Nov. 4, 1941. J. D. REID 2,261,778

RADIO TUNING

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Fig. 1.

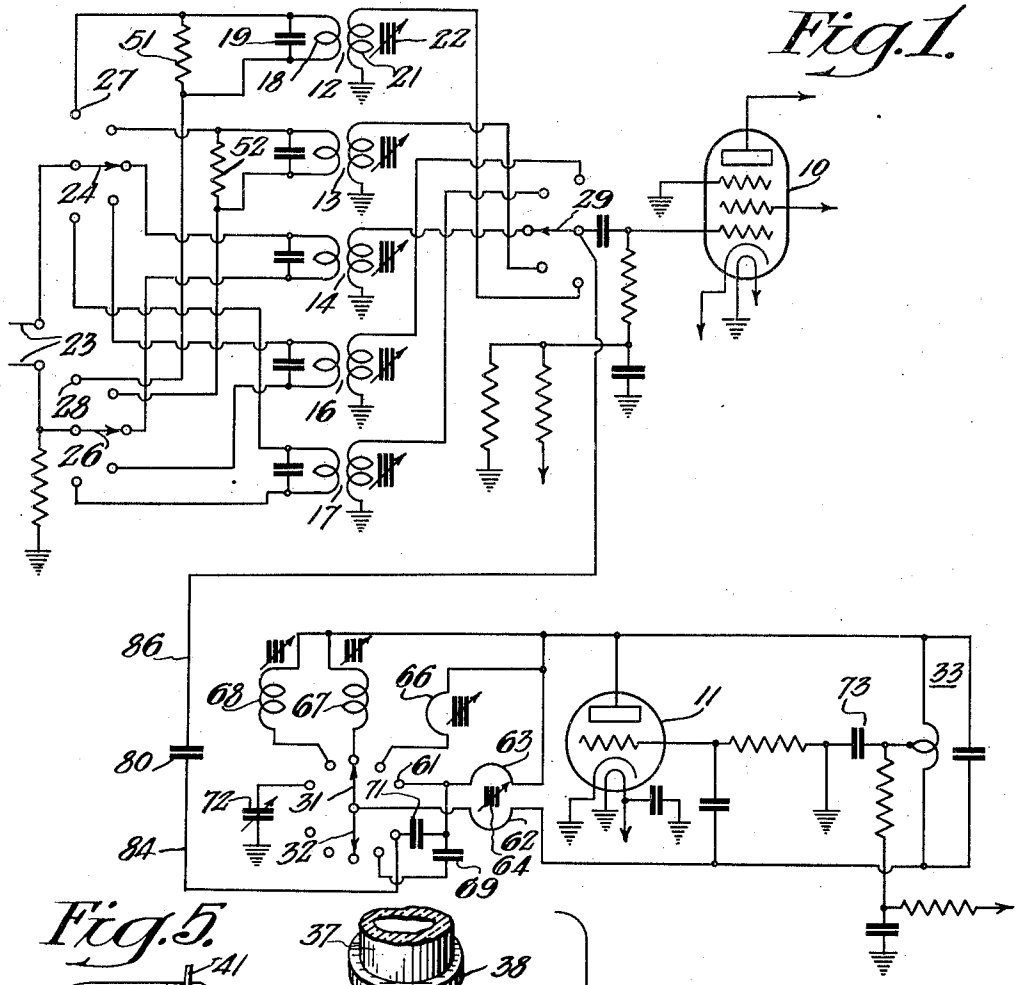


Fig. 5.

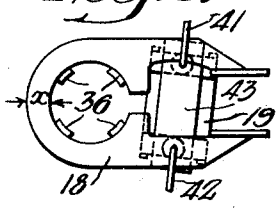
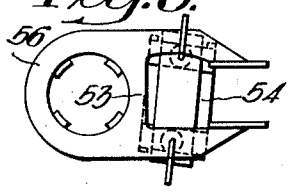


Fig. 6.



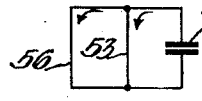


Fig. 6a.

