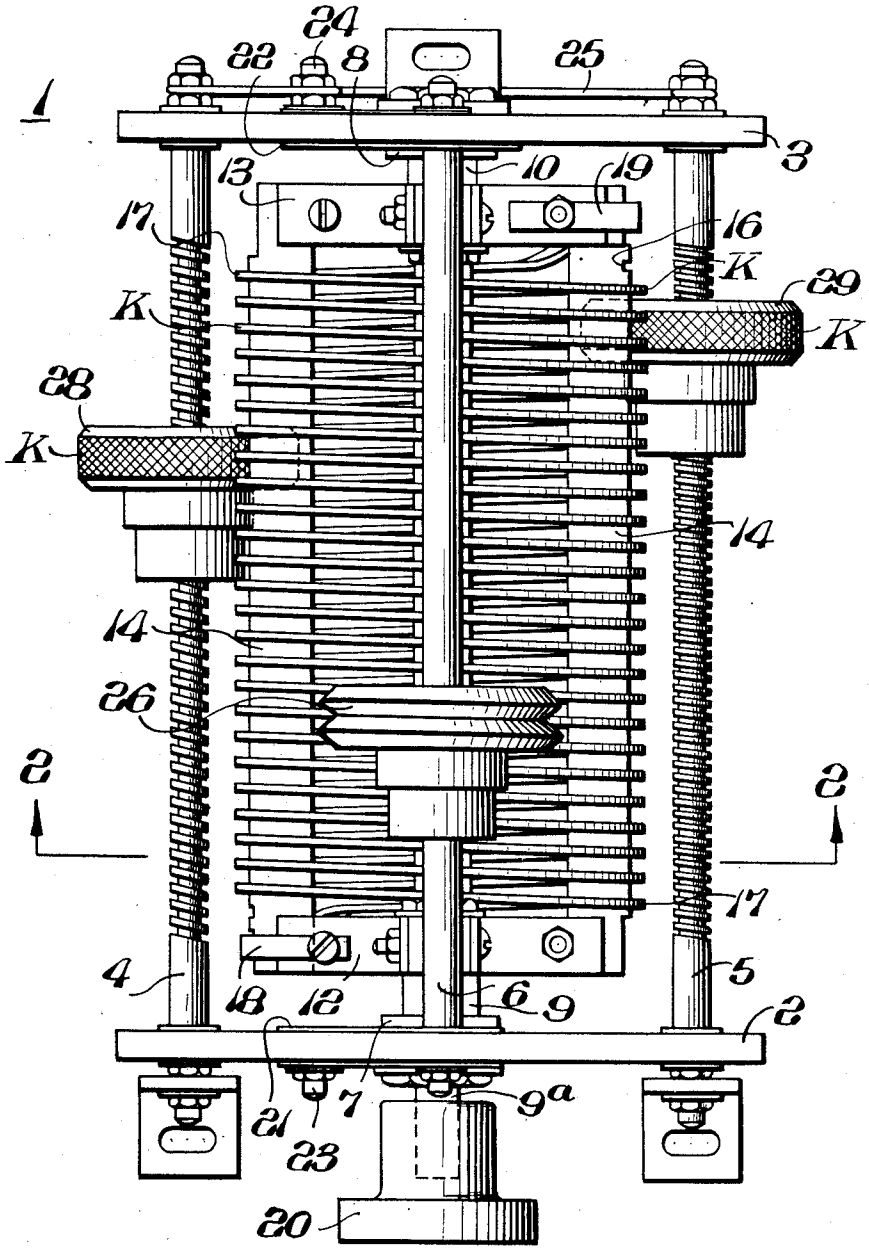
Oct. 12, 1943. D. H. VANCE 2,331,522

CONTINUOUSLY VARIABLE INDUCTANCE DEVICE

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Fig. 1.



Inventor

DONALD H. VANCE

By

Attorney

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Fig. 2.

