

Aug. 22, 1939.

V. GANDTNER

2,170,050

ARRANGEMENT FOR SHIELDING AMPLIFIERS

Filed March 9, 1937

Fig. 1

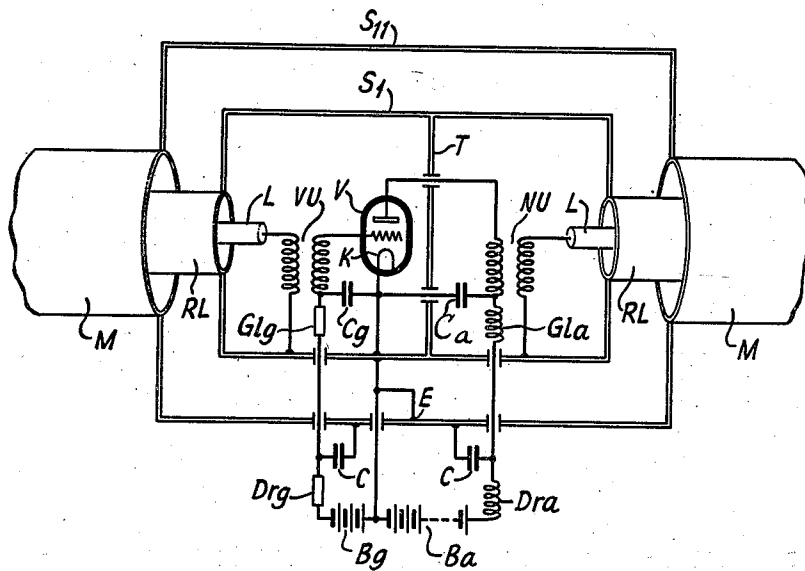
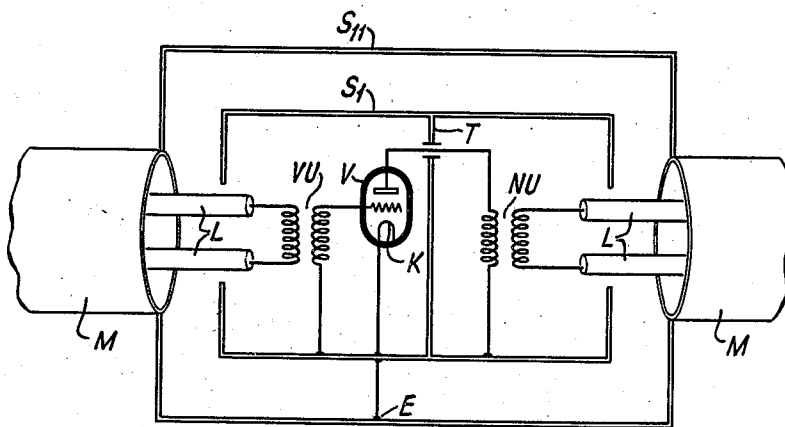


Fig. 2



BY

INVENTOR.
VALENTIN GANDTNER

W. H. Grover
ATTORNEY.

UNITED STATES PATENT OFFICE

2,170,050

ARRANGEMENT FOR SHIELDING
AMPLIFIERS

Valentin Gandtner, Falkensee, Kreis Osthavel-
land, Germany, assignor to Siemens & Halske,
Aktiengesellschaft, Siemensstadt, near Berlin,
Germany, a corporation of Germany

Application March 9, 1937, Serial No. 129,823
In Germany March 9, 1936

5 Claims. (Cl. 179-171)

My invention relates to an arrangement for shielding amplifiers and more particularly amplifiers for high-frequency transmission systems which serve to transmit very wide frequency bands.

It is well known to prevent interfering regenerative phenomena in amplifiers by metallic shields which surround all elements of the connection, by the capacities of which latter portions of the amplified current may return to the input circuit of the amplifier in question or of a preceding amplifier. These shields which are connected with one another and with a point of the amplifier connection are to keep away also external disturbances. Furthermore, it is also known to ground the shields.

It has, however, been found that this simple shielding is not always sufficient to prevent regenerative phenomena and to keep away external disturbances, since it has been ascertained that in shielded amplifiers, particularly in amplifiers in high-frequency transmission systems, notwithstanding the usual shielding, external disturbances were transmitted to the grid circuit and regenerative phenomena occurred. These phenomena are, among other things, due to the fact that potential differences are set up between the input and output circuit of the amplifier thus causing interfering currents.

