Jan. 7, 1941. N. M. RUST 2,227,846

HIGH FREQUENCY COIL

Filed April 24, 1936

Fig. 1

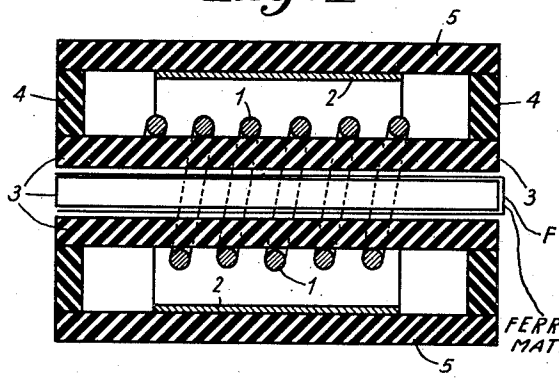


Fig. 2

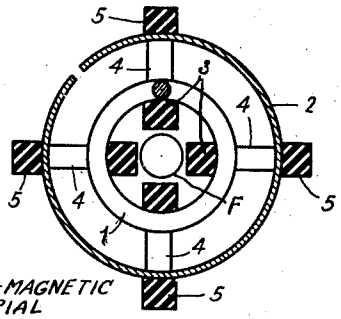


Fig. 3

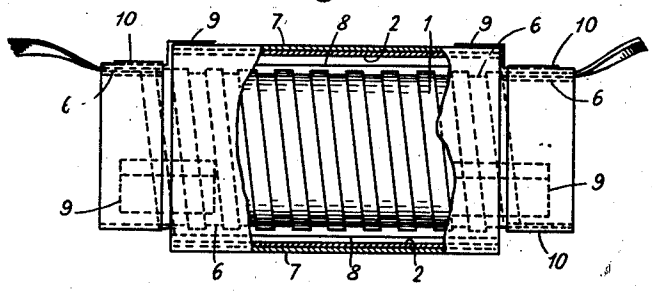


Fig. 4

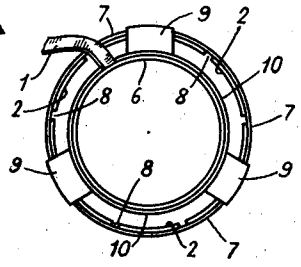


Fig. 5

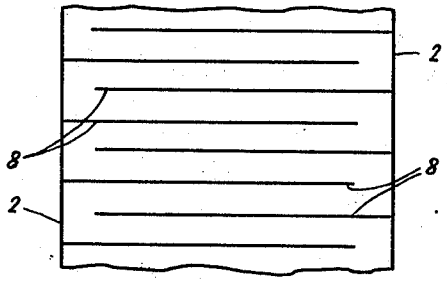


Fig. 7

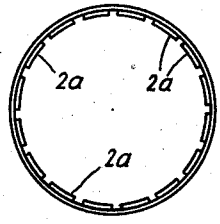
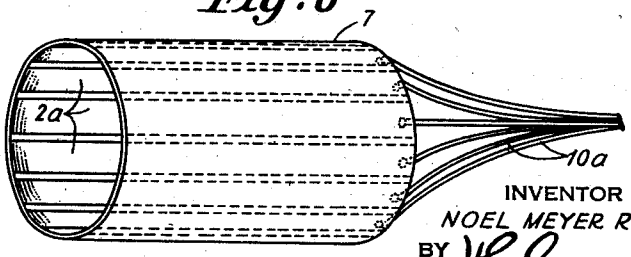


Fig. 6



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HIGH FREQUENCY COIL

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Application April 24, 1936, Serial No. 76,122
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5 Claims. (Cl. 171—242)

This invention relates to coil constructions for use in electrical high frequency circuits and to circuit arrangements incorporating the same.

An important object of the invention is to provide improved quarter wave and half wave length coil constructions which shall be very cheap, light, and of low losses and which can be made directly self-supporting, i. e. without needing terminals or mountings. Where terminals or mountings are provided they are arranged to be out of the field of the coil.

