

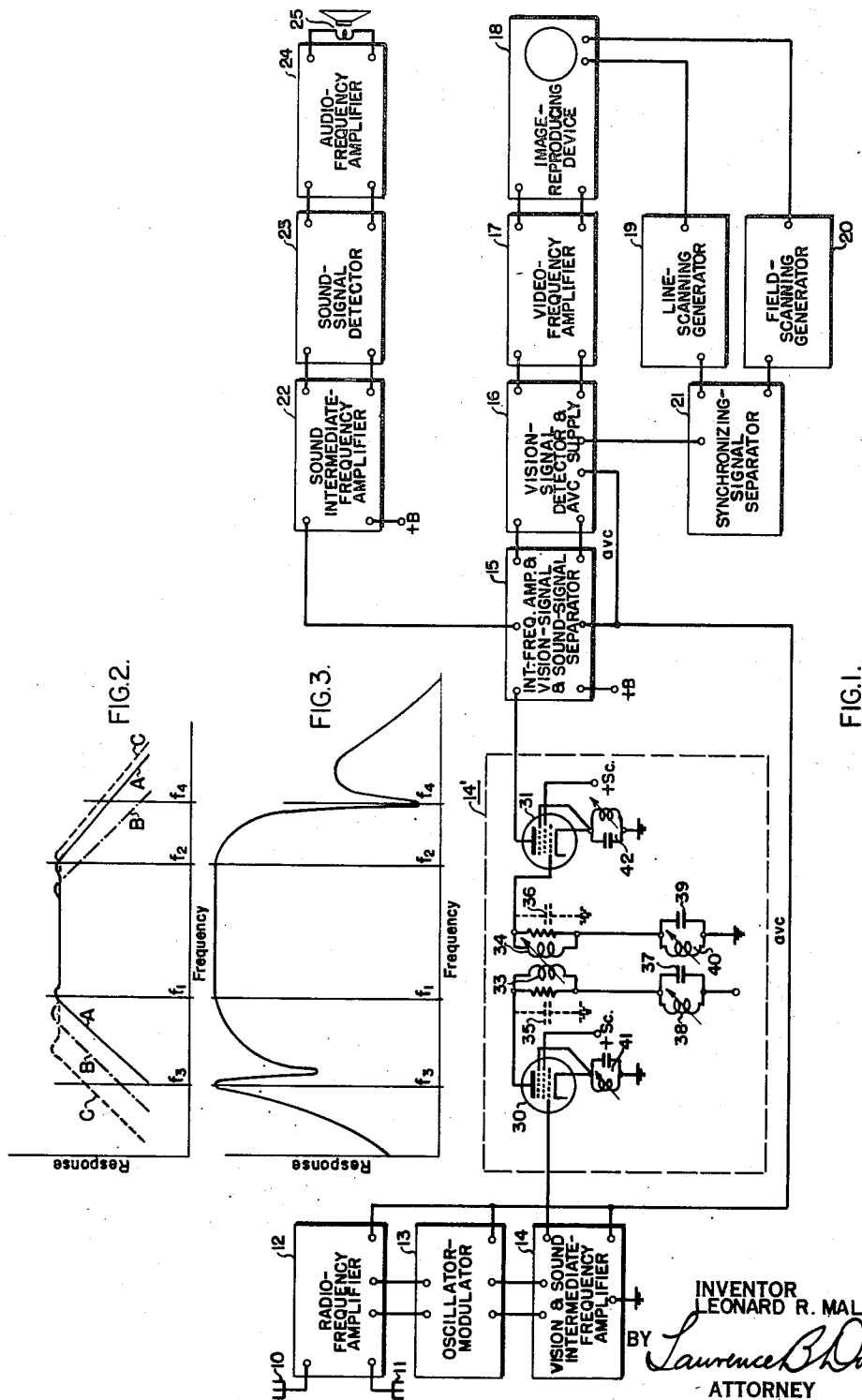
Jan. 20, 1942.

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2,270,539

INTERTUBE INTERMEDIATE-FREQUENCY COUPLING SYSTEM

Filed April 18, 1940



UNITED STATES PATENT OFFICE

2,270,539

INTERTUBE INTERMEDIATE-FREQUENCY
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Application April 18, 1940, Serial No. 330,278

10 Claims. (Cl. 179—171)

This invention relates generally to intertube intermediate-frequency coupling systems for modulated-carrier signal receivers and particularly to such coupling systems suitable for use in television signal receivers.