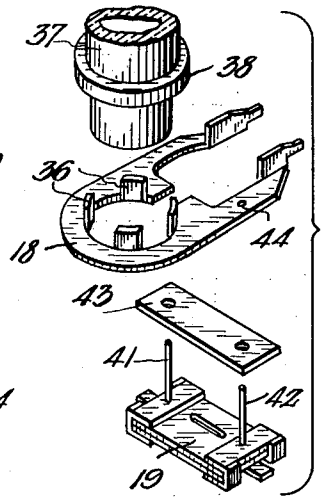


Fig. 4.

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Fig. 2.

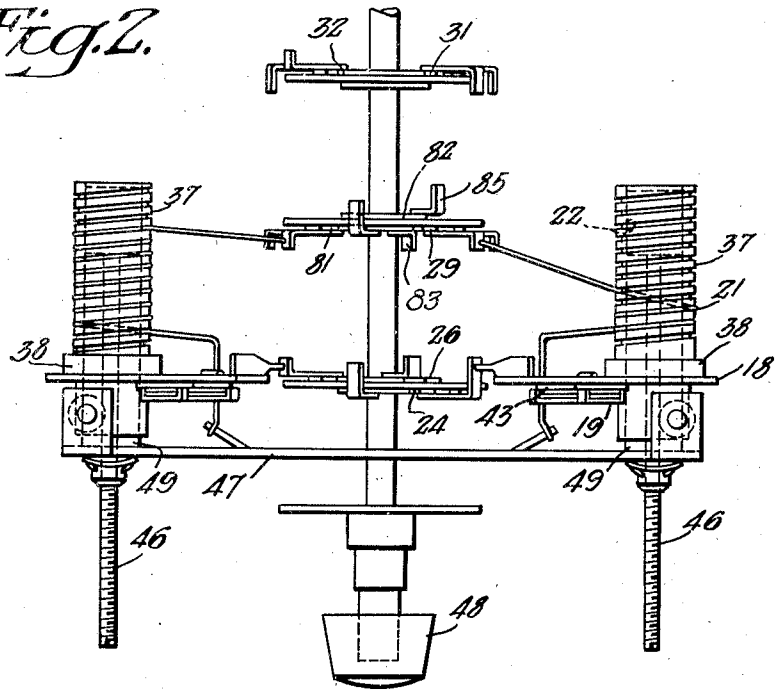
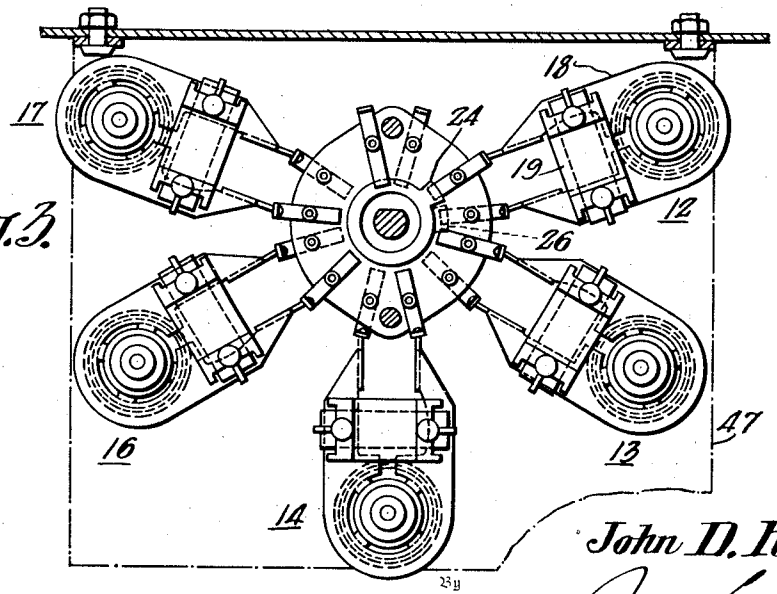


Fig. 3.



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RADIO TUNING

John D. Reid, Philadelphia, Pa., assignor to Radio Corporation of America, a corporation of Delaware

Application March 31, 1939, Serial No. 265,089

6 Claims. (Cl. 178—44)

My invention relates to radio tuning units and particularly to tuning means for television receivers or other receivers designed for the reception of high frequency signals.

