HIGH FREQUENCY TRANSFORMER HAVING AN IMPROVED Q

INVENTOR
Takuo Kameya
Tomo Takahashi

INVENTOR
M. Edward Matera
FIG. 5

FIG. 6

FIG. 7
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Kazuo Kameya, Yokohama-shi, and Tetsuo Takahashi, Ota-ku, Tokyo-to, Japan, assignors to Toko Kabushiki Kaisha, Tokyo-to, Japan, a joint-stock company of Japan
Filed May 17, 1965, Ser. No. 456,266
Claims priority, application Japan, May 15, 1964, 39/37,687, 39/37,688; June 30, 1964, 39/51,942
3 Claims. (Cl. 336—136)

This invention relates to a high frequency coil or a high frequency transformer having a relatively small number of turns, suitable for use in intermediate frequency band for transistorized FM communication apparatus or television apparatus.

It is well known in the art that, in ordinary high frequency coils there is the problem that the Q value of coils is decreased due to the distributed stray capacitance of the coils.

It is therefore an object of this invention to minimize the stray capacitance of coils whereby to increase the Q value.

Another object of this invention is to provide a high frequency coil or a high frequency transformer of improved winding space factor.

A further object of this invention is to provide a high frequency coil having uniform effective inductance.

Briefly stated, in accordance with this invention, the above objects and other objects can be attained by providing a high frequency coil or a high frequency transformer comprising a coil bobbin including a plurality of closely spaced parallel flanges, each of said flanges being provided with a radial slot for passing a coil conductor, and the gap between adjacent flanges having a width S represented by a formula \( d \leq S < 2d \), where \( d \) represents the diameter of said coil conductor, a primary winding and a secondary winding spirally wound in said gaps, a cup shaped core surrounding said bobbin and said windings, an inductance adjusting core adjustably received in a threaded bore of said bobbin and a shield surrounding the above-mentioned components.

The novel features which characterize our invention are set forth with particularity in the appended claims.

The invention itself, however, both as to its organization and method of operation together with further objects and advantages thereof may best be understood by reference to the following description taken in connection with the accompanying drawings in which like parts are designated by like reference characters, and in which:

FIG. 1 is a vertical sectional view of a high frequency coil embodying this invention;
FIG. 2 is a vertical sectional view of a modified embodiment of this invention;
FIG. 3 is a top plan view of a coil bobbin utilized in the high frequency coils shown in FIGS. 1 and 2;
FIG. 4 is an enlarged sectional view of a portion of the coil bobbin and several turns of a coil;
FIG. 5 is a connection diagram of a high frequency transformer;
FIG. 6 is an enlarged sectional view of the bobbin showing the manner of winding coils; and
FIG. 7 is a bottom view of the bobbin shown in FIG. 6.

In the accompanying drawings, the high frequency coil or high frequency transformer shown in FIGS. 1 and 2 comprises a bobbin 1 made of electrically insulating material, a synthetic resin, for example, and provided with a plurality of closely spaced parallel flanges 2 and a coil 3 consisting of a plurality of turns of an insulated conductor, said turns being wound in a single layer in each gap between adjacent flanges.

As shown in FIG. 3, each flange 2 is formed with radial slots 4 which are cut through the flange and adapted to pass conductors extending between adjacent layers of the coil.

According to this invention the width S of the gap between any two flanges is selected to have following relationship with respect to the diameter d of the coil conductor:

\[ d \leq S < 2d \]

As a result, the turns of the coil are necessarily wound as a single layer in each gap as shown in detail in FIG. 4. Thus, each turn directly contacts the succeeding turn and has very little potential difference with respect thereunto, thus greatly decreasing the stray capacitance of the coil and improving the Q thereof.

Where there are more than three flanges, the coil conductor spirally wound in a layer in one gap is passed through one of the slots 4 to form the next layer and the opposite ends of the conductor are connected to terminal pins 6.

In the modification shown in FIG. 2, a portion of the coil 3 is wound into a solenoid around a cylindrical neck portion 7 of the bobbin 1. In this case it is preferable to position the lower end of an inductance adjusting core 9 received in a threaded bore 8 of the bobbin 1 within the solenoid in order to provide fine adjustment of inductance by a slight vertical movement of the core 9.

As shown in FIGS. 1 and 2 the bobbin and the coil are surrounded by a cup shaped core 10 of magnetic material and a cup shaped shield casing 11. In FIG. 1 the bobbin 1 and its base 5 are made integral while in FIG. 2 they are formed as separate components.

FIG. 5 represents a connection diagram of a high frequency transformer including a mid-tapped primary winding L1 and a secondary winding L2, and the arrangement of the primary and the secondary windings is shown in FIGS. 6 and 7. As shown, a portion of the primary winding L1 close to the terminal C is wound around the cylindrical neck portion 7 of the bobbin, and the remaining portion of the primary winding is wound spirally in one or more gaps between flanges. Turns of the secondary winding are interposed between adjacent turns of the primary winding so as to improve coupling between the primary and secondary windings. The mid-tap B may be grounded as shown. Since only a portion of the primary winding is wound around the cylindrical neck portion 7, adjustment of the core 9 results in variation of the inductance of only the primary coil without affecting the inductance of the secondary winding.

For this reason, it is possible to prevent decrease and non-uniformity of Q of the secondary winding thereby assuring uniform effective inductance.

If the ground tap B is let out at an intermediate stage of the process of winding the primary winding, and the winding process is contained, the tap B can be secured in position as a natural result. Moreover, in accordance with this invention, as the turns of the coil are contacting each other, it is possible to improve the space factor of the coil as compared with those of conventional spirally printed coils.

While the invention has been shown and described in connection with some preferred embodiment thereof, it should be understood that this invention is not limited thereto and is intended to include all modifications and
alterations as fall within the true spirit and scope of the invention as defined in the appended claims.

What we claim as new and desire to secure by Letters Patent of the United States is:

1. A high frequency coil comprising a coil bobbin including a plurality of closely spaced parallel flanges, each of said flanges being provided with a radial slot for passing a coil conductor, and the gap between adjacent flanges having a width $S$ represented by a formula $d \leq S \leq 2d$, where $d$ represents the diameter of said coil conductor, a primary winding and a secondary winding spirally wound in said gaps, a cup shaped core surrounding said bobbin and said windings, an inductance adjusting core adjustably received in a threaded bore in said bobbin and a shield casing surrounding the above-mentioned components.

2. The high frequency coil according to claim 1 wherein a portion of the primary winding and the secondary winding are mutually interposed in alternate turns.

3. The high frequency coil according to claim 1 wherein a portion of the primary winding is wound in the form of a solenoid upon a cylindrical neck portion of the bobbin and the lower end of the adjusting core is positioned within the solenoid.

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T. J. KOZMA, Assistant Examiner.