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ELECTRIC TUNING DEVICE.

APPLICATION FILED JUNE 21, 1913.

1,096,065. Patented May 12, 1914.

2 SHEETS—SHEET 1.

Fig. 1

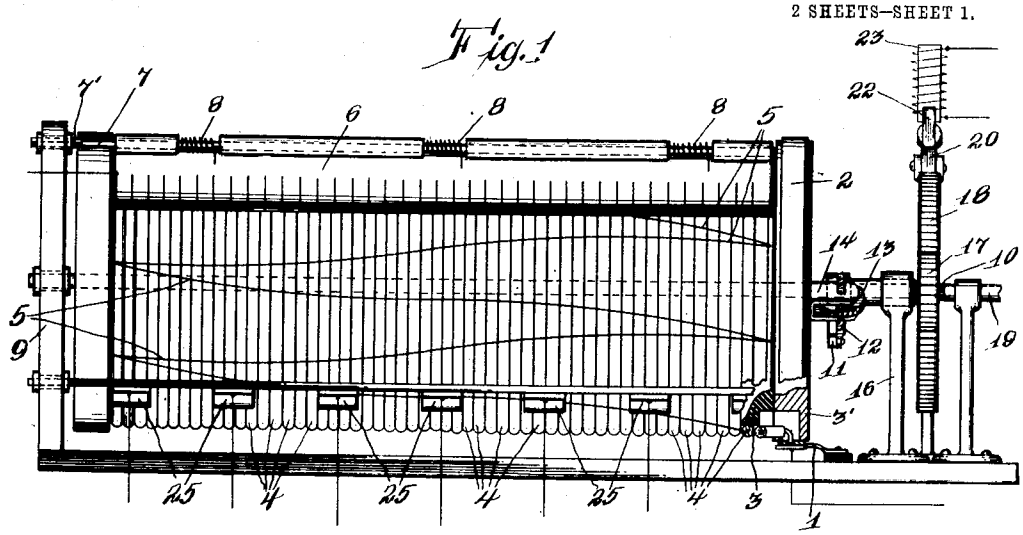


Fig. 2.

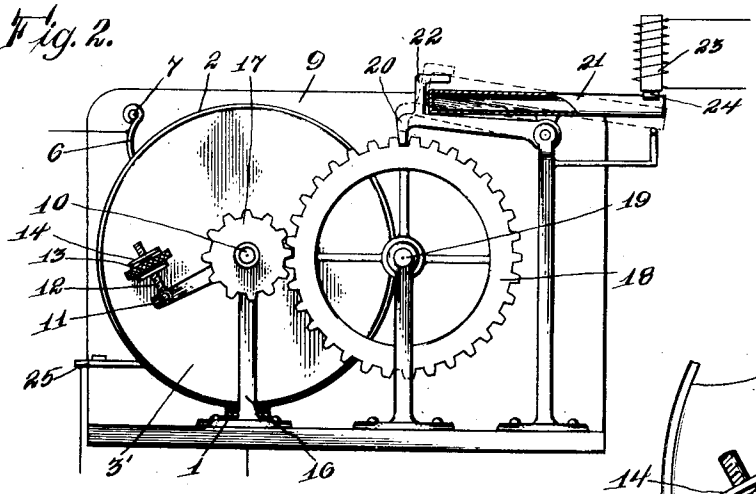


Fig. 4.

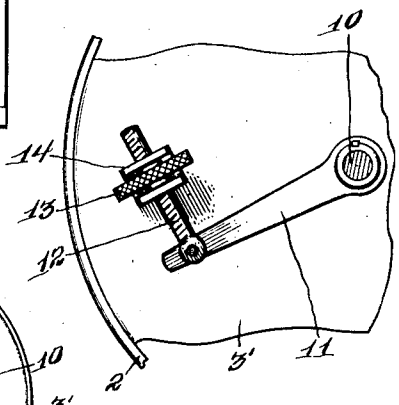
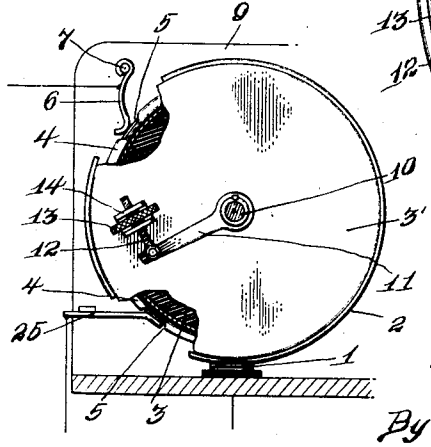


Fig. 3.



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2 SHEETS—SHEET 2.

