

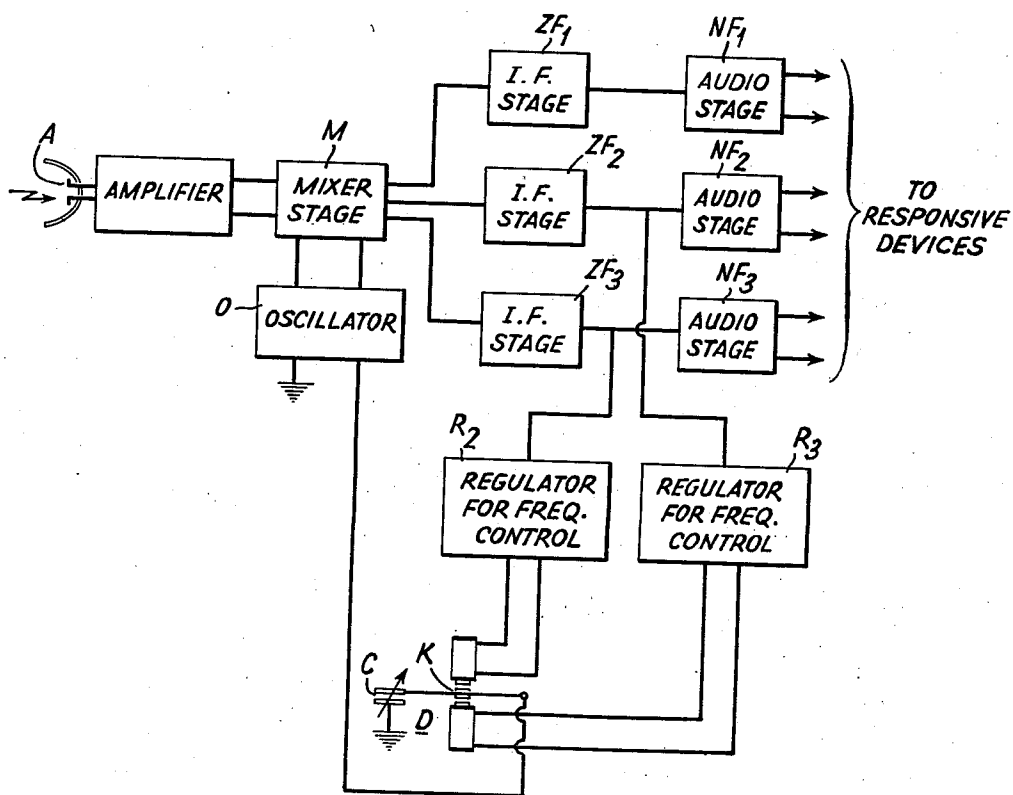
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AUTOMATIC FREQUENCY CONTROL SYSTEM

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AUTOMATIC FREQUENCY CONTROL
SYSTEM

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The invention is concerned with a receiving arrangement for a multiplex signal or message system which operates with a plurality of neighboring ultra-short wave carriers which, in turn, are modulated preferably with different signals or messages. It has been suggested in the earlier art to use for the reception of such a multiplex carrier transmission a single heterodyne by means of which the various ultra-short wave carriers are changed into intermediate frequencies, the selection of the various message carriers taking place only in the intermediate frequency stages. In order to equalize joint fluctuations or drifts of the sending frequencies or of the heterodyne or local oscillator at the receiving end, automatic sharp tuning of the heterodyne was effected according to another disclosure of the prior art so that fair stabilization of the intermediate frequencies results. Now, if the control or regulator potential adapted to operate the said automatic tuning means is derived only from a single intermediate frequency channel, it will be seen that, in case of a failure of the transmitter pertaining to this particular channel, the automatic tuning action will cease completely, and the result is that reception of signals from the other transmitters becomes uncertain. The object of the invention is to cure this difficulty.

