Nov. 29, 1938. J. ROBINSON 2,138,747

RECEIVER FOR WAVE SIGNALS

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Fig. 1.

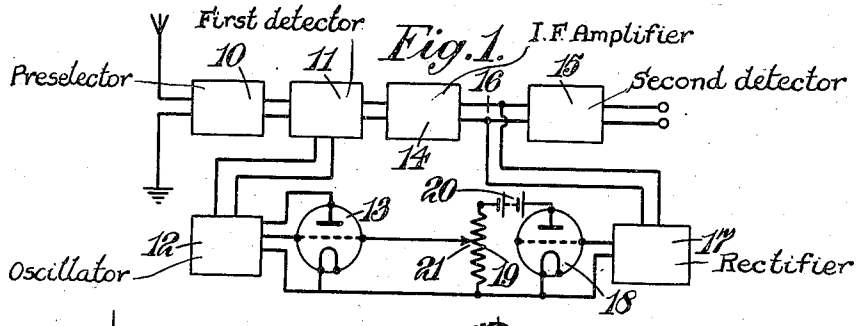


Fig. 2.

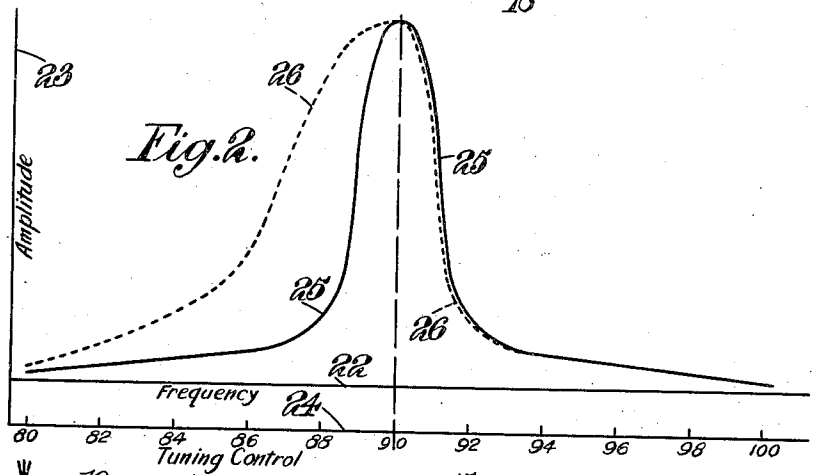


Fig. 3.

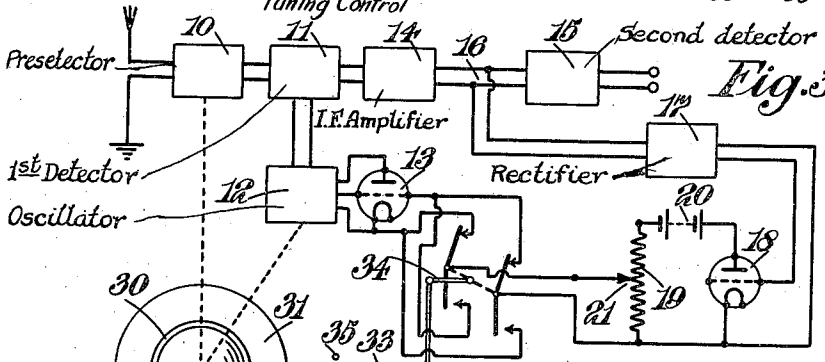
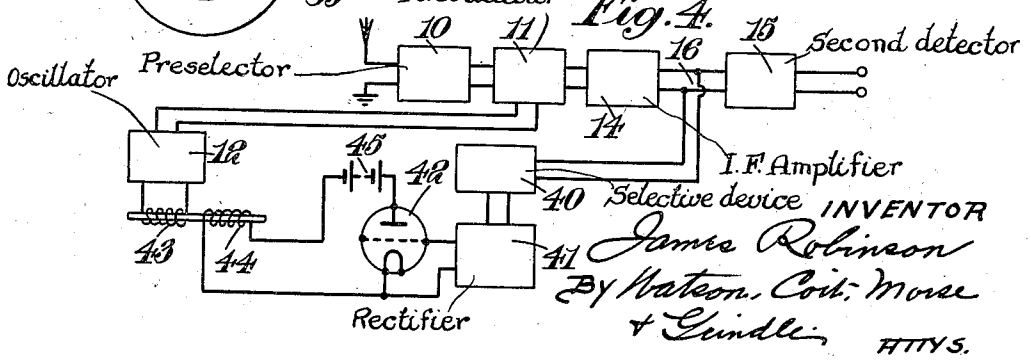


Fig. 4.



