R. H. MARRIOTT.

ELECTRICAL TUNING DEVICE.

APPLICATION FILED JULY 7, 1909.

978,605.

Patented Dec. 13, 1910.

2 SHEETS—SHEET 1.

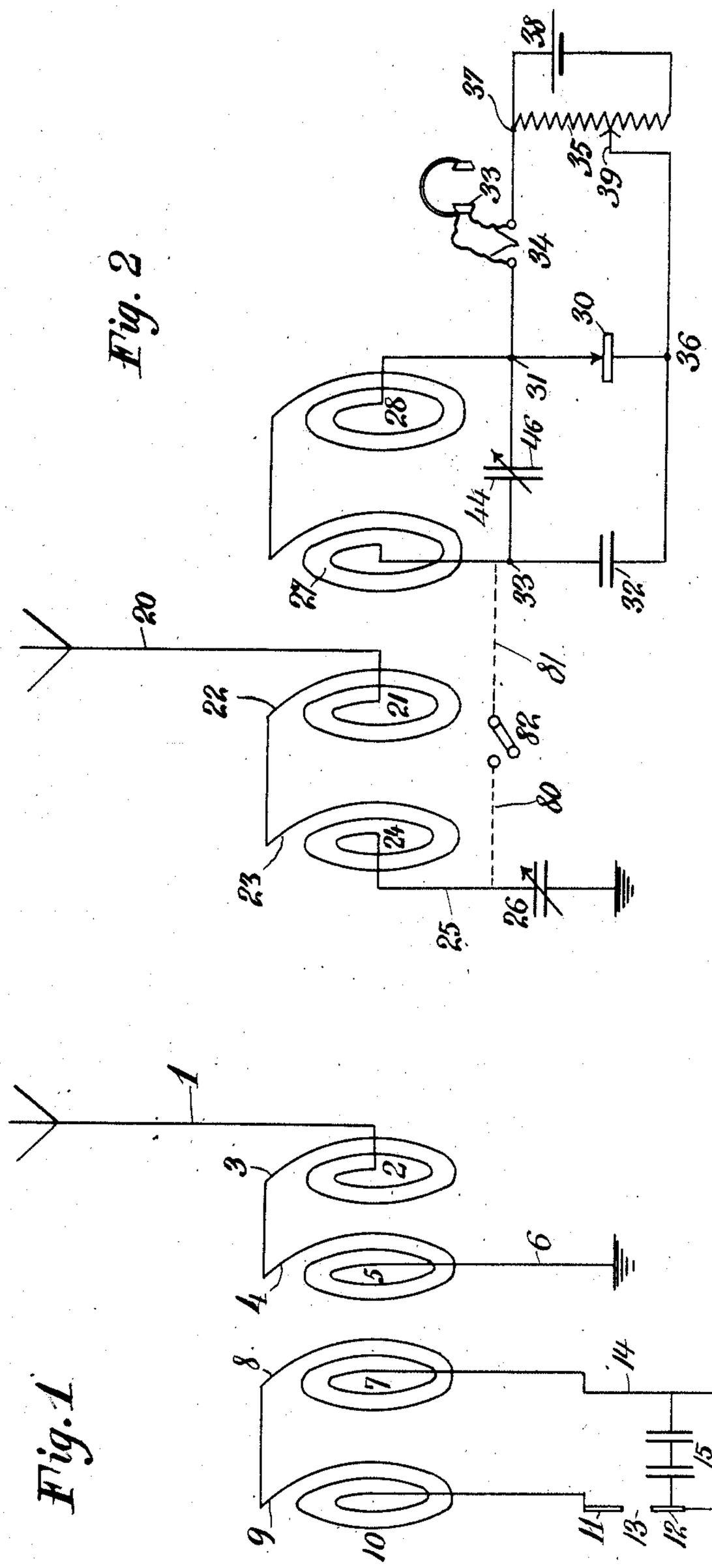

Fig. 2

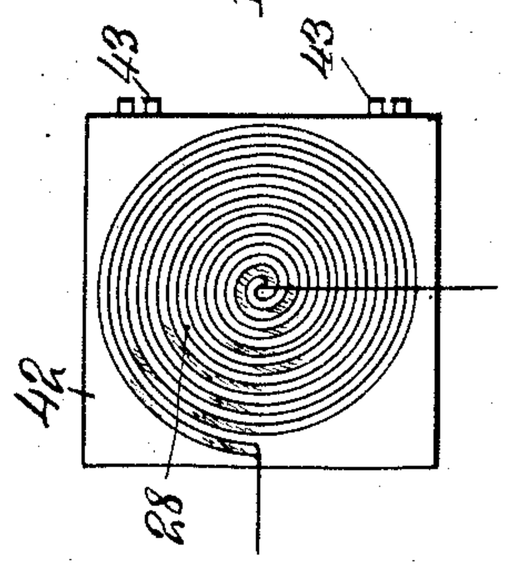

Fig. 9

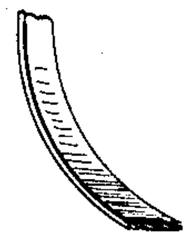

Fig. 10

Fig. 1