To avoid these drawbacks the amplifiers, particularly the high-frequency amplifiers for wide band systems, are surrounded according to the invention by two telescopically arranged metallic shields, the inner shield being connected to a point of the amplifier connection, preferably to the cathode. In the inner metallic shield, metallic partition walls may be provided in a manner well known which protect the amplifier input against the amplifier output. When using various amplifier steps, such partition walls are preferably provided between each step.

The voltage sources necessary for the grid, filament, and anode voltages are preferably arranged between the inner and outer shield so as not to be influenced as far as possible by the external interfering fields. In the grid and anode circuit, filtering means are preferably arranged which are capacitively connected to the cathode. If it is necessary to arrange the voltage sources externally of the outer shield, the supply leads must be choked immediately before the introduction and the high-frequency interfering voltages are caused to act on the outer shield.

In high frequency transmission systems which employ a coaxial double conductor for the trans-

mission, which is insulatedly surrounded by a metallic covering, for instance, by a lead sheath, the inner shield of the amplifier is connected according to the invention to the return conductor and the outer shield to the metallic covering of the double conductor. In this case, the shields are so designed and so connected to the return conductor and to the lead sheath as to be completely shielded, that is to say, the inner shield constitutes a continuation of the return conductor and the outer shield a continuation of the lead sheath; for instance, the shields are provided with branches which may be arranged on the return conductor and the lead sheath respectively or placed thereon by slidable sleeves. In the case of transmission systems with various coaxial double conductors and a common metallic sheath, the inner shields of the amplifiers are connected with the corresponding return conductors and a common outer shield is connected to the sheath.

Coaxial conductor arrangements are employed to advantage for the high frequency transmission of very wide frequency bands, particularly of television currents. They are non-symmetric with respect to ground. It is, therefore, necessary to determine exactly the potential of the individual conductors in order that, for instance, no loops are formed by multiple grounding. This is particularly important at the point at which amplifiers are inserted, since back couplings may easily occur within the amplifiers by the formation of such loops. In general, the capacity of the return conductor with respect to the metallic sheath insulatedly arranged thereon and in the case of underground cables directly connected to ground or the capacity of the inner shield of the amplifier with respect to the outer shield, suffices to determine exactly the potential of the return conductor. Owing to the influence by heavy currents it is, however, possible that a charge occurs between the return conductor and the sheath. In such cases, the inner shield of the amplifier is preferably metallically connected to the outer shield. However, it is essential that this connection take place at a single point in order to avoid earth circuits. In the case of various shielded spaced amplifier arrangements in such a high-frequency transmission system, it is preferable to connect only the inner shield of an amplifier arrangement to the corresponding outer shield at one point. Instead of a galvanic, a capacitive connection may under circumstances be sufficient.

The invention may also be used in amplifiers

which are arranged in high frequency transmission systems with symmetrical double conductors. Although symmetrical conductors, owing to their symmetry with respect to earth, are considerably more insensitive to external disturbances than coaxial conductors, the same conditions prevail at the points in which amplifiers are inserted as is the case with coaxial conductors. In amplifiers in a high frequency transmission system with shielded symmetrical double conductors the inner shield of the amplifier is connected according to the invention to a point of the amplifier connection and the outer shield to the metallic sheath.

For a better understanding of the nature of my invention reference may be had to the following description taken in connection with the accompanying drawing, in which

Fig. 1 shows the use of the invention for transmission systems with coaxial conductors, and

Fig. 2 for transmission systems with symmetrical conductors.

In Fig. 1, L denotes the internal conductor of an air-insulated coaxial double conductor. Around the inner conductor is arranged a spacing piece not shown, for instance, a styroflex spiral. Pairs, quads or the like not shown employed, for the low frequency transmission of intelligence may be placed on the return conductor RL. On an insulation layer is then placed a metallic shield M, for instance, the lead sheath of the cable which may be provided in the usual manner with a wire armoring and a jute covering.

The return conductor RL is enlarged to a closed space S_1 in such a manner as to receive all elements of the amplifier. The enlargement of the return conductor is effected by a metallic shield S_1 which is intimately connected to the return conductors RL at both sides by branch sleeves placed over the return conductors. Inside the shield S_1 are arranged the amplifier elements in such a manner that the cathode K of the amplifier tube V is connected to the return conductor RL and to the shield S_1 respectively. The internal conductor L is connected to the shield through the primary winding of the repeater VU. Under circumstances, adaptation elements may further be arranged in series with the primary winding. The secondary winding of the repeater VU is connected to the grid of the amplifier tube V whose anode circuit is connected to the coaxial conductor L, RL through the repeater NU. The amplifier inlet and outlet are separated by a metallic partition wall T. The shield is provided with bushings for the supply of the grid, filament, and anode voltages. In the grid and anode circuit are preferably arranged filtering means G_{lg} and G_{la} connected to the cathode through capacitors C_g and C_a . The shield S_1 and the current supply circuit is properly insulated against ground.

