

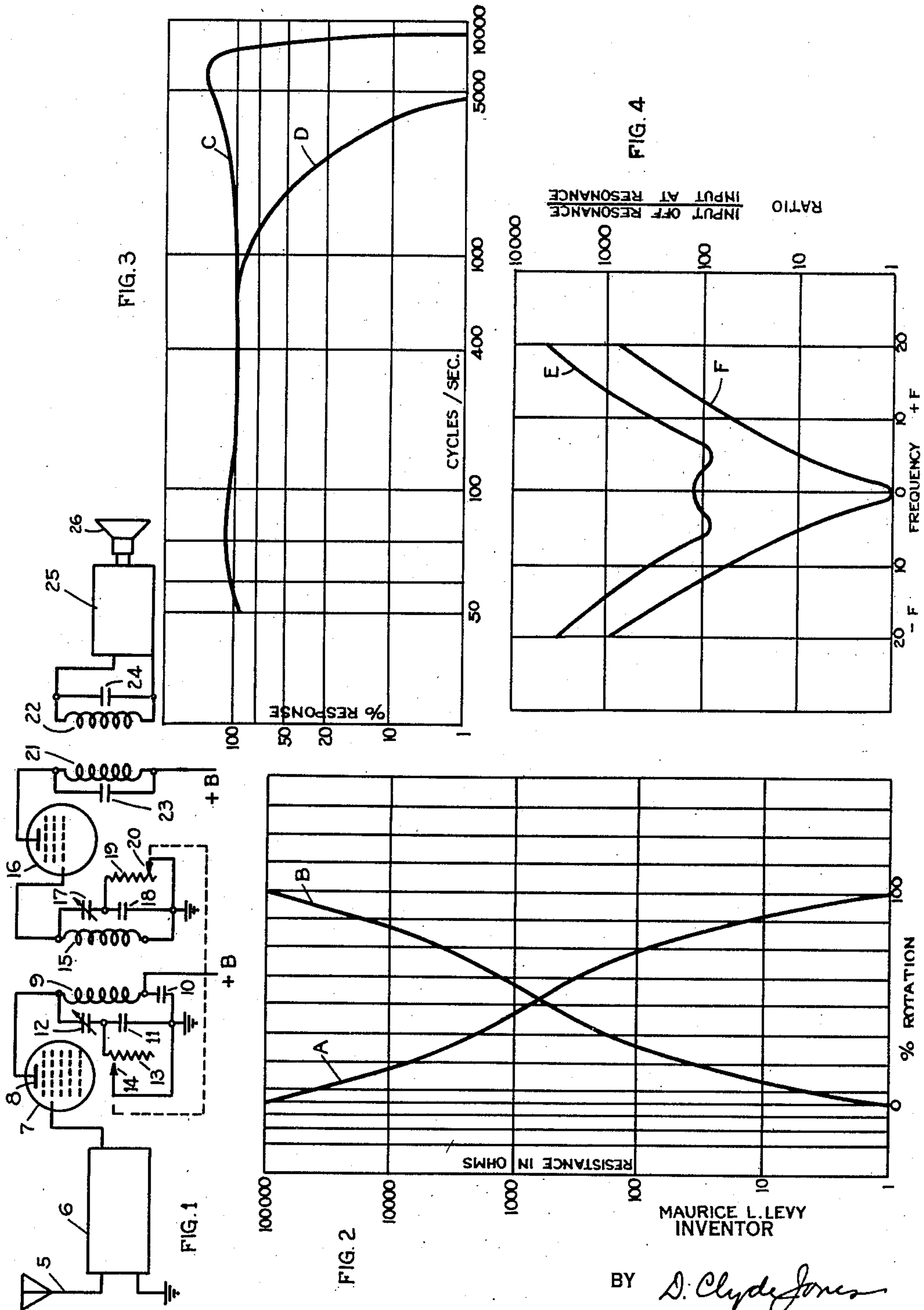
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WAVE SIGNALING SYSTEM

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WAVE SIGNALING SYSTEM

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This invention relates to wave signaling systems.

At the present time certain broadcasting stations are equipped with high quality or high fidelity transmitters so that they transmit carrier waves modulated by audio frequency signals in a range from a very low audio frequency to a maximum audio frequency in excess of 5,000 cycles, for example, 7,500 cycles, while other broadcasting stations are not provided with such high quality transmitters. However, a radio receiver in a given location cannot reproduce programs from all such high quality transmitters with high fidelity characteristics, owing to the interference of the carrier frequencies of adjacent bands, with the result that it is desirable to have the radio receiver continuously adjustable from high fidelity reproduction to lower quality reproduction, so that the listener can adjust the radio receiver to the best operating conditions in accordance with prevailing conditions.

