May 23, 1939. G. M. WRIGHT 2,159,493

MODULATED CARRIER WAVE RECEIVER

Filed March 18, 1936

Fig. 1

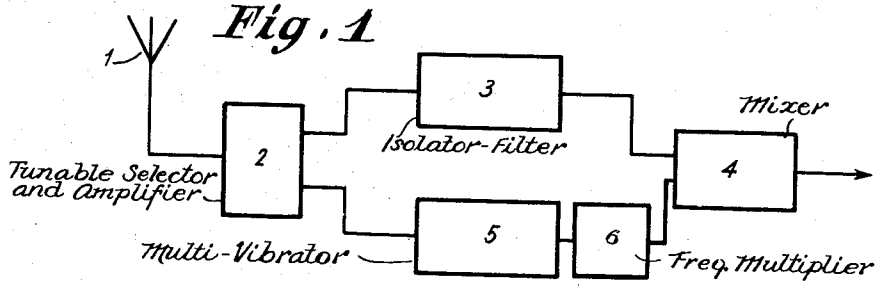
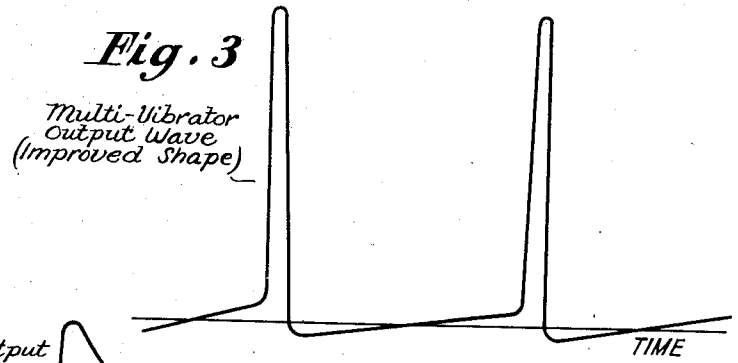


Fig. 3



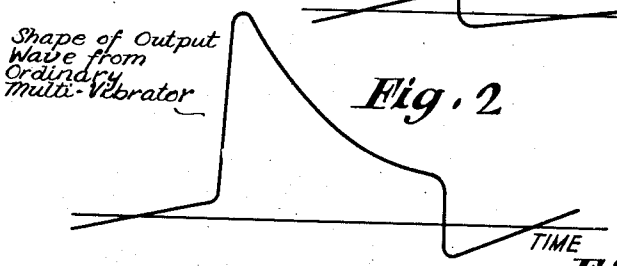


Fig. 2

Fig. 4

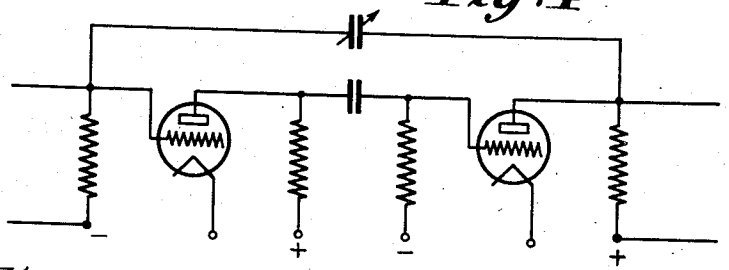
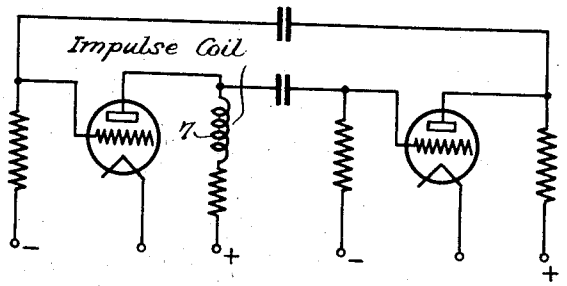


Fig. 5



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MODULATED CARRIER WAVE RECEIVER

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6 Claims. (Cl. 250—20)

This invention relates to modulated carrier wave receivers and more particularly to homodyne receivers of the kind wherein received modulated carrier wave energy is mixed with locally generated un-modulated carrier wave energy, of the same frequency.

Considerable difficulty is met with in practice in homodyne receivers in obtaining the required synchronism between the locally generated unmodulated carrier and the carrier component in the incoming modulated carrier and known forms of homodyne receiver are apt to be either complex and expensive to manufacture or difficult to adjust and operate or both.

The principal object of the present invention is to meet these difficulties and to provide an improved and simple homodyne receiver.

According to this invention a so-called multivibrator or Abraham-Bloch type of oscillation or pulse generator synchronised by the incoming carrier energy is utilised as the source of local oscillatory energy in a homodyne receiver of the kind referred to. Pulses from the generator are utilised to main in continuous oscillation a circuit responsive at the desired local carrier frequency. The generator is preferably constructed or adjusted to operate at a pulse frequency which is a sub-harmonic of the desired local carrier frequency.

The invention is illustrated in and further explained in connection with the accompanying drawing in which,

Figure 1 is a block diagram of a circuit arrangement embodying the features of my invention;

Figs. 2 and 3 represent plots of wave shape from an ordinary multi-vibrator in relation to that of an improved multi-vibrator according to my intion;

Fig. 4 shows a conventional circuit diagram of an ordinary multi-vibrator such as would be useful in the circuit arrangement of my invention, except for the fact that the modified multi-vibrator shown in Fig. 5 is to be preferred.

