Oct. 8, 1940. K. EISELE 2,217,267

TONE CONTROL

Filed Feb. 7, 1939

Fig. 1

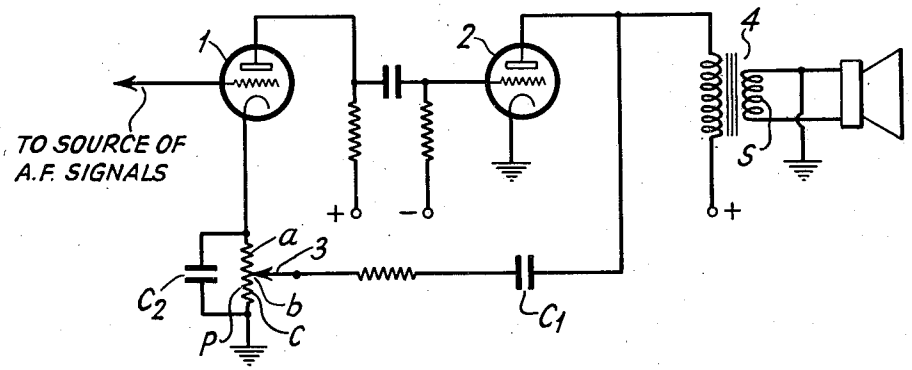
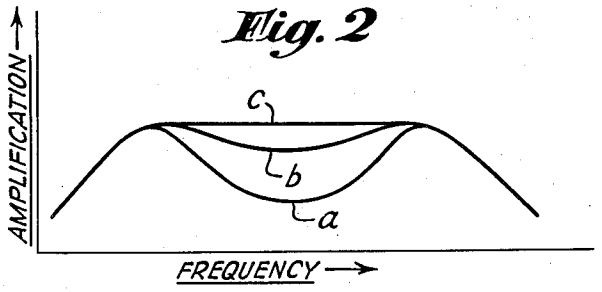



Fig. 2




INVENTOR.
KARL EISELE

BY H. S. Grover

ATTORNEY.

Patented Oct. 8, 1940

2,217,267

# UNITED STATES PATENT OFFICE

2,217,267

## TONE CONTROL

Karl Eisele, Berlin, Germany, assignor to Telefunken Gesellschaft für Drahtlose Telegraphie m. b. H., Berlin, Germany, a corporation of Germany

Application February 7, 1939, Serial No. 255,053
In Germany February 23, 1938

1 Claim. (Cl. 179—171)

The present invention relates to tone control devices operating with counter-coupling depending on frequency.

A tone control is known in which a counter-coupling for low notes is variable. Often the desire exists to favor the low notes and at the same time the high notes over the medium notes whether it is a question of giving the reproduction the correct character, or of providing a compensation for the jeopardizing of the low notes and high notes caused on the one hand by a lack in effectiveness of the sound board, and, on the other hand, by the falling of the frequency-response curve of the loudspeaker. Circuits are known as such through which this end can be achieved.

The advantage of the invention over these known circuits resides, however, in the simplicity of the circuit according to the present invention, since only a single potentiometer and two condensers are required, and as regards the intermediate notes a reduction of distortion is obtained due to the counter-coupling.

The invention consists in that the cathode line and at the same time the grid circuit of a tube contain a potentiometer, whose slidable arm is placed at a point of a following stage and having alternating potential whereby this connection is made across a condenser so chosen that the low frequencies are counter-coupled to a lesser degree than the intermediate frequencies and high frequencies, and the potentiometer is shunted by a condenser so chosen that the high frequencies are counter-coupled to a lesser degree than the intermediate frequencies and low frequencies.

In the drawing—

Figure 1 shows an example of construction in accordance with the invention, and

Figure 2 shows the frequency-response curves for different positions of the potentiometer.

In Fig. 1, an audio frequency amplifier is shown whose tubes 1 and 2 are resistance coupled. The cathode line of the tube 1 contains a potentiometer P shunted by a condenser $C_2$. The slidable arm 3 of this potentiometer receives from the primary winding of the output transformer 4 the counter-coupling potential across the condenser $C_1$. In the upper position *a* of the potentiometer the counter-coupling of the intermediate notes is the greatest since in this case the capacities $C_1$ and $C_2$ have a lesser influence as regards the intermediate frequencies, and for these frequencies the entire counter-coupling potential exists at the potentiometer P. The condenser $C_1$ prevents a counter-coupling of the low notes so that these notes are favored in the amplification according to the curve *a* in Fig. 2. The limit frequency below which the counter-coupling of the low notes is decreased is given by the proportion between the capacity $C_1$ and the potentiometer P. The proportion between the other capacity $C_2$ and the potentiometer P determines the limit frequency above which the counter-coupling for the high notes will be decreased so that also the high notes will be favored in the amplification in accordance with the curve *a*.

When moving the arm 3 down to the point *b* in Fig. 1, the lower limit frequency will be moved upwards and the upper limit frequency downwards, while at the same time the degree of the counter-coupling will be reduced so that the curve *b* in Fig. 2 will be obtained. In the lowest position *c* no counter-coupling at all takes place from the second tube upon the first tube. In order to decrease the counter-coupling potential an ohmic resistance may be connected in series to the condenser $C_1$ in a manner known as such.

What is claimed is:

In an audio amplifier circuit comprising at least two amplifier tubes arranged in cascade, a resistor in the space current path of the first tube, the second tube cathode being connected to a point of said resistor which is at a relatively fixed alternating current point, a degenerative audio voltage feedback path connected between the second tube output and said resistor, said feedback path consisting solely of a condenser in series with an adjustable tap slidable along said resistor, a second condenser in shunt with said resistor having a relatively high impedance to audio currents of high frequency, and said first condenser having a relatively low impedance to audio currents of low frequency, and adjustment of said tap along said resistor varying the amplitude of the intermediate audio frequency response while maintaining the high and low audio frequency response relatively fixed.

KARL EISELE.