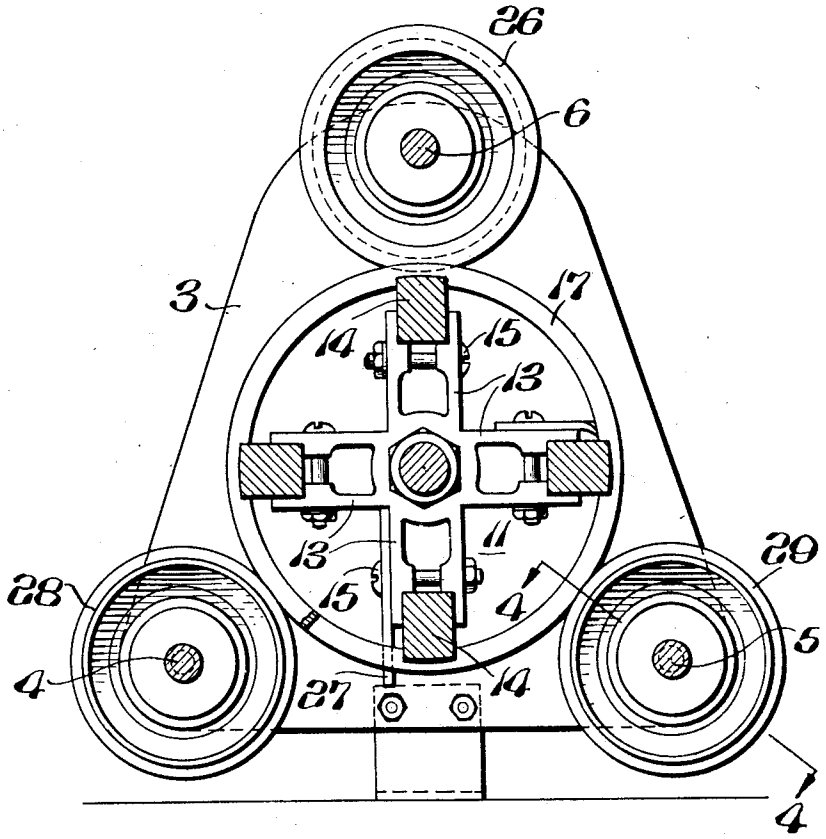


Fig. 3.

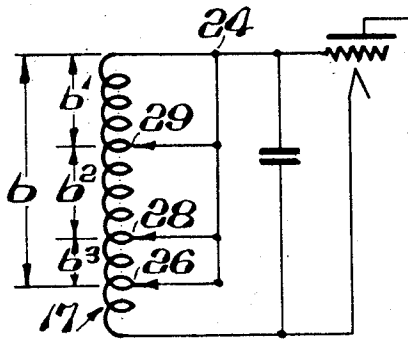
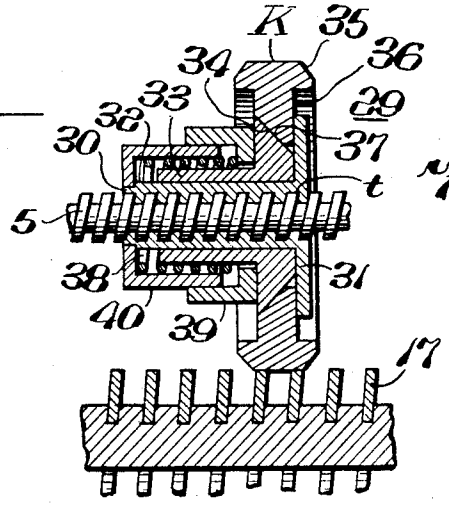


Fig. 4.



Inventor

DONALD H. VANCE

By

Attorney

Patented Oct. 12, 1943

2,331,522

UNITED STATES PATENT OFFICE

2,331,522

CONTINUOUSLY VARIABLE INDUCTANCE DEVICE

Donald H. Vance, Philadelphia, Pa., assignor to Radio Corporation of America, a corporation of Delaware

Application September 30, 1941, Serial No. 413,068

3 Claims. (Cl. 171—242)

This invention relates to variable inductance devices for use in the frequency determining or "tank" circuit of a radio transmitter or like signaling apparatus, and has for its principal object to provide an improved continuously variable inductor incorporating means for reducing or preventing the absorption of power in the unused portion of the inductor.

Another and related object of the invention is to provide a simple and trouble-free means for detuning the unused portions of the variable inductor of a tank circuit, by shorting it in a number of places to prevent power-absorbing parallel resonance, within the desired frequency band.