It is frequently desirable to provide an intertube intermediate-frequency coupling system for a modulated-carrier receiver which includes a double-tuned selector circuit and means for modifying the response of the coupling system at a fixed frequency outside of, but adjacent to, the normal pass band of the selector. For instance, a trap circuit fixed-tuned to an undesired signal has been utilized in series with one of the windings of such a double-tuned selector to provide substantially infinite attenuation of such undesired signal. However, when a receiver including such a coupling system is to be constructed in accordance with the usual production methods, it is necessary to provide some way of adjusting the pass-band characteristic of the selector circuit. For instance, it may be necessary to adjust its pass band to align the circuit with other selective circuits of the receiver. Such alignment has been generally obtained by the use of adjustable trimmer condensers. However, circuits including such trimmer condensers are more complicated than is desired and are subject to frequency drift. Furthermore, it is usually undesirable in television receivers or other receivers which operate at a relatively high frequency to add any capacitance to the circuit. At the same time, it is desirable to provide a coupling system of the type under discussion, the band-pass characteristics of which can be adjusted without affecting undesirably the operation of a trap circuit associated with the selector.

It is well known, of course, that the band-pass characteristics of a double-tuned selector circuit can be adjusted by varying the mutual inductance between the windings of the selector circuit. However, in general, this has the effect of adjusting the band-pass characteristics of the selector symmetrically, thus undesirably impairing the selectivity of the selector at the cut-off frequency other than that being adjusted, and at the same time modifying the operation of a trap circuit associated with the band-pass selector. For this reason, this method of adjusting the band-pass characteristics of double-tuned selector circuits of the prior art to align the coupling system of such type with other selective circuits in a modulated-carrier signal receiver has not been satisfactory. It is, there-

fore, very desirable to provide a coupling system of the type under discussion in which these difficulties are not present.

Also, in television systems, intertube intermediate-frequency coupling systems have been utilized which comprise a double-tuned band-pass selector effective to translate the vision intermediate-frequency signals. However, in television systems the sound intermediate-frequency signals are conventionally transmitted on a carrier wave closely adjacent the frequency band within which the vision signals are transmitted. It is, therefore, frequently desirable to increase the response of an intertube intermediate-frequency coupling system, which includes a double-tuned band-pass selector for translating vision intermediate-frequency signals, at the frequencies occupied by the associated sound signals. If a tuned circuit is used for this purpose, it should be resonant at the intermediate-carrier frequency of the sound signals. However, the same difficulties mentioned above are present in an arrangement of this type; namely, it is difficult to adjust the band-pass characteristics of the double-tuned selector circuit provided for translating the vision signals so that the circuit is correctly aligned with other selective circuits of a television receiver without adding additional capacitance to the circuit. Also, if the mutual inductance of such a double-tuned band-pass selector is adjusted to procure alignment, the response of the tuned circuit provided to secure increased response to sound signals is changed, unless special precautions are taken which have not hitherto been known to those skilled in the art.

It is an object of the invention, therefore, to provide an intertube intermediate-frequency coupling system of the type under discussion in which the mutual inductance of a double-tuned selector circuit can be varied to align the circuit with other selective circuits of a receiver without substantially affecting the frequency of maximum response of a resonant circuit associated with one of the windings of the double-tuned selector circuit.

It is a further object of the invention to provide an intertube intermediate-frequency coupling system including a double-tuned selector circuit having a trap circuit connected in series with one of its windings in which the response characteristic of the selector can be adjusted without varying substantially the effect of the trap circuit.

It is a further object of the invention to pro-

vide, in a superheterodyne receiver including an intertube intermediate-frequency channel adapted to translate vision intermediate-frequency signals and associated sound intermediate-frequency signals, a double-tuned selector circuit effective to translate the vision intermediate-frequency signals and having in series with one of the windings thereof a parallel-resonant circuit effective to accentuate the response of the system to the sound intermediate-frequency signals, in which the mutual inductance between the windings of the double-tuned selector circuit may be adjusted to determine the band-pass characteristics of the selector circuit without altering the response of the coupling system due to the parallel-resonant circuit.

