July 18, 1939. C. C. LANGEVIN 2,166,529

COMMUNICATION SYSTEM

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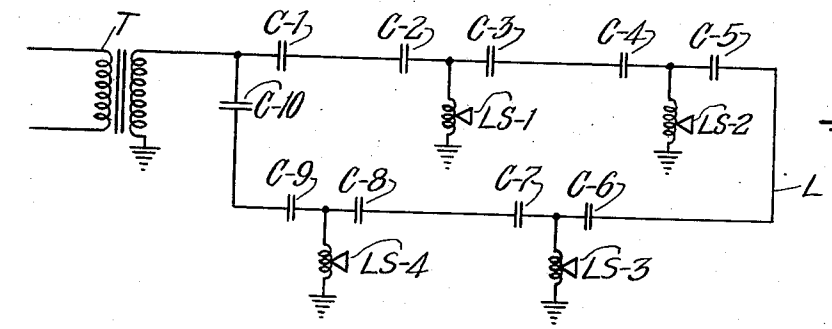


Fig. 1.

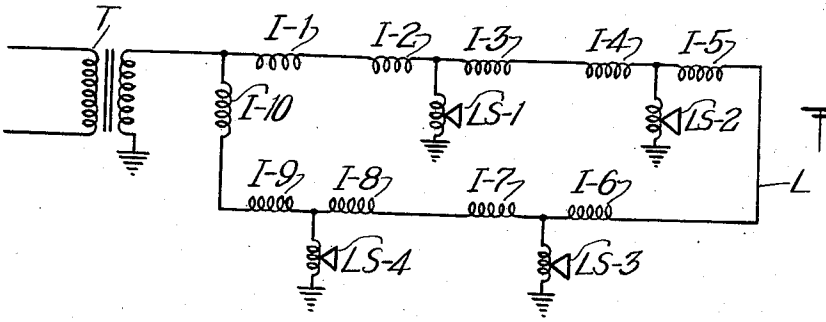


Fig. 2.

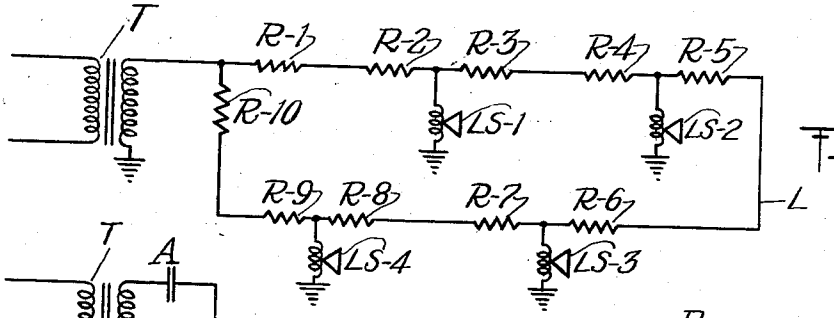


Fig. 3.

