

Jan. 6, 1942.

L. BRÜCK

2,269,140

MODULATION CIRCUIT ORGANIZATION

Filed May 22, 1940

Fig. 1

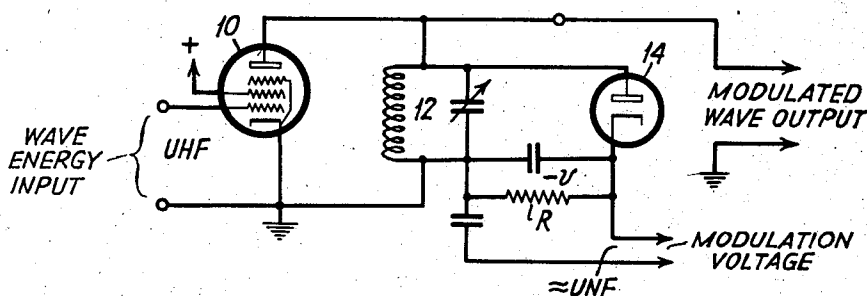


Fig. 2

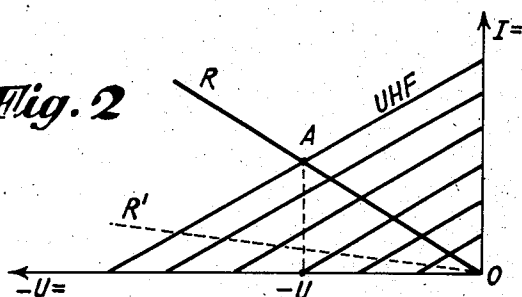


Fig. 3

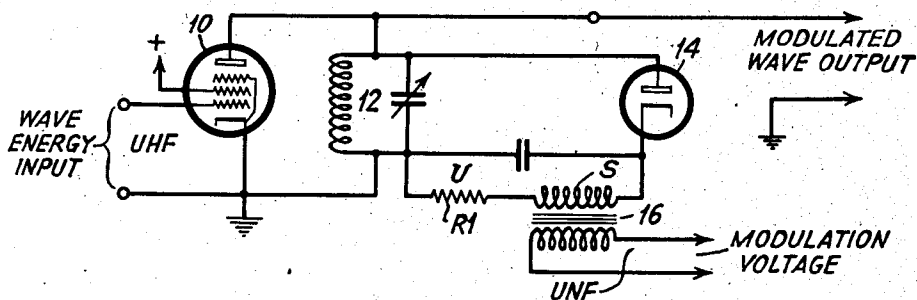
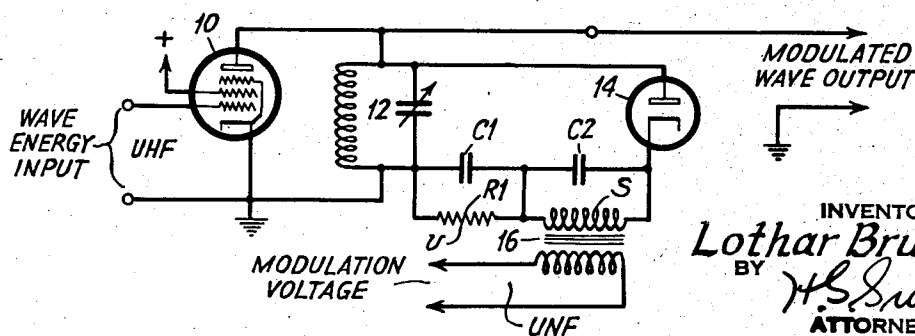


Fig. 4



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2,269,140

MODULATION CIRCUIT ORGANIZATION

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Application May 22, 1940, Serial No. 336,546
In Germany March 14, 1939

2 Claims. (Cl. 179—171.5)

The present invention is concerned with a modulation circuit arrangement for radio-frequency transmitters. Its outstanding feature is that in parallel relation to the oscillation circuit of a radio-frequency amplifier tube, especially a pentode, or else in parallel relation to a circuit being coupled with the said oscillation circuit, there is a series connection comprising a rectifier with linear characteristic (especially a diode) and an ohmic resistance of such size that the family of characteristics of the rectifier is operated as symmetrically as possible, and that the modulation potential is impressed upon the ohmic resistance or upon a transformer connected in series with it.

