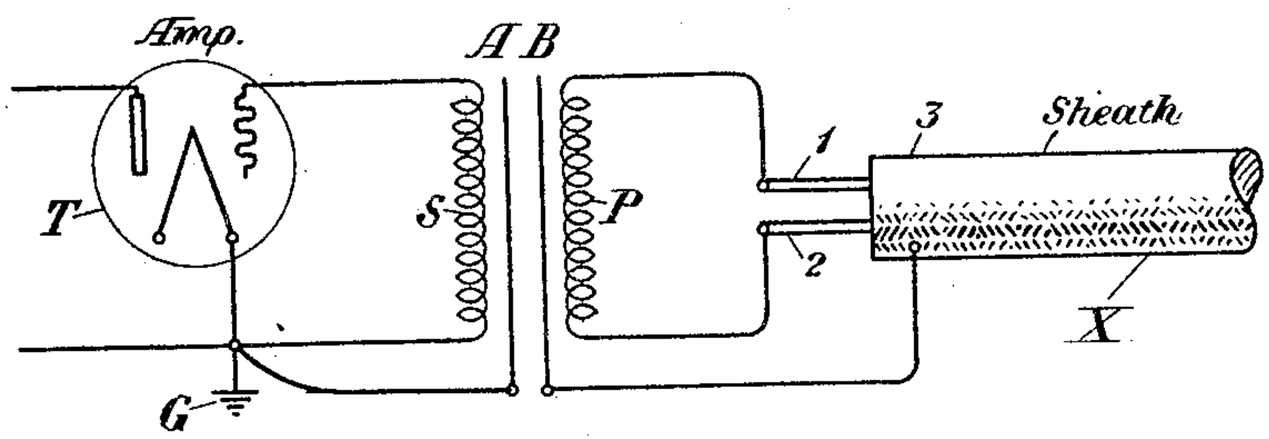
Dec. 23, 1930. G. CRISSON 1,786,412

SHIELDING ARRANGEMENT

Filed Nov. 20, 1929



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SHIELDING ARRANGEMENT

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This invention relates to shielding arrangements, and more particularly to shielding arrangements to be used where cable conductors enclosed in a conducting sheath are connected to an amplifier and there is a potential difference between the ground at the amplifier and the cable sheath.

Where the conductors of a cable such as a submarine cable are enclosed in a conducting sheath, as is common practice, and the cable conductors are associated with the input of an amplifier through a transformer, a noisy condition arises due to the fact that the cable sheath, which lies on the ground under the water, will frequently be at a different ground potential from the office ground connected to the filament of the amplifier. In accordance with the present invention, it is proposed to overcome this difficulty by providing two shields between the windings of the transformer, the one shield being connected to the office ground and the other shield being connected to the cable armor. Such construction gives minimum potentials between each winding and its corresponding shield. Also, the potential difference between the office ground and the cable armor appears between the two shields, thereby causing a charging current through the capacity between the shields, the path of which charging current does not include any part of either winding of the transformer.

The invention will now be more clearly understood from the following description when read in connection with the accompanying drawing the figure of which is a diagram illustrating schematically a preferred embodiment of the invention.

Referring to the drawing, X designates a submarine or other type of cable whose conductors 1 and 2 are enclosed, as is customary, in a metallic sheath 3 which rests upon the ground beneath the ocean and is in contact with the sea water. The conductors 1 and 2 of the cable are connected to the input or grid circuit of a receiving amplifier T through a transformer comprising a primary P and a secondary S. Due to the fact that the sheath of the cable is at a different potential from the office ground to which the input circuit of the amplifier is connected, a noisy condition will result. The cable conductors, being enclosed in the sheath, will have a much smaller potential difference to the sheath than to the office ground, and consequently displacement currents will flow through the capacity between the windings of the transformer from the ground of the cable sheath to the office ground. Since the path of these displacement currents will include at least a part of the windings of the transformer, noise potentials are produced upon the grid of the amplifier.