In accordance with a feature of the invention, an intertube intermediate-frequency coupling system for a modulated-carrier signal receiver comprises a transformer including closely-coupled primary and secondary windings individually adapted to be tuned by capacitance to form a band-pass selector for passing a wide band intermediate-frequency signal, a substantial part of the capacitance being the inherent capacitance of the circuit and associated tubes. In a preferred embodiment of the invention, the capacitance is wholly composed of the inherent capacitance of the tubes and circuits of the selector. A parallel-resonant circuit is also coupled in series with one of the windings to modify the response of the coupling system primarily at a frequency outside of, but adjacent to, the desired pass band of the selector, the parallel-resonant circuit comprising capacitance of a value greater than ten times that of the above-mentioned capacitance. Means are further provided for adjusting the mutual inductance between the windings to adjust the coefficient of coupling of the transformer within a range of $\pm 10\%$ thereby to adjust the band-pass characteristics of the selector without substantially altering the response of the coupling system due to the above-mentioned parallel-resonant circuit.

In a preferred embodiment of the invention, the parallel-resonant circuit is a trap circuit included in series with the primary winding of the transformer to provide high attenuation against undesired signals on an adjacent channel. Also, in accordance with a preferred embodiment of the invention, the receiver is a television receiver adapted to transmit vision intermediate-frequency signals and associated sound intermediate-frequency signals and the above-mentioned band-pass selector is adapted to translate the vision intermediate-frequency signals. In this embodiment of the invention, the parallel-resonant circuit may be coupled in series with the secondary winding of the coupling transformer and utilized to increase the response of the coupling system at the frequency of the sound intermediate-frequency signals, thus rendering at least a portion of the separate sound intermediate-frequency amplification usually provided unnecessary.

Also in accordance with a feature of the invention, an intermediate-frequency signal-translating channel for a television receiver includes a plurality of intertube coupling systems coupled in cascade, each of which comprises, a transformer including closely-coupled primary and secondary windings individually adapted to be tuned by capacitance to form a band-pass selector for passing vision signals of a wide frequency range, the capacitance being wholly composed of

the inherent capacitance of the circuits and the tubes to which the windings are coupled, and means for aligning the coupling systems comprising solely means for adjustably fixing the mutual inductance between the transformer windings. By this arrangement the coupling systems can be aligned with each other and the overall-response of the intermediate-frequency coupling system can be adjusted to transmit with a uniform amplitude a desired wide band of picture signals.

For a better understanding of the present invention, together with other and further objects thereof, reference is had to the following description taken in connection with the accompanying drawing and its scope will be pointed out in the appended claims.

In the drawing, Fig. 1 is a circuit diagram, partly schematic, of a complete television signal receiver system including an intermediate-frequency coupling system in accordance with the present invention, while Figs. 2 and 3 comprise graphs utilized to explain the operation of a portion of the circuit of Fig. 1.

Referring now more particularly to Fig. 1 of the drawing, the receiver there illustrated comprises a television receiver of the superheterodyne type including an antenna system 10, 11 connected to a radio-frequency amplifier 12 to which are connected in cascade, in the order named, an oscillator-modulator 13, a vision-signal and sound-signal intermediate-frequency amplifier 14, a vision-signal and sound-signal intermediate-frequency amplifier 14', an intermediate-frequency amplifier and vision-signal and sound-signal separator 15, a vision-signal detector and AVC supply 16, a video-frequency amplifier 17, and an image-reproducing device 18, for example, a cathode-ray signal-reproducing tube. A line-scanning generator 19 and a field-scanning generator 20 are also coupled to the output of detector 16 through a synchronizing-signal separator 21 and to the scanning elements of the image-reproducing device 18. In order to provide sound reproduction in the receiver shown, there is coupled to intermediate-frequency amplifier 15, a sound-signal intermediate-frequency amplifier 22, to which is coupled in cascade, in the order named, a sound-signal detector 23, an audio-frequency amplifier 24, and a sound-reproducing device 25. A bias is derived from unit 16 and applied over the conductor marked "AVC" to one or more of the tubes of stages 12-15, inclusive, to control the amplification thereof inversely in accordance with the received signal strength. The stages or elements 10-25, inclusive, excepting amplifiers 14 and 14' constituting the present invention and presently to be described, may all be of conventional well-known construction so that detailed illustrations and descriptions thereof are unnecessary herein.