In describing my invention in detail reference will be made to the attached drawing wherein:

Figures 1, 3 and 4 each show a different embodiment of my new and improved modulation means; and

Figure 2 shows the characteristics of the rectifier as used in my modulation scheme.

The circuit organization as outlined is shown in Fig. 1. The radio-frequency or signal energy coming in from the transmitter is amplified in a tube 10 which has a high internal resistance. The tube 10 may as shown be a pentode. The wave energy raised to a high amplitude is fed from the anode of tube 10 to the oscillation circuit 12 and also to the rectifier tube 14. The rectifier tube 14 operates inside the straight portion of its characteristic obtained by plotting the direct current component, I_d , as a function of the high frequency voltage UHF. The rectified radio frequency produces across the resistance R the direct-current potential U.

Fig. 2 shows the family of rectification characteristics where I_d , the direct current component, is a function of U, the direct current voltage (at constant UHF) with operating point A. In Fig. 2 each of the lines sloping up to the right represents, for a particular value of radio-frequency voltage across 12, the relation between rectified current and the direct-current component of voltage between anode and cathode of the rectifier. As this bias is made more negative (abscissa) the rectified current (ordinate) is reduced. The line gets down to zero when this bias equals the peak value of the radio-frequency across 12.

Where audio frequency is superposed on the drop thru resistance R (which drop produces the bias $-U$) then the rectified current is varied. But this is the same, in its effect on tank 12, as if the size of R were varied by the audio-

frequency signals, and the line R of Fig. 2 shows how the effective resistance of the diode circuit varies with the total instantaneous bias on the diode.

R should be chosen to make the self bias, in absence of modulation, one half the cut-off value.

The audio-frequency potential is then superposed upon the direct-current voltage U, and the operation for the family of characteristics is to be as symmetric as possible, with a view to obtaining as high a modulation percentage as feasible, in the presence of reduced distortion. A high resistance R' providing a characteristic which corresponds to the straight (dash) line would, therefore, be wrong. The inclination of the rectification characteristics is a function of the damping in the radio-frequency circuit. Its damping, as far as possible, should be due only to the rectifier load and thus its effective (ohmic) resistance be R/2. It is for this reason that the input tube 10 is a pentode. The circuit 12 could also be replaced by a band-pass filter or a circuit in loose coupling relationship with the transmitter. Modulation is produced by varying the effective resistance R/2 of the circuit at the rate and rhythm of the modulating potential applied across R. As a consequence the radio-frequency resistance in the plate circuit of the input tube 10 is variable and the radio-frequency potential arising across the same fluctuates at the rate and rhythm of the modulation potential.

The audio-frequency potential may be introduced also in the manner shown in Fig. 3 by means of a transformer 16. The sum total of the ohmic resistance of the transformer winding S and R1 must be equal to the resistance R in Fig. 1. Somewhat more suitable as regards the frequency characteristic than circuit scheme Fig. 3 is the circuit organization of Fig. 4 where C1 is a modulation frequency shunt of R1, while C2 is a radio-frequency by-pass for the transformer secondary S.

What is claimed is:

1. In a modulation system, an electron discharge tube of the screen grid type having input electrodes excited by radio frequency energy and having output electrodes, a radio frequency circuit parallel tuned to the frequency of said wave energy coupled to said output electrodes, a rectifier and a resistance in series coupled in shunt to said radio frequency circuit, a source of modulating potentials, and means coupling said source of modulating potentials in shunt to said resistance.

2. In a modulation system, an electron discharge amplifier tube having input electrodes excited by wave energy of carrier wave frequency and having output electrodes from which modulated wave energy may be derived, a circuit parallel tuned to the frequency of the said wave energy connected between said output electrodes, a diode rectifier and a resistance shunted by a condenser in series across said parallel tuned cir-

cuit, the value of said resistance being such that a direct current diode biasing potential is developed therein which is approximately half that necessary to block said diode in the presence of the peak radio frequency voltage and in the absence of modulation, and means for feeding modulating potentials to said resistance.

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