It is proposed to overcome this difficulty, in accordance with the present invention, by providing two shields A and B between the windings of the transformer, the shield A being connected to the office ground and the shield B being connected to the sheath 3 of the cable X. With this arrangement the potential difference between the sheath and the office ground causes displacement currents to flow through the capacity between the shields A and B, and these displacement currents flow from the sheath to the office ground over a path which does not include any part of either the primary or secondary windings of the transformer. Owing to the large impedance of the path between the shields A and B, displacement currents flowing in the sheath 3 are very small and do not induce large noise currents in the transmission circuit including the conductors 1 and 2 of the cable. The shield A acts as a short circuit to ground for the displacement currents to prevent them from flowing through the secondary winding S of the transformer, and the shield B likewise acts to furnish a path for the displacement currents independent of the windings of the primary coil P of the transformer.

If the shield A were omitted, leaving the shield B connected to the sheath 3 and unconnected to the office ground at G, the displacement currents would flow from the sheath to the office ground through a part of the secondary winding S, due to the capacity between the shield B and the windings of the secondary coil. This would obviously result in producing noise potentials upon the grid of the

amplifier T, thereby making the amplifier noisy.

Since the cable conductors 1 and 2 are enclosed in the sheath 3 they have a much smaller potential difference to the sheath than exists between said conductors and the office ground at G. Consequently, if the shield B were omitted, using merely the shield A connected to the office ground, the primary winding P would be exposed to the potential difference between the office ground and the cable conductors, and unless the primary P and the cable conductors were perfectly balanced with respect to ground a noise potential would be set up between the conductors which would be repeated through the transformer to the amplifier.

If, on the other hand, a single shield were used between the primary P and the secondary S, and this shield were connected both to the office ground at G and to the cable sheath 3, relatively large currents would flow through the cable sheath 3 and directly to ground at G. Due to these relatively large currents flowing in the sheath noise currents would be induced in the cable conductors which would be transferred through the transformer to the grid circuit of the amplifier. In accordance with the present invention, the large impedance due to the open circuit between the shields A and B cuts down the currents in the sheath to the relatively small displacement currents which are able to flow through the capacity between the shields A and B, and thereby reduces the noise induced in the cable conductors. At the same time the two shields A and B provide a path for these relatively small displacement currents which does not include any part of either winding of the transformer, the shields also protecting each winding from large potentials.

It will be obvious that the general principles herein disclosed may be embodied in many other organizations widely different from those illustrated without departing from the spirit of the invention as defined in the following claims.

What is claimed is:

1. In a signaling system, a translating means having its input circuit associated with ground, a transmission path inductively related to a ground having a potential different from that associated with the translating means, a transformer for connecting said path to said translating means, and conductively separate shields for said transformer, one connected to the ground associated with said translating device and the other connected directly to the ground associated with said transmitting path.

2. In a signaling system, a translating means having its input circuit associated with ground, a transmission path having its conductors enclosed within a conducting sheath, said sheath being at a ground potential different from that associated with the input circuit of said translating means, a transformer for connecting said path to said translating means, and conductively separate shields for said transformer, one connected to the ground associated with said translating device and the other connected directly to the ground of said sheath.

3. In a signaling system, a vacuum tube having an input circuit connected to its grid and filament and its filament connected to ground, a transmission path having its conductors included within a conducting sheath, said sheath being at a ground potential different from that of the ground connected to the filament of said vacuum tube, a transformer connecting said path to the input circuit of said vacuum tube, and conductively separate shields for said transformer, one connected to the ground associated with the filament of said tube and the other connected directly to the ground of said sheath.

4. In a signaling system, a vacuum tube having an input circuit connected to its grid and filament and its filament connected to ground, a cable having its conductors enclosed within a conducting sheath, said sheath being connected to a ground potential different from that of the ground connected to the filament of said vacuum tube, a transformer between the cable and said vacuum tube having a primary winding associated with the cable and a secondary winding associated with the input circuit of said vacuum tube, a shield for said primary winding connected directly to the sheath of said cable, and a conductively separate shield for the secondary winding of said transformer connected to the ground associated with the filament of the vacuum tube.

In testimony whereof, I have signed my name to this specification this 14th day of November, 1929.

GEORGE CRISSON.