Sept. 10, 1929. N. MEDVED 1,727,932

RADIO COIL

Filed April 6, 1926

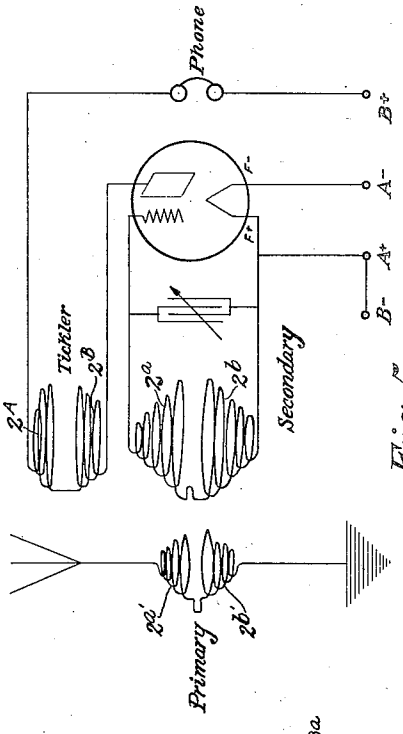



Fig. 5

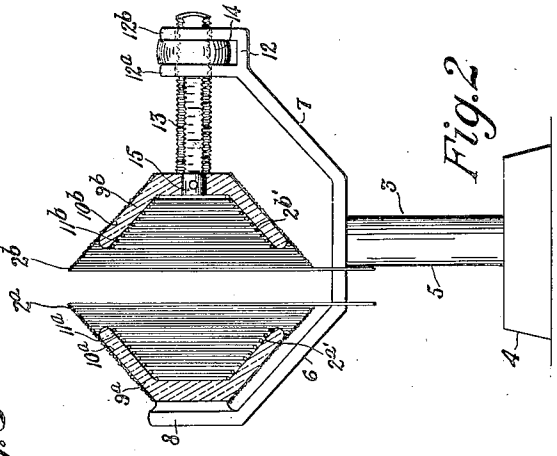


Fig. 2

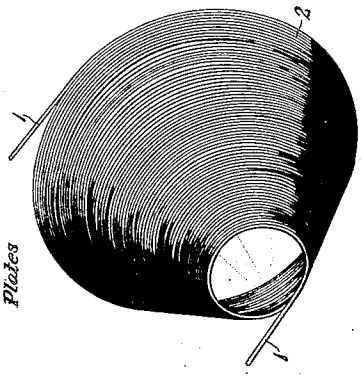


Fig. 1

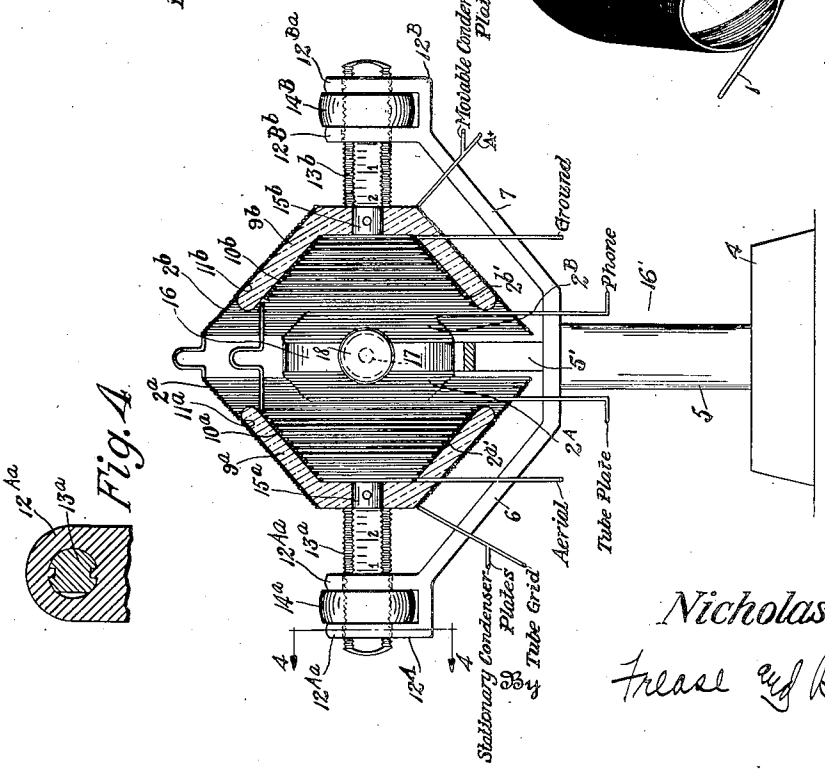



Fig. 3



Fig. 4

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# UNITED STATES PATENT OFFICE.

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## RADIOCOIL.

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The invention relates to coils for use in electrical circuits, and more particularly in radio circuits, in various arrangements such as in a three circuit tuner, or an antenna coil or radio frequency transformer; and the objects of the invention are to provide an improved coil construction which shall have a very limited external magnetic field and will consequently have but little mutual induction with other circuits, and will not be affected to any great extent by mutual induction from other circuits or sources, and will pick up very few strays or other disturbing fields.

