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TUNABLE INDUCTOR

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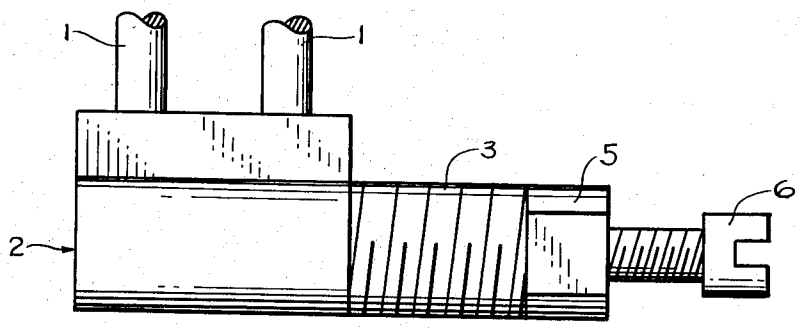


FIG. 1

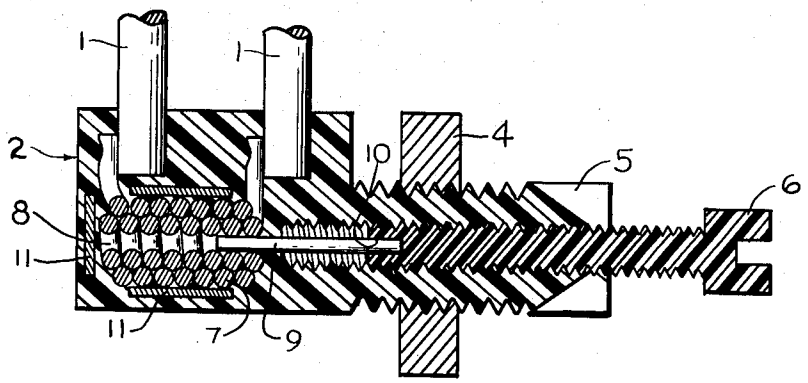


FIG. 2

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TUNABLE INDUCTOR

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The present invention relates to a new and novel construction of tunable inductor which will permit a greater range than is presently obtainable in devices of this category.

It has heretofore been customary in tunable inductances of this type, to wind the inductance member on a hollow cylindrical form which supports the winding. The tuning has been accomplished by the longitudinal displacement of a powdered iron or ceramic core within the cylindrical form. The quality factor or Q of this structure is quite low because of the large spacing between the magnetic material and the inductance winding. The cylindrical form which was located in this spacing, was essential in order to provide support for the winding.

Most of the presently available tunable inductors are not sealed and will become permanently locked and fixed in value when imbedded in an encapsulating compound. Even when elaborate sealing techniques are employed to prevent leakage of the encapsulant into the structure, the encapsulant generally changes the value of the inductance by changing the magnetic or dielectric properties in external contact with the inductance.

The structure in the present invention uses an encapsulating compound to support the inductance winding while simultaneously providing a completely enclosed shell which inherently provides a leakproof seal around the part of the device which is customarily encapsulated, thereby preventing possible leakage of encapsulant into the structure.

The encapsulating compound used to form the inductance structure can be the same as the encapsulant used in potted assemblies and thereby can yield homogeneity to the medium surrounding the inductance, thereby eliminating changes in value of inductance caused by system encapsulation.

The principal object of this invention is to provide a novel construction of tunable inductor which yields equivalent performance in terms of Q, to present designs, yet may be reduced in size to one tenth or less of the volume of presently available devices of this type.

Another object of this invention is to provide a basic construction of tunable inductor which inherently contains a greater tuning range than presently available types.

Still another object of the invention is to provide a construction of tunable inductor which is capable of being designed so as to have a constant Q over a great percentage of the tuning range.

Still another object of the invention is to provide a novel construction of tunable inductor which yields superior performance in terms of Q when constructed in a conventional size.

A further object of the invention is to provide a novel construction of tunable transformer which may have a higher Q and higher coupling coefficient as well as extended range over conventional transformers.

