June 9, 1942. F. BERGTOLD 2,285,798

ADJUSTABLE INDUCTANCE DEVICE

Filed Dec. 27, 1940

Fig. 2

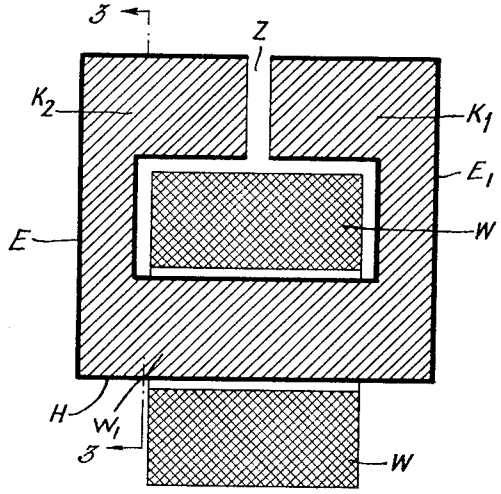


Fig. 1

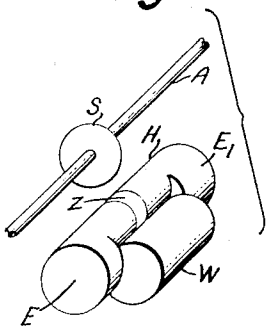
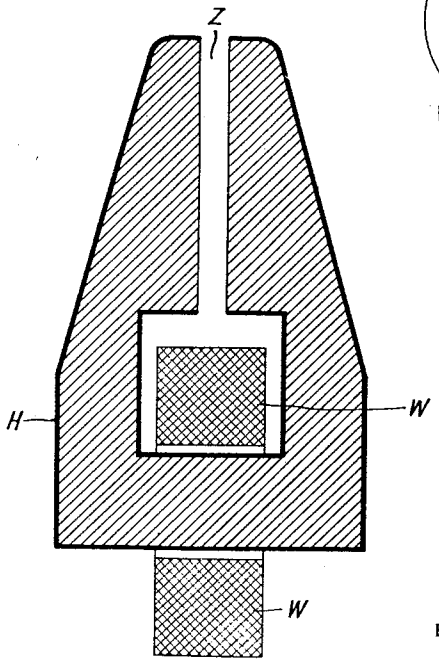


Fig. 4



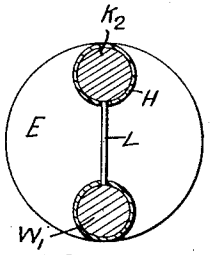


Fig. 3

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ADJUSTABLE INDUCTANCE DEVICE

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Application December 27, 1940, Serial No. 371,880
In Germany October 22, 1938

3 Claims. (Cl. 171—242)

The present application is a continuation-in-part of my co-pending application Serial No. 299,393, filed on October 13, 1939.

As explained in the co-pending application, it is known in the art to use ferro-magnetic materials for the purpose of guiding magnetic fields along desired paths. It is also known to demarcate magnetic fields by electrically conducting shields. It is moreover known in the art to guide electromagnetic radiations of ultra-high frequency in electrically conducting tubes, or pipes.

Guiding by ferro-magnetic substances often proves inadequate where radio frequency magnetic fields are dealt with, for the reason that the permeability of such substances is not very high. Cases are also met with in practice where any extensive use of such substances is prohibitive, say where frequencies amounting to several megacycles are involved.

According to the invention there is used for the guiding of alternating magnetic fields a tubular structure presenting at least one insulating joint extending substantially in the longitudinal direction of the field, while the field is in the interior of the said tubular structure. The interior of the tubular structure may be filled with ferro-magnetic material. Hence, as will be seen, an electrically conducting envelope, or casing, serves not merely as a shield or screen, but also for the guiding of the magnetic field. The conducting sheath, or envelope, surrounds the magnetic field in such a way that the inside cross-section of the tubular structure represents the cross-section of the field.

In the drawing:

Fig. 1 is a perspective view of a variable inductance embodying the invention,

Fig. 2 is a horizontal sectional view through the device of Fig. 1,

Fig. 3 is a vertical section taken along line 3 of Fig. 2, looking in the direction of the arrow,

Fig. 4 is a sectional view, similar to that shown in Fig. 2, showing an alternative embodiment.

Referring to the drawing, wherein like reference characters in the different figures designate similar elements, Fig. 1 shows a perspective view of the variable inductance device. The magnetic field, which is due to the current traversing the winding W, is guided by the conducting sheath, or envelope, H having a slot L. By the disc S, which consists of a material possessing high electrical conductivity, the field path as given by the envelope H in the gap Z may be blocked. The use of the sheath, or tubular structure H in this connection permits the inductance to be reduced to a large extent.