Witnesses
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By his Attorney
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2 SHEETS—SHEET 2.

Fig. 3

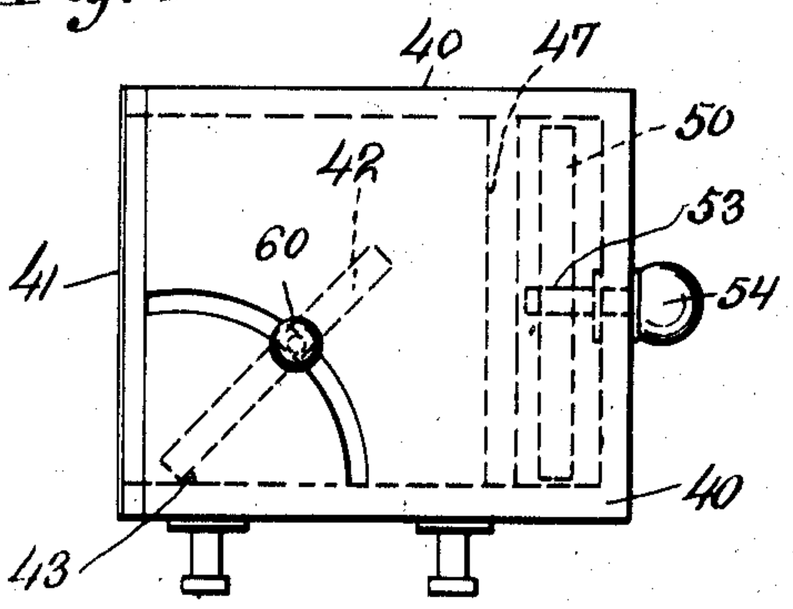


Fig. 4

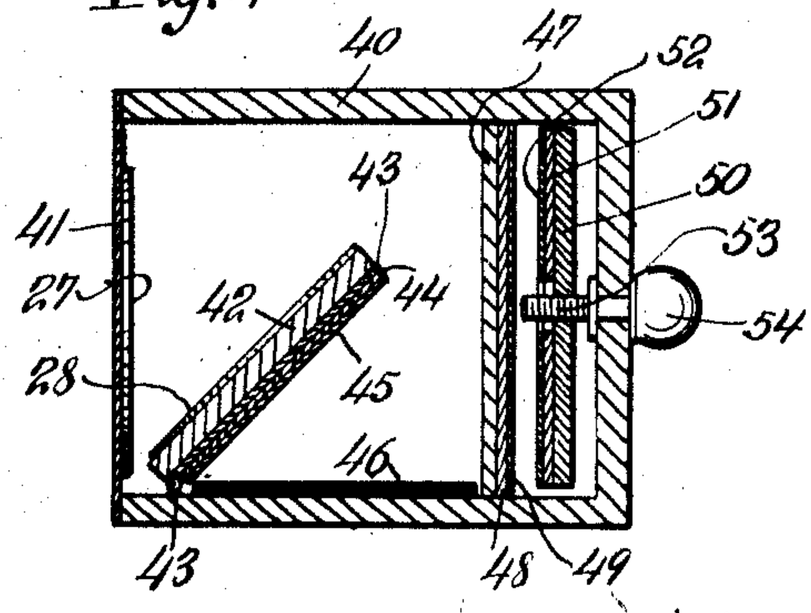
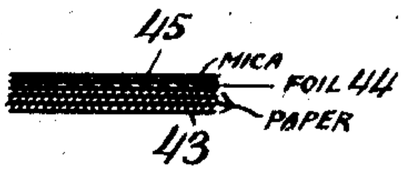