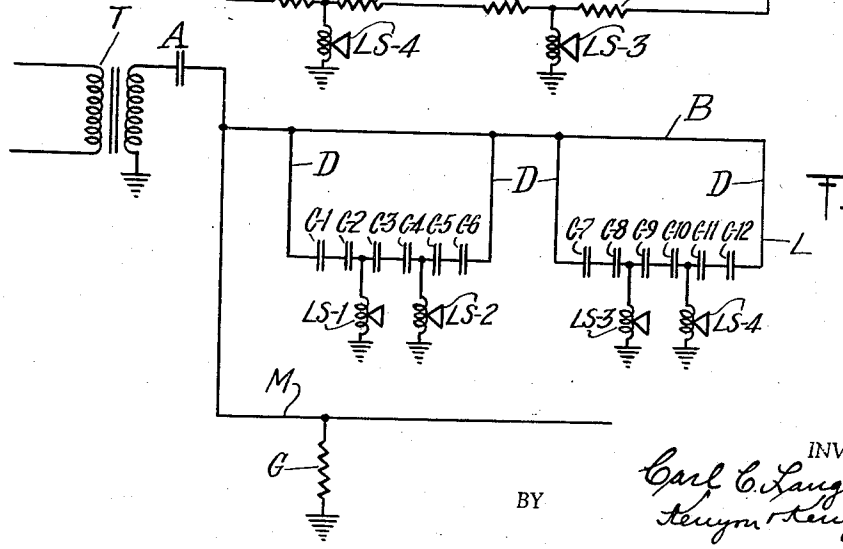


Fig. 4.

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Fig. 5.

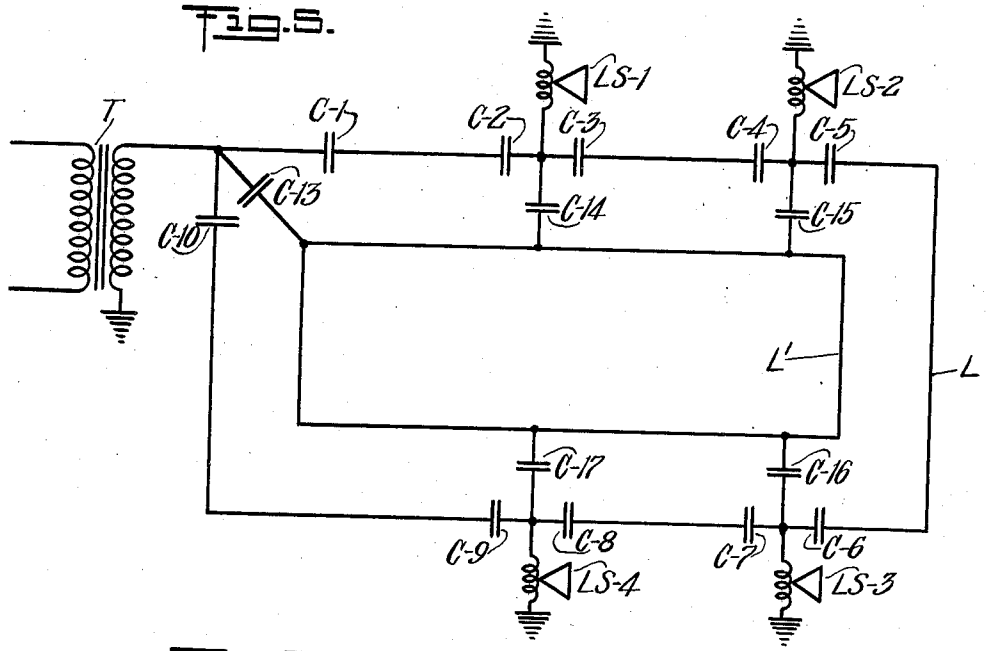
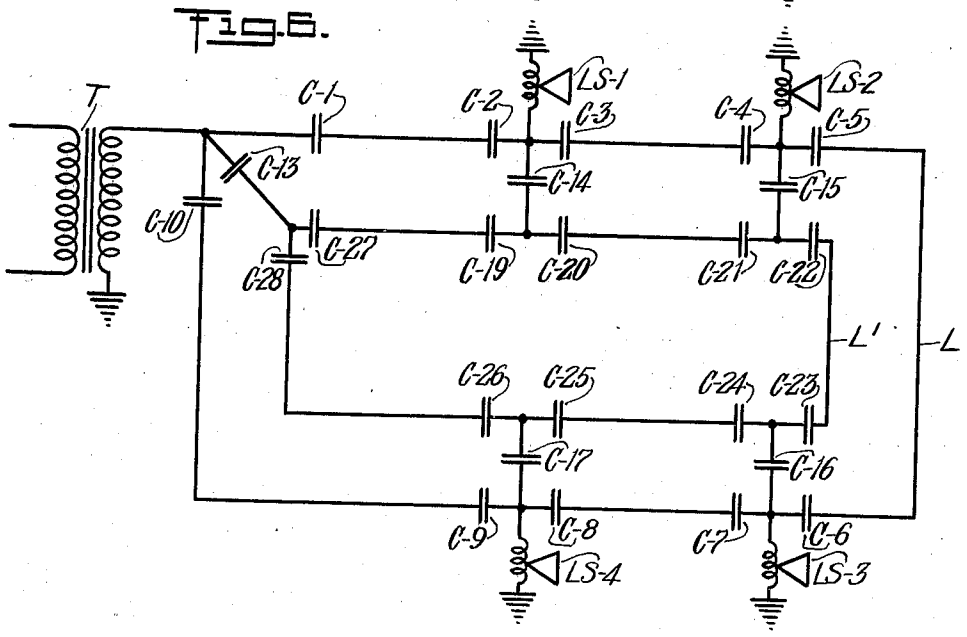