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Fig. 5

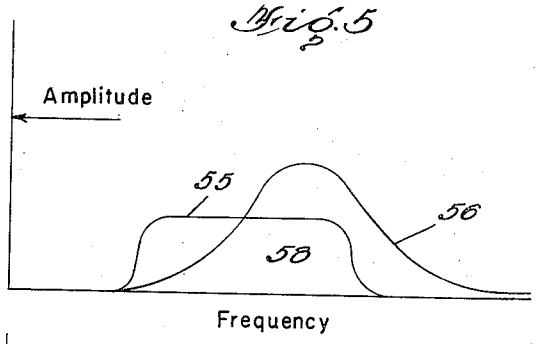


Fig. 6

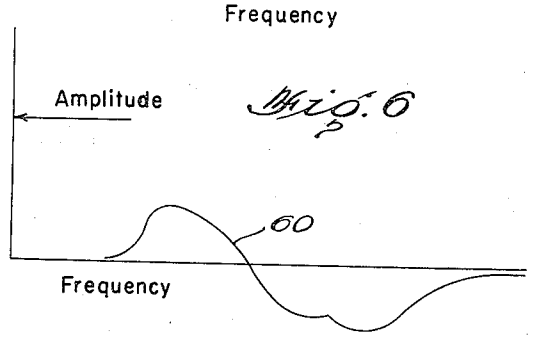
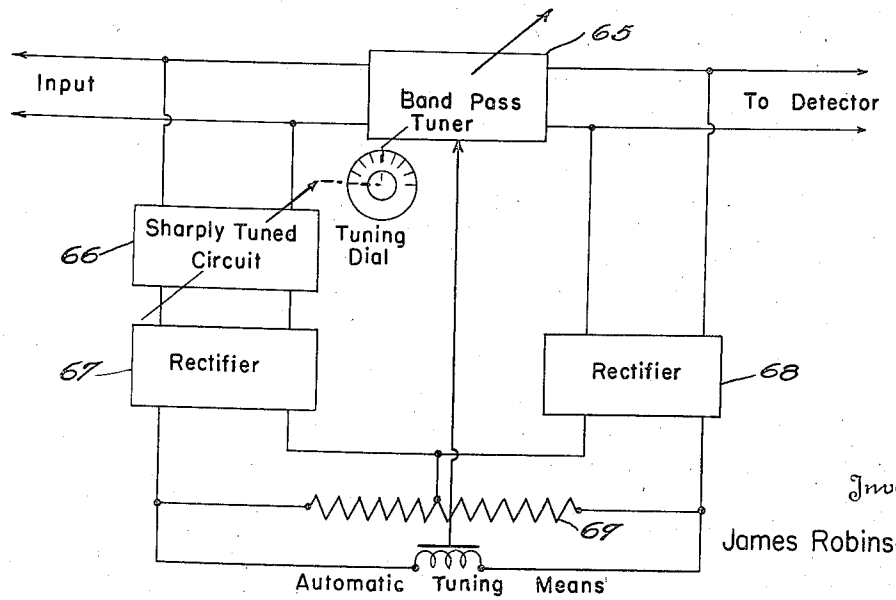


Fig. 7



Inventor

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UNITED STATES PATENT OFFICE

2,138,747

RECEIVER FOR WAVE SIGNALS

James Robinson, Mill Hill, London, England

Application October 2, 1935, Serial No. 43,265
In Great Britain October 5, 1934

1 Claim. (Cl. 250—40)

This invention relates to receivers for wave signals and more especially wireless broadcast transmissions, which receivers are capable of being tuned to any selected one of a plurality of different transmissions.

It is known, for example from British specification No. 407,057, to provide means whereby a receiver, after having been tuned to the required signals, is automatically maintained in tune should a discrepancy arise between the frequency of the transmission and the tuning of the receiver, due, for example, to wandering of the frequency of the transmission.

In order for a receiver manually to be tuned to any given transmission considerable care is necessary to ensure that the tuning should be accurate and it is necessary to observe this accuracy in operating the tuning control each time the receiver is tuned from one transmission to another. One need for this accuracy in tuning is due to the fact that, unless the receiver is properly in tune with the transmission to be received, considerable distortion of the reproduction is obtained and in many receivers at the present time the difficulty is overcome to some extent by providing a visual indication of resonance of the receiver with the transmission being received, but of course this does not obviate the necessity for careful manipulation of the tuning control.

An object of the present invention is to provide an improved tuning control for wireless receivers which will enable the receiver to be tuned easily and apparently without any degree of accuracy, and which further can be arranged automatically to ensure that the apparatus is electrically in proper tune with the incoming signals, as is necessary for obtaining faithful reproduction, despite an initial inexact setting of the tuning control.