Fig. 5



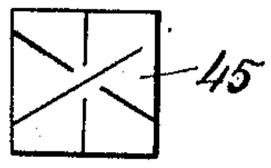
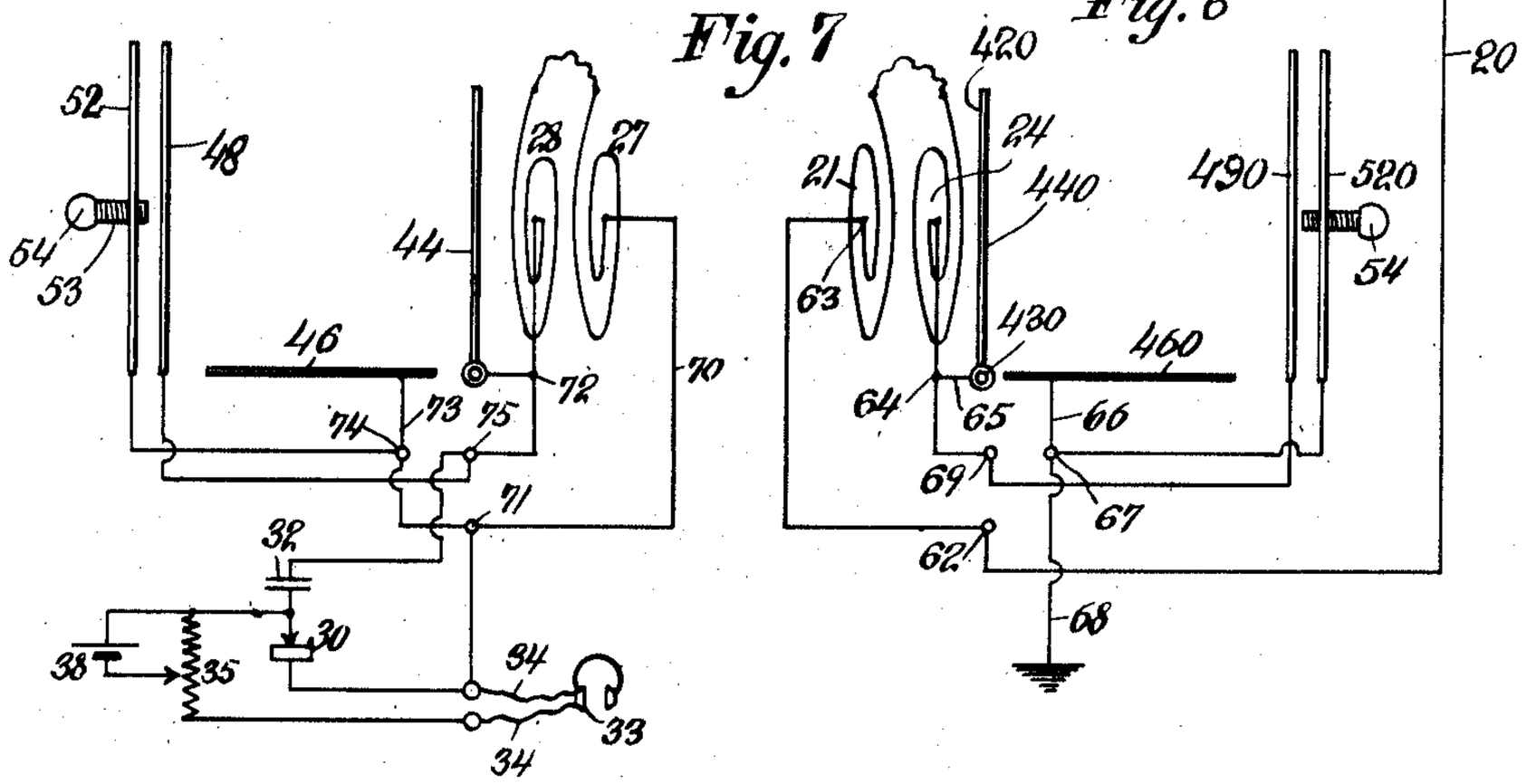