In accordance with the main feature of the present invention, a tuned amplifier is provided which is capable of being sharply tuned to the carrier frequency to be amplified and which can also be adjusted to have its tuning continuously broadened to a limiting value wherein the carrier frequency is amplified with a minimum amount of its side bands cut off.

Another feature of the invention relates to an amplifier having resonant networks in which the inductors and capacitors, after initial factory adjustment, are fixed, but in which adjustable resistors in shunt of certain of the capacitors of the resonant circuits change the resonant frequency thereof.

Other features and advantages of the invention will appear from the detailed description and claims when taken with the drawing in which Fig. 1 is a diagrammatic showing of the amplifying portion of a radio receiver; Fig. 2 is a chart illustrating the characteristics of the resistors forming a part of the amplifier of Fig. 1; Fig. 3 is a chart illustrating the signal response effected by two different adjustments of the amplifier of Fig. 1; and Fig. 4 is another chart showing the bands passed by the amplifier of Fig. 1 in two of its different adjustments.

Referring especially to the circuit diagram of Fig. 1, wherein the invention is disclosed as part of a radio receiver, 5 generally designates an antenna system, while the rectangle 6 indicates any conventional type of radio frequency signal amplifier. The output of this amplifier is electrically connected in any suitable manner to a

vacuum tube 7 herein assumed to be the first detector or demodulator of a superheterodyne type of radio receiver. It will be understood that the input circuit of this demodulator has not been shown in full since it can be of any well known type. The anode 8 of the demodulator is connected to a positive source of anode potential (not shown) through the primary winding 9 of a radio frequency transformer, this primary winding being also connected in series with a by-pass capacitor 10 and the tuning capacitors 11 and 12 to constitute a primary resonant network. It will be noted that the capacitor 11 has connected in parallel therewith, an adjustable resistor unit including the resistor 13 and the movable contactor 14 in engagement therewith. The secondary winding 15 of the radio frequency transformer is included in the input circuit of an intermediate frequency amplifying stage including the vacuum tube 16, this winding being connected in a secondary resonant network including capacitors 17 and 18 in series. It will also be noted that the capacitor 18 has connected in multiple therewith, an adjustable resistor unit comprising the resistor 19 and its adjustable contactor 20. The adjustable contactors 14 and 20 are interrelated preferably by being mounted on a common shaft so that a single knob or adjusting element actuates them simultaneously. The two mentioned adjustable resistor units are preferably made to have characteristics represented by the curves A and B in the chart of Fig. 2, these curves being plotted with respect to percentage rotation or adjustment of the contactors in relation to the resulting effective resistance thereof expressed in ohms. It should be mentioned that coupling present between the primary and secondary coils 9 and 15 is appreciably less than optimum or critical coupling, that is coupling which will produce maximum gain without appreciable tuning interaction between the primary and secondary coils, during tuning, that is, tuning the primary circuit will not detune the secondary circuit and vice versa.

The output of the intermediate frequency stage is coupled, by means of a radio frequency transformer including the primary winding 21 and the secondary winding 22, to any suitable second detector and audio frequency amplifier herein represented by the rectangle 25, the primary winding 21 being tuned by the capacitor 23 and the secondary winding being tuned by the capacitor 24. A suitable sound reproducing system herein indicated as a loud speaker 26 is con-

nected to the output of the detector and audio amplifier 25.

In receiving programs under favorable conditions from a high fidelity broadcasting station, it is desirable to reproduce the signal therefrom with characteristics represented by the response curve C of Fig. 3, that is, with all frequencies between 50 cycles and approximately 8,000 cycles reproduced uniformly. However, under unfavorable conditions wherein there is interference between an adjacent carrier wave or waves or when programs from low quality stations are being received, it becomes necessary to reproduce the signal with characteristics indicated by the response curve D of Fig. 3, that is, with no audio frequencies passed in excess of 5,000 cycles. In order to reproduce a high fidelity signal of the characteristics represented by the curve C of Fig. 3, it is essential that the intermediate amplifier effects its amplification without cutting off the side bands, in other words, the intermediate frequency amplifier must pass therethrough frequencies of 8,000 cycles as indicated by the resonance curve E in the chart of Fig. 4. However, when it is desired to reproduce a signal with the characteristics indicated by the response curve D of Fig. 3, it is necessary that the intermediate frequency amplifier be adjusted to cut off frequencies in excess of 5,000 cycles as indicated by the resonance curve F of Fig. 4. In the present arrangement, the intermediate frequency amplifier is so arranged, that its tuning can be continuously broadened to the limit indicated by the curve E or the tuning thereof can be continuously sharpened to the limit indicated by the curve F. This is effected by the primary resonant network in the output of the first detector and by the secondary resonant network in the input circuit of the intermediate frequency amplifier.

