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B. ROUX ET AL

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ADJUSTMENT OF THE AMPLIFICATION OF AMPLIFIERS

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Prior Art

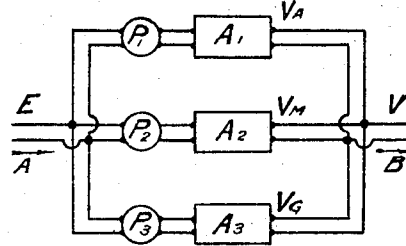


Fig. 1

Fig. 2

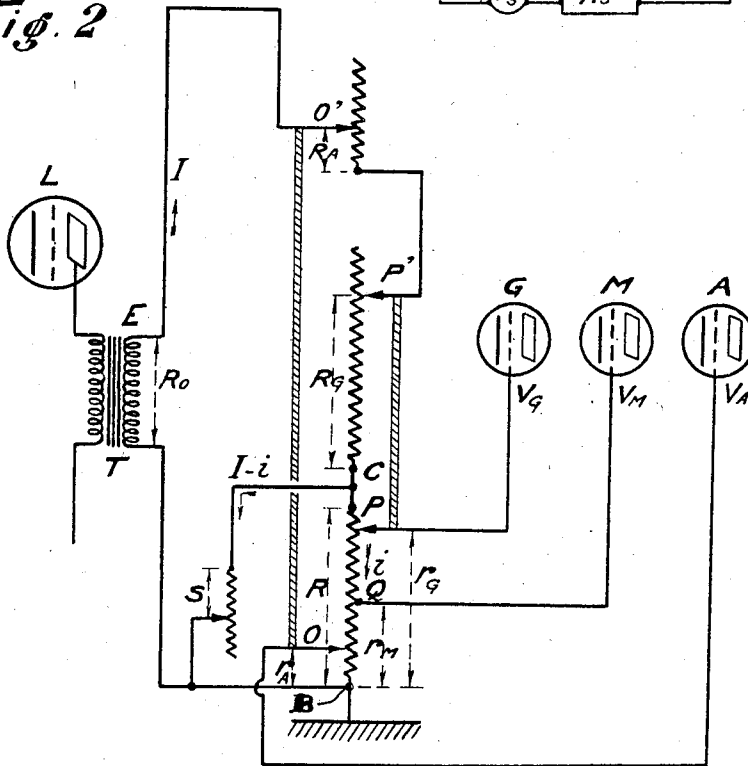
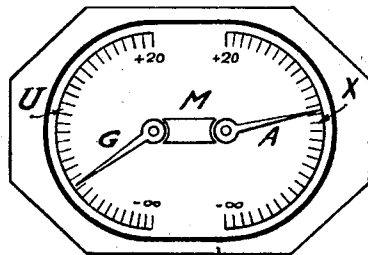


Fig. 3



Inventors:
Bernard Roux
Mario Sollima
Robert Samson
By Summers & Young
Attorneys

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ADJUSTMENT OF THE AMPLIFICATION OF AMPLIFIERS

Bernard Roux, Mario Sollima, and Robert Gamzon, Paris, France

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1 Claim. (Cl. 179—171)

The present invention concerns the adjustment of the amplification of amplifiers of the type of those utilized for emission and reception in wireless transmission, for the recording or reproduction of talking films and discs, and so on.

As a rule, this adjustment is performed by making use of a potentiometer which acts in a uniform manner upon all the frequencies that are amplified by the amplifier.

However, in some cases, it may be desired to separately adjust the amplification of the various musical frequency bands. But this involves certain difficulties and certain drawbacks.

The object of the present invention is to provide an adjustment device for amplifiers which obviates these drawbacks.

According to an essential feature of the present invention, a common potentiometer supplies the tensions upon which depend the amplifications corresponding to a plurality of (say three) frequency bands, these tensions consisting for instance of the grid tensions of the amplifying tubes each corresponding to one of these frequency bands, respectively, said respective feeds of tension being obtained by means of cursors or sliding contacts, the potentiometer in question being in series with a number of rheostats equal to the number of cursors, and the operation of every cursor being adapted to produce the displacement of the arm of the corresponding rheostat in such manner that the sum of the values of the output tensions of the various frequency bands, multiplied by respective coefficients, the whole being divided by the input tension of the system, remains constant.

Other features of the present invention will become apparent from the following description of an illustrative embodiment thereof.

A preferred embodiment of the present invention will be hereinafter described, with reference to the accompanying drawing, only by way of example. In the drawing:

Fig. 1 is a diagram illustrating an arrangement according to the prior art.

Fig. 2 diagrammatically shows an embodiment of the present invention.

Fig. 3 is a detail view showing a specific arrangement according to the invention.

In order to obtain separate amplification of the respective musical frequency bands, it is possible to make use of arrangements known in themselves, such for instance as that illustrated by Fig. 1.

In such an arrangement, the musical current, of a voltage equal to E , coming through E , passes

through three separate potentiometers P_1 , P_2 , P_3 , and then through three amplifiers A_1 , A_2 , A_3 .

These amplifiers are provided with filters so that each of them permits the passage of only a band of the musical frequencies to be amplified: to wit, low, medium, and high frequency bands.

The currents flowing out from these three amplifiers have, as their respective potentials V_A , V_M , V_G , and they are mixed so as to have the total potential V .

It will be readily understood that, with this arrangement, the adjustment of P_1 acts merely upon low notes, that of P_2 upon medium notes and that P_3 merely upon high notes.

In some applications, the three amplifiers each operates a separate loud speaker. The mixing of the different bands is then effected in an accoustical manner instead of being effected in an electric manner. But the operation is analogous. For practical purposes, this arrangement has a very serious disadvantage:

The device above mentioned is chiefly intended to ensure the adjustment of the curve of response of the amplifier system curve, that is, to say the adjustment of the ratios of the three output potentials V_A , V_M , and V_G .