Fig. 6.



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COMMUNICATION SYSTEM

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Application April 1, 1937, Serial No. 134,233

13 Claims. (Cl. 179—1)

This invention relates to communication systems and more especially to a communication system adapted for use on ships. Such systems involve the location of loudspeakers in various parts of a ship with connections to a transmitter on the bridge or other suitable location by means of which intelligence may be communicated from the bridge to various parts of the ship. Navigation laws require that communication systems of this type be of such nature that an accidental open circuit or ground will not seriously impair the operation of the system as a whole, although it may impair the operation of a single loudspeaker.

An object of this invention is a ship's communication system of low cost and simplicity of design which is reliable in operation and meets the requirements of the navigation laws.

In a ship's communication system, embodying the invention, a closed loop is connected to one terminal of the secondary of the output transformer of the amplifier associated with the transmitter and the remaining terminal of the secondary is grounded. The loop is carried through the ship to the various loudspeaker stations at each of which stations a loudspeaker is connected to the loop. At each loudspeaker station a pair of impedances is included in the loop, one terminal of the loudspeaker being connected to the loop between the two impedances and the other terminal being grounded. Preferably, condensers are used as the impedances but inductances or resistances may also be used. The provision of the impedances prevents extremely low impedance grounds from interfering too greatly with the efficiency of the system.

Other objects, novel features and advantages of this invention will become apparent from the following specification and accompanying drawings, wherein:

Fig. 1 is a diagrammatic view of a communication system embodying the invention; and

Figs. 2 to 6 are similar views of modified systems.

A transmitter (not shown) includes an output transformer T. The secondary of this transformer has one terminal grounded and has its other terminal connected to a single wire loop circuit L. Included in the circuit L are a plurality of impedances consisting of the condensers C—1, C—2, C—3, C—4, C—5, C—6, C—7, C—8, C—9, C—10, the connection from the transformer secondary to the loop circuit being located between the condenser C—1 and condenser C—10. A loudspeaker LS—1 has one terminal connected to the loop circuit between the condenser C—2 and the condenser C—3 and has its other terminal grounded. A loudspeaker LS—2 has one terminal connected to the loop between the condenser C—4 and the condenser C—5 and has its other terminal grounded. A loudspeaker LS—3 has one terminal connected to the loop between the condenser C—6 and the condenser C—7 and has its remaining terminal connected to ground. A loudspeaker LS—4 has one terminal connected to the loop between the condenser C—8 and the condenser C—9, while its remaining terminal is grounded. The loop L is thus loaded by means of capacitators which provide the impedance required to prevent a low impedance ground from materially impairing the efficiency of the communication system. It will be seen from an examination of this circuit that high impedance loudspeakers with small capacity values will have identical characteristics and the same reactions to open or ground conditions as a network with low impedance loudspeakers and correspondingly higher capacitator values. Assume that an open circuit occurs between the condenser C—9 and the condenser C—10. There will then be eight condensers remaining in series in the circuit and under this condition, the most remote loudspeakers will receive slightly less low frequency energy than under normal conditions, but the essential parts of the voice frequency range will not be materially altered. If a ground occurs between the condenser C—9 and the condenser C—10 instead of an open circuit, the most remote loudspeaker will receive slightly less high frequency but the low frequency and the middle range will not be affected. This is due to the fact that condensers have higher impedance at low frequencies than at high frequencies. With a condenser between the ground and the nearest loudspeaker, the impedance to ground is high at low frequencies but low at high frequencies. This results in a condition of tilting the frequency characteristic for open circuit or ground condition without material energy losses or lack of intelligibility of speech.

