Dec. 3, 1940. J. E. SMITH 2,223,430

MODULATION SYSTEM

Filed Jan. 25, 1938

Fig. 1

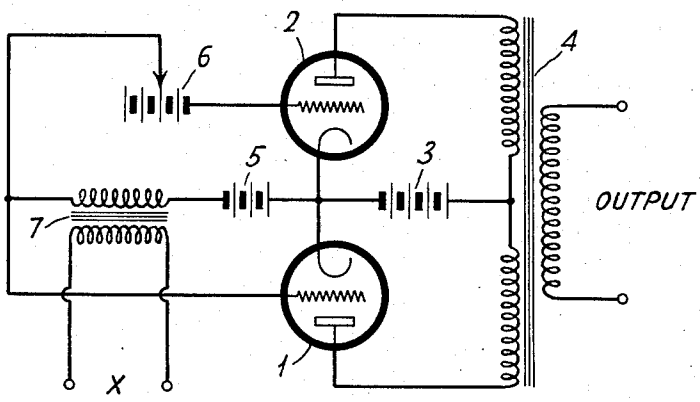
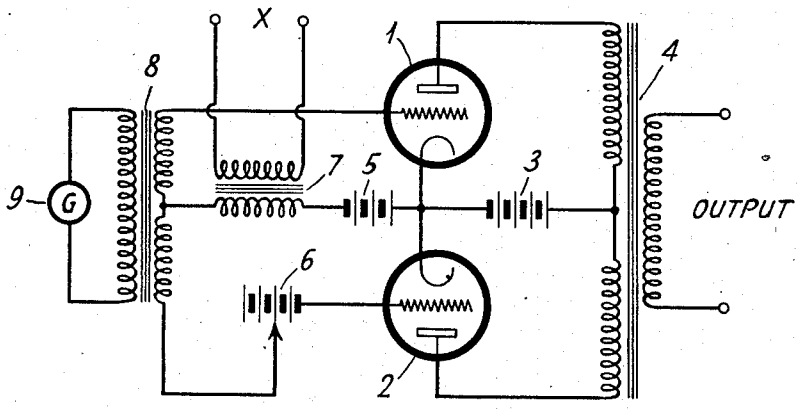


Fig. 2



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MODULATION SYSTEM

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2 Claims. (Cl. 179—171.5)

This invention relates to a novel circuit for limiting of the amplitude of a signal wave applied thereto and has for an object to conveniently produce thereby a flat-topped output wave.

Another object of my invention is to provide a novel peak clipping circuit.

A further aspect of my invention involves the control of one wave by another for signaling or other purposes. Circuits of this general type are known as modulators and my invention relates in this form to a novel balanced modulator in which, preferably, a pair of thermionic discharge tubes are connected so as to prevent amplitudes of the control wave above a predetermined value from exerting any increased effect on the controlled wave.

In accordance with my invention, a pair of thermionic discharge tubes are arranged with their outputs in a push-push or paraphase relationship. One tube has an additional negative grid bias over that supplied to the other tube. The control signal is fed to the grids of the tubes in parallel by suitable coupling means connected in series with the common bias for the two thermionic discharge tubes. Any signal thus introduced will operate one tube but the other will not be operated until the peak signal amplitude exceeds the potential of the additional bias. In the output circuit the plate current of the tube, which has the added bias, has an opposite effect to that of the other tube. Due to this bucking effect the resultant output will be flat-topped having a maximum amplitude dependent on the value of the added bias on the one tube.

Referring, now to the drawing for a more complete disclosure of my invention, Fig. 1 shows diagrammatically one form of my invention, while Fig. 2 shows a modification thereof, particularly adapted for use as a modulator.

In Fig. 1 thermionic discharge tubes 1 and 2 are connected in a phase opposing relationship. The anode potential is supplied from battery 3 through the windings of output transformer 4. The primary winding of this transformer is center tapped and the battery 3 is connected to this tap so that the anode currents are in opposing relationship. A battery 5 is provided in the grid circuit to bias the tubes to cut off. An additional bias is supplied to the grid of tube 2 by means of battery 6. The signal to be controlled is supplied at terminals X and introduced into the circuit through input transformer 7. Any signal introduced at X will operate thermionic discharge tube 1 but will not operate tube 2 until its peak amplitude exceeds the voltage of battery 6. In the primary of the output transformer 4 current will flow in the lower leg in phase with the positive half cycles of the signal applied to the circuit.

When the signal amplitude applied at X exceeds the bias voltage of battery 6, tube 2 will start to conduct thus causing current to flow in the upper leg of transformer 4. This current, if tubes 1 and 2 are identical, will just cancel any further increase in the magnetic flux produced by the current through tube 1. The resultant output will be flat-topped having an amplitude dependent on the voltage of the bias battery 6.

As shown in Fig. 2 the circuit may also be used to modulate another signal frequency inserted by means of input transformer 8. This signal which may be of any desired frequency is supplied by generator 9. The operation of this circuit is similar to that of the circuit shown in Fig. 1. As long as no signal is supplied through transformer 7 both tubes 1 and 2 are biased to cut off by battery 5. A signal supplied at X of any peak amplitude up to the potential of battery 6 will cause the frequency supplied by 9 to be modulated in accordance with the signal applied at X and appear in the output of transformer 4. An increase of the modulating signal supplied at X over the predetermined value will, as before, cause a bucking effect in the output transformer 4, preventing any further increase in the modulated signal appearing therein.

Any distortion in the output may be corrected by suitable filters or resonant circuits. The resultant output wave form may be varied by using tubes of different characteristics.

While I have particularly described my invention in some detail I do not wish to be limited to the particular embodiments shown but intend to include all modifications within the scope of my invention.

I claim:

1. In a modulator, a pair of thermionic discharge tubes each having an anode, a cathode and a control grid, a source of anode potential, a center tapped output transformer having said source connected to the center tap and an anode connected to each end thereof, means for applying a carrier to said grids in a phase opposing relationship, means for biasing said grids to cut off with an additional bias for one of said grids and means in series with said biasing means for applying a signal to said control grids.

2. In a balanced modulator comprising a pair of thermionic discharge tubes each having a control electrode and having their output circuits

connected in phase opposition, means for biasing the tubes to cut off, means for applying a carrier wave to the control electrodes of said tubes in an opposing phase relationship, means for applying a modulating frequency to said control electrodes in like phase relationship and means for additionally biasing the control electrode of one of said tubes whereby said one tube is maintained inoperative until a predetermined signal amplitude is exceeded.

J. ERNEST SMITH.