July 21, 1942. W. PFOST ET AL 2,290,705

SELECTIVITY CONTROL IN BROADCAST RECEIVERS

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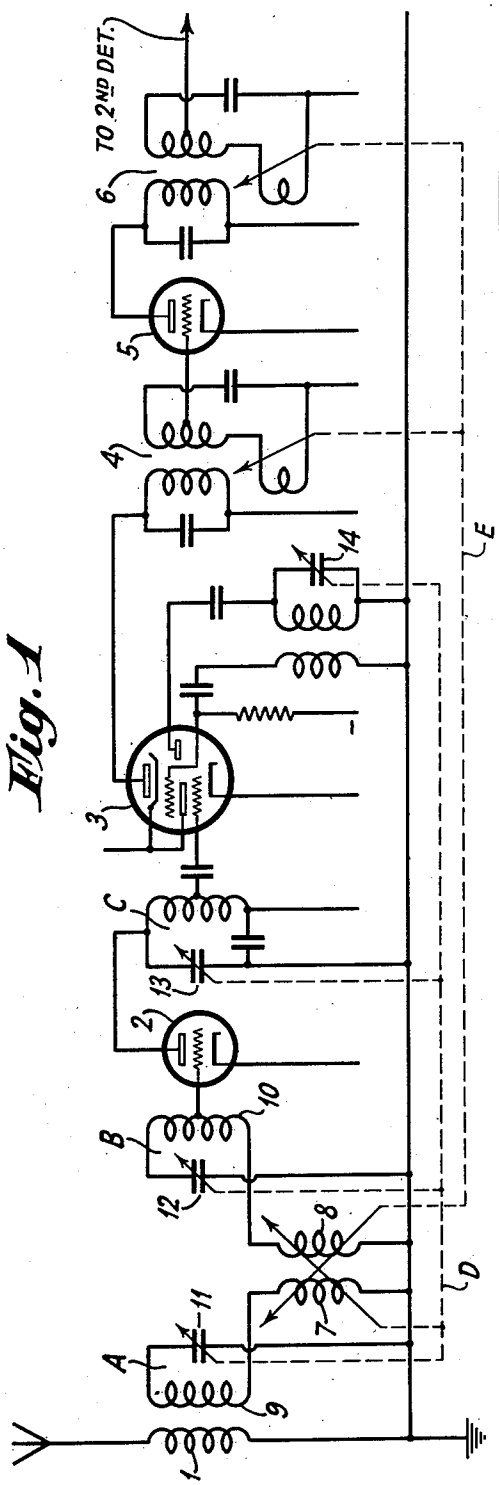