Fig. 6

Fig. 7



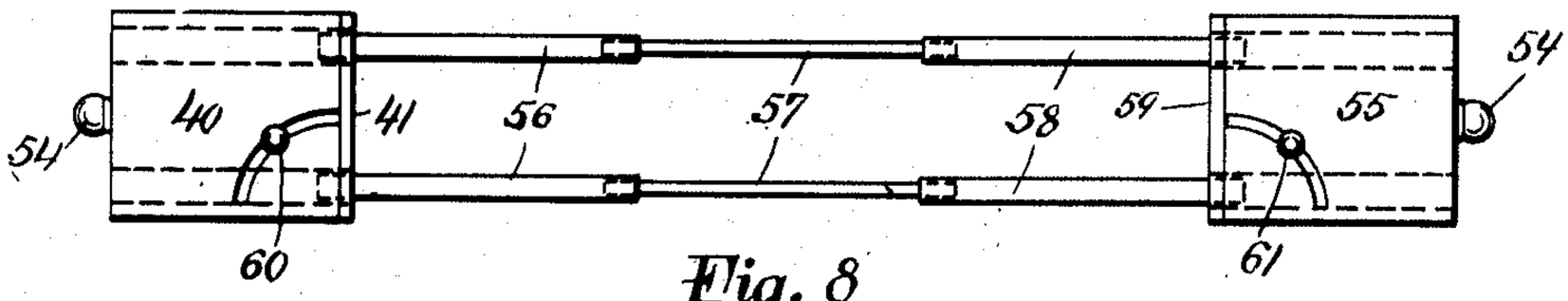


Fig. 8

Witnesses
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Beatrice Minnis

Robert H. Marriott Inventor

By his Attorney
William J. Binney

UNITED STATES PATENT OFFICE.

ROBERT H. MARRIOTT, OF BROOKLYN, NEW YORK, ASSIGNOR TO UNITED WIRELESS TELEGRAPH COMPANY, A CORPORATION OF MAINE.

ELECTRICAL TUNING DEVICE.

978,605. Specification of Letters Patent. Patented Dec. 13, 1910.

Application filed July 7, 1909. Serial No. 506,424.

To all whom it may concern:

Be it known that I, ROBERT H. MARRIOTT, a citizen of the United States, and a resident of Brooklyn, Kings county, New York, have invented certain new and useful Improvements in Electrical Tuning Devices, of which the following is a specification.

My invention relates to a tuning apparatus for the high frequency transmission of electrical energy and particularly to wireless telegraphs.

One of the objects of my invention is to provide a tuning apparatus in which the inductance and capacity are simultaneously varied and in the same direction so that when the inductance is decreased, the capacity is decreased and vice versa.

Another object of my invention is to provide a variable inductance in which one portion of the inductance is fixed and another portion is mounted on a frame which swings toward and from the fixed coil.

Another object of my invention is to provide a tuning apparatus of the class referred to, in which a variable condenser is utilized, the said condenser comprising fixed and movable plates, the movable plate being mounted on a swinging frame, which, in the best embodiment of the invention, also carries a coil forming part of a variable inductance.

With the above and other objects in view, my invention consists in the parts, improvements and combinations more fully pointed out hereinafter.

