April 25, 1944. R. VILLEM 2,347,584

MARINE SOUND SYSTEM

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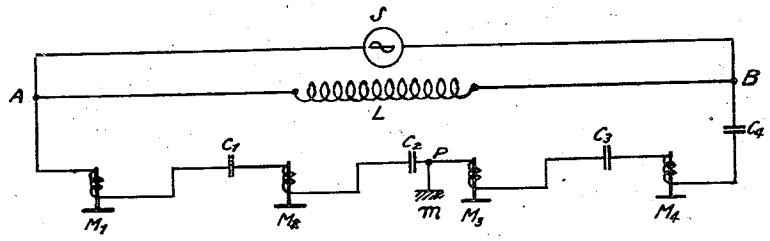


FIG: 1

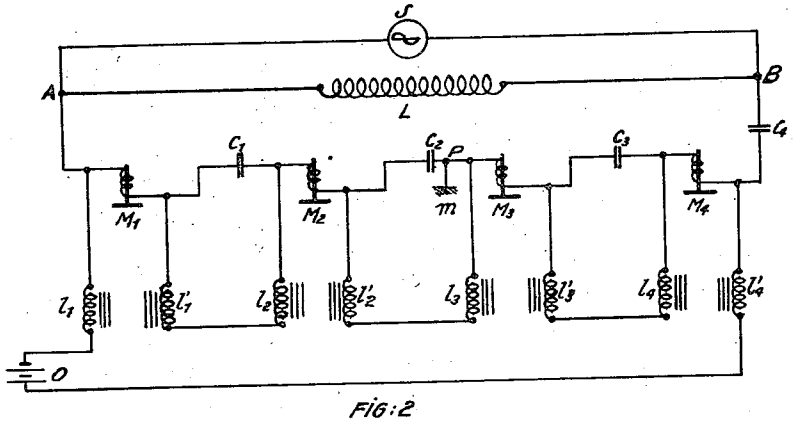


FIG: 2

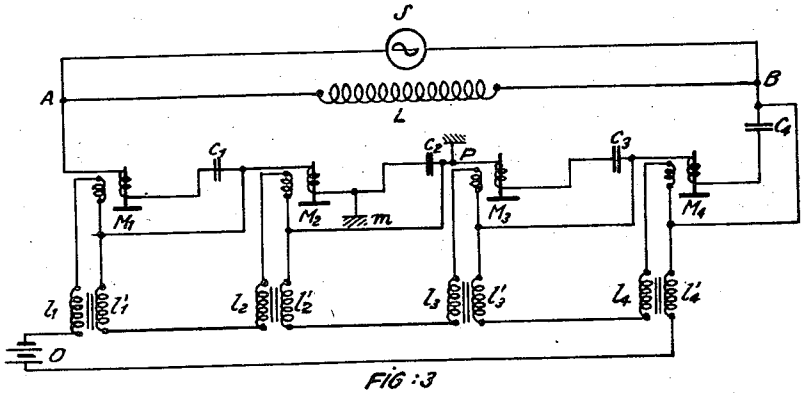


FIG: 3

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MARINE SOUND SYSTEM

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3 Claims. (Cl. 177—386)

The present invention relates to a connection system enabling the potential to be reduced with respect to earth, of microphone transmitter windings in particular of magneto strictive microphones, grouped in the same locality.

In such systems the microphones are preferably connected in series and not in parallel, in order to effect the better distribution of the loads.

By such a series connection the least favorable elements are subjected to a high potential, that is to say, at the windings of the microphones which are the furthest away from the main or sole ground connection of the circuit, the height of the potential being derived from the reactive impedance of the microphones.

The invention consists essentially in reducing the potentials of the microphonic windings with respect to the ground, by interposing at various points in their circuit, for example between each microphone or even between the coils comprising the microphone, capacities of sufficient value to compensate for the reactance of these various elements.

The invention will be better understood by reference to the annexed drawing which sets forth various embodiments thereof merely by way of example.