Fig. 1

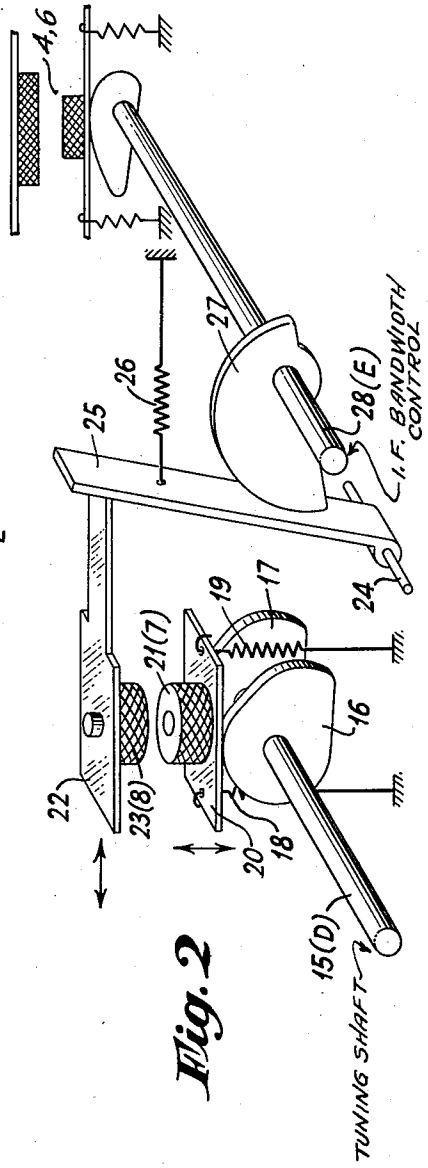

Fig. 2

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Fig. 3

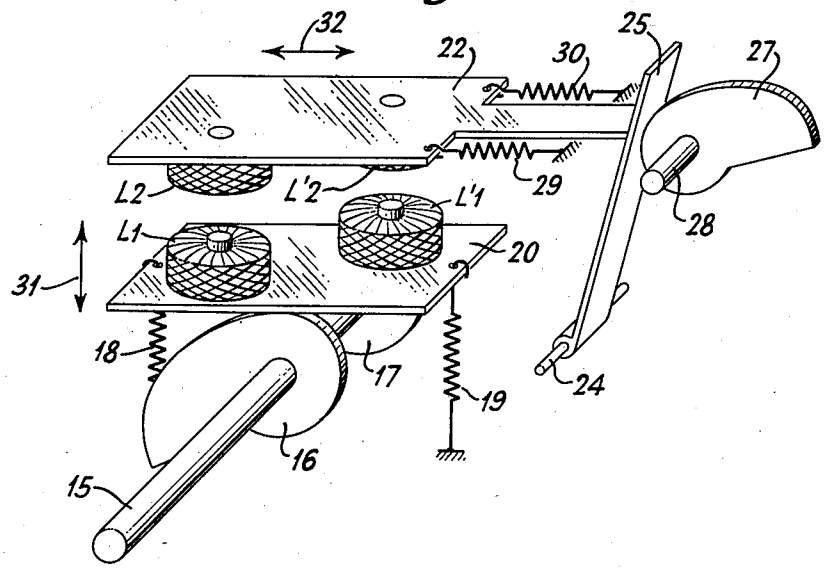
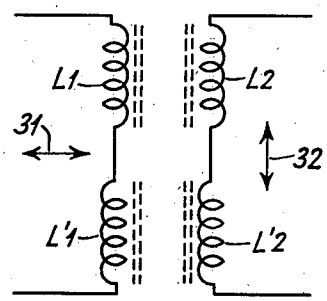


Fig. 4



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SELECTIVITY CONTROL IN BROADCAST RECEIVERS

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3 Claims. (Cl. 250—20)

The invention is concerned with broadcast receiver sets comprising an input band-pass filter. In the operation of input band-pass filters one disadvantage is that there occurs a change in the selectivity or the band-width as a function of the tuning of the set, inside the signal band width, with the coupling remaining unvaried.

This shortcoming and difficulty, according to the present invention, may be obviated by causing a change of coupling in the band filter by positively acting means, that is, in inter-lock relation with the adjustment of the tuning means of the apparatus. In this connection it may prove expedient, with a view to insuring a finer adjustment and the avoidance of possible formation of a crevass in the filter response curve, to couple the circuits only through parts of their circuit elements, that is to say, to couple only a portion of their entire windings with one another. In addition, besides such stabilization of the selectivity regardless of the signal or incoming frequency, it may prove advantageous to make arrangements so that a locked interdependence is created between the regulation of the band-width in the I. F. circuit of the set and that of the input band-pass filter, for the reason that if the band-width of the input filter at any time is comparatively great as compared with that of the I. F. portion, that is liable to lead to undesirable disturbances in reception, while if the band-width of the input filter is smaller than that in the I. F. portion the quality of reception is impaired. Thus, according to the invention regulation of the coupling of the input filter is made dependent upon the regulation of the band-width of the I. F. band-pass filter or filters, although this regulation or coupling adjustment is brought about independently of the adjustment and setting of the tuning means of the apparatus inside the signal frequency band.