Fig. 5.

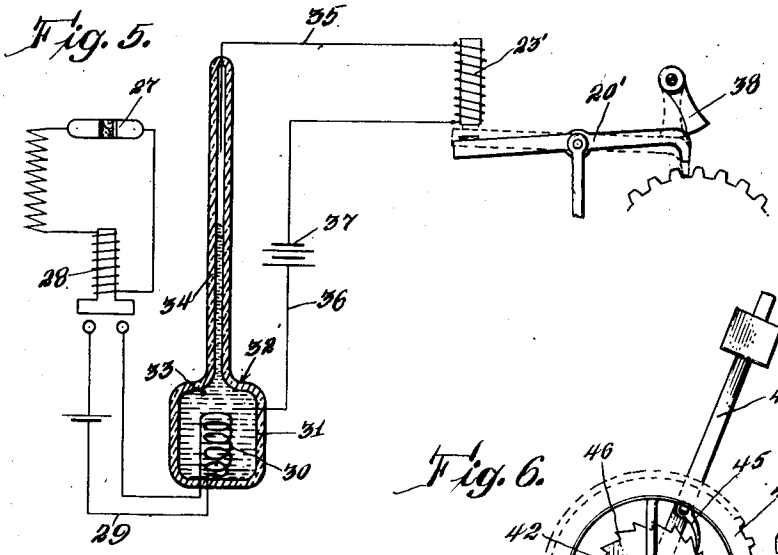


Fig. 6.

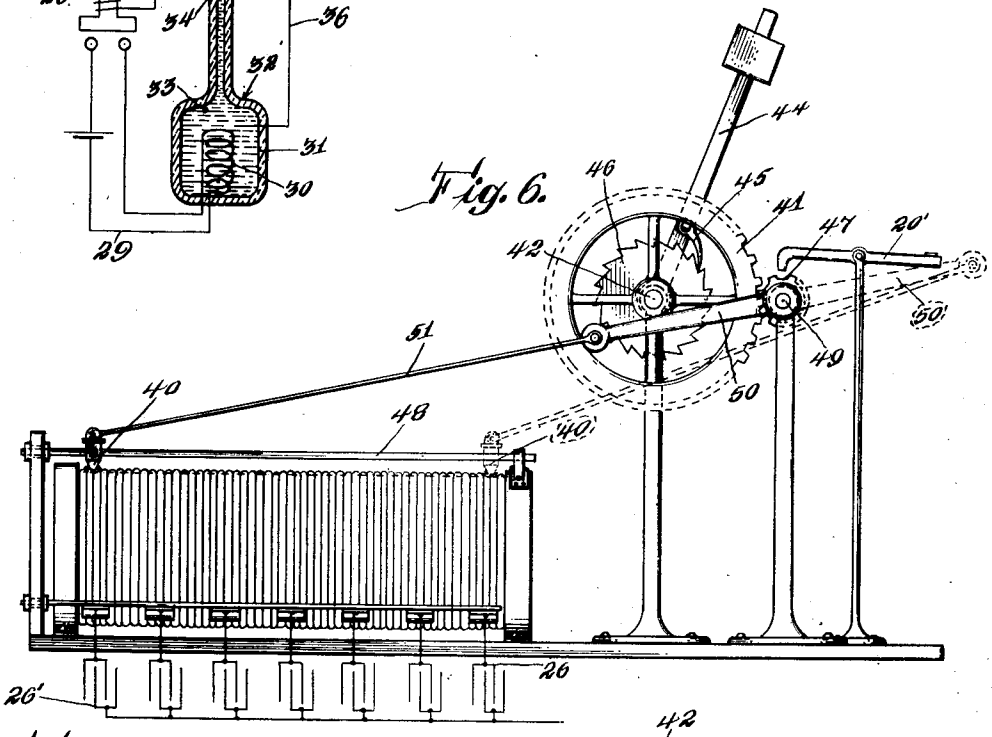
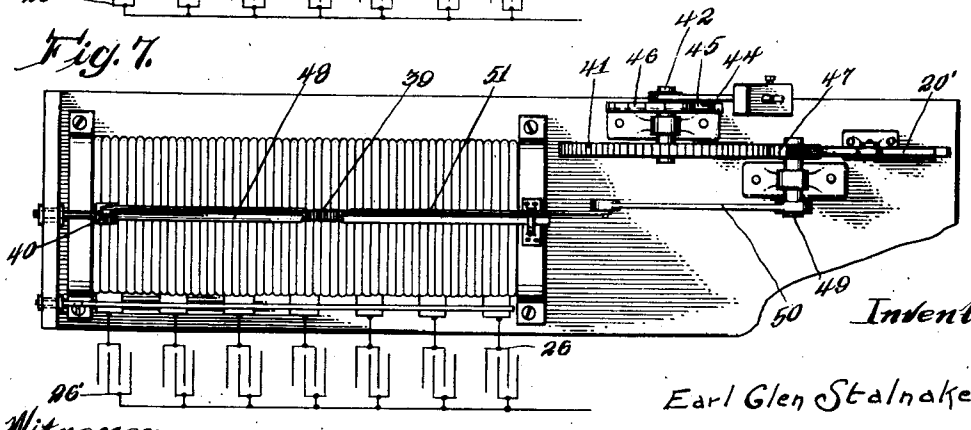