In the circuit disclosed in Fig. 2, the arrangement is the same as in Fig. 1, except that inductances I—1, I—2, I—3, I—4, I—5, I—6, I—7, I—8, I—9, I—10, constitute the impedances in the circuit instead of the condensers of Fig. 1. The operation of this circuit will be readily understood from a comparison with the circuit of Fig. 1.

In Fig. 3, the impedances of the circuit L consist of resistors R—1, R—2, R—3, R—4, R—5, R—6, R—7, R—8, R—9, R—10. This circuit has

the disadvantage that if the resistors are of the same value, the loudspeaker at the far end of the loop will not receive the same amount of energy as those closest to the transformer T, as the power loss will be greatest in the resistors nearest the transformer as these resistors must pass the greatest current. This effect will be considerably exaggerated if the loop should be open circuited between the resistor R—1 and the resistor R—2 or between the resistor R—9 and the resistor R—10 as in the first case, LS—1 would then be at the end of a single line and the second case LS—4 would be the end speaker with all the energy flow through the resistor closest to the transformer T. In the case of an open circuit at either of these locations, the normal current through the first resistor and the resistors adjacent to the first two loudspeakers would be doubled with the voltage drop across these elements being also doubled and all the loudspeakers would receive less than their normal energy with the most remote one being most effected. The condition above described may be somewhat lessened by using resistance composed of tungsten or some similar metal or alloy which has the inherent property of increasing its resistance as the current through it increases. In this case, the open circuit condition is less objectionable than the grounded condition at the same location and open circuit or grounds occurring at more remote sections have practically no ill effect.

Fig. 4 discloses a communications system in accordance with the invention embodied in the ship lighting system which include a neutral leg. In most ships, emergency lighting systems are provided with switchboards having bussed neutrals located near the uppermost part of the ship, such a buss being indicated at B and being connected to the amplifier through a condenser A which blocks the lighting current from flowing through the amplifier output to ground. The usual neutral riser cables are indicated at D, these cables being connected at their upper ends to the buss B. The lower ends of the riser cables are interconnected through condensers C—1, C—2, C—3, C—4, C—5, C—6, C—7, C—8, C—9, C—10, C—11, C—12 inclusive, thus forming loops and the loudspeakers LS—1, LS—2, LS—3, LS—4 are connected to the loops as described in connection with Fig. 1, each loudspeaker having one terminal connected to a loop between two condensers and having its other terminal grounded. The main lighting system low potential buss M is suitably connected to the buss B and is kept above ground potential by a ground detector G which is generally from 10 to 15 ohms resistance. With this arrangement, the regular and emergency lighting systems are not coupled together and consequently through faulty condensers or other means cannot cause any interference or interference to either or both of the lighting systems. The speech frequencies are imposed on one wire of the lighting system and are returned to the transmitter by ground. This method avoids the necessity of installing inductance coils in series with the riser cables to provide a means of segregation.

In installations where alternating current lighting systems are used and the neutral leg is grounded, a series resonant circuit may be inserted between the neutral leg and ground. This resonant circuit should be tuned to the frequency of the alternating current lighting system which will provide practically zero impedance to ground for that frequency but will have high impedance to ground for all other frequencies. In the event troublesome harmonics are experienced from the lighting current, this resonant circuit may be supplemented by one or more sections of a low pass filter. In such A. C. lighting circuit installation, a small potential to ground is usually found on the neutral leg. If high impedance speakers are used, the interference to this is minimized as high impedance systems require higher operating voltage and lower current for the same power consumption.