In order to insure as great as possible a constancy or stability of the selectance of the input band-pass filter in a superheterodyne type receiver apparatus as a function of the tuned frequency of a sending station, it is necessary to alter the coupling between the filter circuits with the incoming or signal frequency. Now, if the set is furnished with a special band-width control which works upon any of the circuit elements included in the I. F. portion of the set it is necessary to cause simultaneously with the band-width variation in the I. F. portion also a band-width variation of the input band filter, so as to prevent the width of the signal input filter being narrower than that of the I. F. filter.

In a circuit organization as here to be disclosed, independent variation of the coupling between inductance coils by separate drive means is attained by shifting the inductance coils by the agency of the various adjusting means in different planes, that is, planes preferably at right angles to each other. The most advantageous plan is to cause by one of the adjusting means a shift of the coil in axial direction, and by the other means a shift at right angles to the axial direction. For the adjustment recourse could be had to cams, one such cam being mounted upon the rotary condenser shaft, for instance, or a shaft coupled therewith, while another cam could be connected with the adjusting means serving for variation of the band-width in the I. F. circuits.

The essential features of the invention shall now be explained more fully by reference to the appended drawings wherein Fig. 1 is a schematic circuit diagram of so much of a radio receiving circuit necessary for an understanding of the present invention, Fig. 2 shows a structural arrangement according to the invention. Fig. 3 is a modification of the construction shown in Fig. 2, and Fig. 4 shows the electrical connections of the coils of Fig. 3.

Referring to Fig. 1, 1 denotes the antenna coupling coil. In coupling relation therewith is the band-pass filter comprising the circuits A and B, circuit C being added thereto by way of the tube 2 to result in a three-circuit filter. Connected with this circuit in sequence are the mixer tube 3, the I. F. band-pass filter 4, the I. F. amplifier tube 5, and the I. F. band filter 6. The two circuits A and B are inter-coupled only by way of their fractional coils 7 and 8 of their inductances, the latter comprising in addition the windings 9 and 10. 11 to 14 denote the ganged tuning condensers in circuits A to C and the oscillator circuit of the mixer tube 3 jointly adjusted by the drive mechanism D. Positively adjusted by this drive D, as shown in the drawings, is moreover the means for variation of the coupling of the fractional coils 7 and 8 of circuits A and B. By the agency of drive E acting in a positive manner the I. F. band-pass filters are altered in their band-width and also the coupling of the fractional coils 7 and 8 of the circuits A and B.

Fig. 2 shows an exemplified embodiment to explain in what way the two regulator actions between fractional coils 7 and 8 in Fig. 1 are practiced. Seated upon the shaft 15 of the rotary condenser or a shaft connected therewith

are the two cams 16 and 17. Bearing upon the cam faces so as to be guided vertically and subject to the springs 18 and 19 is the support or carrier 20 for the winding 21 which corresponds to one, let us say 7, of the fractional windings of Fig. 1. Above this arrangement for the purpose of horizontal adjustment is guided the support 22 of the winding 23, which corresponds to the other winding 8 of Fig. 1. The coil carrier 22 comes to bear with its right-hand end, under the action of a spring (not shown), against the rocking lever 25 supported on the shaft 24. This rocker by the force of spring 26, is held in contact with the circumference of the cam 27 which is seated upon the shaft 28 which is actuated by the drive for the I. F. band-width regulation means.

In order that the coupling distance may be as small as possible, the various coils whose intercoupling relations are to be altered, may be split or divided. When splitting the same into two or more coils it is expedient to choose the sense of winding so that consecutive fractional coils turn always out to be wound in opposition. If, then, the coupling coils are shifted in respect to one another, it will be feasible even for short coupling distances to cause one of the fractional coils to be placed at great proximity to another coil having an oppositely wound winding, with the result that the coupling will be very markedly reduced.