Referring briefly to the operation of the system just described, sound and vision modulated-carrier signals intercepted by the antenna circuit 10, 11 are selected and amplified in the radio-frequency amplifier 12 and supplied to the oscillator-modulator 13 wherein they are converted to intermediate-frequency signals which, in turn, are amplified in intermediate-frequency amplifiers 14 and 14'. The signal output of amplifier 14' is further amplified in amplifier 15, from which vision intermediate-frequency signals are delivered to detector 16. The modulation components of this signal are derived in

the detector 16 and are supplied to the video-frequency amplifier 17, wherein they are amplified and from which they are applied to a brightness control element of image-reproducing device 18. The intensity of the scanning beam of device 18 is thus modulated or controlled in accordance with the video-frequency voltages impressed on its control electrode in the usual manner. A control-bias voltage developed by the AVC supply 16 and proportional to the average vision-carrier amplitude and independent of its modulation components is supplied in the usual manner to the control grids of tubes in one or more of the stages 12-15, inclusive, for maintaining the signal input to detector 16 within a relatively narrow range for a wide range of received signal intensities.

The modulation signal output of detector 16 is also applied to synchronizing-signal separator 21 from which suitable synchronizing-signal components of the signal are supplied to line-scanning generator 19 and field-scanning generator 20 to synchronize the operation of these circuits with corresponding apparatus at the transmitter. Saw-tooth current or voltage scanning waves are developed by generators 19 and 20 and these waves are applied to the scanning elements of device 18 to produce scanning fields, thereby to deflect the scanning beam in two directions normal to each other so as to trace successive series of parallel lines or fields on the target of the image-reproducing device 18 to reconstruct the image. Sound intermediate-frequency signals derived from amplifier 15 are further amplified in sound intermediate-frequency amplifier 22 and delivered to detector 23, wherein the audio-frequency components are derived. These components are, in turn, amplified by audio-frequency amplifier 24 and delivered to sound-reproducing device 25 for reproduction in a conventional manner. The AVC bias derived from AVC supply source 16 and applied to stages 12-15, inclusive, also serves to maintain the signal input to detector 23 within relatively narrow limits for a wide range of received signal intensities.

Referring now more particularly to the portion of the system of Fig. 1 embodying the present invention, there is provided an intertube intermediate-frequency coupling system for a modulated-carrier signal receiver for coupling the output circuit of a vacuum tube 30 of amplifier 14' to the input circuit of a succeeding vacuum tube 31. It will be understood that only the portions of the circuits of tubes 30 and 31 necessary for an explanation of the present invention are shown in detail and that the other necessary portions of these two circuits may be in accordance with conventional design. The intermediate-frequency coupling system of the invention comprises a transformer including closely-coupled primary and secondary windings 33 and 34 individually adapted to be tuned by the inherent capacitance of the circuit and of the tubes to which they are coupled to form a band-pass selector for passing vision intermediate-frequency signals. The tuning capacitances of windings 33 and 34 are indicated by the dotted-line condensers 35, 36 for the reason that these capacitances may be comprised in whole or in part, preferably in whole, of the inherent capacitance of the circuit. The term "closely coupled" as used in this specification is intended to refer to an arrangement in which the coefficient of coupling is over 25%.

In order to modify the response of the coupling system of the invention primarily at a fixed frequency outside of, but adjacent to, the normal pass band of the selector, and specifically in order to provide a trap circuit effective to provide a high attenuation of undesired signals on such fixed frequency, there is provided in series with primary winding 33 a parallel-resonant circuit 37, 38. Also, in order to modify the response of the coupling system primarily at a second fixed frequency outside of, but adjacent to, the desired pass band of the selector, specifically to provide an increased response for the associated sound intermediate-frequency signals, there is provided a parallel-resonant circuit 39, 40 connected in series with secondary winding 34. Means indicated by an arrow are provided for adjustably fixing the mutual inductance between the windings 33, 34. Trap circuits 41 and 42 are included in the cathode circuits of tubes 30 and 31, respectively, to provide increased attenuation of undesirable signals on adjacent channels. Circuits 41 and 42 as well as circuits 37, 38 and 39, 40 are preferably tuned by means of an adjustably-fixed magnetic core in the inductance element of the circuit, the capacitance element in each case being fixed. It will be understood that there may also be included in amplifier 14 an intermediate-frequency coupling system identical with that of amplifier 14' and that units 14 and 14', therefore, provide a plurality of similar intertube coupling systems coupled in cascade.