Referring now to the drawings which are attached to the specification and form a part thereof, Figure 1 illustrates diagrammatically the sending end of a wireless telegraph system employing a variable inductance, which may be constructed in accordance with my invention. Fig. 2 illustrates diagrammatically the receiving end of a wireless telegraph system embodying my invention. Fig. 3 is a top plan view of a box containing a tuning apparatus constructed in accordance with my invention. Fig. 4 is a cross-section through the box shown in Fig. 3. Fig. 5 is a detailed cross-section through the various layers of the condenser constructed in accordance with my invention. Fig. 6 is a plan view of the condenser plate shown in Figs. 4 and 5. Fig. 7 is a diagrammatic view of the receiving circuit showing the variable condensers and variable inductances arranged in circuit. Fig. 8 is a plan view of the boxes, one of which is shown in Fig. 3, which are arranged to slide toward and from each other. Fig. 9 shows a face view of one of the coils spread apart for clearness. Fig. 10 is a detail showing the thin flat strip of which the coil may be wound.

The sending end of the system may be of the usual form. As illustrated, it includes variable inductances so that when tuned, the aerial will send out a wave of definite frequency. The aerial 1 is connected with a coil 2. As shown, the outer end 3 of the coil is connected to the outer end 4 of a coil 5, the inner end of the coil 5 being connected to ground by means of the wire 6. The coil 5 is in inductive relation with the coil 7. As shown, the outer end 8 of the coil 7 is connected with the outer end 9 of a coil 10, the inner end of the coil 10 being connected to a spark knob 11, separated from a spark knob 12 by a gap 13. The inner end of the coil 7 is connected by a wire 14 with one or more condensers 15, one plate of the condenser being connected to the knob 12. The circuit just outlined including the spark gap 13 constitutes an oscillatory circuit. It may be charged in any desired manner, as by means of an alternating current dynamo 16, having its terminals connected to the primary 17 of an induction coil, the circuit being closed through a telegraph key 18. The secondary, 19, of the induction coil has its terminals connected with the oscillatory circuit, as indicated. When the telegraph key 18 is closed, the oscillatory circuit, including the spark gap 13 is charged and becomes the source of high frequency oscillations which are inductively transmitted to the aerial 1, the aerial sending out waves. As shown in Fig. 2, the receiving circuit consists of an aerial 20 which may be connected to the inner end of a coil 21, the outer end 22 of the coil being then connected by a wire to the outer end 23 of a coil 24. The coils 21 and 24 are in inductive relation, so that the self-induction of the pair of coils may be varied by moving one coil, as, for example, the coil 24 with relation to the coil 21. The inner end of the

coil 24 is connected by a wire 25 through a variable condenser 26 to ground. The coils 21 and 24 are in the aerial circuit of the receiving system. The coil 21 which is preferably the fixed coil is inductively mounted with relation to a coil 27, the latter being in the local circuit. The outer end of the coil 27 is connected to the outer end of the coil 28, the two inner ends of the coils 27 and 28 being connected to points in the local receiving circuit. As illustrated, they are connected on opposite sides of a variable condenser 44, 46, so that the local circuit 27, 28, 44, 46 constitutes a receiving circuit of high frequency oscillations which can be tuned. A wave detector 30 is connected to the receiving circuit. As illustrated, one terminal of the receiver is connected to the point 31 and the other terminal of the receiver is connected to one plate of a condenser 32, the other plate of the condenser being connected at 33 with the receiving circuit.

When the oscillations in the receiving circuit develop electrical energy of sufficient amount, the detector 30 responds and allows an indicating current to flow through the telephone. The telephone circuit is connected about the wireless detector 30 in any suitable manner. As illustrated, the telephone 33 which is shown as a head telephone is connected by wires 34 to a telephone circuit including a potentiometer 35, the latter being connected at 36 to one side of the detector and at 37 to one side of the telephone. The battery 38 has its terminals connected to the potentiometer, one terminal 39 sliding along the potentiometer to vary the drop in potential through the potentiometer as will be understood.

Referring now to Figs. 3 to 9, the tuning apparatus forming part of my invention will be readily understood. It is preferably constructed in duplicate, each set being contained in a suitable box 40,-55. A fixed frame 41, which, in the best embodiment of the invention closes the front of the box, carries the coil 27. This coil is wound as a flat disk, (the companion coil 28 being shown particularly in Figs. 9 and 10), and consists preferably of a thin ribbon of wire mounted on the face of the frame 41. By constructing the coil of thin ribbonlike wire, the resistance of the coil for the same number of turns, that is, with a given self-induction is reduced over what it would be were a round wire used. A movable frame 42 carrying the coil 28 which is constructed like the coil 27 is mounted within the box. It is so mounted as to swing about an axis, which, as illustrated, is outside of the fixed coil. The means for mounting the swinging coil may be widely varied. In the particular embodiment of the invention illustrated, the axis about which the coil swings is a fixed axis or pivot 43 located inside of the box 40, to which pivot the frame 42 is secured. The coil 28 thus swings toward and from the coil 27.