According to the invention automatic tuning of the heterodyne is insured by joint regulating potentials which are produced simultaneously by two or more intermediate frequencies. Hence automatic sharp tuning will be preserved even in case one of the transmitting channels should happen to drop out or fail. Moreover, there results the following particular advantage: If in the presence of normal automatic tuning of the local oscillator in the receiver, the transmitter should fail, the regulating potential will not drop to the zero level, but will retain a constant value which is due to the noise potentials of the circuits serving to produce the regulating potential. For it will be noted that these circuits are never so sharply tuned in respect to one another that the two noise potentials will exactly offset. The result is that the heterodyne or local oscillator becomes detuned and will no longer operate at the correct point when the transmitter comes back. But if, according to the present invention, the regulating potential is furnished from two or more intermediate frequency channels, the failure of one transmitter will incur no difficulty, since the noise potentials of the circuits pertaining to this transmitter will be substantially ineffective

in comparison with the high regulating potentials of the other intermediate frequency channels which will arise immediately in case of detuning of the heterodyne. The latter, therefore, is completely stabilized independently of such noise potentials of some of the circuits. The measure of such stabilization in comparison with the noise potentials of such circuits, of course, is a function only of the slope of the other circuits so it may be raised at will, say, by the use of very steep frequency characteristics as found, for instance, in the slopes of band-pass filters, or the like. The result of such constancy in respect to noise potentials is that, contradistinct from conventional automatic tuning arrangements, there is no particular reason why the regulating voltage circuits should be sharply balanced in respect to noise potentials.

The invention will now be described more fully by reference to the appended drawing, the sole figure of which represents a schematic diagram of the essential parts.

Referring to the latter, A denotes an aerial whence the signal waves are fed to an amplifier and thence to a mixer stage M, the latter being also in coupling relation with the heterodyne or local oscillator O. Associated with the mixer stage are the various intermediate frequency channels indicated at ZF1, ZF2, ZD3, the latter, in turn, being connected with demodulation and AF units NF1, NF2, and NF3. For automatic tuning are provided the regulator means R2 and R3, which are coupled with the intermediate channels ZF2 and ZF3, and which normally furnish regulating potentials of equal and opposite sense to the respective magnets of the retuning means D. The armature K common to the two said magnets of the latter is mechanically connected to the movable plate of the tuning condenser C. This condenser is in circuit with the oscillator O and controls the frequency thereof.

Instead of a relay actuated tuning device such as shown, other means may be adopted according to well known practice in the art of automatic frequency control of an oscillator. Also the means furnishing the regulating potentials, basically speaking, could be of any desired kind at all and need not be confined to the circuits detuned to one another as hereinbefore mentioned. Finally, the various intermediate frequencies, instead of the organization shown in the drawing, where they are fed directly above the mixing stage to selective intermediate frequency channels, could first be amplified in a joint intermediate frequency amplifier designed

for a correspondingly broad pass-band, and could afterwards be separated by filters. If a great number of intermediate frequencies is involved, then for each two or more a common amplifier could be provided instead of a single joint amplifier. It goes without saying that the invention in no way depends upon any particular mode of producing the transmitter frequencies, though it will be found expedient to so generate the various sending waves that the frequency intervals between them will be constant and stable. This desirable condition will be insured if the sending frequencies are produced by the modulation of an ultra-short wave with several audible or supra-sonic frequencies according to well known practice in the art of multiplex transmission systems operating with longer waves.

I claim:

1. A radio system receptive of a plurality of simultaneously propagated radio frequency carriers of different neighboring frequencies, said system having an oscillator, means including a single mixer stage for mixing the output from the oscillator with said simultaneously received radio frequency carriers, a plurality of intermediate frequency amplifiers, each responsive to a different heterodyne frequency derived from said mixer stage, and means controlled by output components from a pair of said amplifiers for regulating the frequency of said oscillator, said regulation being in one sense in response to a predominant output component from a particular amplifier of said pair, and in the opposite

sense in response to a predominant output component from the other amplifier of said pair.

2. A system according to claim 1 in which the last said means includes a tuning element in circuit with said oscillator and reversibly operative relay means for adjusting said tuning element.

3. A system according to claim 1 in which the last said means includes a plurality of regulating devices each under control of a different one of said intermediate frequency amplifiers, a relay-operated tuning element in circuit with said oscillator, and means for causing said element to be adjusted in the same sense by corresponding frequency variations in the intermediate frequency responses of the respective amplifiers.

4. A multiplex receiving system having a radio frequency amplifier simultaneously receptive of radio frequency carriers of different neighboring frequencies, an oscillator, a mixer stage for heterodyning the output from said oscillator with different simultaneously received components of said carriers, means for separately and selectively amplifying and detecting the modulated energies appearing in different portions of the intermediate frequency spectrum as derivatives from said mixer stage, and a relay-controlled tuning device operable to adjust the frequency of said oscillator, said device being responsive to variations in the heterodyned frequencies derived from different intermediate frequency bands within said spectrum.

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