Fig. 7.



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UNITED STATES PATENT OFFICE.

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ELECTRIC TUNING DEVICE.

1,096,065. Specification of Letters Patent. Patented May 12, 1914.

Application filed June 21, 1912. Serial No. 704,977.

To all whom it may concern:

Be it known that I, EARL GLEN STALNAKER, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Electric Tuning Devices, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this application.

My invention relates to apparatus for adjusting or varying the oscillation-responsiveness of circuits used in high frequency systems of transmitting energy, such as the receiving circuits of wireless telegraph systems. Its object is to provide an apparatus by which the inductance of a circuit, or its static capacity, or both, may be varied so as to make the circuit responsive successively to wireless impulses varying greatly in wave-lengths or periodicity and in intensity; to provide means whereby the wireless impulse itself may automatically lock the apparatus in the position in which it has made the circuit responsive to the impulse to be received by it; whereby the apparatus will maintain this adjustment until the message has been received in its entirety; and whereby the apparatus will discontinue this adjustment and make a new adjustment for each succeeding message, regardless of differences in the wave-lengths or periodicities of the various messages. Also, to provide means whereby the apparatus when locked in approximately the properly adjusted position, may be more accurately adjusted or attuned by the operator.

The apparatus of my invention is particularly adapted for use as part of the wireless receiving systems shown in my copending application filed June 15, 1912, Serial No. 703,814, and is shown in this adaptation in the accompanying drawings, in which—

Figure 1 is a side elevation of the preferred form of my tuning apparatus. Fig. 2 is an end view of the same, showing the timing mechanism. Fig. 3 is a partially sectional end view of the drum of the apparatus. Fig. 4 shows the manual adjustment. Fig. 5 shows an alternative timing mechanism. Fig. 6 shows an alternative arrangement of the inductive, contact and driving elements. Fig. 7 is a plan view of Fig. 6.

In the drawings, 1 is a brush contacting with a ring 2 mounted on one end of a cylinder or drum 3, which latter is preferably of hard rubber. Wound upon the cylinder 3 is a single layer of insulated copper wire 4, having the insulation scraped off the surface along lines 5 diagonal of the axis of the cylinder.

6 is a contact brush pivoted on a shaft 7 and pressed against the wire on the cylinder by springs 8, the shaft 7 having a square end 7′ to keep it from turning in the end bracket 9.

10 is a shaft passing loosely through the cylinder 3, but rigidly fastened to an arm 11. This arm 11 is connected by a screw 12 and knurled nut 13 to a fork 14 fastened to the end 3′ of the cylinder 3, so that the position of the cylinder relative to the shaft may be varied by turning the nut 13 in either direction.

16 is a bearing for the shaft 10.

17, 18 are gears connecting the shaft 7 with a driving shaft 19 which is preferably driven by a clock or an electric motor.

20 is a detent adapted to hold the gear 18 from rotating, but normally held out of its latching position by the weight of a liquid in a brass tube 21 which engages the hook 22 at one end of the detent. 23 is an electro-magnet which, when energized, will attract a soft iron armature 24 fastened to the other end of the brass tube 21, whereby the tube forces the detent into the latching position.

25 are contact brushes adapted to bear on a considerable arc of the exposed wire 4 on the cylinder 3, each brush being connected to a separate section 26 of a condenser. 26′ are the other terminals of the same condenser.

