Aug. 12, 1930. W. K. McIVER 1,772,839

TUNING UNIT

Filed April 7, 1928 2 Sheets-Sheet 1

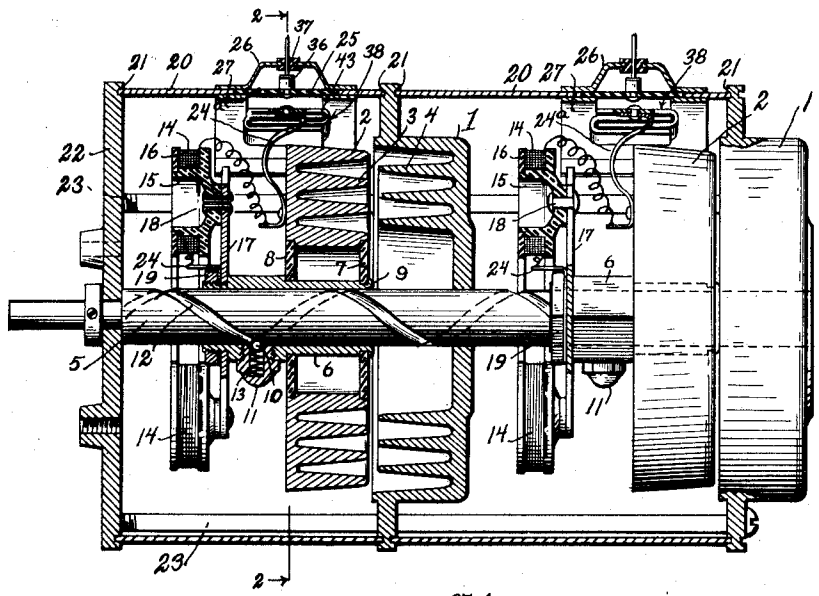


Fig. 1.

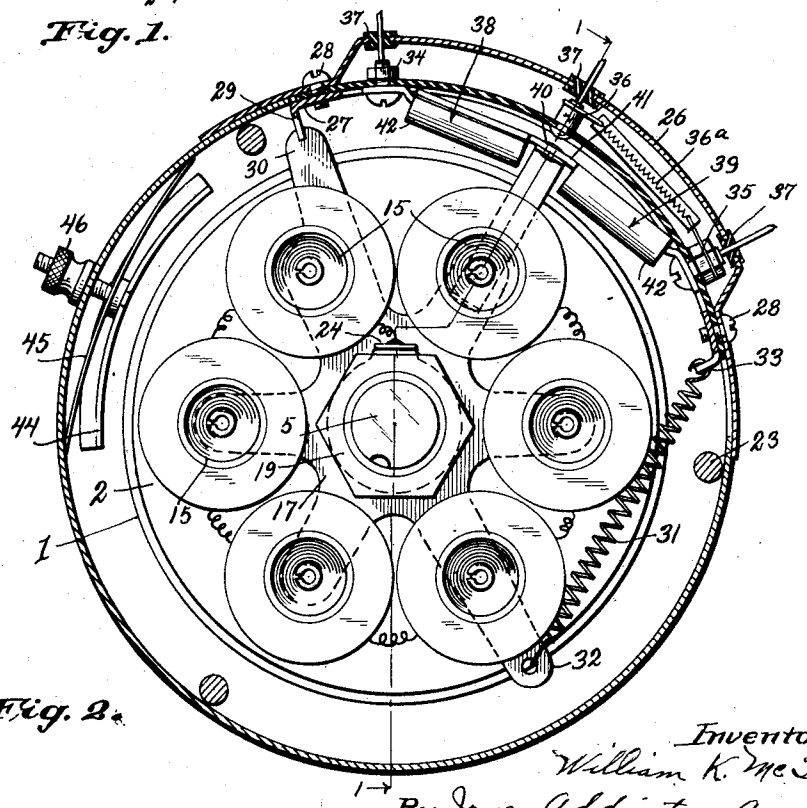


Fig. 2.

Inventor:
William K. McIver
By Jones, Addington, Ames & Seibold
Attys.

Aug. 12, 1930. W. K. McIVER 1,772,839

TUNING UNIT

Filed April 7, 1928 2 Sheets-Sheet 2

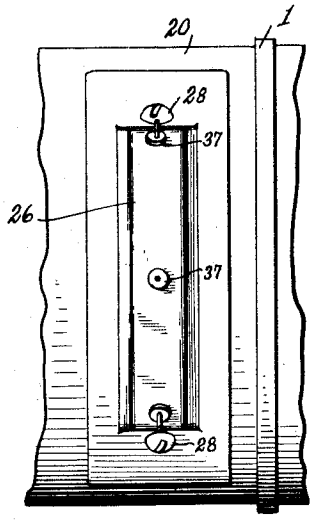


Fig. 3.