An object of my invention is to provide an improved tuning means of the above-mentioned type.

A further object of my invention is to provide an improved tunable band pass selecting circuit or unit for television receivers, or the like.

A still further object of my invention is to provide an improved means for and method of adjusting or lining up a tunable selecting circuit.

My invention is applied to a receiver in which pretuned selecting circuits are switched into the receiver input circuit for selecting the desired station. In accordance with one embodiment of my invention, each selecting circuit comprises two coupled tuned circuits, one tuned circuit being a tuned primary comprising a U-shaped or half-turn member preferably stamped from flat material and tuned by means of a condenser, the terminals of which may be moved along the legs of the U to pretune the primary accurately before both terminals are soldered in place. The other tuned circuit or tuned secondary comprises a winding which is tuned by means of a core of magnetic material or by means of a metal cup or disc if preferred.

Both the U-shaped member and the secondary winding preferably are supported on a tube of a thermoplastic substance such as styrol in a manner described hereinafter.

The invention will be better understood from the following description taken in connection with the accompanying drawings in which—

Figure 1 is a circuit diagram of the front end or tuning portion of a television receiver embodying my invention;

Figure 2 is a plan view of the tuning unit located between the antenna and the first detector in Figure 1;

Figure 3 is an end view of the unit shown in Figure 2;

Figure 4 is an exploded view of one of the tuned primary assemblies used in the apparatus shown in the preceding figures;

Figure 5 is a view which is referred to explaining how the primary is tuned;

Figure 6 is a view showing another embodiment of my invention; and

Figure 6a is a circuit diagram which is referred to in explaining the operation of the unit shown in Figure 6.

Figures 2 to 6 are drawn to scale, full scale being used.

Referring to Fig. 1, there is shown the front end of a television receiver of the superheterodyne type comprising a first detector 10, an oscillator 11 and a plurality of pretuned selecting circuits 12, 13, 14, 16 and 17. Each selecting circuit comprises a tuned primary and a tuned secondary, the coupling between them being such as to provide a band pass characteristic. For example, the selecting circuit 12 includes a primary coil 18 tuned approximately to the midband frequency by a condenser 19 and a secondary 21 also tuned approximately to the midband frequency by means of the input capacity of the tube 10 and an adjustable core 22 of magnetic material.

The primary of a desired selecting circuit is connected to a transmission line 23 through the switch arms 24 and 26 and the associated contact points of a gang switch, the primary 18, for instance, being connected through the contact points 27 and 28. Simultaneously, the secondary of this selecting circuit is connected to the input electrodes of tube 10 through a contact arm 29 of the gang switch and an associated contact point.

It will be understood that the tuning of the oscillator 11 is changed simultaneously as the different selecting circuits are switched in, this tuning change being accomplished by means of arms 31 and 32 of the gang switch which switch is a suitable amount of inductance and/or capacity to change the tuning of the oscillator tank circuit 33.

In accordance with one feature of my invention, each primary coil of a selecting circuit comprises a U-shaped piece of metal as shown at 18 in Figures 2 to 5. As indicated more clearly in Figures 4 and 5, each primary is a metal strap forming a fraction of one turn and having lugs 36 thereon. These lugs secure the primary strap firmly to a supporting tube which preferably is of styrol. The primary strap 18, for example, is slipped over the end of a styrol tube 37 and the strap 18 heated sufficiently to permit embedding the lugs 36 in a ring 38 which is an integral part of the tube 37. Thus, the primary strap is rigidly supported a fixed distance from the secondary winding which is wound in grooves on the supporting tube surface as shown at 21 in Fig. 2.

The secondary windings may be held in place on the styrol tube by running a warm iron over

the tube after the winding has been put on to partially close the grooves.

It will be seen that the primary strap extends beyond its supporting tube sufficiently to provide space for connecting a condenser across the legs of the U. This is shown clearly in Figs. 3 to 5. Considering the primary 18, a small fixed condenser 19 having terminal wires 41 and 42 is positioned across the legs of the U, preferably with an insulating strip 43 between the condenser 19 and the strap 18.

