up unit 8 consisting of circuit units such as inductances, condensers, rectifiers and the like, whereby the received electric energy is translated into carrier energy of a different frequency which is impressed back upon the same link leading from the central station. In circuit with each translating unit is a signalling device 9 such as a microphone, telegraph key or the like for varying the amplitude of the outgoing translated carrier. At the central station a suitable signal reproducing device 36 is located.

Referring to Fig. 2 a typical circuit arrangement is disclosed. At the main or central station 1 there are provided the two sources 6 and 7 for generating sustained alternating currents of different frequencies. Any well-known form of alternating current generator may be employed for this purpose preferably capable of generating substantially sinusoidal alternating current. The generators are connected in parallel to the two conductors 10, 11 which may be the conductors of a telephone pair, a radio antenna of any known type, or any two metallic adjuncts of an existing structure such as the grounded frame-work of the building in which the generators are located, and the neutral wire of a three-wire power or lighting system. If desired the conductors 10 and 11 may be the conductors of a two-wire power or lighting circuit. Connected across non-equipotential points of the network is a tuned circuit

consisting of an inductance 12 and a condenser 13, the condenser-inductance combination being adjusted to resonate at the frequency of one of the generators at the central station, for example the generator 6. Connected in parallel with the first tuned circuit is another similar tuned circuit consisting of the inductance 14 and the condenser 15 which have been adjusted to resonate at the frequency of generator 7. Coupled to inductance 12 is an inductance 16, and coupled to inductance 14 is a similar inductance 17. While the drawing shows the inductances 16 and 17 as separate inductances, it will be understood that a single inductance symmetrically coupled to the inductances 12 and 14 may be employed. The conductors 18, 19 leading from the terminals of the inductances 16, 17 are connected to a suitable rectifying arrangement designated generally by the numeral 20. Preferably, although not necessarily, this rectifying arrangement consists of two full-wave rectifiers connected in bridge formation as shown. Merely for purposes of explanation, the rectifying arrangement is shown as consisting of four half-wave rectifiers 21, 22, 23 and 24. These rectifiers may be of any well-known type but preferably are of a type not requiring separate power supply. Thus crystal, contact type rectifiers, chemical or electro-chemical rectifiers may be employed. It will be understood that the conductors 18, 19 instead of being coupled to the tuned circuits by inductive coupling, may be coupled in any other manner well-known in the art, e. g. by means of resistors, resistor-condenser combinations, chokes, or choke-condenser combinations, so long as energy of the two frequencies is efficiently applied to the rectifier arrangement.

Since the rectifiers are being supplied with two alternating currents of different fundamental frequencies, each of substantially sinusoidal wave form, there will appear in the output of the rectifier combination, namely across the conductors 25, 26, a plurality of components consisting of a direct current component, alternating components corresponding to multiples of the input frequencies, components equivalent to the sum of the input frequencies, and components equivalent to the difference of the input frequencies. The output conductors of the rectifier arrangement are connected in circuit with the tuned circuit 27 and the aperiodic circuit 28. The former preferably comprises an inductance 29 in parallel with a condenser 30, while the latter comprises a D. C. load resistor 31 in parallel with a by-pass condenser 32. The resistor 31 is preferably of such a value that it dissipates the D. C. component of the rectifier output and applies a sufficient load on the rectifier to insure proper operation thereof, while the condenser 32 is merely of sufficient capacity to provide a low impedance path for the alternating components. The inductance 29 and condenser 30 are adjusted to resonate at a frequency which is equivalent to the difference in frequency between sources 6 and 7. Coupled to inductance 29 is another inductance 33 and a series condenser 34, the said inductance 33 and condenser 34 being adjusted to resonate at the same frequency as that of the elements 29, 30. The energy in the circuit 33, 34 is applied to the connecting network 10, 11 through some suitable modulating device such as the microphone 35.

Located at some remote point where the signals impressed upon microphone 35 are to be received, for example at the central station 1, is an electrical signal reproducing device 36 which is capable of

being tuned to the frequency of the circuit 27. Preferably this signal reproducing device is provided with means for demodulating or detecting the signal modulations in the received modulated wave transmitted from the outlying station 2 over the connecting network described.