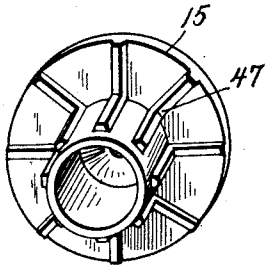


Fig. 4.

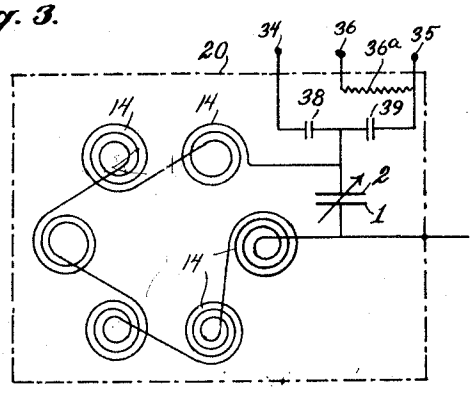


Fig. 5.

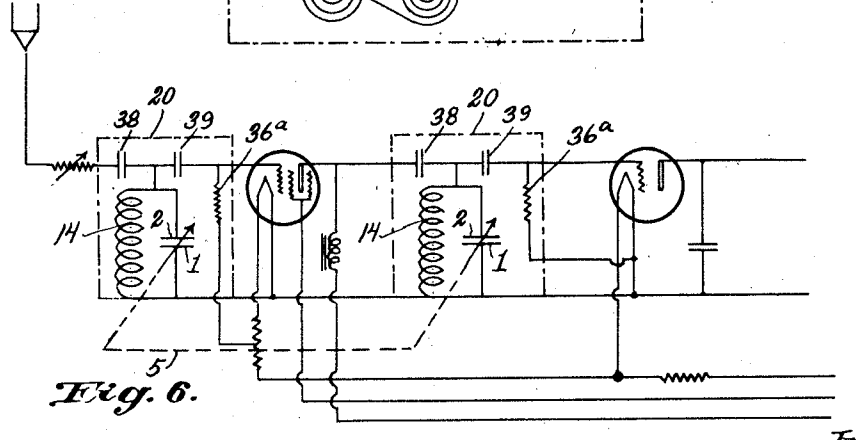


Fig. 6.

Inventor:
William K. McIver
By Jones, Addington, Ames & Seibold
Attys

Patented Aug. 12, 1930 1,772,839

UNITED STATES PATENT OFFICE

WILLIAM K. McIVER, OF ELGIN, ILLINOIS, ASSIGNOR TO BENJAMIN ELECTRIC MFG. COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS

TUNING UNIT

Application filed April 7, 1928. Serial No. 268,103.

My invention relates to shielded tuning units for radio sets and is especially adapted for use in tuned radio frequency circuits in which it is desirable to carefully shield all of the radio frequency circuits from each other and also from other parts of the circuits.

In attempting to shield transformers or coils of the usual type used in radio frequency circuits it has been necessary to make the inclosing shield or box relatively large with relation to the coil as the close proximity of the shield causes certain undesirable effects in the tuned circuit. Certain power losses are also introduced when the shield is in the most dense magnetic field of the coil.

In my invention I have overcome these difficulties and have furthermore introduced other improvements over the previous art, and one of the objects of my invention is to provide a shielded tuning unit in which the magnetic field of the inductance is extremely small and in which the shield may very closely surround the inductance without the usual detrimental effects of close shielding.

Another object of my invention is to provide an extremely small and compact shielded tuning unit containing all the elements necessary for use in a variable, tuned radio frequency circuit.

Another object is to provide a compact, shielded, tuned radio frequency unit which may be easily ganged whereby several circuits may be tuned by means of a single control, and in which each circuit and its elements will be effectively shielded from each of the others.

Further objects will appear from the detailed description to follow and from the appended claims.

In the drawings in which an embodiment of my invention is shown—

Figure 1 is a sectional view of a two-gang tuning unit, one of the condensers being shown in full lines;

Fig. 2 is a rear end view of the construction shown in Fig. 1, the casing being shown in transverse section on a line corresponding to line 2—2 of Fig. 1;

Fig. 3 is a plan view of a portion of the casing including the terminal support and capacity curve adjusting means;

Fig. 4 is a perspective view of one of the inductance spools;

Fig. 5 is a diagrammatic view illustrating the method of electrically connecting the coils and other elements of my improved tuning unit; and

Fig. 6 is a diagram of a circuit adapted for use with my invention.