The system disclosed in Fig. 5 is in the nature of a modification of the system disclosed in Fig. 1. A second loop circuit L' is connected through the condenser C—13 to the loop circuit L between the condensers C—1 and C—10. The circuit L' is further connected to the circuit L through the condensers C—14, C—15, C—16 and C—17, the connection of the last-named condensers to the circuit L being respectively between condensers C—2 and C—3, between C—4 and C—5, between C—6 and C—7 and between C—8 and C—9. The loudspeakers LS—1, LS—2, LS—3 and LS—4 are connected to the circuit L in the same manner as in Fig. 1.

In Fig. 6 is disclosed a system which also is in the nature of an improvement over the circuit disclosed in Fig. 1 and is generally similar to the circuit disclosed in Fig. 5. In this circuit, the condensers C—14, C—15, C—16 and C—17 are connected to the loop L' respectively between condensers C—19 and C—20, between condensers C—21 and C—22, between condensers C—23 and C—24 and between condensers C—25 and C—26. Also, the condenser C—13 is connected to the loop L' between condensers C—27 and C—28.

Both the systems disclosed in Figs. 5 and 6 comprise two loops, one having series impedance and the other having shunt impedances connecting it to the first loop. With this arrangement, an equalization of volume is obtained as well as the equalization of the frequency characteristic so that under the most adverse conditions no appreciable loss of volume obtains and no appreciable discrimination against frequency occurs. With the double loop arrangement, it is possible to open, short or ground both circuits at any point in the network without making inoperative more than one of the loudspeakers.

For the maximum transfer of energy from the loop L to the loudspeakers, it is important that the impedance of each loudspeaker should be conjugate with the impedance of the circuit as seen from the point of connection. This arrangement offers greater protection against interruption to service due to its apparent resonant condition.

I claim:

1. A communication system comprising a loop circuit, a transmitter including an output transformer, a connection from one terminal of the transformer secondary to said loop, a plurality of loudspeakers, a physical connection from one terminal of each loudspeaker to said loop circuit and a ground connection to the remaining terminal, and an impedance in said loop circuit at either side of each loudspeaker connection.

2. A communication system according to claim 1 in which the impedances are condensers.

3. A communication system according to claim 1 in which the impedances are inductors.

4. A communication system according to claim 1 in which said impedances are resistors.

5. A communication system comprising a loop circuit, a transmitter, a connection from said transmitter to said loop, a plurality of loudspeakers, a physical connection from one terminal of each loudspeaker to said loop circuit and a ground connection to the remaining terminal, and an impedance in said loop circuit at either side of each loudspeaker connection.

6. A communication system according to claim 5 in which the impedances are condensers.

7. A communication system according to claim 5 in which the impedances are inductances.

8. A communication system according to claim 5 in which said impedances are resistors.

9. A communication system comprising a loop circuit, signal responsive devices, a physical connection from one terminal of each signal responsive device to said loop circuit, and a ground connection to the remaining terminal, and series inductors inserted in said circuit between said signal responsive devices as a protection against service interruption by open, shunt or ground conditions.

10. A communication system comprising a loop circuit, signal responsive devices connected to said loop, series impedances inserted in said circuit between said signal responsive devices, a second loop circuit, and shunt impedances connecting said two loops.

11. A communication system according to claim 10 in which said impedances are capacitors.

12. A communication system, comprising a loop circuit, signal responsive devices connected to said loop, series impedances inserted in said circuit between said signal responsive devices, a second loop circuit, shunt impedances connecting said two loops, and series impedances inserted in said second loop circuit between said shunt impedance connections.

13. A communication system according to claim 12 in which said impedances are capacitors.

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