In the example shown, the terminal wire 42 is passed through a hole 44 in one leg of the strap 18, bent over, and soldered to the strap. The terminal wire 41 falls inside the U and is bent over the other leg of the U. By swinging the condenser about the hole 44 as a pivot, the amount of inductance in the primary circuit may be varied to tune the primary to the proper frequency. After the condenser has been moved to the position giving the proper tuning, the terminal wire 41 is soldered to the strap 18. The finally adjusted position of the condenser may be some such position as shown in Fig. 5.

Obviously a condenser may be connected across the primary strap and adjusted in other ways to obtain proper tuning. For example, while the hole 44 facilitates rapid assembly and adjustment, it is not necessary, and both condenser terminal wires may be slid along the primary strap to tune the primary before being soldered to the legs of the U.

The secondary windings of the selecting circuits 12, 13, 14, 16 and 17 are tuned by the input capacity of the tube 10 and the tuning is adjusted, in the example illustrated, by means of magnetic cores. Thus, the tuning of the secondary 21 may be adjusted to the desired frequency by moving the core 22 axially inside the tube 37 by means of a rod 46 (Fig. 2) to which the core 22 is attached.

As shown in Figs. 2 and 3, the gang switch and the styrol tubes are mounted upon a metal supporting plate 47. The gang switch is of a well known type comprising a plurality of wafers of a phenol condensation product or the like having a plurality of contact points mounted thereon which may be engaged successively by rotating the knob 48, thus rotating the several switch arms.

The supporting tubes of styrol or the like for the tuned selecting circuits are supported on the plate 77 by pressing them over short cylindrical plugs secured to the plate 47. Considering the supporting tube 37, it is held in position by a plug 49 over which it fits. It will be understood that the magnetic core 22 may be moved coaxially along the tube 37 by rotating the rod 46 which is threaded into the plug 49.

It may be noted that thermoplastic materials other than styrol may be employed for the supporting tube. For example, one of the acetates such as cellulose acetate could be used although styrol is preferred. Obviously, the supporting tube need not be thermoplastic providing suitable means is provided for securing the primary and secondary to the tube.

Referring again to Fig. 1, the impedance of the selecting circuits 12, 13, etc., is matched to that of the transmission line 23. As is well known, such matching may be obtained by selecting a value of capacity in shunt to the primary such that the reactance of this capacity at the desired band width for the selecting circuit (approximately 6 megacycles in the instant case) is equal to the transmission line impedance, this being 100 ohms in the example being described. The primary inductance may be made different for different selecting circuits, if desired, by varying the width of the strap, i. e., the dimension x (Fig. 5) and, of course, by varying either the actual or effective length of the U.

It may be desirable to employ resistors such as resistors 51 and 52 in shunt to some of the primaries to obtain the desired pass band width for the selecting circuits.

The above-described receiver is designed for the reception of television signals within the range from 44 megacycles to 90 megacycles.

Where signals at frequencies above this range are to be received, it may be desirable to employ the primary coil design shown in Fig. 6. With one exception, it is the same U-shaped strap as previously described and is mounted in the same way on a styrol tube carrying a secondary winding. The exception is that the portion immediately adjacent to the styrol tube is completely closed by a transverse portion 53, whereas, in Fig. 5 for example, this portion has been cut away. The primary is tuned by a condenser 54 in the manner described above.

The manner in which coupling is obtained between a secondary winding and a primary winding such as shown in Fig. 6 will be understood by referring to Fig. 6*a*. The primary proper comprises the transverse portion 53 and the portion of the strap to the right thereof as viewed in Fig. 6. Thus, the primary circuit is through condenser 54, and portion 53, the greater part of the current circulating as indicated by the right-hand arrow. A portion of the current, however, circulates through the condenser 54 and the end portion 56 of the strap as indicated by the left-hand arrow. This latter portion which may be one-third of the total primary current, for example, provides the coupling between primary and secondary.