Referring to Figure 1 which shows in block diagram form one way of carrying out this invention a homodyne receiver comprises a receiving aerial 1 which feeds into any suitable form of tunable high frequency selector circuit 2 which may, if desired, include a high frequency amplifier. The output from this selector circuit and amplifier (if any) is passed through a thermionic valve stage 3 (which acts as an isolator stage) to a mixing circuit at 4 at which the necessary unmodulated carrier component is to be added. Output energy from the selector circuit and amplifier (if any) is also branched off and fed to a so-called multi-vibrator or Abraham Bloch type of oscillator 5 which is adjusted to operate at a frequency which is a sub-harmonic of the carrier component frequency in the received energy. Thus the oscillator 5 is synchronised at the required frequency by means of the carrier frequency actually received. The synchronised output from the multi-vibrator oscillator is fed to a tuned circuit 6 harmonically related to the multi-vibrator fundamental frequency so that continuous oscillations at the required local frequency are maintained in this tuned circuit. The oscillations in this tuned circuit are combined with the output from the isolator stage in the mixing circuit at 4. It will be seen that these local oscillations will be synchronised correctly with the incoming carrier since the multi-vibrator is itself synchronised thereby. The rest of the receiver is well known and accordingly is not shown.

The tuned circuit which is maintained in oscillation by the multi-vibrator should be an oscillatory circuit of low damping and preferably, though not necessarily, the multi-vibrator at 5 has incorporated therewith an inductive impedance 7, otherwise termed an "impulse coil".

It has been found experimentally that accurate synchronism can be maintained when the incoming carrier and the local heterodyne oscillations are of a frequency which is as much as thirty times that of the multi-vibrator natural frequency; for example, a multi-vibrator designed to produce a frequency in the neighbourhood of 30,000 cycles per second can be used satisfactorily to produce homodyne local oscillator energy to enable homodyne reception to be effected with an incoming carrier frequency in the neighborhood of one million cycles per second.

This readiness for accurate synchronism will be appreciated from a consideration of Figures 2 and 3 which show respectively the wave shapes generated by an ordinary multi-vibrator such as is shown in Figure 4 and a multi-vibrator such as is shown in Figure 5. In both cases the sudden sharp changes in potential ("flicks"), once initiated, are extremely rapid and since the instants of commencement of these "flicks" are controlled by the exact moments of occurrence of a critical potential difference, the multi-vibrator type of oscillator shows great readiness to generate pulses in synchronism with any applied cyclically varying voltage.

I claim:

1. A receiver of the homodyne type having in combination a tunable selector, means for isolating a desired component of the output from said selector, a circuit in shunt with said isolating means, said circuit including a multi-vibrator connected to said selector and maintained in synchronism with a sub-harmonic of the output from said selector, said multi-vibrator having incorporated therein an inductive impedance otherwise termed an "impulse coil", and a mixer circuit having input connections both from said isolating means and from said multi-vibrator.

2. A receiver of the homodyne type having in combination a selective radio frequency amplifier, a filter, otherwise termed an isolator, connected to the output side of said amplifier, a multi-vibrator also connected to the output side of said amplifier and maintained in synchronism with the received radio frequency energy, means for causing said multi-vibrator to oscillate at a frequency which is a sub-harmonic of the received radio frequency energy, means for characterizing the output of said multi-vibrator with sharply peaked pulses separated by periods of relatively low amplitude output, said means comprising an inductive impedance in circuit with an anode potential source applied to one unit of said multi-vibrator, a frequency multiplier having an input circuit fed with energy from said multi-vibrator and a mixer circuit having input connections both from said filter and from said frequency multiplier.

3. In a radio receiver, a radio frequency tuning circuit, a homodyne oscillator of the multi-vibrator type comprising a pair of electronic devices having control electrodes and resistive output circuits, the control electrode of each device being capacitively coupled to the output circuit of the other device, and an inductive impedance in one only of said output circuits, and means for synchronizing the frequency of said oscillator with a sub-harmonic of the radio frequency accepted by said radio frequency tuning circuit.

4. A radio receiver comprising a radio frequency tuning unit, a multi-vibrator adapted to be synchronized by the application thereto of incoming carrier energy accepted by said tuning unit, said vibrator comprising electronic means having two space discharge paths between cathodic and anodic-elements thereof for completing different output circuits alternately, a control electrode in each space discharge path, a capacitor in circuit between the control electrode of each path and the anodic element of the other path, a source of operating potentials for said multi-vibrator, resistances in circuit between said source and each of said anodic elements and control electrodes, and an inductive impedance in circuit with one only of said resistances leading to an anodic element.

5. In a system for homodyne reception of an incoming carrier wave and for the generation of impulses at a sub-harmonic frequency with respect to the frequency of said incoming carrier wave by means of a multi-vibrator having two electron discharge tubes, each tube comprising a cathode, an anode and a control electrode, the method of abbreviating the duration of the impulses generated which consists in introducing a considerable excess of inductance into the anode potential supply path of one tube over that of the other tube.

6. In a radio receiver, a radio frequency tuning circuit, a homodyne oscillator comprising a pair of discharge tubes constituted as a multi-vibrator, means including an inductive impedance so disposed in the circuit of said multi-vibrator as to provide sharply peaked impulses separated by periods of relatively low amplitude output, means for synchronizing the frequency of said multi-vibrator with a sub-harmonic of the radio frequency accepted by said tuning circuit, a filter of the so-called isolator-type in shunt with said multi-vibrator, a mixer circuit jointly fed by energy from said filter and from said multi-vibrator, and a frequency multiplier interposed between said multi-vibrator and said mixer circuit.

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