Nov. 8, 1938. R. WEBER 2,135,953

VARIABLE RESISTANCE BRIDGE CIRCUIT

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Fig. 1

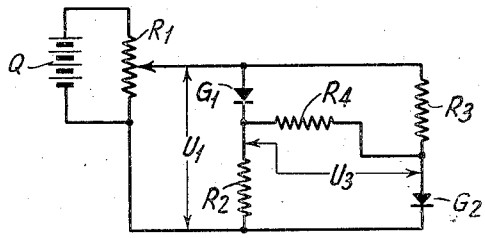


Fig. 2

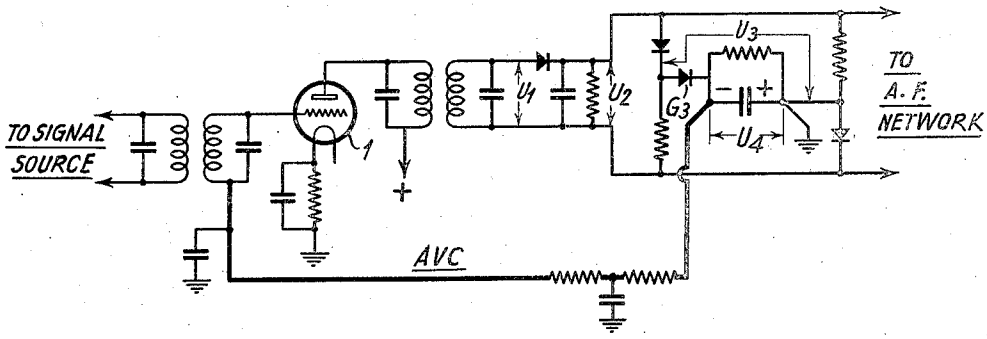
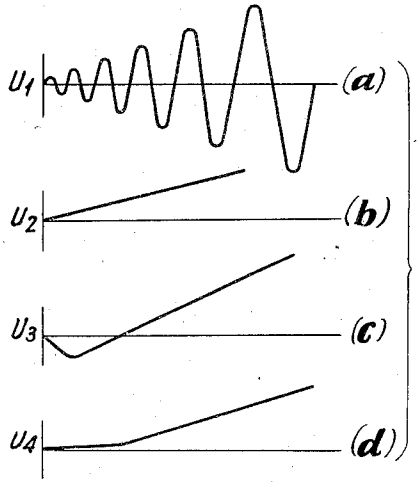


Fig. 3



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Fig. 4

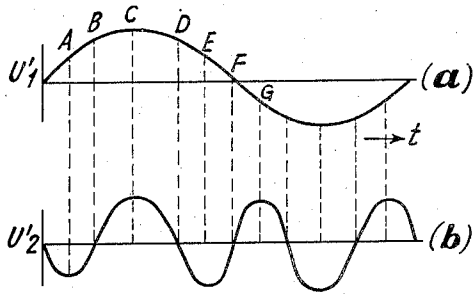


Fig. 5

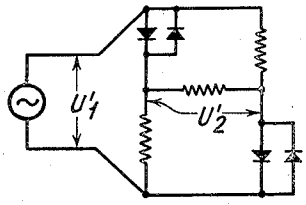
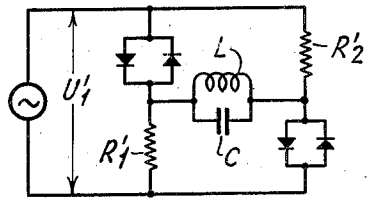


Fig. 6



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VARIABLE RESISTANCE BRIDGE CIRCUIT

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Application July 1, 1936, Serial No. 88,393
In Germany July 26, 1935

3 Claims. (Cl. 250—20)

The present invention relates to a four pole device with resistance value depending upon amplitude.

In accordance with the invention the four pole device consists of a bridge arrangement in which two bridge arms not adjoining each other, consist of resistors depending in resistance value upon voltage; and the other two arms consist of constant resistors equal to the value of the variable resistors at a mean voltage. The input and output terminals are connected respectively to the end points of each diagonal of the bridge.

In the drawings:

Fig. 1 shows, in a schematic manner, a bridge circuit embodying the invention,

Fig. 2 shows an automatic volume control circuit, for a high frequency transmission system, embodying the invention,

Fig. 3 shows four curves correlating the voltages U_1—U_2—U_3—U_4 in Fig. 2,

Fig. 5 is a modification adapted for frequency multiplication,

Fig. 4 graphically shows the operation of the circuit in Fig. 5, and

Fig. 6 is a modification of Fig. 5.

