

Nov. 22, 1927.

1,650,432

H. D. CURRIER

RADIO RECEIVING SET

Filed Sept. 8, 1923

3 Sheets-Sheet 1

Fig. 2.

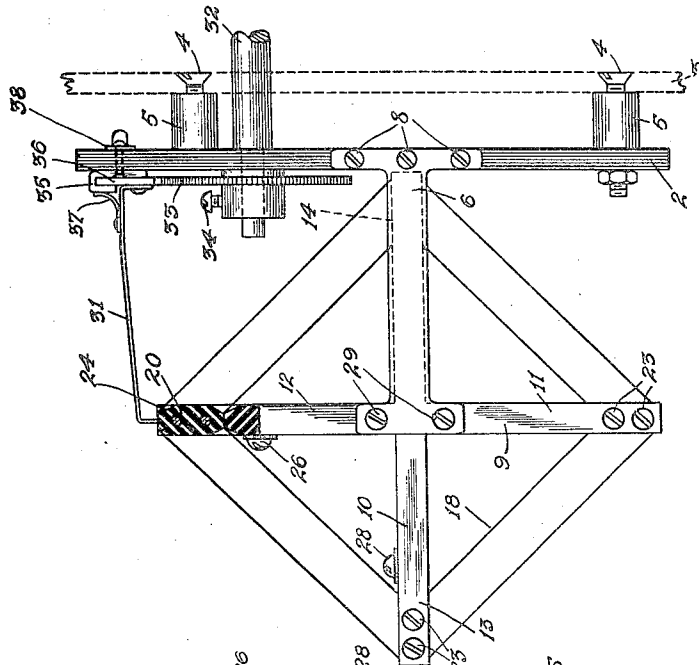
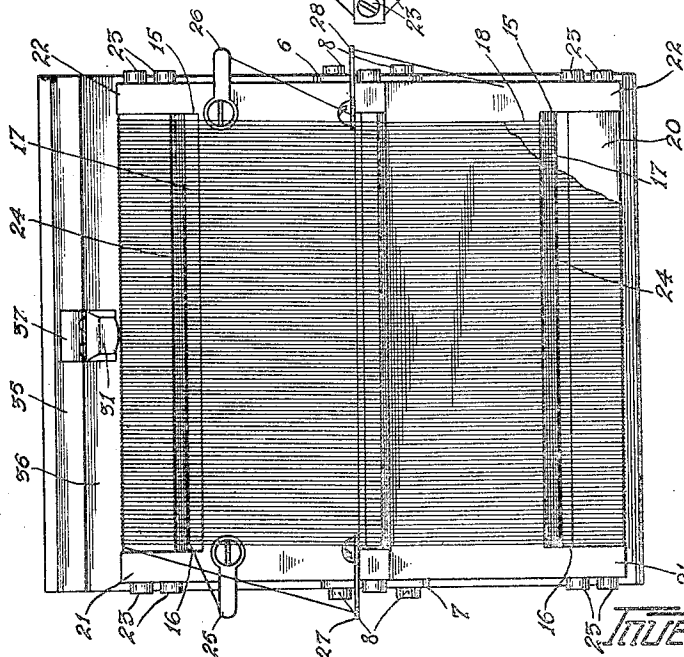


Fig. 1.



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Fig. 4.