In the construction shown in the drawings I have illustrated my invention as incorporated in a so-called two-gang tuning device, the units being electrically adjustable independently of each other although being operated by a single mechanical control, that is, the electrical characteristics may be varied in each of the units to conform to the tuning requirements of the particular circuit in which it is used without disturbing the single control operating means.

Each of the units comprises a variable tuning condenser having a stationary member 1 and a movable member 2, the movable member being provided with concentric circular blades 3 arranged to mesh with the similar concentric circular blades 4 on the stationary member 2 when the movable member is moved laterally toward the stationary member, the unit being tuned to the lowest frequency and the condenser to its maximum capacity when the members are intermeshed as far as possible without touching each other. In the position illustrated in Fig. 1 the circuits would be tuned to the highest frequency with the blades entirely separated and the condenser at its minimum capacity.

The shaft 5 is rotatably supported in the stationary members 1 and may be operated by any suitable means, such as the ordinary dial or drum commonly used on radio sets. The movable member is slidably mounted on the shaft 5 by means of the bushing 6 and insulated therefrom by the insulating washers 7 and 8, the bushing, washers, and movable member being rigidly held together by riveting the end of the bushing at 9 against the washer 7.

A steel ball 10 is supported in the bushing 6 by means of the threaded plug 11 and is

held in engagement with the helical groove 12 in the shaft by the spring 13, and as the bushing and movable member are prevented from rotation by means to be later described, the condenser may be operated from maximum to minimum capacity by a 340° turn of the shaft, the pitch of the groove being such that the required tuning range is obtained with a 340° movement of the dial or drum.

A plurality of comparatively small coils 14 are wound on the insulating spools 15 and held in place thereon by the washers 16. These spools are radially disposed around the shaft 5, the axes of the coils being parallel with each other and with the shaft 6, a circle intersecting the axes of the coils being concentric with the shaft.

The spools are mounted on the spider 17 by means of the hollow rivets 18, the spider being rigidly secured to the bushing 6 by the nut 19.

The coils are connected in series, alternate coils being wound in a reverse direction as illustrated in Fig. 5 to provide what is commonly known as a closed magnetic field. I have found in practice that when a plurality of coils are used which are comparatively short and of small diameter, the magnetic field extends only an extremely short distance beyond the ends of the coils, thus making it possible to place shielding or other metal parts very close to the coils.

The shielding is accomplished by means of the sheet metal cylindrical members 20 which are held in position in the grooves 21 of the stationary members 1 and the end plate 22 by means of the screws 23, the end plate being used only on the last unit of the gang. The entire shield including the stationary condenser members, bushings, and spiders are always electrically connected to the low potential or ground side of the circuit in which they are used. By means of this construction an exceptionally small and compact device may be constructed which will be efficiently shielded and in which all of the parts are protected from dust and injury.

The low potential end of the inductance formed by the coils 14 is electrically connected to the washer 24 held in electrical connection with the bushing 6 by means of the nut 19. The high potential end is connected to the flexible conductor 24a on the movable condenser member 2. The circuit is thus tunable to the desired frequency by the manual operation of the condensers.

An insulating member 25 is slidably mounted in an opening in the casing 20 and is adjustably held in position by means of the cover 26 and clamping member 27 which are clamped to the casing 20 by the screws 28. The opening in the casing is somewhat longer than the insulating member 25 and when the screws are loosened the cover, insulating member, and clamping member may be moved and clamped in any desired position within the limits of the opening. An inwardly extending flange 29 engages in a slot in the arm 30 of the spider 17, thus preventing rotation of the bushing and parts mounted thereon. A spring 31 is connected to the arm 32 of the spider and the lug 33 to prevent lost motion between the moving parts.

The insulating member 25 is provided with terminals 34, 35, and 36 extending through insulating bushings 37 and adapted for connection in any desired circuit. Comparatively small fixed blocking condensers 38 and 39 are connected in series to the terminals 34 and 35, and the conductor 24 is connected to the common plate 41 of these condensers at 40, and a biasing resistance 36a is connected to the terminals 36 and 37. The condensers 38 and 39 are preferably made with a common plate 41 and terminal plates 42 between which is clamped the insulator 43, as shown in Fig. 1.