Now, if the amplification of say A_1 is reduced by acting upon P_1 , V_A is reduced, which indeed gives the desired result. But, in addition, the total output potential V is reduced.

The total amplification, which is represented by the ratio

$$\frac{V}{E}$$

is reduced.

In other words, as soon as it is endeavoured to modify the curve of response, the total amplification is simultaneously modified.

This defect is extremely disturbing, especially in applications in which the output level must be kept within narrow limits (radio emission, disc or film recording).

The present invention provides a multiple adjustment device which permits of varying at will the ratios of the potentials V_A , V_M , and V_G with respect to one another in such manner that the total amplification

$$\frac{V}{E}$$

remains constant.

Furthermore, this device replaces the three potentiometers by only two operating devices, which constitutes an important simplification.

In this case, the expression "constant total amplification" should be clearly defined.

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and P are sufficient for adjusting the relative value of the three potentials V_G , V_M and V_A , which is an important simplification in many cases.

This arrangement further permits of automatically complying with the condition of compensation, which is:

$$a = \frac{V_G + mV_M + V_A}{E} = \frac{r_G i + mr_M i + r_A i}{E} = \frac{ir_G + mr_M + r_A}{E}$$

Furthermore, if it is desired to give m any predetermined value, it is necessary, according to the invention, to shunt potentiometer R by means of a variable resistance S .

As a matter of fact, the total current is

$$I = \frac{E}{R_0 + R_A + R_G + \frac{SR}{S+R}}$$

The current i in R is

$$i = \frac{S}{S+R} I$$

so that

$$i = \frac{S}{S+R} \times \frac{E}{R_0 + R_A + R_G + \frac{SR}{S+R}}$$

and, consequently:

$$a = \frac{V_G + mV_M + V_A}{E} = \frac{S}{S+R} \times \frac{E}{R_0 + R_A + R_G + \frac{SR}{S+R}} \times \frac{r_G + mr_M + r_A}{E}$$

and

$$a = \frac{S}{S+R} \times \frac{R_G + mr_M + r_A}{R_G + R_0 + \frac{SR}{S+R} + R_A}$$

Now, it will be understood that, as a consequence of the mechanical connection between cursors P and P' , resistances r_G and R_G vary simultaneously. It is therefore possible to arrange the windings in such manner that these resistances are proportional to one another, whatever be the position of the cursors. Therefore, in this case R_G is equal to Kr_G , G being a constructional constant.

In a similar manner R_A may be considered as equal to Kr_A .

The formula then becomes:

$$a = \frac{r_G + mr_M + r_A}{Kr_G + R_0 + \frac{SR}{S+R} + Kr_A} \times \frac{S}{S+R}$$

It will be seen that in order to have a constant value of a , independent of the adjustable value of r_G and r_A , it suffices to comply with the following relation:

$$R_0 + \frac{SR}{S+R} = Kmr_M$$

As all the terms of this equation are constant, it is easy to choose S and R in such manner as to comply with this condition, so that a has a constant value.

It will be noted that, by modifying the value of S , the condition that the amplification remains constant is maintained, but with a different value of m , that is to say with a variable importance of the medium frequency band. This permits of experimentally adjusting the value of m as well as possible in accordance with the limits chosen for the three bands of frequencies.

For practical purposes, it is advantageous to

arrange the operating members in such manner that their position is easily visible (Fig. 3).

Arm A controls cursors P , P' . Arm G controls cursors O , O' . These arms move in front of dials U , X , graduated in decibels.

When G , M and A are the three low, medium and high frequency bands of a triple amplifier, the position of the arms reproduces, at least approximately, the curve of transmission obtained for the adjustment that is considered, which greatly facilitates the operation of the apparatus.

Although, in the preceding description, we have referred merely to an amplifier relating to three bands of frequencies, which is the most frequent case for practical purposes, it should be well understood that the present invention is applicable to all cases, whatever may be the number of bands of frequencies that are being considered.

Furthermore, we might provide one or several fixed intakes on the potentiometer for one or several bands, or, on the contrary, provide no fixed intake.

Of course, the number of rheostats in series with the potentiometer will be always equal to the number of movable current intakes of the potentiometer, the cursors of these movable intake elements driving through suitable transmission means the various cursors of the rheostats respectively.

While in a general manner, in the above description, we have disclosed what is now deemed to be practical and efficient embodiments of the invention, it should be well understood that it is not intended to limit the scope of the patent thereto as there might be changes made in the arrangement, disposition, and form of the parts without departing from the principle of the present invention as comprehended within the scope of the appended claim.

What we claim is:

A system of the type described comprising, in combination, three amplifiers, each corresponding to a band of sound frequencies, a source of electric current connected to supply electric current to said amplifiers, a potentiometer connected between said source and said amplifiers, cursors on the potentiometer for connecting said potentiometer with said amplifiers, a plurality of rheostats, equal in number to the number of cursors electrically connected in series with the potentiometer, manipulating members for the rheostats, respectively, and mechanical means interconnecting said manipulating members with the respective cursors, the manipulation of each cursor having the result of actuating the manipulating member of the corresponding rheostat, so that, whatever the position of the cursors may be, the different values of the amplifications of the said bands of sound frequencies have a relation of the type:

$$\frac{lV_A + mV_M + nV_G}{E} = \text{constant}$$

in which V_A , V_M , V_G designate the values of the different discharge potentials of the three said bands (low, medium and high frequency) E the entrance potential of the whole, and l , m , n empirical coefficients representing the relative values of the intensities of the three said sound frequency bands.

BERNARD ROUX.
MARIO SOLLIMA.
ROBERT GAMZON.