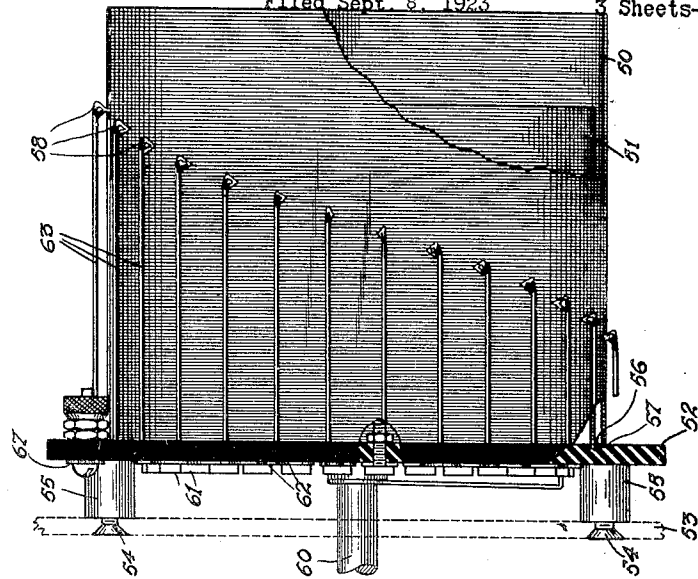
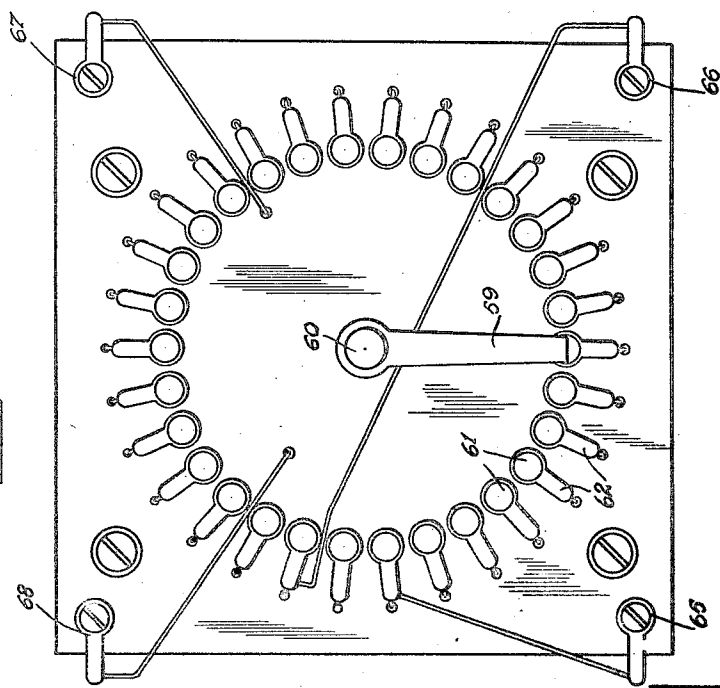


Fig. 5.



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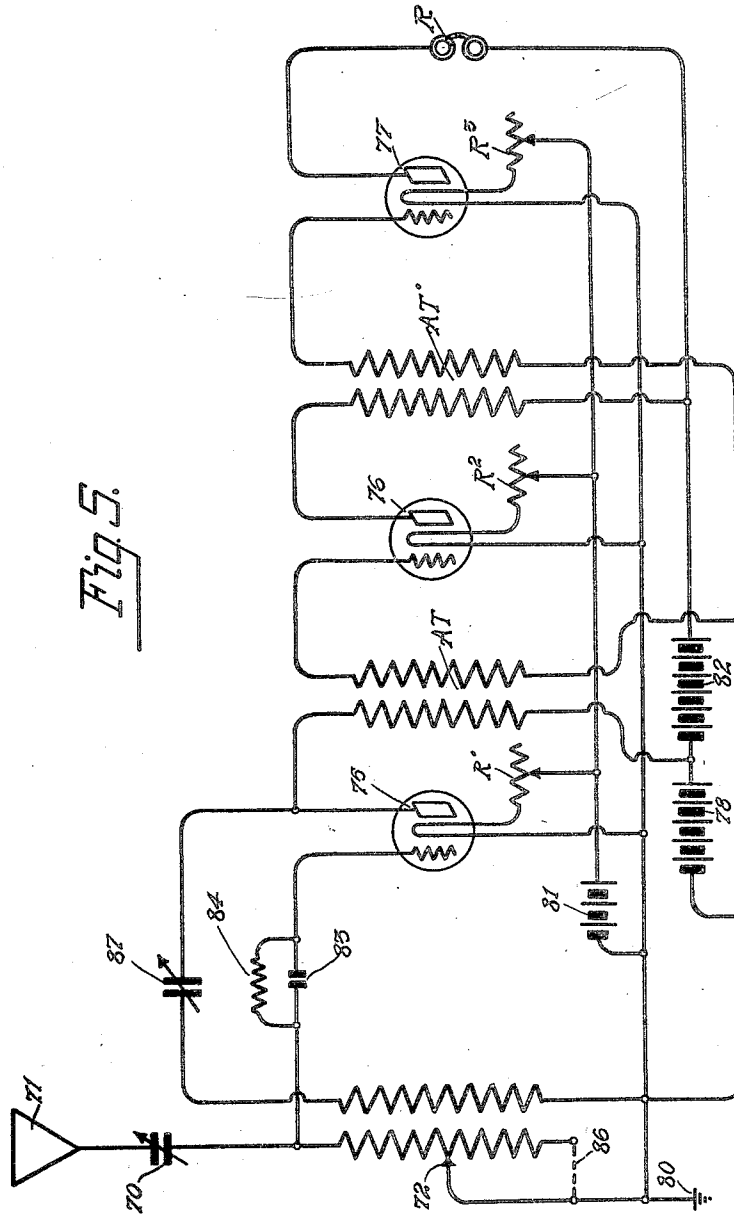
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3 Sheets-Sheet 3