The tubular sleeve H, as shown in Fig. 2, is completely filled with a ferro-magnetic core. The winding W is wound around the leg W_1. The core sections K_1 and K_2 project from the cylindrical end pieces E_1 and E respectively. The gap Z is provided between the spaced ends of sections K_2 and K_1. The disc S, disposed on shaft A, as shown in Fig. 1, may be adjusted within the gap Z so as to vary the inductance within wide limits. As shown in Fig. 3, the longitudinal slot L extends substantially in the longitudinal direction of the magnetic flux originating in coil W. The adjustable member S is traversed by magnetic flux. The tubular structure, or sleeve, H guides the magnetic flux through the disc S. It will be understood that the ferro-magnetic core within the sleeve H substantially conforms to the shape thereof. The core sections K_2—K_1 are flat in the direction of the winding axis and broad at right angles thereto, so that there results a reduced axial length. All magnetic field lines pass through air gap Z, and have no stray action. In this way a wider range of control is attained.

However, in using this device in high frequency oscillatory circuits, the selectivity (absolute band width) is not constant throughout the tuning frequency range. The high frequency iron core is, therefore, given such high losses that, in order to obtain constant selectivity, the inductance increases in the same degree as the total loss resistance of the oscillatory circuit.

It is preferable to have the losses of the coil W substantially in the iron core, and only a small part of such losses in the coil proper. This can be achieved, for instance, by employing high frequency iron having a very high permeability, for example 200 to 500, and relatively high losses. The high permeability entails a coil having but few turns, and which can be wound from a high frequency litz wire with a large total cross-section of the litz wire. In view of the fact that the coil W is magnetically shielded from the iron core, the losses of the coil can be reduced still further. It will now be seen that the core provides sufficiently high losses so that the ratio of inductance and resistance of coil W is maintained substantially constant over the tuning range of a circuit employing the variable inductance.

In Fig. 4 there is shown a structure in which the tubular sleeve H is made of large cross-section at gap Z. The sleeve has outwardly flared ends; the same slot L is to be understood as ex-

tending in the longitudinal direction of the magnetic flux. For given mechanical tolerance limits, this is conducive to greater precision in the adjustment of the inductance.

What is claimed is:

1. In a variable high frequency inductance device adapted to be used as a tuning means for a high frequency oscillatory circuit providing substantially constant selectivity over a range of frequencies, an inductance coil, an adjustable member for varying the inductance of said coil, said member being traversed by magnetic flux originating in the coil, a substantially tubular structure for guiding said flux through said member, said tubular structure being composed of material having high electrical conductivity and having at least one slot formed therein and extending substantially in the longitudinal direction of the magnetic flux, the tubular structure being formed so that its two ends face each other and form a gap for receiving the adjustable member, and a ferro-magnetic core for said coil mounted within said tubular structure and substantially conforming to the shape thereof, said core being adapted to provide sufficiently high losses so that the ratio of inductance and resistance of said coil is maintained substantially constant over said tuning range.

2. In a variable high frequency inductance device adapted to be used as a tuning means for a high frequency oscillatory circuit providing substantially constant selectivity over a range of frequencies, an inductance coil, an adjustable member for varying the inductance of said coil, said member being traversed by magnetic flux originating in the coil, a substantially tubular structure composed of material having high electrical conductivity passing through said coil for guiding said flux through said member, said tubular structure having outwardly flared ends and at least one slot formed therein and extending substantially in the longitudinal direction of the magnetic flux, the tubular structure being formed so that its two ends face each other and form a gap for receiving the adjustable member, and a ferro-magnetic core for said coil mounted within said tubular structure and substantially filling the same, said core being adapted to provide sufficiently high losses so that the ratio of inductance and resistance of said coil is maintained substantially constant over said tuning range.

3. In a variable high frequency inductance device adapted to be used as a tuning means in a high frequency oscillatory circuit providing substantially constant selectivity over a range of frequencies, an inductance coil, an adjustable member for varying the inductance of said coil, said member being traversed by magnetic flux originating in the coil, a C-shaped tubular structure composed of material having high electrical conductivity passing through said coil for guiding said flux through said member, said tubular structure having outwardly flared ends and an insulating break extending substantially in the longitudinal direction of the magnetic flux, the tubular structure being formed so that its two ends face each other in substantial registration and form a gap for receiving the adjustable member, and a ferro-magnetic core for said coil within said tubular structure and substantially filling the tubular structure, said core being adapted to provide sufficiently high losses so that the ratio of inductance and resistance of said coil is maintained substantially constant over said tuning range.

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