In Figure 1 the microphones M_1, M_2, M_3, M_4 are excited by alternating current from a source S without the addition of continuous current.

The capacities C_1, C_2, C_3, C_4 are chosen in such manner that they compensate exactly or almost exactly, the self-inductance of each microphone. It will be seen immediately that with this arrangement the total potential at each microphone is small, as the only potential is that resulting from the impedance of the microphone itself. It is to be furthermore noted that in order still further to reduce or neutralize the extraneous sound or noise effects of the resultant potential and increase sensitivity there may be connected to the ground *m*, as shown on the figure, a point P selected at the electric center or in the vicinity of the electric center of the system, when this connection to earth may be made either directly or through a resistance or resistances.

If the apparatus operates with very high alternating voltages, it may happen that the saturation of the microphones is reached and that it is no longer possible to preserve as above, with respect to the source S, a zero phase displacement of the whole of these microphones ($\cos \phi = 1$).

Owing to phenomena of ferro-magnetic resonance which come into play in this case, it is necessary in order to obtain a stable rate of the alternating current, that the circuit of the microphones regarded from the points A and B acts as a capacity, that is to say, presents a displacement of phase in advance of the current over the potential.

Then to re-establish a $\cos \phi$ (regarded from the source S) equal to unity, there is arranged between the points A and B, as represented in broken lines on Figure 1, a self-inductance L not subject to the effects of saturation.

In Fig. 2, the microphones are not only polarized as before by the use of alternating current from source S, but are also subjected to supplementary polarization by means of a direct current from a source D in the same microphone windings after passing through choke windings l_1, l'_1, . . . l_4, l'_4, which double polarization further increases the active range and sensitivity of said microphones and the system as a whole. The alternating current connections and circuit being the same as in Fig. 1, these parts are referenced in like manner.

The latter statement also holds true for Fig. 3, in which the microphones are likewise subjected to supplementary polarization by direct current from a source D and through the choke windings as in Fig. 2, but in this last figure, the direct current passes through independent windings in said microphones. The latter windings are in each case connected at one point to each one of the alternating current microphone circuits, so that the common ground connection P will serve for the whole system, the two forms of polarization and distinct microphone windings for each greatly increasing the sensitivity of the system and increasing the range or capacity of the microphones for ultra sounds. In the last two figures, the blocking self-inductances l_1 and l'_1, l_2 and l'_2, l_3 and l'_3, l_4 and l'_4 which are shown in both Figures 2 and 3 are intended to reduce the derivation of the alternating current in the circuit from the continuous current source D. It may be noted that the self-inductance L is of no interest except when the amplitude of the alternating current is sufficiently great to require neutralization control with respect to the continuous current.

In Figure 2 the blocking self-inductances l_1 and l'_1, l_2 and l'_2, etc. are represented as separate but obviously if a suitable direction of the windings is maintained, they may be wound on a common core, either for each microphone (as

illustrated in Figure 3) or even for all of the microphones.

What I claim as my invention and desire to secure by Letters Patent of the United States is:

1. In a marine sound system of the character wherein sound waves are transmitted and received, the combination of, a plurality of magnetostrictive microphones positioned to transmit sound waves of predetermined characteristics to the water and to be vibrated by sound waves from the water, circuit means connecting said microphones in series and to a source of alternating current, a direct current circuit including a source of direct current and a plurality of blocking coils and connected to produce magnetic flux in each of said microphones with the blocking coils being effective to carry the direct current by preventing the passage of a substantial amount of alternating current, and a plurality of condenser units connected in said circuit respectively at said microphones and adapted to compensate for the phase displacements caused by the inductance of the microphones.

2. A system as described in claim 1 wherein each microphone is provided with a single coil assembly which carries the alternating current and the direct current and wherein the electrical center of the circuit which includes the microphones is grounded.

3. A system as described in claim 1 wherein each microphone includes two coils one of which carries the alternating current and the other of which carries the direct current and wherein there is associated with each of the coils carrying direct current a pair of said blocking coils which are magnetically coupled together.

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