Reference is made to Figs. 2 and 3 for an explanation of the operation of the portion of the circuit of Fig. 1 constituting the present invention. In Fig. 2 there is shown in full-line curve A the desired frequency-response characteristic of the band-pass selector, per se, of the intermediate-frequency coupling system of the invention. This response characteristic extends over a broad frequency range including a frequency range f_1 , f_2 over which it is desired to procure a relatively high and uniform response by means of the double-tuned band-pass selector circuit 33, 35 and 34, 36. The actual band-pass characteristic of the circuit before an aligning operation has been performed thereon may be of the form illustrated by dashed-line curve B which comprises resonance peaks in the response characteristic which are widely separated in frequency. The band-pass characteristic of the circuit after the mutual inductance between windings 33 and 34 has been adjusted to procure the desired response over the frequency range f_1 , f_2 is illustrated by the curve C, and is preferably such that the double peaks thereof are outside of the frequency range f_1 , f_2 . If amplifier 14 also comprises an identical coupling system, its response characteristic may be aligned in a similar manner.

The desired over-all response characteristic of the coupling system of the invention or of a plurality of such coupling systems coupled in cascade is illustrated in Fig. 3. The curve of Fig. 3 comprises a portion of increased response at a frequency f_3 which is the carrier frequency of the intermediate-frequency sound signals associated with the desired intermediate-frequency sound signals; this increased response being due to the parallel-resonant circuit 39, 40 which is resonant at the carrier frequency of the intermediate-frequency sound signals. The curve of Fig. 3 also has a high attenuation at a frequency f_4 which is due to the trap circuit 37, 38

resonant at frequency f_4 . The system is preferably designed so that the frequency f_4 corresponds to the carrier frequency of undesired sound intermediate-frequency signals of an adjacent television band.

In manufacturing television receivers including coupling systems in accordance with that illustrated in Fig. 1, it is usually found that, due to variations in the electrical constants of the elements which are assembled to produce the coupling system and variation of inherent wiring inductance and capacitance, the desired response characteristic illustrated by curve A of Fig. 2 is not obtained. Specifically, in the example chosen for illustration, the response characteristic of curve B may be obtained. The procedure in procuring the desired over-all response characteristic may be as follows: the desired maximum response in the over-all coupling characteristic illustrated in Fig. 3 at frequency f_3 may be first procured by adjustably fixing the inductance of inductor 40 to tune the resonant circuit 39, 40 to the frequency f_3 and thereafter inductor 38 may be adjustably fixed to tune the resonant circuit 37, 38 to the frequency f_4 , thereby to procure maximum attenuation at frequency f_4 . If an attempt is then made to procure the desired over-all band-pass characteristic from the system by means of adjustment of trimmer condensers or other means used in prior art arrangements, it is found that the frequency of increased response f_3 and the frequency of maximum attenuation f_4 tend to vary with such adjustments.

Therefore, in accordance with one feature of the present invention, the L/C or inductance-to-capacitance ratio of the parallel-resonant circuits 37, 38 and 39, 40 is designed to be only a small fraction of that of the resonant circuits 33, 35 and 34, 36 in series with which they are respectively connected. Under these conditions the mutual inductance between windings 33 and 34 may be adjusted over a range sufficient to adjust the coefficient of coupling over a range of $\pm 10\%$ to cause the band-pass characteristic of selector 33, 35 and 34, 36, assumed to be represented by curve B to be broadened, as illustrated by curve C to include the range f_1, f_2 within the portion over which it has a maximum and substantially uniform response. This adjustment has substantially no effect upon the over-all response characteristic represented in Fig. 3 at the frequency of increased response f_3 or at the frequency response of maximum attenuation f_4 . In other words, if the parallel-resonant circuits 37, 38 and 39, 40 individually comprise capacitances of a value of the order of, or greater than, ten times that of the capacitances 35 and 36, respectively, the circuit of the invention may be aligned with other selector circuits of the receiver by adjustment of the mutual inductance between windings 33 and 34 without substantially altering the response of the coupling system due to the parallel-resonant circuits 37, 38 and 39, 40. At the same time the over-all selectivity is not impaired at the cutoff frequencies due to the effect of tuned circuits 37, 38 and 39, 40.

It will be understood that, while parallel-resonant circuits 37, 38 and 39, 40 have been shown as being connected to the low signal-potential terminals of windings 33 and 34, respectively, these parallel-resonant circuits may be connected to the high signal-potential windings of their respective circuits and that certain of the benefits of the invention still will be pro-

cured. However, if the parallel circuits are connected to the high signal-potential terminals of their associated windings, the capacitance of the parallel-resonant circuits to ground may produce undesirable effects.