Also the shield M is enlarged to a metallic shield S_{11} which may also be placed on the shields M by means of branch sleeves. The shield S_1 may be connected in a point E to the shield S_{11} galvanically or capacitively. The shield S_{11} is preferably also insulated against ground and is only connected at the joints to the shield M and, therefore, to earth. The shield S_{11} may, for instance, be obtained by covering the entire amplifier space with thin sheet copper or with a wire gauze. The power sources B_g and B_a for the grid and anode voltage are arranged externally of the shield S_{11} . In order to keep away high frequency interfering voltages from the inside of the shielded space, it is necessary to choke the supply leads

immediately before the introduction (Dra and Drg) and to cause the interfering voltages to act on the shield S_{11} . The filament voltage source is not shown.

The shielded amplifier arrangement for transmission systems with symmetrical double conductors is denoted in Fig. 2 by the same characters of reference as in Fig. 1. The voltage sources are not shown in order not to complicate the drawing. L denotes both symmetrical conductors, M the shielding of the symmetrical conductors. The inner shield S_1 is connected to a point of the amplifier connection, preferably to the cathode. The connection of the shield S_1 with the return conductor is omitted in this arrangement. However, also in this case a charge of the shield S_1 with respect to the shield S_{11} may occur by the effect of a heavy current. Also in this case the inner shield may preferably be connected to the outer shield galvanically or capacitively.

I claim as my invention:

1. In combination, an electron discharge device amplifier having a cathode, anode, and control electrode; an input circuit connected between said control electrode and cathode; an output circuit connected between said anode and cathode; a first metallic shielding container surrounding said amplifier, its input and output circuits; a second metallic shielding container surrounding and spaced from said first container; a metallic partition wall in said first container separating said first container into two chambers, said input circuit being in one chamber, and said output circuit being in the other chamber; a path of low impedance to radio frequency energy connected between said cathode and said first container, and means coupling one point on said first shielding container to a point on said second shielding container.

2. In combination, an electron discharge device amplifier having a cathode, anode, and control electrode; an input circuit connected between said control electrode and cathode; an output circuit connected between said anode and cathode; a first metallic shielding container surrounding said amplifier, its input and output circuits; a second metallic shielding container surrounding and spaced from said first container; a metallic partition wall in said first container separating said first container into two chambers, said input circuit being in one chamber, and said output circuit being in the other chamber; a path of low impedance to radio frequency energy connected between said cathode and said first container; a first coaxial cable having its inner conductor in one chamber coupled to said control electrode and its outer conductor connected to said first container; and a second coaxial cable having its inner conductor in the other chamber coupled to said anode, and its outer conductor also coupled to said first container.

3. In combination, an electron discharge device amplifier having a cathode, anode, and control electrode; an input circuit connected between said control electrode and cathode; an output circuit connected between said anode and cathode; a first metallic shielding container surrounding said amplifier, its input and output circuits; a second metallic shielding container surrounding and spaced from said first container; a metallic partition wall in said first container separating said first container into two chambers, said input circuit being in one cham-

ber, and said output circuit being in the other chamber; a path of low impedance to radio frequency energy connected between said cathode and said first container; a first coaxial cable having its inner conductor in one chamber coupled to said control electrode and its outer conductor connected to said first container; a second coaxial cable having its inner conductor in the other chamber coupled to said anode, and its outer conductor also coupled to said first container; and a metallic sheath insulated from and surrounding each of said coaxial cables, said sheaths both being connected to said second metallic container.

4. In combination, an electron discharge device amplifier having a cathode, anode, and control electrode; an input circuit connected between said control electrode and cathode; an output circuit connected between said anode and cathode; a first metallic shielding container surrounding said amplifier, its input and output cir-

uits; a second metallic shielding container surrounding and spaced from said first container; a metallic partition wall in said first container separating said first container into two chambers, said input circuit being in one chamber, and said output circuit being in the other chamber; a path of low impedance to radio frequency energy connected between said cathode and said first container; a source of energy comprising a pair of leads coupled to said input circuit; and a utilization circuit comprising another pair of leads coupled to said output circuit, a metallic sheath insulated from and surrounding each of said pairs of leads, said sheaths being connected to said second metallic container.

5. A system in accordance with claim 4, including a direct connection from solely one point on said first shielding container to a point on said second shielding container.

VALENTIN GANDTNER.