Instead of employing two separate frequency generators at the central station 1 connected in parallel to the transmission network, any other arrangement for producing two differing frequency currents may be employed. In accordance with the present invention there is shown in Fig. 3 a source 37 of sustained sinusoidal alternating currents is modulated by sustained sinusoidal currents from a source 38 of a lower or modulating frequency as compared with the frequency of source 37. It is well-known that such an arrangement produces in its output, currents not only of the fundamental frequency, i. e. frequency of source 37, but also upper and lower side-band frequencies. The modulated output of source 37 is impressed upon any of the transmission networks mentioned in connection with Fig. 1, and at the outlying station 2, two out of the three frequencies are selected by means of the tuned circuits 12-13, and 14-15. For example the circuit 12-13 may be tuned to the frequency of source 37, while the circuit 14-15 may be tuned to the frequency of either the upper side-band or the lower side-band. Alternating currents of two differing frequencies are rectified in the manner already described in connection with Fig. 1, and are used as the local carrier at the outlying station for transmitting a signal therefrom, either to the central station 1 or to some other point.

It will also be clear to those familiar with the art while the systems disclosed can be used for speech transmission, that any other type of signal device may be substituted for the microphone 35 to vary the resistance of the output circuit of the pick-up units for other types of transmission. For example a telegraph key, code signalling devices, facsimile, television and other signal devices may be employed. In like manner other types of signal devices may be substituted for microphone 62 and receiver 64. Further while in some of the embodiments the several sources of high frequency currents have been shown connected in parallel, it is possible to use a series connection. Likewise instead of coupling these sources directly to the transmission network, they may be coupled thereto capacitatively, inductively, or through a suitable corrective network, filter, bridge circuit or the like, as will be obvious to those familiar with the art. Other changes may be made in the various embodiments without departing from the spirit and scope of the invention.

In the embodiment of Fig. 3, instead of transmitting the fundamental frequency and the upper and lower side bands to the receiving station and effecting the selection at the receiving station, the selection of the two frequencies may be effected at the transmitting station. For example, as shown in Fig. 3A, the modulated current resulting from the interaction of the sources 37 and 38, consists of a fundamental frequency, and the upper and lower side-band frequencies. By any well-known arrangement designated schematically by the numeral 65 the fundamental frequency may be suppressed and only the upper and lower side-band frequencies are then impressed upon the channel 10, 11. The remainder

of system of Fig. 3A may then be identical with that of Fig. 3.

Instead of suppressing the fundamental frequency, the lower side-band frequency may be suppressed. Such an arrangement is indicated schematically in Fig. 3B, wherein the numeral 66 represents any well-known arrangement for suppressing the lower side-band. Consequently, only the fundamental frequency and the upper side-band frequencies are impressed upon channel 10, 11. A similar arrangement is shown in Fig. 3C, wherein the device 67 suppresses the upper side-band and consequently only the fundamental frequency and the lower side-band are impressed upon channel 10, 11.

This application is a continuation-in-part of Application Serial No. 106,789, filed October 21, 1936, Patent No. 2,189,267, Feb. 6, 1940, in the name of Louis W. Kolozy whose name was changed by judicial procedure to Louis William Parker on or about January 28, 1937.

Subject matter disclosed herein but not claimed is claimed in applicant's Patent No. 2,144,380, granted January 17, 1939.

What I claim is:

1. The method of message signalling which comprises generating at a first station an alternating current, modulating at said station said alternating current by a second alternating current of lower frequency, transmitting the fundamental and only one side-band of the modulated alternating current to a second station, passing the fundamental and said one side-band through respective tuned circuits at said second station, combining the output of the tuned circuits to produce a third alternating current having a frequency different from either said fundamental or said side-band, and at said second station modulating in accordance with message signals only said third alternating current and transmitting said modulated current back to said first station.