According to the invention there is provided in a wireless receiver the combination of one or more selective devices providing a response varying in amplitude over a range of frequencies adjacent the carrier-frequency of the signals for which the receiver is tuned, which range is of the order of the range of modulation frequencies required for reproduction, e. g. not less than one kilocycle, means for applying a portion of the received signals to said selective devices and means for automatically controlling the tuning of the receiver, in accordance with the response of the selective device or devices towards or into tune with the received signals.

As the normal manual control is moved through turning of the signals to be received the actual tuning of the receiver is advanced beyond that represented by the position of the manual control and this automatic variation is maintained until the tuning control has been moved to the position for correct tuning. Thus, the signals are picked up as the manual control approaches the proper setting and are maintained during a range of adjustment just as though the receiver were non-selective.

Furthermore, during the adjustment of the tuning control the receiver is actually brought into tune with the incoming signals before the tuning control has reached true position, and true tuning is maintained for a further movement of the manual control up to the true tuning position. Thus, the receiver is automatically brought into tune with the incoming signals as soon as the tuning control has been moved to a position within the range of operation of the control.

The invention also comprises in a wireless receiver, the combination of a selective device in tune with the receiver, to which selective device the signals are applied, and means for applying the response of the selective device automatically to control the tuning of the receiver.

Since by this arrangement the apparatus is only operative for movement of the tuning control in one direction it is a further feature of the invention to provide a change-over switch for the controlling potential and means controlled by the reversal of movement of the tuning control for operating the switch. By this means the automatic control tuning is obtained for movements of the tuning control in either direction.

In one form of the invention the selective device or devices which serve to provide the automatic control of the tuning are those which are employed for the normal function of selecting the signals for reproduction.

According to another feature of the invention there is provided in a wireless receiver the combination of a selective device, e. g. a band-pass circuit for selecting the signals for reproduction, an additional selective device to which the signals are applied and having a sloping characteristic and means for applying the output of the additional selective device automatically to control the tuning of the receiver. In one form there is provided means for rectifying the outputs of both selective devices, means for combining the rectified signal energy in opposed sense such that a zero response is obtained for accurate tuning and means for applying the resultant automati-

cally to control the tuning of the receiver.

and in such a manner that there is zero response obtained for accurate tuning. The resultant response which thus varies in amplitude according to the amount by which the receiver is out of tune in either direction is applied to control the electrical tuning of the band-pass circuit automatically, for example by means as described with reference to Figures 1, 3 and 4. Alternatively, the controlling effort may be utilized to operate an electro-magnet device for mechanically adjusting a tuning element of the band-pass circuit.

This method of controlling receiver tuning is illustrated in Figures 5, 6 and 7 of the drawings. Thus in Figure 5 the curve 55 represents the resonance characteristic of the band-pass circuit just referred to, whereas the curve 56 represents the resonance characteristic of the additional resonant device having the sloping portion 57. These curves intersect at the point 58, of which the abscissa represents the carrier frequency of the incoming signal when the receiver is properly tuned. When a portion of the output from the band-pass circuit and the additional circuit are rectified and combined in the opposite sense, there will be no resultant response if the receiver is accurately tuned to the incoming signal. Improper tuning, however, will give a response from this combination of signal energy which will vary in amplitude and direction of flow depending on the extent to which and the direction in which the receiver is out of tune with the incoming signal, the response at different frequencies being indicated by the curve 60 of Figure 6. This resultant response can thus be utilized as proposed in Figures 1, 3 and 4 to adjust the effective tuning of the receiver in either direction toward and into resonance with the incoming signals, and when such adjustment has been effected, the absence of such resultant response will maintain the receiver in the correct adjustment.

Figure 7 illustrates one form of circuit by which this method of control may be effected. It will be observed that in this circuit the received signals are impressed on a tunable band-pass circuit 65. A part of the input signal is passed through a sharply tuned circuit 66 and rectified at 67. A part of the output of the band-pass circuit is also rectified at 68, and the output of these rectifiers is combined and applied to the control of the tuning correcting device, a center-tapper resistance 69 being employed, across which the rectified potentials are applied in opposed sense.

When the band-pass and sharply tuned circuits are tuned together, the correcting device is controlled by the opposed rectified and smoothed output of these circuits, and the resultant response is that shown in Figure 6.

In another arrangement two additional resonant devices are provided, tuned to two frequencies, one higher and the other lower than the tuning of the intermediate frequency stage for the receiver. A portion of the signal energy in the receiver is applied to both these additional resonant devices and their outputs are separately fed to rectifiers which are employed in a position to control the tuning of the receiver.