From what has been said it will be apparent that, if amplifier 14 also includes an intertube coupling system similar to that of amplifier 14' and having a band-pass selector response characteristic as illustrated by curve B of Fig. 2, it can also be properly aligned by means comprising solely means for adjustably fixing the mutual inductance between the transformer windings in the manner just described.

While there has been described what is at present considered to be the preferred embodiment of this invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention, and it is, therefore, aimed in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What is claimed is:

25 1. An intertube intermediate-frequency coupling system for a modulated-carrier signal receiver comprising, a transformer including closely-coupled primary and secondary windings individually adapted to be tuned by capacitance to form a band-pass selector for passing a wide band intermediate-frequency signal, a substantial part of said capacitance being the inherent capacitance of the circuits and the tubes to which the system is coupled, a parallel-resonant circuit effectively in series with one of said windings to modify the response of said coupling system primarily at a frequency outside of, but adjacent to, the desired pass band of said selector, said parallel-resonant circuit comprising capacitance of a value greater than ten times that of said first-mentioned capacitance, and means for adjusting the mutual inductance between said windings to adjust the coefficient of coupling of said transformer within a range of $\pm 10\%$ thereby to adjust the band-pass characteristics of said selector without substantially altering the response of said coupling system due to said parallel-resonant circuit.

50 2. An intertube intermediate-frequency coupling system for a modulated-carrier signal receiver comprising, a transformer including closely-coupled primary and secondary windings individually adapted to be tuned by capacitance to form a band-pass selector for passing a wide band intermediate-frequency signal, said capacitance being composed wholly of the inherent capacitance of the circuits and the tubes to which the system is coupled, a parallel-resonant circuit effectively in series with one of said windings to modify the response of said coupling system primarily at a frequency outside of, but adjacent to, the desired pass band of said selector, said parallel-resonant circuit comprising capacitance of a value greater than ten times that of said first-mentioned capacitance, and means for adjusting the mutual inductance between said windings to adjust the coefficient of coupling of said transformer within a range of $\pm 10\%$ thereby to adjust the band-pass characteristics of said selector without substantially altering the response of said coupling system due to said parallel-resonant circuit.

75 3. An intertube intermediate-frequency coupling system for a television receiver adapted to translate both sound and vision intermediate-

frequency signals comprising, a transformer including closely-coupled primary and secondary windings individually adapted to be tuned by capacitance to form a band-pass selector for passing vision signals of a wide frequency band, said capacitance being wholly composed of the inherent capacitance of the circuits and the tubes to which the system is coupled, a parallel-resonant circuit effectively in series with said secondary winding to increase the response of said coupling system primarily at the carrier frequency of said sound intermediate-frequency signals, said parallel-resonant circuit comprising capacitance of a value greater than ten times that of said first-mentioned capacitance, and means for adjusting the mutual inductance between said windings to adjust the coefficient of coupling of said transformer within a range of $\pm 10\%$ thereby to adjust the band-pass characteristics of said selector without substantially altering the response of said coupling system due to said parallel-resonant circuit.

4. An intertube intermediate-frequency coupling system for a modulated-carrier receiver comprising, a transformer including over-coupled primary and secondary windings individually adapted to be tuned by capacitance to form a band-pass selector for passing a wide band intermediate-frequency signal, said capacitance being wholly composed of the inherent capacitance of the circuits and the tubes to which the system is coupled, and a parallel-resonant circuit effectively in series with said primary winding to attenuate the response of said coupling system primarily at a fixed frequency of an undesired signal outside of, but adjacent to, the desired pass band of said selector, said parallel-resonant circuit comprising capacitance of a value greater than ten times that of said first-mentioned capacitance, and means for adjusting the mutual inductance between said windings to adjust the coefficient of coupling of said transformer within a range of $\pm 10\%$ thereby to adjust the band-pass characteristics of said selector without substantially altering the response of said coupling system due to said parallel-resonant circuit.