A further object of the invention is to provide an improved radio coil which may be arranged for varying the electrical characteristics, that is to say, the resistance, induction and capacity of a radio circuit as desired; thereby enabling the balancing of the circuits, in for instance, a neutrodyne receiving set, so that signals from a station of a given wave length may always be received by setting the several dials of the set at the same calibrated points on the dial scales.

A further object of the invention is to provide a coil enabling, with a given antenna, a material increase in the wave lengths possible of reception by a given radio set, without switching in or out increases or decreases of antennæ, as heretofore required.

These and ancillary objects, which will be apparent to persons skilled in the art of alternating currents and particularly the alternating currents used in radio broadcasting and reception, are attained by the use in various arrangements hereinafter set forth of spirally wound conical coils.

Several embodiments of the invention are illustrated in the accompanying drawing, forming part hereof, in which

Figure 1 is a perspective view of one of the improved spirally wound conical coils;

Fig. 2, an elevation with portions in axial vertical cross section of a plurality of coils arranged for use for example as a variable radio frequency transformer or antenna coil;

Fig. 3, a side elevation with portions in axial vertical cross section of a plurality of improved coils arranged as a variable three circuit tuner;

Fig. 4, a transverse cross section thereof as on line 4—4, Fig. 3; and

Fig. 5, a circuit diagram illustrating the use of the improved coils arranged as the aforesaid three circuit tuner of Figs. 3 and 4 in a simple radio receiving circuit.

Similar numerals refer to similar parts throughout the drawings.

Referring to Figure 1, a conductor wire 1, is spirally wound to form a conical coil 2 including a plurality of successive turns 2—1, 2—2, 2—3, . . . 2—$n$, each turn having a different diameter than the next adjacent turns, and the plurality of successive turns determining a flaring and preferably conical surface.

The winding of the coil tube is preferably done upon a conical mandrel. After winding the coil upon the mandrel, material such as collodion is applied to structurally secure the turns of the coil to each other and to enable the removal of the spirally wound conical coil from the mandrel without damaging its conical shape.

Such spirally wound conical coils may be formed of wire such as, (1) bare wire, (2) Litzendraugh wire or (3) cotton covered or otherwise insulated wire. In the case of the use of bare wire the coils are wound upon a threaded conical mandrel so that each coil turn will be spaced, for example $\frac{1}{32}$ of an inch from the next adjacent turn; and the collodion application is made before removing the coil from the mandrel and secures the turns of bare wire in the spirally wound conical coil in the proper position with relation to each other so that there are no short circuits of the coil turns.

In preparing the coils wound from Litzendraugh wire and for cotton covered or otherwise insulated wire it is unnecessary to use a threaded mandrel, the insulation of the wire being sufficient to properly space the coil turns.

In Fig. 2 a plurality of spirally wound conical coils are arranged for use for ex-

ample as a variable radio frequency transformer or antennæ coil indicated generally at 3, and including a suitable base 4 preferably made of hard rubber, and provided with an upwardly extending stem 5 terminating in outwardly and upwardly extending spaced arms 6 and 7. Upon the outer end 8 of the arm 6 is mounted a hollow conical coil support $9^a$ including an outer conical surface $10^a$ and an inner conical surface $11^a$, both surfaces preferably being co-axial and having the same taper. Through the outer bifurcated end 12 of the arm 7 a threaded and graduated rod 13 extends and is keyed in the arms $12^a$ and $12^b$ of the end 12, and screwed in a nut 14 spaced between the arms $12^a$ and $12^b$, and which nut when rotated causes the threaded rod 13 to move one way or the other through the arms $12^a$ and $12^b$.

The rod 13 is preferably co-axial with the conical surfaces $10^a$ and $11^a$, and the rod 13 carries upon its inner end 15 a hollow conical coil support $9^b$, having inner and outer conical surfaces $10^b$ and $11^b$ preferably geometrically congruent with the surfaces $10^a$ and $11^a$ and co-axial therewith, and the surfaces $10^a$ and $10^b$, and $11^a$ and $11^b$ being preferably concave towards each other, that is to say, the large bases of the conical supports $9^a$ and $9^b$ are adjacent each other between the small bases.

The surfaces $10^a$ and $10^b$ support outer spirally wound conical coils $2^a$ and $2^b$; while the surfaces $11^a$ and $11^b$ may support inner spirally wound conical coils $2^{a'}$ and $2^{b'}$ constructed according to the present invention as heretofore described, and the large bases of the conical coils being adjacent each other between the small bases.

The terminals of the coils may be connected with each other or with associated apparatus in any desired fashion and the effect of the coils upon each other may be varied by rotation of the nut 14 to move the conical support $9^b$ and its conical coils away from or towards the conical support $9^a$ and its conical coils.

In Figs. 3 and 4 are illustrated a plurality of spirally wound conical coils arranged for use for example as a three circuit tuner indicated generally at 16, and which may include a suitable base 4 preferably made of hard rubber, and provided with an upwardly extending stem 5 terminating in outwardly and upwardly extending spaced arms 6 and 7.