In the best embodiment of the invention, I make use of a variable condenser, one plate of which is moved when the coil 28 moves. This occurs in such a manner that as the self-induction of the local coils is increased, by their separation, the capacity of the associated condenser is increased by the approach of its condenser plates, and vice versa, as the self-induction of the local coils diminishes, the capacity of the condenser diminishes. The wave length to which the circuit is tuned, is increased or diminished quickly, the change in both self-induction and capacity coöperating. In the particular embodiment of the invention illustrated, the coil 28 and the condenser plate are mounted on the frame 42, on opposite sides thereof. I construct the condenser by mounting upon the frame 42, yielding material such as paper 43 on which a sheet of foil 44, forming the condenser plate is mounted. On top of the foil, I secure a sheet of insulating material such as mica 45. The fixed condenser plate in the particular embodiment of the invention illustrated is mounted upon the side of the box 40. It is mounted upon yielding material, such as paper and may be covered with mica.

In the best embodiment of the invention and in order to avoid eddy currents, which waste energy and which may be introduced in the condenser plates by the inductive action of the coil 28, I slit the foil of one or both condenser plates, as illustrated in Fig. 6. This prevents the circulation of eddy currents around the plates.

In order to secure compactness of construction, I prefer to locate another variable condenser within the box 40. The fixed plate of the condenser is mounted upon the support 47, carrying yielding material 48, on which the condenser plate 49 is mounted. The condenser plate 49 may be provided with a coating of insulating material. The removable plate of the condenser is carried by a frame 50, which in turn carries yielding material 51, supporting the condenser plate 52. The screw 53 which may be turned by the knob 54 will cause the frame 50 to advance the condenser plate 52 toward and from its companion plate 49 so as to vary the capacity.

Referring now to Fig. 8, it will be observed that boxes 40, 55 are used, which are alike in all substantial particulars. These may be connected by guiding means 56, 57, 58, so that the faces 41, 59 of the boxes, which carry the fixed coils, can be brought in juxtaposition or can be widely separated. The guiding means may be omitted, if desired, without interfering with this capability of adjustment. Knobs 60 and 61

which are attached to the swinging frames 42 carrying the movable coils, permit the positioning of the movable coils with relation to the fixed coils, as will be readily understood.

The arrangement of the devices in the receiving circuits will be clear from an examination of Fig. 7. The receiving aerial 20 is connected to a binding post 62 from which a wire leads to preferably the inside 63 of the fixed coil 21. The outside of the coil 21 is preferably connected with the outside of the movable coil 24. The windings of the coils 21 and 24 are so arranged that the high frequency current passing through the coil 21 will pass in the opposite direction through the coil 24, so that when the coils are in juxtaposition, the self-induction of the coils is substantially neutralized; as for example, when the movable coil is fully open the inductance may be 400 micro henries and when closed 35 micro henries. From the inner end of the coil 24, a wire passes to a suitable binding post 64 or point of connection with the circuit. The movable frame 420 carrying the condenser plate 440, which swings about the pivot 430 also carries the coil 24. The condenser plate is likewise connected with the binding post 64 by wire 65. The fixed plate 460 of the condenser is connected by means of a wire 66 to binding post 67 and then by ground wire 68 to the ground. The wireless oscillations coming in on the receiving aerial 20 will thus pass in succession through the coils 21, 24, condenser 420, 460 and then to ground. The adjustable condenser 490, 520 may have its plates connected at 67 and 69 in parallel with the condenser 440, 460, or it may be connected in the circuit in any suitable manner. Turning now to the local circuit connected with the receiver, the fixed coil 27 has its inner terminal connected by means of wire 70 with binding post 71, the outer end of the coil 27 being connected to the outer end of the coil 28, the coils being wound, so that the inductive effects are substantially neutralized when the coils are together. The inner end of the coil 28 connects by wire with a binding post 72 which is connected to the movable condenser plate 44. The fixed condenser plate 46 is connected to the binding post 71, completing the tuning circuit through the coils 27 and 28 by a wire 73 and binding post 74. The condenser 48, 52 has its coatings connected to binding posts 74, 75, so as to be in parallel with the condenser 44, 46, but other arrangements of the condenser 48, 52 may be made. The circuit containing the detector 30 is connected to binding posts 75, 71, a condenser 32 being preferably connected in one of the leads. The potentiometer 35, battery 38, telephone 33 are connected about, that is on opposite sides of the detector 30, as indicated. When the wireless oscillations surging through the local tuned circuit are sufficiently strong to cause the detector 30 to respond, the potentiometer sends its current through the detector and gives the signal in the telephone.