In a modification of the foregoing arrangement the additional selective devices are such as to provide a plurality of peaks over a range such that the rectified output of each predominates over the other for alternate bands of frequencies.

Conveniently, the extent of these bands of frequencies may be determined by the form of the resonance curves or by a reduction or amplification of the output of one with respect to the other; or again, by means of a permanent bias assisting the output of one of the devices. Thus, there is provided a resultant control force, the effective direction of which is reversed in each band of frequencies and conveniently the extent of two such opposed bands is arranged to be equal to the required breadth of the control hereinbefore referred to.

The tuning adjustment effected by the automatic control may be proportional or have any other desired relationship with the control current which is produced by the rectified outputs of the control devices but it is desirable that the frequency variation for a given variation of control current should be a maximum at or adjacent the resonant frequency in order to obtain the maximum accuracy for the automatic control.

In the specific examples hereinbefore described a receiver of the superheterodyne type is employed, but it will be understood that the invention is also applicable to receivers of the "straight" type, in which the control for tuning is applied to the selective device of the receiver. Similarly, in a receiver of the superheterodyne type, the control potential current may be applied directly to change the tuning of the intermediate frequency stage instead of being applied to change the frequency of the local oscillator.

I claim:—

In a radio receiver which is manually tunable through a range of frequencies for selecting the required signals, the combination of a band-pass selective device for selecting the signals for reproduction, a tunable selective device having a sloping characteristic for frequencies adjacent the resonant frequency of the receiver, means for applying incoming signals to both said devices, means for rectifying the output of both said selective devices, means for combining the rectified outputs in the opposed sense such that a zero resultant is obtained for accurate tuning of the receiver and means for applying the said resultant automatically to adjust the effective tuning of the receiver towards resonance with the received signals when the receiver is manually tuned to include incoming signals in the range of said selective device which has the sloping characteristic.

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Nov. 29, 1938. E. C. SHERLIN ET AL 2,138,748

ATTACHMENT FOR KNITTING MACHINES

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Fig. 1

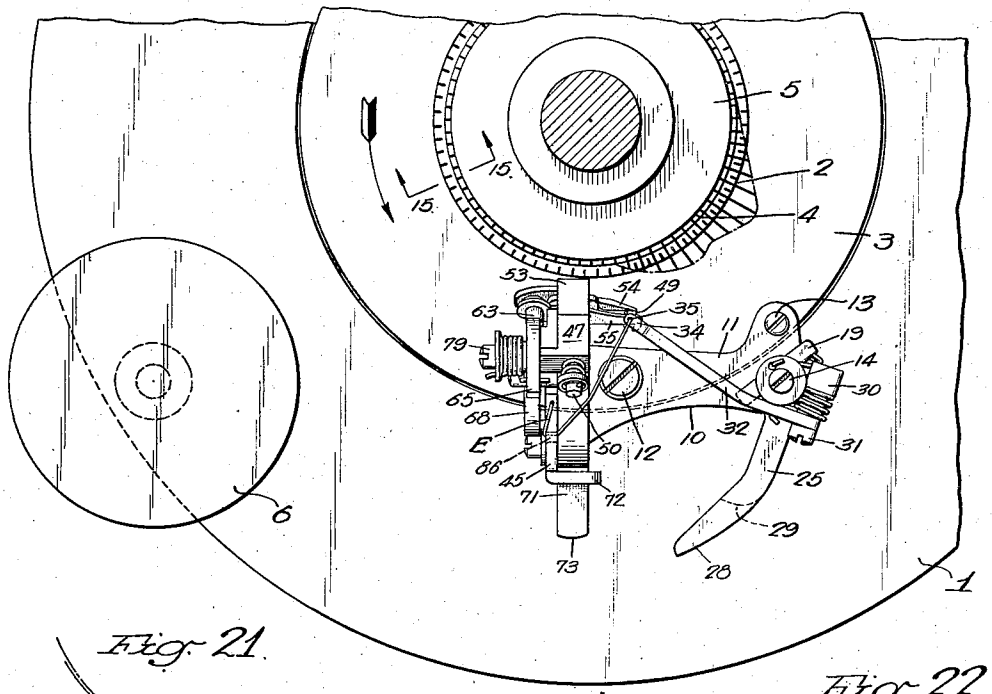


Fig. 21.

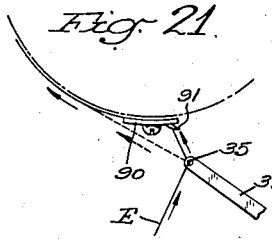


Fig. 2

Fig. 22.

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