Inventor:
Hiram D. Currier.
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UNITED STATES PATENT OFFICE.

HIRAM D. CURRIER, OF CHICAGO, ILLINOIS, ASSIGNOR TO KELLOGG SWITCHBOARD AND SUPPLY COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

RADIO RECEIVING SET.

Application filed September 8, 1923. Serial No. 661,552.

My invention relates to the art of wireless or radio, and has to do more particularly with the apparatus and circuits used in systems of radio or wireless.

5 In the transmission of radio messages a very high frequency current is used to carry the radio signals, and the sets that are to receive the signals from the transmitting station must be constructed to function in response to these extremely high oscillations. 10 The high frequency currents are generally picked up by an antenna or loop and carried to a tuning coil in the receiving set. The tuning coil generally consists of a number of turns of wire wound upon a tube of 15 insulating material or a number of turns of wire wound upon a molded member of insulating material. It has been found that large losses occur due to leakage and drainage of the coils owing to the fact that the convolutions of wire are in contact with the supporting tube or form. It is one of the objects of my invention to construct a coil which obviates a large percentage of this 25 loss found in the coils of the prior art. This loss may be overcome to a large extent by lessening the contact space of the winding or windings of the coil with the supporting member or frame in such a manner that a very small percentage of the winding actually contacts with the supporting member or 30 members.

It is a further object of my invention to so arrange the circuits and apparatus as to 35 greatly increase the efficiency of the same thereby not only obtaining a greater volume or strength of signal, but at the same time vastly increasing the selectivity and sensitivity of the circuits and apparatus.

40 A still further feature of my invention resides in the novel circuit arrangement which I use in transmitting the plate variations caused by the incoming signals back to the grid circuit to sustain the incoming oscillations.

45 The features just mentioned, as well as others, relating to the detail of construction, combination of parts, and circuit arrange-

ment will be hereinafter more particularly pointed out in the ensuing specification and 50 appended claims.

For a more complete understanding of my invention, reference may be had to the accompanying sheets of drawings in which like reference characters, in the different 55 views, denote like parts, and in which;

Fig. 1 is a rear elevation of one of my combined tuning and feed back coils or coupler;

Fig. 2 is a side elevation of the same; 60

Fig. 3 shows a second form of my combined antenna and feed back coil or coupler. This is a front view of the same;

Fig. 4 is a side view of the coil shown in Fig. 3; and 65

Fig. 5 is a diagrammatical illustration of the circuit of a receiving set using my type of coil and feed back circuit.