According to this invention a coil structure for use as a resonant device in high frequency electrical circuit arrangements comprises an inner conductive coil winding positioned within an outer conductive screen member and is characterized in that said winding and screen member are so constructed and supported that there is no solid dielectric material between the face of said winding presented to said screen member and said screen member.

The invention is illustrated in the accompanying drawing in which Fig. 1 is a longitudinal section of an improved coil construction of this invention; Fig. 2 is a cross-section of Fig. 1; Fig. 3 is an elevation of another construction of coil structure with part of the screen portion broken away to show its construction; Fig. 4 is an end view of Fig. 3; Fig. 5 is a developed view of part of the screen conductor; Fig. 6 is a perspective view of another modification of screen structure to be substituted for the screen structure shown in Figs. 3, 4 and 5; and Fig. 7 is an end view of Fig. 6.

Referring to Figs. 1 and 2 which are mutually perpendicular sectional views showing one form of construction in accordance with the invention, a quarter or half wave length coil construction comprises a helix 1 of solid conductive wire or strip e. g. copper, concentrically arranged within a split cylindrical member 2 of conductive material, e. g. copper foil. The helix is wound over parallel insulating support rods 3 which carry at or near their ends further radial insulating rods 4 which in turn carry additional insulating rods 5 running parallel to the axis of the helix and also parallel to the rods 3 over which the said helix is wound. The outer insulating rods 5 serve to support the split foil cylinder 2 which is positioned within the said outer rods 5 and may be struck or otherwise affixed thereto in any convenient manner. Since in this arrangement the supporting rods 3 for the helix are inside the turns thereof and the supporting rods 5 for the foil are outside the same, the insulating material of which those rods are constituted will substantially not be cut by the field between the helix and foil, and accordingly dielectric losses will to a great extent be reduced. It will be appreciated that the middle point of the helix of a half wave coil construction in accordance with the preceding description will be a potential node and accordingly it may be directly connected to the split cylinder of foil.

Referring to Figs. 3 to 5, the inner conductor of the line is in the form of a helix 1 of flat strip conductor wound upon and stuck to an inner approximately cylindrical former 6 of paper or the like impregnated and coated with a suitable insulating varnish. The former 6 is somewhat longer than the helix and extends beyond it at both ends. The screen conductor 2 is of copper foil and is stuck to the inside of an approximately cylindrical backing 7 also of paper impregnated with a suitable varnish. The screen conductor is split with a plurality of splits 8 running parallel to the axis of the whole structure, adjacent splits starting from opposite edges and extending rather less than the length of the screen. The said screen conductor is made by slitting a sheet of copper foil as shown in Fig. 5 and then bending it up into a cylinder, the edges, which are at right angles to the slits forming the circular edges of the bent-up cylinder. The conductor 2 with its outer backing 7 is pushed over the inner conductor 1 and former 6 and is held in place by strips 9 of fairly stiff, insulation impregnated or coated paper. The ends of the conductor 1 are brought out parallel to the axis and are held firmly by insulation coated or impregnated paper layers 10 which pass over the conductor 1 and also over the strips 9 and are stuck in position.

Figs. 6 and 7 are respectively a perspective view and an end view of a screen structure which may be substituted for that adopted in the coil structure shown in Figs. 3 to 5. In Figs. 6 and 7, the screen is in the form of a number of copper foil strips 2a stuck to the inside of an insulation impregnated or coated cylindrical backing 7. The copper strips may be earthed as shown in Fig. 6 by wires 10a leading out to a common point, or, instead of using wires the strips themselves may be extended beyond the backing and brought out to a common point in the same way as the wires 10a of Fig. 6.

It will be observed that in all the illustrated coil structures the inner conductor is above its insulating support, the face of said conductor presented to the screen being free of insulating

material and the outer conductor is inside its insulating support. Thus, the field between outer and inner conductors does not pass through any insulating material (other than air)—an important point for securing high efficiency in high frequency operation.