Through the outer bifurcated end $12^A$ of the arm 6 a threaded and graduated rod $13^a$ extends and is keyed as best illustrated in Fig. 4 in the arms $12^{Aa}$ and $12^{Ab}$ of the end $12^A$, and screwed in a nut $14^a$ spaced between the arms $12^{Aa}$ and $12^{Ab}$, and which nut when rotated causes the threaded rod $13^a$ to move one way or the other through the arms $12^{Aa}$ and $12^{Ab}$.

Likewise through the outer bifurcated end $12^B$ of the arm 7 a threaded and graduated rod $13^b$ extends and is keyed in the arms $12^{Ba}$ and $12^{Bb}$ of the end $12^B$, and screwed in a nut $14^B$ spaced between the arms $12^{Ba}$ and $12^{Bb}$, and which nut when rotated causes the threaded rod $13^b$ to move one way or the other through the arms $12^{Ba}$ and $12^{Bb}$.

The rods $13^a$ and $13^b$ are preferably co-axial and carry upon their inner ends $15^a$, and $15^b$, respectively, hollow conical coil supports $9^a$ and $9^b$, respectively, having inner and outer conical surfaces $10^a$ and $10^b$, and $11^a$ and $11^b$, preferably geometrically congruent with each other, and preferably concave towards each other.

The surfaces $10^a$ and $10^b$ support outer spirally wound conical coils $2^a$ and $2^b$ having their large bases adjacent each other between their small bases; while the surfaces $11^a$ and $11^b$ may support inner spirally wound conical coils $2^{a'}$ and $2^{b'}$ similarly arranged and constructed according to the present invention as heretofore described.

Upon a bifurcated upward extension 5′ of stem 5, a tickler winding 16 upon a support 16′ may be pivotally mounted as by means of a horizontal median shaft 17 extending through the support, and provided at its outer end with a knob 18 for rotating the tickler winding in the bifurcated extension 5′.

The tickler winding preferably includes a pair of conical coils $2^A$ and $2^B$ preferably geometrically congruent with each other, co-axial with each other, and concave toward each other.

For use in a three circuit tuner in a simple radio receiving circuit the terminals of the coils $2^a$ and $2^b$, $2^{a'}$ and $2^{b'}$, and $2^A$ and $2^B$, may be connected with each other and with associated apparatus as designated in Figs. 3 and 5. In such a circuit arrangement, the connected coils $2^{a'}$ and $2^{b'}$ may be considered a primary winding; the connected coils $2^a$ and $2^b$ may be considered a secondary winding; and the connected coils $2^A$ and $2^B$ may be considered a tickler winding; and the connections as illustrated in Figs. 5 are for a well known single tube radio receiving circuit, ordinarily equipped with other types of coils.

It is obvious that in such a circuit, rotation of nuts $14^a$ and $14^b$ will vary the distance between the component coils $2^{a'}$ and $2^{b'}$ of the primary winding, and between the component coils $2^a$ and $2^b$ of the secondary winding, and will therefore change the characteristics of the circuit thereby enabling the attainment of the advantages heretofore described.

I claim:

1. Electrical apparatus including a plu-

rality of coils, each coil including a winding having a plurality of turns determining a flaring surface, and having a large base and a small base, the large bases of the coils being adjacent each other between the small bases.

2. Electrical apparatus including a plurality of coils, each coil including a winding having a plurality of turns determining a conical surface, and having a large base and a small base, the large bases of the coils being adjacent each other between the small bases.

3. Electrical apparatus including a plurality of sets of coils, the sets being axially spaced endwise of each other and the coils of each set being stationary with respect to each other, means for moving the sets axially with respect to each other, a coil of one set and a coil of another set being electrically connected with each other and constituting a primary coil, and another coil of one set and another coil of another set being electrically connected with each other and constituting a secondary coil.

4. Electrical apparatus including a plurality of sets of coils, the coils of each set being stationary with respect to each other, means for moving the sets axially with respect to each other, a coil of one set and a coil of another set being electrically connected with each other and constituting a primary coil, and another coil of one set and another coil of another set being electrically connected with each other and constituting a secondary coil, the coils of each set each including a winding having a plurality of turns determining a flaring surface, and having a large base and a small base, the large bases of the coils of one set being adjacent the large bases of the coils of the other set and between the small bases of the several coils.

5. Electrical apparatus including a plurality of sets of coils, the coils of each set being stationary with respect to each other, means for moving the sets axially with respect to each other, a coil of one set and a coil of another set being electrically connected with each other and constituting a primary coil, and another coil of one set and another coil of another set being electrically connected with each other and constituting a secondary coil, the coils of each set each including a winding having a plurality of turns determining a conical surface, and having a large base and a small base, the large bases of the coils of one set being adjacent the large bases of the coils of the other set and between the small bases of the several coils.

In testimony that I claim the above, I have hereunto subscribed my name.

NICHOLAS MEDVED.