Referring now more particularly to Figs. 1 and 2, it will be noted that the coils and 70 means for varying the same are mounted upon a sub-panel or plate 2, and constitute a unitary structure. The device, as a whole, is adapted to be secured to a panel 3 by means of screws 4, which extend through spacing 75 lugs 5 for properly spacing the mounting plate from the panel 3. Attached to the plate 2 is a pair of arms 6 and 7 which support the frame upon which the windings are wound. These arms are secured to the plate 80 2 by screws 8. The winding frame consists of two plates 9 and 10 of insulating material which are dove-tailed into each other to form four arms. The arms 11 and 12 extend at right angles to the arms 13 and 85 14. A portion of each of the arms is cut away, as shown at 15 and 16 forming an edge 17, which is chamfered off to form a very narrow contacting space for the wire which forms the inner or secondary winding 18. The winding 18 is wound upon 90 these arms and equally spaced to form a continuous secondary or feed back winding. Strips 20 are placed between the projecting ears 21 and 22 of the arms 11, 12, 13 and 14 95 and are secured in position by means of

screws 23. The outer edges of these strips are chamfered off, as shown most clearly at 24 in Figure 2. The primary winding consists of wire wound upon these strips and equally spaced. The turns of the secondary winding are connected to electrical terminals 25 and 26 and the terminals of the primary winding are connected to electrical terminals 27 and 28. The frame work and coils are held in position with reference to the arms 6 and 7 by means of screws 29. At the point where the primary winding contacts with the chamfered edge of strip 20 carried by arm 12, the insulation (if insulated wire is used) is removed, so that a slidable wiper 31 may make electrical contact with each convolution or turn of the primary winding.

Extending through the panel plate 3 and mounting plate 2 is a shaft 32, to the end of which is connected a gear wheel 33 by means of a screw 34, and to the outer end of the shaft 32 is connected a dial or controlling member (not shown) for rotating the gear 33. Attached to the plate 2 is a track member 35 and fitting into this track member is a rack 36 which has teeth that mesh with the teeth of the gear 33. Attached to the rack member 36 is a wiper 31 which is adapted to contact with the portion of the primary winding immediately above the chamfered edge of strip 20 of arm 12. A pressure spring 37 is riveted to the wiper 31 and has contact with track 35 to insure good electrical connection between the wiper and the track 35. A terminal 38 is provided, which is connected to the wiper through track 35 and rack 36. The turning of the dial which rotates the shaft 32 causes the wiper to move across the primary winding frame from one end thereof to the other end thereof.

From the foregoing it will be noted that the primary winding and secondary winding are each rectangular in form and only engage the supporting frame at four points of contact. By this method of construction, I get away from the large leakage or drainage of the prior coils which were directly in contact with the supporting tube or member throughout the entire length thereof.

It may also be pointed out that by this method of construction, I am able to make contact and engage with each convolution or turn of the primary winding thereby forming an accurate means of adjustment of the primary winding.

Referring to Figs. 3 and 4, I here show a different form of coupler which consists of a primary winding 50, and a secondary winding 51. The primary winding is provided with taps which extend to contact buttons, which buttons are for engagement with a wiper 59 so that the effective turns of the primary winding may be adjusted by means of the wiper. The coils and adjustable

switch are connected to a sub-base 52 which is adapted to be secured to a panel 53 by means of screws 54. Spacing lugs 55 are provided to accurately space the sub-panel or plate 52 relative to the panel 53. The secondary winding 51 is formed by winding suitable insulated wire upon a cylindrical form and then cementing the adjacent turns together to form a single winding. A groove 56 is cut in the plate 52 and the secondary winding cemented into this groove, so that it only contacts with the plate 52 where it extends into the groove 56. The primary winding is of the same form and is made by winding suitable insulated wire upon a cylindrical form, then cementing the turns together and removing the same from the form. The coil is then inserted in a circular groove 57 in plate 52. The primary winding is provided with a number of taps 58. Rotatably secured to the plate 52 is a wiper 59 which is fastened to a shaft 60 that extends through the panel 53 and is provided at its outer end with a dial or controlling member. Arranged in a circle on plate 52 are a number of contact buttons 61, which are provided with extension terminals 62. Conductors 63 are connected to the taps 58 of coil 50 and extend through orifices in the plate 52 to the terminals 62. The wiper 59 is adapted to rotate to make contact with the contact buttons 61, whereby the primary coil may be tapped at any desired point. Terminals 65, 66, 67 and 68 are fastened to the plate 52 and have conductors extending to the primary and secondary windings 50 and 51. From this description it will be seen that the primary winding and secondary winding are each a self supporting winding, and only contact with the supporting plate 52 at one end thereof.