Quarter and half wave coil constructions in accordance with this invention and suitable for use in high frequency circuits can, if desired, be so arranged as to be variable for tuning purposes. For example, in the constructions of coil in accordance with this arrangement where there is an outer conductor or screen having a slit running along its whole length, means may be provided for increasing and decreasing the width of the slit for tuning purposes; or an auxiliary slotted inner cylinder F (slotted so as not to act as a short circuiting turn) may be arranged to be slid coaxially to an adjustable extent into the coil proper of the coil construction; or a block or cylinder of ferro-magnetic material may be arranged to be slid coaxially to an adjustable extent into the said coil proper; or an eddy current conductor may be arranged to be slid coaxially to an adjustable extent into the said coil proper. Another way of providing for tuning in the case of a half wave length coil construction is to connect a variable condenser across the ends of the coil proper; or to connect a variable condenser between one end of the coil proper and the outer conductor; or to connect variable condensers between each end of the coil proper and the outer conductor. Again tuning may be provided for by so constructing the coil proper that it can be subjected to concertina-like control action, that is to say, so that its pitch may be varied substantially without altering its diameter or its concentric arrangement within the outer conductor.

What is claimed is:

1. A low loss coil for use as a resonant device in a high frequency circuit comprising an inner conductive coil winding, a cylindrical conductive member located concentric with said conductive coil winding, self-supporting means for said coil winding including two groups of support members of insulating material located parallel to the axis of said coil, one of said groups located within said coil, the other group located outside of said cylindrical conductive member, radial spacing means interposed between each group of support members and located beyond the ends of said coil, said cylindrical conductive member positioned between the outside group of insulating members and said coil winding to provide an electrical field space between said coil and said cylindrical member which is free from solid material.

2. A low loss coil for use as a resonant device in a high frequency circuit comprising an inner conductive coil winding, a cylindrical conductive member having a longitudinal slot located concentric with said conductive coil winding, self-supporting means for said coil winding including two groups of support members of insulating material located parallel to the axis of said coil, one of said groups located within said coil, the other group located outside of said cylindrical conductive member, radial spacing means interposed between each group of support members and located beyond the ends of said coil, said cylindrical conductive member positioned between the outside group of insulating members and said coil winding to provide an electrical field space between said coil and said cylindrical member which is free from solid material.

3. A low loss coil for use as a resonant device in a high frequency circuit comprising an inner conductive coil winding, a cylindrical conductive member having a longitudinal slot located concentric with said conductive coil winding, self-supporting means for said coil winding including two groups of support members of insulating material located parallel to the axis of said coil, one of said groups located within said coil, the other group located outside of said cylindrical conductive member, radial spacing means located at both ends of said coil and radially with respect to said coil and interposed between said first and second groups of spacing members to provide an electrical field space between said coil and said cylindrical member which is free from solid material.

4. A low loss coil for use as a resonant device in a high frequency circuit comprising an inner conductive coil winding, a cylindrical conductive member having a longitudinal slot located concentric with said conductive coil winding, self-supporting means for said coil winding including two groups of support members of insulating material located parallel to the axis of said coil, one of said groups located within said coil, the other group located outside of said cylindrical conductive member, radial spacing means located at both ends of said coil and radially with respect to said coil and interposed between said first and second groups of spacing members to provide an electrical field space between said coil and said cylindrical member which is free from solid material, and a member of ferro-magnetic material arranged to slide coaxial to an adjustable extent within said coil winding to vary the tuning thereof.

5. A high frequency wave coil comprising a coil winding, a cylindrical conductive member concentric with said coil winding and having a longitudinal slot therein, a plurality of parallel arranged rods of insulating material positioned along non-adjacent surfaces of said coil and cylindrical member, radial spacing means interposed between said parallel arranged rods and located beyond the ends of said coil and cooperating with said coil, cylindrical member and parallel arranged rods to maintain said coil and said cylindrical member in position, whereby the space between the coil winding and the inside of said conductive member is void of solid material.

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