In operation, both the inductance coil 4 and the condenser 26 are preferably connected to some part of the same circuit so that the inductance of this circuit will vary with the number of turns of the coil 4 included in the circuit, while the capacity of the circuit will vary with the number of sections 26 connected to the circuit. If the driving shaft 19 is continuously rotated, the cylin-

der 3 will likewise rotate continuously, thereby steadily shifting the points of contact of the exposed lines on the drum with the brushes 6 and 25. Consequently, both the inductance and the capacity of the circuit to which the apparatus is connected, or in other words the resonance of this circuit, will be continually varied. If this is done in the presence of a series of wireless impulses (such as the dots and dashes comprising a wireless message) the first impulse which finds the apparatus in the position where it makes the circuit responsive to these impulses, will actuate any sensitive wave-responsive device included in the circuit. Then if this wave-responsive device, such as a detector 27, is arranged to close another circuit (as in my copending application, Serial No. 703,814), it may close a battery circuit through the magnet 23. In doing so, it will cause the pivoted tube 21 to force the detent 20 into engagement with the gear 18, thereby halting the rotation of the cylinder 3 and consequently stopping a further change in the adjustment of the inductive coil 4 and the condenser 26. In other words, it will halt the varier in a position in which the varier makes the circuit resonant or responsive to the wireless impulses.

When the wireless impulse which actuated the wave-responsive device to close the circuit of the magnet 23 ceases, this magnet will release its armature 24, thereby allowing the tube 21 to tilt until its upper edge strikes the hook 22 of the detent. In this position, the weight of the armature 24 would not be sufficient to overbalance the weight of the detent 20, hence it would not immediately raise the detent out of its latching position. However, the slowly flowing liquid in the tube would now flow back toward the armature end of the tube until its added weight would overbalance that of the detent, thus raising the latter out of engagement with the gear 18. By using a sticky liquid, the time required for it to move the detent may be made considerably greater than the ordinary interval between the successive dots and dashes in a wireless message, so that the magnet will again and again be energized before the detent has been raised, thereby holding the tuning apparatus in a fixed position until the message has been completed.

It will be obvious that with the arrangement just described, the tune-varying coil and condenser will be automatically adjusted by the first wireless wave to which the circuit including this apparatus is responsive. However, this adjustment may only be approximate and not so accurate as to insure best results with the receiving apparatus used. I therefore preferably provide a manual adjustment by which the operator can give the tune-varying apparatus a further and more delicate adjustment; as by turning the knurled nut 13, which will rotate the cylinder 3 slightly while the shaft 10 is held rigidly through the action of the detent 20 on the gears 17 and 18.

Instead of depending upon a sluggish liquid to provide the desirably slow releasing of the detent, whereby the latter is held in engagement for a predetermined interval of time, this time interval may be provided by using a thermal circuit-controller for the stop magnet 23, as shown in Fig. 5. In this case the relay 28, actuated by a wave-responsive device such as a detector 27, closes a battery circuit 29 through a heating coil 30, which is made of fine enameled wire and sealed into the bulb 31 of a thermometer 32. When the circuit is thus closed, the heating of the wire 30 expands the mercury 33 in the bulb, causing the mercury to rise in the tube 34. In so doing, it closes the circuit 35, 36 of a battery 37 connected to the stop magnet 23′. Upon cessation of the impulse which actuated the relay 28, the current through the heating coil 30 will cease likewise, but the mercury expanded into the fine tube 34 will be slow in contracting sufficiently to cease contacting with the wire 35; hence the detent will be held in latching engagement with the varier for a sufficient interval of time to enable a succeeding wireless impulse to again actuate the relay 28 and the heating coil 30. When the receivable message is ended, the mercury will gradually recede from the tube 34, breaking the circuit to the magnet 23 and releasing the detent; whereupon the tuning apparatus will resume its round of inductance- and capacity-varying until checked by an impulse stopping it in the position where it attunes the circuit to the next message.

If the apparatus is to be used when an operator is on duty, the timing device may not be needed. In this case I provide a simple pawl 38 which will hold the detent 20′ in the latched position until the operator has recorded the message.

While I preferably rotate the inductive coil of my apparatus and vary the connections by having a brush contact with spirally disposed bare spots on the surface of the coil, I do not wish to be limited to this particular construction, as various other methods could be used for varying the number of turns of the inductive coil which are included in the circuit. For instance, the coil may have a single row of bare spots arranged parallel to the axis (as at 39 in Fig. 7), in which case the contact can be made by reciprocating a brush 40. This may be done by meshing a pinion 47 with a gear 41 on the driving shaft 42, mounting a crank 50 on the same shaft 49 with the pinion, and connecting this crank 50 by a pitman 51 to the brush 40.

Instead of using a clock or motor as the driving mechanism, the varier of my invention may be driven by a weight, as in Fig. 6, where the weighted arm 44 carries a pawl 45 engaging a ratchet wheel 46. Upon raising the weighted arm, its weight will turn the ratchet wheel 46 and the shaft 42 to which the ratchet 46 is fastened, thereby rotating the gears 41 and 47, thus rotating the crank 50 and moving the brush 40 back and forth along a guide rod 48. In this way the operator can rapidly oscillate the varier through its entire range so as greatly to reduce the time required for finding the position in which the tuning apparatus brings the circuit of which it forms a part, into resonance or syntonism with the wireless waves.