2. The method according to claim 1 in which the frequency of said third alternating current is equal to the difference between said fundamental and said one side-band.

3. The method of message signalling which comprises generating at a first station an alternating current, modulating at said station said alternating current by a second alternating current of lower frequency, suppressing the fundamental and transmitting only the upper and lower side-bands to a second station, passing the said side-bands through respective tuned circuits at said second station, combining the output of the tuned circuits to produce a third alternating current of a frequency different from either of said side-bands, and at said second station modulating only said third alternating current and transmitting said modulated current back to said first station.

4. The method according to claim 1 in which only the fundamental and the lower side-band are transmitted to said second station.

5. The method according to claim 1 in which only the fundamental and the upper side-band are transmitted to said second station.

6. The method according to claim 1 in which the said third alternating current is produced by combining and rectifying the output of said tuned circuits.

7. The method according to claim 1 in which the said third alternating current after being modulated in accordance with message signals is transmitted back to the first station over the same signalling channel over which the currents

were transmitted from the first station to the second station.

8. In a system of the character described the combination of a transmission network adapted to receive from a distant station an alternating current of fundamental frequency and a single side band, means to combine said received currents to derive an alternating current of a frequency different from said received currents, and means to modulate in accordance with message signals only said derived current and means to transmit said modulated current back to said distant station.

9. In a system of the character described the combination of a transmission network adapted to receive from a distant station an alternating current of fundamental frequency and a single side band, means including a pair of tuned circuits each tuned respectively to said fundamental and said single side band, means to combine the output of said tuned circuits to derive an alternating current of a frequency different from either said fundamental or said single side band, and means to modulate in accordance with message signals only said derived current and means to transmit said modulated current back to said distant station.

10. A system according to claim 9 in which the means to derive said alternating current includes a rectifier network upon which the output of the tuned circuits is impressed.

11. A system according to claim 9 in which the output of the tuned circuits is passed through a rectifier network employing rectifiers of the type requiring no local source of power.

12. A system according to claim 9 in which the output of the tuned circuits is passed through a rectifier network, and the output of the rectifier network is passed through a tuned circuit tuned to the frequency of said derived alternating current.

13. In a system of the character described the combination of a first station, means at said station for generating an alternating current of a fundamental frequency, means at said station to modulate said fundamental frequency by currents of a lower frequency, means to transmit only said fundamental and one side-band to a second station, means at said second station to combine said fundamental and side-band to derive an alternating current of a third frequency, and means at said second station to modulate in accordance with message signals only said de-

rived alternating current and means to transmit said modulated current back to said first station.

14. In a system of the character described, the combination of a first station, means at said station for generating an alternating current of a fundamental frequency, means at said station to modulate said fundamental frequency current by currents of a lower frequency, means to suppress said fundamental frequency current and to transmit only the upper and lower side-bands of the modulated current to a second station, means to combine said side-bands at said second station to derive an alternating current of a third frequency, and means at said second station to modulate only said derived alternating current and means to transmit said modulated current back to said first station.

15. In a system of the character described, the combination of a first station, means at said station for generating an alternating current of a fundamental frequency, means at said station to modulate said fundamental frequency by currents of a lower frequency, means to transmit only the fundamental and one of the side-bands to a second station, means to combine said fundamental and side-band at the second station to derive an alternating current of a third frequency, and means to modulate in accordance with message signals only said derived current at said second station and means to transmit said modulated current back to said first station.

16. In a system of the character described, the combination of a first station, means at said station to generate an alternating current of a fundamental frequency, means at said station to modulate said fundamental frequency by currents of a lower frequency, means to select from the fundamental frequency and the upper side-band and the lower side-band frequencies only two frequencies for transmission to a second station, means at said second station to receive and combine said transmitted frequencies, the last-mentioned means including a pair of tuned circuits and a rectifier network for deriving a third frequency different from the received frequencies, and means at said second station to modulate in accordance with message signals only said third frequency and means to transmit said modulated frequency back to the first station.

17. A system according to claim 16 in which the rectifier network includes a rectifier of the contact type.

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