In Fig. 1, there is shown primarily a voltage source Q with the shunt potentiometer R_1, and a bridge circuit is indicated which is distinguished from the ordinary bridge circuit by the detectors G_1 and G_2. The detectors, in view of each one having a non-linear voltage-current characteristic, act in this arrangement as resistors depending upon voltage. That is, at low voltages the resistors G_1 and G_2 are high as compared with R_2 and R_3. The reverse condition exists at high voltages. Hence, when varying the input voltage U_1 by means of the resistor R_1, a voltage variation across resistor R_4 can be secured as indicated in *c* of Fig. 3. It is seen that at first the absolute value of the voltage U_3 increases, then decreases, and becomes equal to zero when all resistors are equal, in order finally to increase in the opposite sense.

Fig. 2 shows a circuit for automatic volume control with initial delay. Here, the voltage U_2 is produced through detection of the signal input voltage U_1. At an increase in U_1 (*a* of Fig. 3) the voltage U_2 increases (*b* of Fig. 3). The voltage U_3 across the resistor in the bridge diagonal varies as shown in *c* of Fig. 3. When introducing the detector G_3 in the bridge diagonal, the negative part of the characteristic of U_3 will be suppressed, and for U_4 the voltage curve is that shown in *d* of Fig. 3. The voltage U_4 is used as control potential; for instance, as grid bias for a prior high-frequency tube I whereby such an arrangement offers the advantage that the control action first begins at a certain minimum amplitude while small amplitudes have no effect upon the amplification of the apparatus.

If, in place of the increasing direct potential, an alternating potential is used the curve of which is, for instance, that shown in *a* of Fig. 4, there results therefrom a simple arrangement for frequency multiplication such as will be further explained in the following:

In order to utilize both alternations of the alternating potential the circuit is designed as shown in Fig. 5, i. e. there are always two opposed detectors used as resistors depending upon voltage. The voltage curve U'_2 produced in the branch of the bridge as a function of the terminal potential U'_1 is shown in *a* and *b* of Fig. 4. This voltage curve U'_2 will now be analyzed more closely. To this end, the voltage U'_1 is divided into the intervals A, B, C, etc. At zero, the voltage U'_2 is zero. At point A, U'_2 reaches a negative maximum value which, at an increase in U'_1, finally returns to zero at point B. U'_1 increases still further up to the point C. Then U'_2 increases likewise. At point D, U'_2 in accordance with B becomes again zero, in order to reach in E and F again the maximum negative value and the zero value respectively. This is repeated for the second time for the negative alternation, but in this case another detector functions as the resistor depending upon voltage.

Obviously, the voltage U'_2 does not represent a purely sinusoidal oscillation, but is composed of a series of individual oscillations. With the aid of a tuning circuit L—C, in Fig. 6, the multiplied frequency can be filtered out. The resistors R'_1 and R'_2 in Fig. 6 may, also, be substituted by inductances representing for the multiplied frequency across the circuit L—C a higher resistance than for the primary frequency.

What is claimed is:

1. In a radio receiver having a high frequency transmission tube feeding a detector, an automatic volume control network comprising a resistive bridge having a pair of rectifiers as opposed arms, a resistive diagonal across which a direct current voltage is developed, means for impressing across a rectifier arm in series with a resistor arm the direct current output of said detector, and means for applying the diagonal voltage to said transmission tube.

2. In a radio receiver having a high frequency transmission feeding a detector, an automatic volume control network comprising a resistive

bridge having a pair of rectifiers as opposed arms, a resistive diagonal across which a direct current voltage is developed, means for impressing across a rectifier arm in series with a resistor arm the direct current output of said detector, means for applying the diagonal voltage to said transmission tube, and a rectifier in series with said diagonal, said last rectifier preventing the delevopment of voltage across the diagonal until the input voltage to said bridge exceeds a desired value.

3. In a radio receiver having a high frequency transmission tube feeding a detector, an automatic volume control network comprising a resistive bridge having a pair of rectifiers as opposed arms, a resistive diagonal across which a direct current voltage is developed, means for impressing across a rectifier arm in series with a resistor arm the direct current output of said detector, means for applying the diagonal voltage to said transmission tube, each of said rectifiers being in series with a resistor arm of said bridge, and means in said diagonal for preventing the development of said diagonal voltage to delay the action of the control circuit.

RUDOLF WEBER.