While I have shown the device of my invention as simultaneously varying the inductance of a rotating coil and the capacity of a condenser connected to the coil, I do not wish to be limited to this particular application, as the same combination of a wave-responsively actuated detent (which detent is quick in acting but slow in releasing) may be applied to other types of apparatus for continuously varying the resonance or oscillation-responsiveness of a circuit; *i. e.* to any apparatus by which a circuit may be made successively responsive to, or brought into syntonism with, oscillations of widely varying periodicity. Nor do I wish to be limited to a tuner for receiving apparatus, as it will be evident that the device of my invention can be used for adjusting the resonance of a circuit regardless of whether or not this is a receiving circuit. So also, I do not wish to be limited to apparatus in which the wave-responsive device is actuated by a wireless impulse emanating from a distant point, as it will be evident that the source of this impulse could be near to my tuning apparatus without departing from the spirit of my invention. Neither do I wish to be limited to the particular forms of manual adjustment, latches or other details shown by me, as numerous modifications could be made in the same without departing from the spirit of my invention.

What I claim as new and desire to cover by Letters Patent is:

1. Wireless tuning apparatus, including a rotatable inductance coil having bare spots helically disposed on the exterior of the coil, a stationary contact brush adapted to contact successively with the bare spots on successive turns of the coil as the latter is rotated, a shaft for the said coil, and an adjustable connection between the said coil and the said shaft.

2. Wireless tuning apparatus, including an inductance coil, a brush adapted to contact with the exterior of the coil, power-actuated mechanism for continuously and reciprocatingly shifting the point of contact between the brush and the coil to vary the inductance of the coil, a detent for halting the said mechanism, and manual means for shifting the said point of contact when the said mechanism is halted.

3. Wireless tuning apparatus, including a rotatable inductance coil having bare spots helically disposed on the exterior of the coil; a stationary contact brush adapted to contact successively with the bare spots on successive turns of the coil as the coil is rotated; mechanism for rotating the said coil, a detent for halting the said mechanism, and manual adjusting means for moving the said coil with respect to the said mechanism when the latter is halted.

4. Wireless tuning apparatus, including a rotatable inductance coil having bare spots helically disposed on the exterior of the coil, a stationary contact brush adapted to contact successively with the bare spots on successive turns of the coil as the latter is rotated, a shaft for the said coil, an arm carried by the said shaft and rigid therewith, and an adjustable connection between the said arm and the said coil.

5. Wireless tuning apparatus, including an inductance coil, a brush adapted to contact with the exterior of the coil, and power actuated mechanism for continuously and reciprocatingly shifting the point of contact between the brush and the coil, thereby varying the inductance.

6. Wireless tuning apparatus, including a rotatable inductance coil having bare spots helically disposed on the exterior of the coil, a stationary contact brush adapted to contact successively with the bare spots on successive turns of the coil as the coil is rotated, and means for rotating the said coil.

7. Wireless tuning apparatus including an inductance coil having bare spots helically disposed on the exterior of the coil; a contact brush; the said coil and brush relatively rotatable, the brush adapted to contact successively with the bare spots on successive turns of the coil upon relative rotation of the coil and brush; and means for effecting said relative rotation.

8. Wireless tuning apparatus including an inductance coil having bare spots helically disposed on the exterior of the coil; a contact brush; the said coil and brush relatively movable, the brush adapted to contact successively with the bare spots on successive turns of the coil upon relative movement of the coil and brush; and means for effecting said relative movement.

9. Wireless tuning apparatus including an inductance coil having bare spots helically disposed on the exterior of the coil, a stationary contact brush adapted to contact successively with the bare spots on successive turns of the coil as the coil is rotated; a

sectional condenser, connections from the successive sections of the said condenser to successive portions of the coil, and means for rotating the said coil.

10. Wireless tuning apparatus including an inductance coil having bare spots helically disposed on the exterior of the coil; a contact brush; the said coil and brush relatively rotatable, the brush adapted to contact successively with the bare spots on successive turns of the coil upon relative rotation of the coil and brush; a sectional condenser, the sections thereof connected to successive portions of the coil; and means for effecting said relative rotation.

11. Wireless tuning apparatus including an inductance coil having bare spots helically disposed on the exterior of the coil; a contact brush; the said coil and brush relatively movable, the brush adapted to contact successively with the bare spots on successive turns of the coil upon relative movement of the coil and brush; a sectional condenser, the sections thereof connected to successive portions of the coil; and means for effecting said relative movement.

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