Sept. 27, 1949. J. F. GORDON 2,483,197

VARIABLE INDUCTOR

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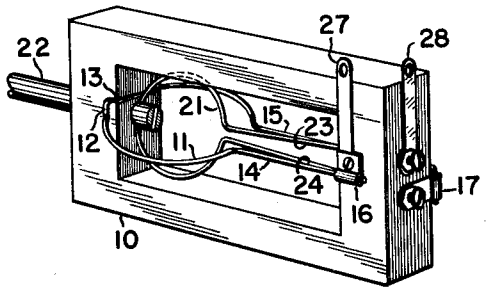


FIG. 1

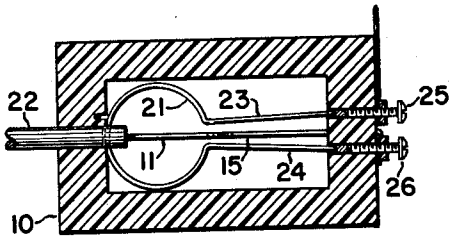


FIG. 2

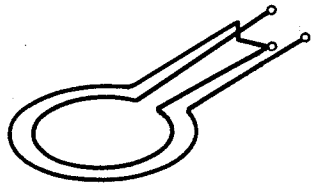


FIG. 3

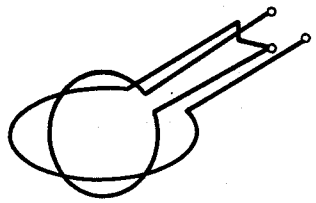


FIG. 4

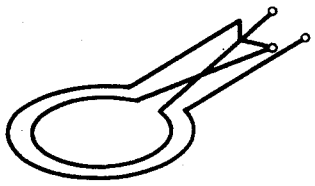


FIG. 5

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VARIABLE INDUCTOR

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8 Claims. (Cl. 171—242)

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This invention relates to variable inductors; more particularly to inductors adaptable to be used as tuning means at relatively high radio frequencies.

The innate structure of a variable capacitor makes it inadequate as a tuning means when relatively high radio frequencies are to be handled. The structure necessitates a sliding contact in which an unwanted, variable resistance becomes a part of the tank circuit. The necessarily frail and eccentric nature of a tuning capacitor makes it readily subject to undesired movement resulting from shock or vibration.

When a desired tuning range within a high radio frequency band is accomplished by capacitor tuning, the value of the capacitance must be somewhat greater than the value desired for proper L-C ratio, in which a minimum of capacitance is desired.

The accuracy requirements together with the manner of construction of the variable capacitor are factors which increase the cost of their manufacture. The small, trimming capacitor which may be required for use with a variable inductor, such as is disclosed herein, requires comparatively less expense.

An object of this invention is to provide a variable inductor adaptable as a tuning means at high radio frequencies.

Another object of this invention is to provide a tuning means which provides a relatively large tuning range within a high radio frequency band.

Another object of this invention is to provide a high radio frequency tuning means which is not microphonic.

A further object of this invention is to provide a means for tuning at high radio frequencies whereby the detrimental effects of vibration and shock are very small.

Still another object of this invention is to provide a variable inductor, adaptable as a high radio frequency tuning means, whose physical size and space requirements are relatively small.

Yet another object of this invention is to provide a high radio frequency tuning means which can be constructed with few parts at little expense.

There are other ways of varying the inductive elements of a tank circuit used with high radio frequencies than that disclosed herein. One prevalent system involves the variation of the size of the inductive loop by changing the position of a shorting bar. Such a system requires considerable space and necessitates two sliding contacts. Another method, involving the slug tuning of a small inductor, often presents such unwanted results as microphonics and the lowering of the "Q" of the circuit.

In the instant invention, the variation of inductance by changing the relative relation of two concentric, single-turn, series-connected loops in

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the manner depicted proves to be quite satisfactory as to size, "Q", lack of microphonics, cost, and simplicity of construction.

Other objects and advantages will be apparent from a consideration of the following specification when taken in conjunction with the accompanying drawing, in which,

Fig. 1 is a view in perspective of an embodiment of the invention,

Fig. 2 is a cross-sectional view of the embodiment of Fig. 1 with the cross-section taken along the median plane of the member 10 of that figure,

Fig. 3 is a schematic diagram in perspective of the electrical components of the invention so positioned as to provide maximum inductance,

Fig. 4 is similar to Fig. 3 except that the position of the components is such as to provide an intermediate value of inductance, and,

Fig. 5 is similar to Fig. 3 except that the positioning provides minimum inductance.

Referring now more particularly to the drawing, there is shown in Figs. 1 and 2 a rectangular frame member 10 of suitable insulating material in which is supported a stationary one-turn loop 11. The apex of this loop is deformed at 12 into an offset of rectangular shape which is supported in a slot 13 formed in the adjacent end of the member 10 and offset from the longitudinal axis of symmetry of the member. The ends of the loop terminate in elongated legs 14 and 15, the ends of which are conductively secured to terminals 16 and 17, respectively, the terminals being attached to the remaining end of the member 10.

Supported also in the member 10 is a rotatable loop 21. This loop is of similar shape to the loop 11, but smaller, and is supported concentrically therewith. The apex of the loop is carried in a slot formed in the end of a shaft 22 which extends from outside the member 10 through the adjacent end of the member, and along the axis of symmetry thereof. The ends of the loop 21 terminate in elongated legs 23, 24, the ends of which are shaped to form pivot points and are carried in bearing sockets formed in the ends of set screws 25 and 26, as better shown in Fig. 2. The set screws are parallel to the axis of symmetry of the member 10 and their axes lie in the median plane of the member.