Generally, the present invention exploits a basic principle involving inductors which has either been unknown or has been heretofore unexploited. This principle deals with the fact that the Q factor of core type tunable inductances is most strongly dependent upon the ratio of core material to the air gap inside the coil. If the air

space is minimized, the Q is not strongly dependent upon wire size or core diameter. Therefore the present invention eliminates most of the air space commonly employed in a tunable inductance by utilization of a novel geometry.

The present improvement makes possible an initimate contact between the inductance wires and the magnetic core which virtually eliminates air spaces and thereby maintains a high Q irregardless of wire diameter.

The invention will best be understood from a consideration of the following detailed description taken in connection with the accompanying drawing, forming a part of this specification, with the understanding that the invention is not confined in any strict conformity with the showing of the drawing but may be changed and modified so long as such changes and modifications mark no material departure from the salient features of the invention as expressed in the appended claims.

In the drawing:

FIGURE 1 is a side elevation of the device.

FIGURE 2 is a side elevation in section of the device.

Referring now to the drawing, an encapsulated tunable inductor is shown in FIGURE 1, details of which are shown in FIG. 2. Basically, the inductor comprises four main parts: molded plastic housing 2, winding 7, tuning slug 9, and plastic adjusting screw 6. Housing 2 has therein a centrally located cylindrical cavity 8 connected to the exterior of the housing by a threaded hole whose axis is colinear with the axis of cavity 8 and which receives screw 6 to seal the cavity from the exterior of the housing. The housing further includes threads 3 for engaging a mounting nut 4. A locking nut 5 is provided to lock adjusting screw 6 in position. Winding 7 is constituted by a plurality of helical turns of wire which define a cylindrical coil having an outer surface in supporting engagement with the walls of the housing defining the cylindrical cavity. The term "supporting engagement" is used to describe the fact that the housing is molded around the exterior of the coil in such a manner that wires are a part of the wall structure of the cavity, and thus the housing mechanically supports each turn of the coil eliminating the need for the tuning slug to provide any rigidity to the coil.

The cylindrical coil also has an inner surface which is of such diameter relative to cylindrical slug 9 that the latter is axially slidable on the coil. Slug 9 extends axially out of the coil towards screw 6 which is threaded into the threaded hole and which has, in the end thereof facing the slug, a counterbored recess 10. The slug is rigidly attached to the screw by snugly fitting the end of the slug extending beyond the coil into the recess. In this manner rotation of screw 6 imparts axial movement to the slug relative to the coil so that the inductance of the coil can be adjusted

When an extremely high Q is desired, magnet members 11 may be located at the axial end of the coil remote from the end from which the slug extends; and may also surround the coil as shown in the drawing. When magnetic members 11 are not employed, the close proximity of the magnetic element 9 with the inductance member 7 permits a relatively high maximum inductance when the adjustment screw is set at maximum value. When the adjustment screw is moved to minimum value, however, the diameter of the inductance member is so infinitesimal, that the value of the inductance is barely measureable.

By having the magnetic element 9 inserted into a cavity 10 of the adjustment screw 6, it is possible, by proper selection of material, to obtain a constant Q over a large tuning range.

What I claim as my invention is:

1. An encapsulated tunable inductor comprising:

(a) a plastic housing having a centrally located cylindrical cavity therein connected to the exterior by a threaded hole whose axis is colinear with the axis of said cavity;

(b) a winding with a plurality of helical turns of wire defining a cylindrical coil having an outer surface and an inner surface, said winding being contained in said cavity with said outer surface in supporting engagement with the surface of said housing defining said cylindrical cavity;

(c) a tuning slug mounted in said coil for sliding engagement with the inner surface thereof, and extending beyond said coil into said threaded hole; and

(d) a plastic screw threaded into said threaded hole and rigidly connected at one end to the end of said slug that extends beyond said coil, the threaded engagement of said screw in said threaded hole serving to seal said cavity from the exterior of said housing.

2. An inductor in accordance with claim 1 wherein said screw is provided with an axial recess into which said slug fits and is rigidly connected to the screw so that rotation of the latter imparts axial movement to the slug relative to the coil.

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