It should be noted that the primary winding or inductor 9, the capacitors 11 and 12, in the primary resonant circuit, as well as the secondary winding or inductor 15 and the capacitors 13 and 17 in the secondary resonant circuit are not adjustable by the user, the capacitors 12 and 17 being adjusted and then locked at the factory so that the intermediate frequency amplifier is sharply tuned as represented by curve F when the contactors 14 and 20 are adjusted to the position shown in Fig. 1 with the resultant response as represented by curve D. However, when the positions of the contactors 14 and 20 are reversed, that is, when all of the resistance 13 is effective and none of the resistance 19 is effective, the intermediate frequency amplifier is broadly tuned as indicated by the curve E with the resultant response indicated by curve C, since the primary resonant circuit is tuned approximately 8 kilocycles below true resonance and the resonant point of the secondary resonant circuit is tuned approximately 8 kilocycles above the true resonant point. It will be understood that the resulting over-all fidelity curves C and D of Fig. 2 are limiting values and that the intermediate frequency amplifier is continuously adjustable to give a large number of response curves between these two limiting values.

The above results are obtained since the contactor 14 in its position shown, short-circuits the capacitor 11 so that the primary resonant circuit is tuned essentially by the capacitor 12. As the contactor 14 is moved downward, thereby increasing the effective resistance of the unit 13, the capacitor 11 is effectively connected in se-

ries with the capacitor 12 thus reducing the total capacitance across the inductor 9 and increasing the resonant frequency of the primary circuit. With the contactor 20 in its uppermost position, the total resistance of the unit 19 is connected across the capacitor 18, in effect, reducing the total capacitance of the capacitors 17 and 18 connected across the inductor 15. Thus, by simultaneously moving capacitors 14 and 20 from the position shown, the effective resonance of the primary and secondary resonant networks is broadened as represented by the curve E. Thus, by increasing the shunting resistance in one circuit, the capacitance is effective in moving the resonant frequency peak to approximately eight kilocycles maximum from resonance in one direction while by decreasing the other shunting resistance in the other circuit the capacitance is effective in moving the resonant peak to approximately eight kilocycles maximum in the other direction. It should be mentioned that the resistors 13 and 19 are large for example 100,000 ohms each, as compared with the impedance of the capacitor 11 which may have a capacitance of .002 mf. and capacitor 18 which may have a capacitance of .004 mf.

The principle of operation of applicant's networks will be appreciated from the following discussion: The impedance of a capacitance, shunted by a resistance of equal impedance in a network, will change the total impedance of the network in quadrature but since the impedance is a capacitance the phase change is not serious because this impedance is small compared with the total impedance of the tuned circuit. Thus the effective capacitance is reduced and the phase shift can be tolerated. The shunting resistance of each tuned circuit is large as compared with the impedance of the condenser of the circuit and is effective only when the resistance value approaches the actual impedance of the condenser, from that point to zero the value of the effective capacitances shifts the resonant frequency of the tuned circuits from exact resonance to plus and minus approximately eight kilocycles respectively therefrom. The curves shown in Fig. 4 are drawn from experimental data.

I claim:

1. In an arrangement for effecting the uninterrupted adjustability of the selectivity of a radio receiver provided with an amplifier, said amplifier including a primary resonant circuit and a secondary resonant circuit coupled together, each circuit comprising an inductor connected in series with two capacitors and having an adjustable resistor connected in shunt of one of said capacitors, and means for simultaneously adjusting in the opposite sense, the resistors in shunt of one of the capacitors in each of said resonant circuits.

2. In an arrangement for effecting the uninterrupted adjustability of the selectivity of a radio receiver provided with an amplifier, said amplifier including a primary resonant circuit and a secondary resonant circuit coupled together, each circuit comprising an inductor connected in series with two capacitors, and means for adjusting the total effective capacitance of the capacitors in each circuit including an adjustable resistor connected in shunt of one of said capacitors.

3. In a signaling system, an amplifier including a primary resonant circuit and a secondary resonant circuit, each circuit being tunable to approximately a given resonant frequency, a

transformer having a primary winding connected in said primary resonant circuit and a secondary winding connected in said secondary resonant circuit whereby said circuits are inductively coupled together, a pair of capacitors connected in each circuit in series with each transformer winding, a pair of adjustable resistors, one of such resistors being connected in shunt of a capacitor of each pair of capacitors and means

for adjusting said resistors simultaneously in the opposite sense to reduce the effective resistance of one resistor and to increase the effective resistance of the other resistor and vice versa, so that the resonant frequency of one of said circuits is increased and the resonant frequency of the other circuit is decreased with respect to said given resonant frequency.

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