The way in which the oscillator is tuned is similar to that described and claimed in my U. S. Patent No. 2,159,105, issued May 23, 1939, and assigned to the Radio Corporation of America. In the first tuning position, the switch arm 31 is on contact point 61 and the short straps 62 and 63 are connected in series with each other and in parallel to the tank circuit 33. As indicated on the drawings, each of the straps 62 and 63 is not a complete turn but, instead, a short loop of copper strap or the like. Trimming or pretuning for the first oscillator position is accomplished by a magnetic core 64 located between the two straps and adjustable at right angles thereto.

In the second tuning position, the strap 66 is substituted for strap 63 and trimming is done by means of a magnetic core positioned between straps 66 and 62. In the third tuning position, a coil 67 having one or more turns is substituted for the strap 66.

In the fourth tuning position, a coil 68 is substituted for the coil 67 and, in addition, a condenser 69 is connected across the tank circuit 33. It will be noted that the connection of condenser 69 is through the straps 62 and 63. This is not objectionable as their effect in the circuit is negligible at this lower frequency to which the receiver is tuned.

In the fifth tuning position, a condenser 71 is connected in parallel to the tank circuit 33. At the same time, a trimmer condenser 72 is connected across the lower half of the tank circuit

coil, this connection being through the strap **62** and the large capacity condenser **73**.

It may be noted that, in the above-described circuit, the oscillator is tuned 8¼ megacycles above the frequency signal. Obviously, other oscillators than the one illustrated may be utilized in combination with my improved selecting means.

The particular coupling between the oscillator **11** and the detector **10** which is illustrated in Fig. 1 and which includes the capacity **80** has been found to give a uniform transfer of energy from oscillator to detector over the receiver tuning range. The cost of a separate condenser for the capacity **80** is saved by utilizing the capacity between the switch arm rings **81** and **82** of the gang switch as shown in Fig. 2. The contact member **83** makes contact with the ring **81** and is connected to the conductor **84** (Fig. 1) while the contact member **85** makes contact with the ring **82** and is connected to the conductor **86** (Fig. 1).

My invention is not limited to the use of the tuned U-shaped member as a transformer primary. If desired it may be utilized as a trap circuit to reject an undesired frequency. For example, two units such as shown in Fig. 5 may be connected in the transmission line, one in each conductor of the line, for the purpose of rejecting the sound signal of an adjacent television channel. In this case the condenser is adjusted along the legs of the U and soldered at a point where the unit is tuned to the undesired sound signal.

I claim:

1. A tuned transformer unit comprising a coil support, a secondary winding wound on said support, a substantially U-shaped member mounted on said support and coupled to said secondary winding, and a condenser connected across the legs of said U-shaped member, said U-shaped member having a conducting element connected across the legs of said member at a point between said coil support and said condenser.

2. A band-pass transformer unit comprising a coil support having a secondary winding thereon adapted to be tuned by tube input capacity, a transformer primary comprising a member on said support, said member comprising a partial coil turn having at least approximately parallel legs, means comprising a core of magnetic material for varying the inductance of said secondary winding, and a condenser connected across the legs of said member at the proper point to tune the primary to the desired frequency.

3. A transformer coupling unit comprising a supporting tube of a thermoplastic material, a secondary winding thereon, said tube having an external raised portion integral therewith and adjacent to one end of said winding, and a U-shaped strap supported on said tube and held rigidly in position by means of lugs on said strap which are embedded in said raised portion, said strap being coupled to said secondary winding to function as a primary.

4. The invention according to claim 3 wherein said supporting tube is made of styrol.

5. A transformer coupling unit comprising a supporting tube of a thermoplastic material, said tube having an external ring portion integral therewith, a secondary winding on said tube on one side of said ring and a primary loop having lugs thereon, said primary loop being supported on said tube on the opposite side of said ring with said lugs embedded in said ring.

6. A transformer coupling unit comprising a supporting tube of an insulating material, a secondary winding thereon, said tube having an external raised portion integral therewith and adjacent to one end of said winding, and a U-shaped strap supported on said tube and held rigidly in position by means of lugs on said strap which are embedded in said raised portion, said strap being coupled to said secondary winding to function as a primary.

JOHN D. REID.