Instead of the inductive connection illustrated in Fig. 2, the receiving aerial circuit may be connected with the local receiving circuit conductively. As illustrated, I have shown in dotted lines wires 80, 81 which may be connected by the switch 82 so as to conductively connect the aerial circuit with the local circuit containing the coils 27, 28.

What I claim and desire to secure by Letters Patent is:—

1. A tuning device for the high frequency transmission of electrical energy comprising a fixed coil mounted on the frame, a coil mounted on a movable frame, a condenser plate mounted on the opposite side of said movable frame, and a fixed support carrying another condenser plate, with which the former coöperates to form a condenser of variable capacity.

2. A tuning apparatus for the high frequency transmission of electrical energy comprising a box, a frame closing the mouth of the box, a fixed coil mounted on said frame, a movable coil mounted to swing within said box toward and from said fixed coil, a condenser plate carried by one side of said box, a movable condenser plate mounted adjacent to said movable coil and coöperating with said fixed condenser plate.

3. A tuning apparatus for the high frequency transmission of electrical energy comprising a box, a fixed frame closing the mouth of said box, a coil carried by the face of said frame, and movable toward and from said fixed coil, yielding material carried by the back of said movable frame, a condenser plate mounted thereon, yielding material carried by the side of said box, a condenser plate carried thereon, said condenser plates constituting a condenser of variable capacity.

4. In a wireless telegraph tuning system, the combination of an aerial circuit, a local circuit, a fixed coil in each of said circuits in inductive relation with each other, said fixed coils being adapted to be placed and maintained at different fixed distances from each other, a movable coil in said local circuit, means for adjusting the position of each movable coil with relation to the corresponding fixed coil, two of the ends of said local coils being connected together and the remaining ends of the local coils being connected each to a point in said local circuit.

5. In a wireless telegraph tuning system, the combination of an aerial circuit, a local circuit, a fixed coil in each of said circuits in inductive relation with the other, means for adjusting said fixed coils, said fixed coils being adjustable toward and from each

other, so as to adjust and fix the inductive relation between them, a movable coil in said local circuit, said movable coil lying wholly outside of the plane of the fixed coil and being adjustable toward and from said fixed coil, two of the ends of said coils in a local circuit being connected together and the remaining ends of the local coils being connected each to a binding post so as to permit their connection with the local circuit.

6. In a wireless telegraph tuning system, the combination of an aerial circuit, a local circuit, a fixed coil in each of said circuits in inductive relation with each other, a pivoted coil in said local circuit movable toward and from said fixed coil, two of the ends of said local coils being connected together and the remaining ends of the local coils being connected each to a binding post so as to permit their connection to the local circuit.

7. In a wireless telegraph tuning system, the combination of an aerial circuit, a local circuit, a flat frame, a fixed coil mounted on the face of said frame and included in said aerial circuit, a flat frame carrying a fixed coil included in said local circuit, said fixed coils being adjustable toward and from each other so as to vary the inductive relation between them, a movable coil being adapted to swing about an axis toward and from the fixed coil in the local circuit, two of the ends of said local coils being connected together and their remaining ends being connected each to a point in the local circuit.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

ROBERT H. MARRIOTT.

Witnesses:
H. M. SEAMANS,
W. L. BISSING.