Referring now more particularly to Figure 5, I here show the primary winding of either of my coils connected through a variable tuning condenser 70 to an antenna 71. The arrow 72 may either be the wiper 31 of Figures 1 and 2 or the wiper 59 of Figures 3 and 4, and is adapted to adjust the antenna inductance of the primary winding of either of my coils.

Reference characters 75, 76 and 77 represent audion or vacuum tubes, 75 being the detector audion and 76 and 77 being the amplifying audions. The reference characters AT and AT' represent audio frequency transformers, the primary winding of transformer AT is connected to the plate of the detector tube 75 and to the positive terminal of B battery 78, and the secondary winding of this transformer is connected to the grid of tube 76 and to ground 80 and to the negative terminal of A battery 81. The primary winding of transformer AT' is connected to the plate of tube 76 and to the positive terminal of B battery 82, and the secondary

winding of this transformer is connected to the grid of tube 77 and to the negative terminal of A battery 31. The plate of tube 77 is connected through the receivers R, or
 5 through a loud speaker to the positive terminal of B battery 82. The usual rheostats R', R² and R³ are provided for controlling the filament current of the filaments of tubes 75, 76 and 77 respectively.

10 The grid of the detector tube 75 extends through the usual grid condenser 83, with its associated grid leak 84, to a point between one terminal of the primary winding and the tuning condenser 70. The other terminal of the primary winding may be left open or connected by conductor 86 to ground, in which instance, when the arrow 72 is adjusted it controls the short-circuited turns of the primary winding. I have found it
 15 desirable in some instances to ground the unused turns of the primary winding. A conductor extends from the plate of the detector tube 75 through a variable condenser 87 and a secondary winding of the coupler or tuning coil back to the negative filament terminal of the detector tube. It will be noted that the secondary coil or feed back coil is connected between the plate of the detector tube and negative filament terminal
 20 of the detector tube.

To tune in the oscillations of a transmitting station, the antenna is tuned to the wave of the transmitting station by means of the arrow 72 and the variable condenser 70.
 25 The incoming signals, when tuning is properly made are effective upon the grid of tube 75, to vary the electron flow between plate and filament of the detector tube in the usual manner, and the plate potential variations are brought back to the grid by the secondary winding of the coil, which serves to impress these variations upon the grid of the detector tube 75 inductively, through the windings of the coil. The variable condenser 87 assists in controlling the feed back through the secondary winding and it will be noted that the feed back through this winding is of radio frequency, and that it does not pass through a high impedance coil as in other circuits. The audio frequency transformers AT and AT' with their associated audions amplify the incoming signals in the usual manner.

I have found that by extending the plate circuit through a variable condenser 87 and the feed back winding of the coil, that I am able to greatly increase the strength of the incoming signals, over the older method of placing the feed back winding in series
 45 with the primary winding of the transformer AT, in which instance the feed back winding receives audio frequency happenings instead of radio frequency happenings, as in the present case. I also find that the

selectivity and the sensitivity of the circuit arrangement is greatly increased by my method of feed back.

From the above it will be noted that my tuning coils are of a very simple construction and are supported by only a very small percentage of their area, thereby doing away with leakage from the coil to the supporting surface. The variable condenser 87 and rheostat R' permit an accurate control of the radio frequency feed back to the secondary of the coil.

While I have described two particular forms of coils and a particular circuit arrangement, it is to be understood, that changes and modifications will readily suggest themselves to those skilled in the art, and I, therefore, do not wish to be limited to the exact structure and circuit arrangement, as shown, but aim to cover all such changes and modifications, as come within the spirit and scope of the appended claims.

What I claim as new and desire to secure by United States Letters Patent, is:

1. A coil of the character described including a plurality of arms positioned at right angles relative to each other supporting a spaced primary winding comprising turns of wire of substantially the same length, and members attached to said arms supporting a spaced second winding.