This embodiment of the invention is shown in Fig. 3 in which like parts are similarly labeled as in Fig. 2. The plate 29 supports the two coils L1 and L'1 which represent two fractions of the coupling coil. Opposite the said coils is mounted the plate 22 on which are secured two fractional coils, L2 and L'2 corresponding to the coils L1 and L'1. These two coils represent also fractional coils of the second coupling coil. The sense of the winding of the various coils is so chosen that the coils L1 and L'1 are wound in opposition. Similarly the coil portions L2 and L'2 are wound in contrary senses.

The plate 22 which serves to secure the coils L2 and L_22 is shifted in dependence upon the band-width variator working upon the I. F. of the filter circuits. Connected with the band-width control is the shaft 28 which supports a cam 27. By the action of the springs 29 and 30, plate 22 is pressed through an intermediary or link piece 25 against the cam 27. As a result the said plate is enabled to experience movement in the directions indicated by the arrows 32. The motion occasioned by the cams 16 and 17 as a function of the frequency adjustment of the plate 20 carrying the fractional coils L1 and L'1 is by the arrows 31.

The fractional coils are suitably disposed more or less diagonally in reference to the direction of adjustment. By adjustment of the shaft 28 the fractional coils L2 and L'2 are shifted in such a way that at the beginning of such adjustment the fractional coil L2 is shifted out of the range of the fractional coil L1 and fractional coil L'2 out of the range of fractional coil L'1. As the shifting movement proceeds, fractional coil L2 will get into the range of action of fractional coil L'1. Inasmuch as the sense of winding of the two coils L2 and L'1 is contrary, the coupling as a result is thus diminished considerably.

In Fig. 4 the coils L1, L'1, and L2, L'2 are shown schematically. The direction of the adjustment by the rotary-condenser shaft 15 is in the sense indicated by the double-headed arrow 31, while the adjustment produced by the band-width regulator is in the direction of the double-headed arrow 32.

In an arrangement of the kind here disclosed it is also readily possible to effect adjustment not only in two planes, but to produce, whenever this is necessary, adjustment also by a third regulator and adjustment means in another plane. For instance, the plate 22 or the plate 20, or both, may be moved by suitable means in one plane which is at right angles to the two movements caused by shaft 15 and shaft 28. For this purpose cams could also be used in this case as drive means.

What we claim is:

1. In a radio receiver, a plurality of cascade-connected band-pass filters, only certain of which are provided with means for variably tuning said filters over a range of signal frequencies, means for regulating the band-width of the variably tuned filters, means for effecting the simultaneous control of the tuning means and the band-width regulating means of said variably tuned filters, separate means for regulating the band-width of the filters other than the variably tuned filters, and means under the control of the latter means for effecting control of the band-width of the variably tuned filters supplementary to the first band-width regulating means.

2. In a radio receiver of the superheterodyne type, a tunable band-pass selector comprising at least two circuits resonant to a common frequency, each having inductance and a shunt variable condenser, said inductances being mutually coupled and the condensers arranged for simultaneous control over the signal frequency range, means for effecting the simultaneous control of the variable condensers and the coupling varying means to maintain the selectivity of the band-pass sector circuits substantially constant throughout said frequency range, said means comprising a control shaft for the variable condensers and a cam device mounted on said control shaft for varying the coupling, a fixed-tuned intermediate frequency filter network included in said receiver, means independent of the first means for adjusting the band width of said network, and means under the control of the latter band-width adjusting means for effecting control of the tunable band-pass selector supplementary to first-mentioned selectivity control means.

3. In a radio receiver of the superheterodyne type, a tunable band-pass preselector and at least one intermediate frequency filter network, means for tuning the preselector over the signal frequency range and simultaneously varying the degree of coupling to maintain the selectivity of the band-pass preselector substantially constant throughout said frequency range, means for regulating the band width of the intermediate frequency filter network, means for effecting simultaneous control of the preselector tuning means and the preselector variable coupling means, and means for effecting simultaneous control of the band width regulating means for the intermediate frequency filter network and the preselector coupling means.

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