The foregoing and other objects are achieved in accordance with the invention by the combination with a space wound coil of a plurality of tap means movably mounted in short-circuiting relation with respect to different turns of said coil, and means for simultaneously moving said tap means at different rates along the said coil.

Certain details of construction together with other objects and advantages will be apparent and the invention itself will be best understood by reference to the following specification and to the accompanying drawings, wherein

Figure 1 is a top plan view of a continuously variable inductor which is provided, in accordance with the invention, with a plurality of continuously and relatively movable taps or trolleys.

Figure 2 is a transverse sectional view taken on the line 2—2 of Fig. 1,

Figure 3 is a circuit diagram which will be referred to in explaining the electrical connections for the device of Fig. 1,

Figure 4 is a fragmentary sectional view taken on the line 4—4 of Fig. 2 showing the details of a preferred form of trolley.

In the drawings, wherein like reference characters designate the same or corresponding parts in all views, 1 designates generally a chassis or frame having a front and rear insulating panel 2 and 3, respectively, which are maintained in spaced rigid relationship by a pair of threaded metal rods 4 and 5 which are fixed to the panels adjacent their base, and a third preferably unthreaded metal rod 6, which is centrally disposed between the two panels adjacent the top of the frame.

Journalled for rotation in bushings 7 and 8 in the panels 2 and 3 are two metal stub shafts 9 and 10, respectively, which support a coil form indicated generally at 11 (Fig. 2). This coil form may comprise a front and a rear group of four bifurcated arms 12, 13, respectively, which extend radially from the stub shafts 9 and 10 upon which they are respectively mounted. The arms 12 and 13 are aligned one with the other and each pair of arms supports an insulating spacer bar 14 which is clamped rigidly in the bifurcated ends by bolts 15. Each spacer arm is provided with lateral grooves 16 (see Fig. 1) on its exposed outer surface in which a wire or ribbon-like conductor 17 is spirally wound, edgewise. The opposite ends of this coil are fixed, as at 18, 19, respectively, to the oppositely located bifurcated sets of crossed arms 12 and 13. The coil form has an axis of rotation which coincides with the common axis of the stub shafts 9 and 10 and may be rotated thereabout as by means of an insulating control knob 20 which is fixed on an extension 9a of the stub shaft at the front of the chassis.

Since the cross arms 12 and 13 are of metal and are supported on the metal stub shafts 9 and 10 which are journalled for rotation in the metal bushings 7 and 8, it is apparent that electrical connections may be made to the exterior of the panels 2 and 3, irrespective of the "setting" or angle of rotation of the coil form. Such electric connections are conveniently established by means of metal strips 21 and 22 which extend along the opposite faces of the front and rear panels to the binding posts 23 and 24, respectively. For a purpose later described, an additional strip or wire 25 is provided adjacent the rear surface of panel 3 for connecting the rods or shafts 4, 5 and 6 to the binding post 24. Thus, as in standard practice, a tap in the form of a grooved trolley wheel 26 which is mounted for slidable movement on the upper central rod 6 serves to variably adjust the electrically effective number of turns of the coil 17 upon rotation of the control knob 20. Thus, when the control knob 20 is rotated, the coil rotates in contact with the trolley 26 and, since the coil is spiral-wound, the said tap or wheel will be moved along the rod 6 in a direction determined by the direction of rotation of the coil. Thus, a maximum value of inductance may be achieved when the wheel 26 is moved to the rear of the coil and a minimum value of inductance when this wheel is at the front end of the coil. In order to halt the movement of the coil 17 when the wheel 26 reaches the ends of the coil, a stop 27 is provided on each of the sets of cross arms 12 and 13. As shown more clearly in Fig. 2 (which shows the rear stop 27), each stop may be in the form of a rigid metal strip fixed to the side of one of the

arms of the coil support, and which extends radially therebeyond. Thus, when the wheel 26 reaches an end of the rod 6, one or the other of the stops 27 is in the path of the said wheel and halts its movement as well as that of the coil.