2. A device of the character described including a supporting frame comprising a plurality of arms positioned in angular relation to each other, a winding spaced on said frame, members attached to said arms, a second spaced winding supported by said members, and a slidable member for making electrical contact with different turns of one of said windings of said device.

3. A device of the character described including a supporting frame comprising a plurality of arms positioned in angular relation to each other, a winding spaced on said frame, members attached to said arms, a second spaced winding supported by said members, a slidable member for making electrical contact with different turns of one of said windings, and a rotatable member for moving said slidable member back and forth across said winding.

4. A device of the character described including a mounting plate, a supporting frame comprising a plurality of arms positioned at right angles relative to each other attached to said mounting plate by supporting arms, a pair of longitudinally extending spaced windings supported by said frame, and a contact member supported by said plate for making electrical contact with one of said windings.

5. A device of the character described including a mounting plate, a supporting frame comprising a plurality of arms posi-

tioned at right angles relative to each other attached to said mounting plate by supporting members connecting said arms to said plate, a pair of spaced windings supported by said frame, a contact member supported by said plate for making electrical contact with one of said windings, and a rotatable member journaled in said supporting plate for moving said contact member back and forth across said winding.

6. A device of the character described including arms positioned in intersecting planes supporting an angularly shaped primary winding having turns of substantially the same length and an angularly shaped secondary winding, the one winding being within the other and in inductive relation thereto.

7. A device of the character described including a frame having a plurality of arms positioned in intersecting planes and supporting a spaced winding having turns of substantially the same length, and members adapted to be attached to the said arms of said frame for supporting a second spaced winding having turns of substantially the same length, said second winding being in inductive relation to said first winding.

8. A device of the character described including a frame having a plurality of arms positioned in intersecting planes and supporting a spaced winding, members adapted to be attached to the said arms of said frame supporting a second spaced winding having turns of substantially the same length, said second winding being in inductive relation to said first winding, and a contact member adapted to be adjusted for electrical connection with different turns of one of said windings.

9. A device of the character described including a frame having a plurality of arms positioned in intersecting planes and supporting a spaced winding, members adapted to be attached to the said arms of said frame supporting a second spaced winding, and a slidable member adapted to slide back and forth across one of said windings to make electrical contact with different turns of said windings.

10. A device of the character described including a frame having a plurality of arms positioned in intersecting planes and supporting a spaced winding, members adapted to be attached to the said arms of said frame supporting a second spaced winding, a slidable member adapted to slide back and forth across one of said windings to make electrical contact with different turns of one of

said windings, and a rotatable member for controlling said slidable member.

11. A device of the character described having a mounting frame comprising relatively thin arms positioned in intersecting planes and adapted to receive a plurality of spaced turns of wire to form a winding, and a plurality of thin strips adapted to be secured to said arms to support a second spaced winding in inductive relation to said first winding.

12. A device of the character described having a mounting frame comprising relatively thin arms positioned in intersecting planes and adapted to receive a plurality of turns of wire of substantially the same length to form a spaced winding, a plurality of thin strips adapted to be secured to said arms to support a second spaced winding having turns of substantially the same length, and a contact member for making electrical engagement with different turns of one of said windings.

13. A device of the character described including a supporting frame having a plurality of arms positioned in angular relation to each other, a spaced winding supported by said arms, and a slidable member adapted to make electrical engagement with the turns of said winding immediately adjacent the point where the turns contact with one of said arms.

14. A device of the character described comprising a plurality of arms positioned in angular relation to each other, a spaced winding supported by said arms, strips secured to said arms, a second spaced winding supported by said strips, and a contact member adapted to make contact with different turns of one of said windings immediately adjacent the point where one of said windings is supported by one of said strips.

15. A device of the character described including an angular frame work comprising a plurality of intersecting arms supporting an angularly shaped spaced winding, a contact member adapted to make electrical engagement with different turns of said winding immediately adjacent the point where the winding contacts with said frame, and a second angularly shaped spaced winding supported by the arms of said frame, said second winding being within the other winding.

Signed by me at Chicago in the county of Cook and State of Illinois, this 5th day of September, 1923.

HIRAM D. CURRIER.