The terminal 17 is conductively connected to both the leg 15 of loop 11 and the set screw 26, as shown in Fig. 1, thus connecting the two loops in series. Soldering connectors 27 and 28 are conductively connected to the terminals 16 and the set screw 25.

The rotatable loop 21, at least, is intended to be formed of some very resilient material such as phosphor bronze or beryllium copper. In its position of rest, as shown in Figs. 1 and 2 this loop should be held in a state of compression between the set screws 25 and 26 and the shaft 22.

In operation, tuning is accomplished by rotation of the loop 21 about the axis of symmetry of the member 10. This is accomplished by rotation of the slotted shaft 10 which turns the loop, the legs 23 and 24 being twisted about their ends which are at all times retained in their bearing sockets in the ends of the set screws. They are enabled to be retained in the sockets during the application of maximum twist due to the compressive stress applied to the loop in the condition of rest. Rotation of the loop 21 varies the inductive coupling between it and the loop 11 as in a variometer.

As shown in Figs. 1, 2 and 4, the loop 21 is in a state of rest and the inductive coupling between the loops is at an intermediate value. Rotation of the shaft 22 in a counter-clockwise direction will increase the inductive coupling until a condition of maximum coupling is reached when the loops are oriented as shown in Fig. 3. Rotation of the shaft in the clockwise direction will decrease the coupling until a condition of minimum coupling is reached when the loops are oriented as shown in Fig. 5.

If desired, two of these units may be ganged. For this purpose the shaft 22 may enter the member 10 from the end carrying the terminals and terminate in the end adjacent the apices of the loops. It is, of course, not necessary that the shape of the frame 10 be restricted to a rectangle as other shapes will serve.

It has been found that a tuner constructed in accordance with the invention for frequency modulation would stay tuned to a station for several days without requiring retuning and that readjustment to a previous setting could be made with ease and accuracy. Uniformity in production can be easily accomplished. The tuning curve is substantially straight line.

What is claimed is:

1. A variable inductor comprising a pair of conductors each shaped to form a single turn open loop, said loops being of different sizes, means insulatingly supporting said loops in concentric relation with each in symmetry about a common axis passing through its center and open portion, the inner of said loops terminating in elongated portions extending in substantial parallelism, said supporting means supporting the ends of said elongated portions and constraining them against lateral movement while permitting each to rotate about its axis, and means engaging the inner of said loops for rotation thereof, about said axis of symmetry, said conductors being serially connected.

2. A variable inductor comprising an insulating supporting means, a conductor shaped to form a first single turn loop having each of its ends led to a terminal member, said loop being non-rotatively supported by said supporting means, a second conductor shaped to form a second single turn loop having each of its ends terminating in an elongated portion, said portions extending in substantial parallelism and being spaced from each other, said supporting means supporting the apex of said second loop and the ends of said portions so that said loops are concentric, the ends of said portions being supported in a manner allowing each to be freely rotated about its axis, means engaging the apex of said second loop for rotation thereof with respect to said first loop about an axis passing through the common center of said loops and constituting an axis of symmetry of said portions, means conductively joining one of said portions to one of said terminal members and a separate terminal member connected to the other of said portions.

3. A variable inductor comprising a conductor shaped to form a first single turn open loop, a second conductor shaped to form a second single turn open loop smaller than said first loop, the ends of said second loop being extended into a pair of elongated spaced portions, means insulatingly supporting said conductor in a manner such that said loops are concentric and their open portions are symmetrical with respect to an axis passing through their common center, and the ends of said elongated portions are held against lateral movement but are rotatable about their respective axes, and means engaging the inner of said loops and operative to rotate it about said axis of symmetry, said conductors being serially connected.

4. A variable inductor comprising a conductor shaped to form a single turn open loop, a second conductor shaped to form a second loop smaller than said first loop, means insulatingly supporting said conductors in a manner such that said loops are concentric, the ends of said second conductor being led from adjacent points of said second loop as a pair of spaced elongated portions, said adjacent points and the open portion of said single turn loop being symmetrically arranged with respect to an axis passing through the common center of said loops, the ends of said elongated portions being held against lateral movement but being rotatable about their respective axes, and means engaging said second loop for rotation thereof about said axis of symmetry, said conductors being serially connected through one of said ends of said elongated portions.

5. A variable inductor as set forth in claim 4, said second conductor being formed of resilient material.

6. A variable inductor as set forth in claim 5, said supporting means having thrust bearings formed therein for the support of the ends of said elongated portions, said second loop when not rotated being held under compressional stress along said axis of symmetry.

7. A variable inductor as set forth in claim 4, said rotating means comprising a shaft extending along said axis of symmetry and mechanically coupled to the apex of said second loop.

8. A variable inductor comprising a pair of serially connected conductors, each shaped to form a single turn open loop having its ends formed into adjacent spaced elongated portions, means mounting said loops to lie in planes normal to each other and intersecting along a line passing through their centers and constituting an axis of symmetry with respect to the open portions of said loops, said loops being of different sizes, means holding the ends of the elongated portions of the inner of said loops against lateral movement, and means rotating said inner loop about said axis of symmetry, the serial connection of said loops extending between respective ends of said elongated portions of said loops.

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