The inductance unit as thus far described is of more or less standard construction and, in operation, may exhibit the disadvantages which the present invention is designed to overcome. That is to say, in the absence of the auxiliary tap means (hereinafter described), that portion of the coil which at any given moment is unused may absorb power from that portion of the coil which is in circuit and in certain cases (depending upon the electrical constants of the unused portion of the coil) set up disturbing electrical fields. To obviate this difficulty, the present invention provides a pair of auxiliary taps or trolleys 28 and 29 which are mounted upon the rods 4 and 5, respectively, in contact with different "trailing" turns of the coil. The treads of the wheels 28 and 29 are preferably wide enough to contact more than one turn of the coil. The rods 4 and 5, and the hubs of trolleys 28, 29 thereon, are provided with threads of different pitch. The pitch of these threads is preferably, but not necessarily, so calculated that these auxiliary trolleys, 28, 29, advance, respectively, two-thirds and one-third the number of turns the main trolley 26 advances. Since, as previously set forth, the rods or shafts 4, 5 and 6 upon which the trolleys 28, 29 and 26 advance are electrically connected by the wire or wires 25 to the common binding post 24, the unused portion *b* (see Fig. 3) of the coil 17 is broken up or "detuned" by the auxiliary taps 28 and 29 into small sections *b1*, *b2* and *b3* of very high (and hence undisturbing) self-resonant frequencies. This permits the design of a rotary inductance coil for use at low frequencies and over a wide range without disturbing power absorption due to so-called "back-end resonance."

As a practical matter, there may be some eccentric movement between the coil and the several taps or trolleys therefor. Accordingly, in carrying the invention into effect, it is preferable to employ a form of trolley incorporating a spring or the like for compensating for such eccentricity. The compensated trolley wheel 28 shown in section in Fig. 4 is claimed in copending application Serial No. 391,164, to Charles T. Cole, Jr., filed April 30, 1941, and comprises a hub 30 which may have a smooth bore or a threaded bore *t* (as shown) as determined by the type of shaft 5 upon which it is mounted, a head 31 integral with the hub, and a bearing surface 32 of reduced diameter upon which a sleeve 33 is slidably mounted. The sleeve 33 is provided with a conically tapered head 34 which extends outwardly therefrom at an angle with respect to the head 31 on the hub 30. The rim 35 which contacts the coil 17 is mounted in the space between the hub-head 31 and the sleeve head 34, and is provided on the one side with a conically tapered surface 37 which rides on the complementarily tapered surface 34 on the head of the sleeve 33. The tread 35 and the surface of the coil 17 against which it bears are preferably knurled, as indicated at *k*, to reduce or obviate slippage therebetween.

A coiled spring 38 arranged about the sleeve 33 and which is anchored adjacent the bearing end of the hub 30 exerts its force against the head of the sleeve and causes the tapered surface 34 thereon to bear against the tapered surface 37 of the rim 35. This serves to center the rim with respect to the axis of movement of the hub 30 and, in the event that the tread encounters any eccentricity in the rotation of the coil 17 about its axis, permits the rim 35 to be rotated off its normal center as long as the eccentricity is encountered. Where, as in the instant case, the spring 38 is constituted of steel, it is preferable to shield the spring from radio frequency voltages and to this end a "dust cap" comprising two oppositely located inwardly directed and interfitting cup-shaped elements 39, 40, respectively, surround the spring.

Other modifications of the invention, such, for example, as the use of more than two or less than two auxiliary taps, will suggest themselves to those skilled in the art. It will be understood, therefore, that the foregoing description of a presently preferred embodiment of the invention is to be interpreted as illustrative and not in a limiting sense except as required by the prior art and by the spirit of the appended claims.

What is claimed is:

1. In combination, a rotatable inductance coil, a plurality of conductive shafts extending axially of said coil and electrically connected one to the other, a tap mounted for longitudinal movement upon one of said shafts and arranged to be moved therealong in contact with said coil at a certain rate, a second tap mounted for longitudinal movement upon another of said shafts and arranged to be moved therealong in contact with said coil at a different rate, and means for simultaneously moving said taps along their respective shafts at said different rates.

2. The invention as set forth in claim 1 and wherein three shafts and three taps are employed, and wherein the rate at which one of said taps is moved along said coil is twice the rate of another tap and the rate at which said third tap is moved along said coil is three times that of said second-mentioned tap.

3. In combination, an inductance coil, a plurality of tap means mounted for movement in contact with said coil, and means for simultaneously moving said tap means along said coil in the same direction and at different rates whereby said coil is at all times effectively divided into a plurality of sections of different values of inductance.

DONALD H. VANCE.