When the insulating member 25 and the parts mounted thereon are moved to any desired position, the bushing 6 will be rotated on the shaft 5 and the variable condenser member 22 will be moved laterally with relation to the stationary member, thus increasing or decreasing the maximum capacity and raising or lowering the maximum capacity end of the characteristic capacity curve.

An adjustment of the minimum capacity end of the curve may be made by means of the trimming condenser shown in Fig. 2, comprising a movable plate 44 which is normally pressed inwardly toward the member 2 by the spring 45, and which may be adjusted to any desired position by the nut 46. This adjustment for the minimum and maximum capacity ends of the curve is disclosed and claimed in the co-pending application of Reuben B. Benjamin, Serial No. 198,104, filed June 11, 1927.

The insulating spools 15 as illustrated in Fig. 4 are provided with ribs 47 on which the coils are wound. These ribs keep the coils from close contact with the insulation and increase their efficiency.

While I have illustrated in Fig. 6 a circuit in which my invention may be efficiently used, it will be understood that its use is not confined to this particular hookup.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A tuning unit comprising a stationary condenser member, a movable condenser member to cooperate with said stationary member, and a closed field inductance mounted on said movable member, said inductance being electrically connected with said condenser members.

2. A tuning unit comprising a variable condenser having manually operable members for tuning an electrical circuit, and a

closed field inductance in said circuit and mounted on said condenser, said inductance comprising a plurality of coils in circular formation having their axes parallel, alternate coils being wound in reverse direction, said coils being connected in series with each other and electrically connected with said condenser.

3. A tuning unit comprising a variable condenser, an inductance electrically connected therewith, said condenser comprising a fixed member and a movable member, and means for moving said movable member with relation to said fixed member to vary the capacity of the condenser, said inductance comprising a plurality of comparatively small coils connected in series and disposed in circular formation with their axes substantially parallel, alternate coils having reverse polarity.

4. A tuning unit comprising a variable condenser having a fixed member, with concentric blades thereon, a movable member having concentric blades for meshing with the blades of the fixed member, and a closed field inductance mounted on said movable member and movable therewith, said inductance comprising a plurality of coils disposed around the axis of said blades and electrically connected is series.

5. A tuning unit comprising a variable condenser having a fixed member with concentric blades thereon, a movable member having concentric blades for meshing with the blades of the fixed member, and a closed field inductance mounted on said movable member and movable therewith, said inductance comprising a plurality of coils disposed around the axis of said blades and electrically connected in series, alternate coils having reverse polarity to provide a closed magnetic field.

6. A tuning unit comprising a closed cylindrical shield having comparatively small compartments therein, electrical circuits in said compartments, each of said circuits including a closed field inductance comprising a plurality of coils connected in series and disposed in circular formation, their axes substantially parallel, alternate coils having reverse polarity to provide a closed magnetic field, a variable condenser electrically connected with said inductance and comprising a stationary member and a movable member, one of said members forming a part of said shield.

7. A tuning unit comprising a closed cylindrical shield having comparatively small compartments therein, electrical circuits in said compartments, each of said circuits including a closed field inductance comprising a plurality of coils connected in series and disposed in circular formation, their axes substantially parallel, alternate coils having reverse polarity to provide a closed magnetic field, a variable condenser electrically connected with said inductance and comprising a stationary member and a movable member, one of said members forming a part of said shield, and electrical terminals for said circuits accessible from outside said shield.

8. A tuning unit comprising a closed cylindrical shield having comparatively small compartments therein, electrical circuits in said compartments, each of said circuits including a closed field inductance comprising a plurality of coils connected in series and disposed in circular formation, their axes substantially parallel, alternate coils having reverse polarity to provide a closed magnetic field, a variable condenser electrically connected with said inductance and comprising a stationary member and a movable member, one of said members forming a part of said shield, electrical terminals for said circuits accessible from outside said shield, and adjustable means accessible from outside said shield for varying the electrical characteristics of said circuits.

9. A tuning unit comprising a manually operable shaft, variable condensers mounted on said shaft and comprising stationary members and movable members, said movable members being adjustable with relation to said stationary members when the shaft is operated, inductances mounted on said shaft and connected to said condensers to form individual electrical circuits, said inductances comprising a plurality of comparatively short coils connected in series and supported around said shaft with their axes substantially parallel therewith to provide a closed magnetic field, and a shield enclosing each individual circuit and supported on said stationary members.

In witness whereof, I have hereunto subscribed my name.

WILLIAM K. McIVER.