5. An intertube intermediate-frequency coupling system for a modulated-carrier receiver adapted to translate associated vision and sound intermediate-frequency signals of a television signal comprising, a transformer including closely-coupled primary and secondary windings individually adapted to be tuned by capacitance to form a band-pass selector for passing a wide band intermediate-frequency vision signal, said capacitance being wholly composed of the inherent capacitance of the circuits and the tubes to which the system is coupled, a parallel-resonant circuit effectively in series with said primary winding to attenuate the response of said coupling system at a frequency corresponding to the sound intermediate-carrier frequency of an adjacent television signal, and a parallel-resonant circuit coupled in series with said secondary winding to increase the response of said coupling system primarily at the intermediate-carrier frequency of the associated sound signals, said parallel-resonant circuits each comprising capacitance of a value greater than ten times that of said first-mentioned capacitance, and means for adjusting the mutual inductance between said windings to adjust the coefficient of coupling of said transformer within a range of $\pm 10\%$ thereby to adjust the band-pass characteristics of said selector without substantially altering the

response of said coupling system due to said parallel-resonant circuits.

6. An intertube intermediate-frequency coupling system for a modulated-carrier receiver comprising, a transformer including closely-coupled primary and secondary windings individually adapted to be tuned by capacitance to form a band-pass selector for passing a wide band intermediate-frequency signal, said capacitance being wholly composed of the inherent capacitance of the circuits and the tubes to which the system is coupled, and a parallel-resonant circuit effectively in series with the low-potential terminal of one of said windings to modify the response of said coupling system primarily at a frequency outside of, but adjacent to, the desired pass band of said selector, said parallel-resonant circuit comprising capacitance of a value greater than ten times that of said first-mentioned capacitance, and means for adjusting the mutual inductance between said windings to adjust the coefficient of coupling of said transformer within a range of $\pm 10\%$ thereby to adjust the band-pass characteristics of said selector without substantially altering the response of said coupling system due to said parallel-resonant circuit.

7. An intermediate-frequency signal-translating channel for a television receiver including a plurality of intertube coupling systems coupled in cascade, each of which comprises, a transformer including closely-coupled primary and secondary windings individually adapted to be tuned by capacitance to form a band-pass selector for passing vision signals of a wide frequency range, said capacitance being wholly composed of the inherent capacitance of the circuits and the tubes to which the system is coupled, a parallel-resonant circuit effectively in series with one of said windings to modify the response of said coupling system primarily at a frequency outside of, but adjacent to, the desired pass band of said selector, said parallel-resonant circuit comprising capacitance of a value greater than ten times that of said first-mentioned capacitance, and means for adjustably fixing the mutual inductance between said windings to adjust the coefficient of coupling of said transformer within a range of $\pm 10\%$ thereby to adjust the band-pass characteristics of said selector without substantially altering the response of said coupling system due to said parallel-resonant circuit.

8. An intermediate-frequency signal-translating channel for a television receiver including a plurality of intertube coupling systems coupled in cascade, each of which comprises, a transformer including closely-coupled primary and secondary windings individually adapted to be tuned by capacitance to form a band-pass selector for passing vision signals of a wide frequency range, said capacitance being wholly composed of the inherent capacitance of the circuits and the tubes to which said windings are coupled, and means for aligning said coupling systems comprising solely means for adjustably fixing the mutual inductance between said windings, whereby said coupling systems can be aligned with each other and the over-all response of said intermediate-frequency coupling system can be adjusted to transmit with a uniform amplitude a desired wide band of picture signals.

9. An intermediate-frequency coupling system for a television receiver including a plurality of intertube coupling systems coupled in cascade, each of which comprises, a transformer including

primary and secondary windings having a coefficient of coupling therebetween of over 40% and individually adapted to be tuned by capacitance to form a band-pass selector for passing vision signals, said capacitance being wholly composed of the inherent capacitance of the circuits and the tubes to which said windings are coupled, and means for aligning said coupling systems comprising solely means for adjustably fixing the mutual inductance between said windings to vary the coefficient of coupling between said windings over a range of $\pm 10\%$, whereby said plurality of intertube coupling systems can be aligned to pass a predetermined desired band of frequencies with a substantially uniform response.

10. An intermediate-frequency coupling system for a television receiver including a plurality of intertube coupling systems coupled in cascade,

each of which comprises, a transformer including closely-coupled primary and secondary windings individually adapted to be tuned by said capacitance to form a band-pass selector for passing vision signals of a wide frequency range, said band-pass selector having resonance peaks in its response characteristic which are widely separated in frequency, and said capacitance being composed wholly of the inherent capacitance of the tube circuits in which said windings are coupled, and means for aligning said coupling systems comprising solely means for adjustably fixing the mutual inductance between said windings to adjust said intertube coupling systems to pass a relatively wide band of frequencies between said resonance peaks with substantially uniform response.

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