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HETERODYNE FREQUENCY CONVERTER

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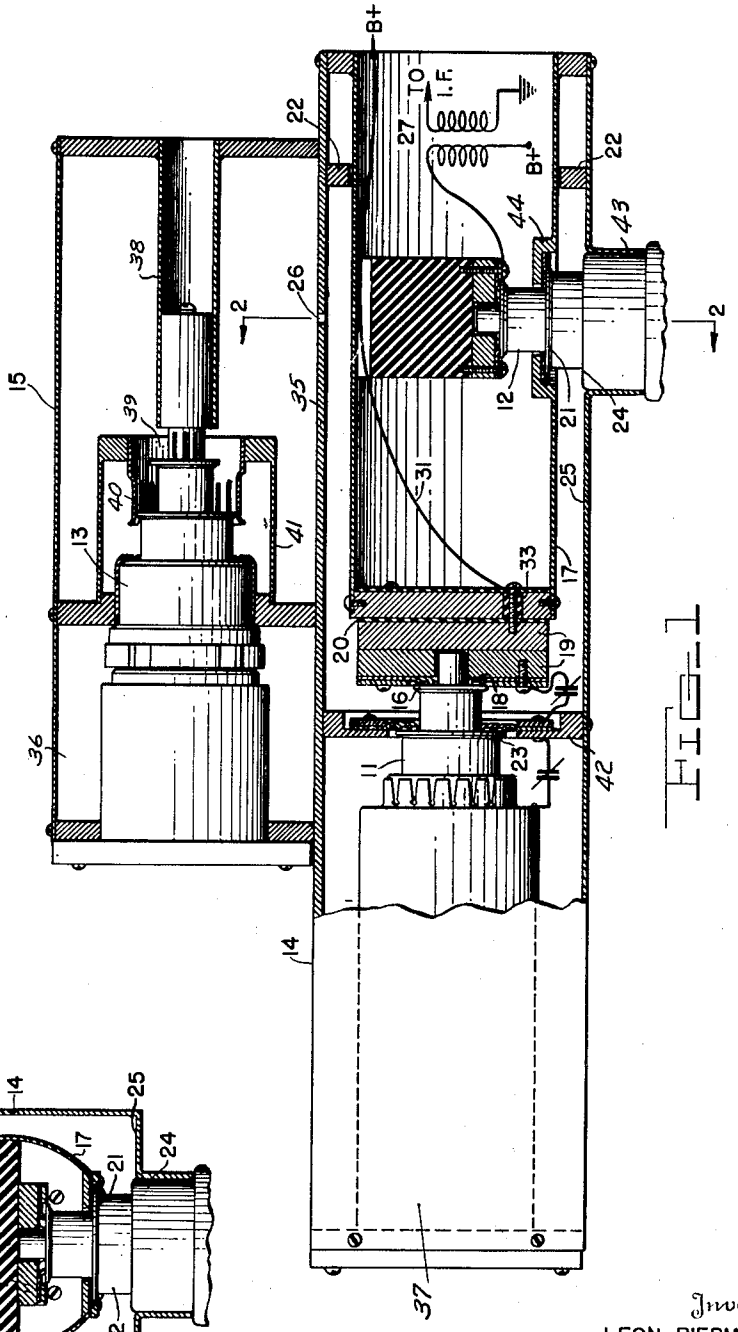


FIG. 1

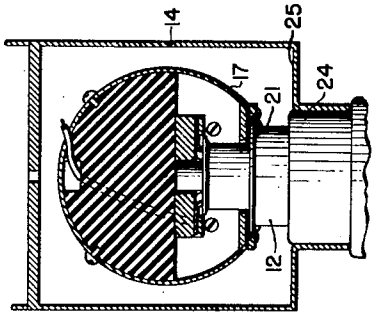


FIG. 2

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HETERODYNE FREQUENCY CONVERTER

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3 Claims. (Cl. 250—20)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

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This invention relates to radio frequency components and is particularly directed to a novel arrangement of components for greater compactness and simpler coupling.

The invention provides means for inserting a lighthouse type tube longitudinally in a coaxial line and another lighthouse tube transversely in the coaxial line. The tubes can be so arranged that the plate of an amplifier can be coupled to the grid of another amplifier or to a mixer through the coaxial line without the use of wire connections. The losses due to ohmic resistance are thereby minimized. Also, by this arrangement, an amplifier or mixer unit can be made to occupy less space.

It is an object of the invention to provide a means of inserting a tube longitudinally and another tube transversely in a coaxial line.

It is another object of the invention to provide a more compact amplifier or mixer unit at radio frequencies.

It is another object of the invention to couple the plate of one lighthouse type tube to the grid of another by suitable insertion of one tube longitudinally and the other transversely in a coaxial line.

The invention will be further understood with reference to the exemplary embodiment shown in the drawing in which:

Fig. 1 shows, partially in longitudinal cross section and partially in schematic diagram, an exemplary arrangement of R.-F. components in a mixer or converter; and

Fig. 2 is a partial cross sectional view of Fig. 1 taken on the line 2—2 of Fig. 1.

The converter unit of Fig. 1 comprises an amplifier tube 11, a mixer 12, and an oscillator 13. These tubes are of the type having annular rings for coupling the tube elements to circuit elements.

Coaxial lines 14 and 15 each have an outer conductor of a rectangular cross section and are joined together by having a common side 35. Lines 14 and 15 also have coaxially disposed therein tubular inner conductors 17 and 38 respectively.

Oscillator tube 13 is inserted longitudinally in end 36 of coaxial line 15 and securely positioned therein by known means. The grid element of tube 13 is connected through its annular ring by cylinder 41 and the fingered annular contact ring 40 to the outer conductor of coaxial line 15. The plate element of tube 13 is connected by means of a cup shaped fingered contact member 39 to the inner conductor 38 of coaxial line 15.

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Amplifier tube 11 is inserted longitudinally in end 37 of coaxial line 14 and securely positioned therein. Plate ring 16 of tube 11 is coupled for R. F. to the outside of inner conductor 17 of coaxial line 14 through fingers 18 and conductors 19 and capacitively across insulator 20. Grid ring 23 is connected, such as shown at 42, to the inside wall of outer conductor 25 of line 14.

Mixer tube 12 is inserted transversely within coaxial line 14 having provisions therein for receiving the tube such as shown at 43. The position of mixer tube 12 in the line with respect to amplifier tube 11 is chosen to permit maximum power transfer to the mixer 12 from amplifier 11. Shorting bar 22 is made adjustable to obtain a better match of the input impedance of mixer tube 12 to the line 14. Grid line 21 of mixer tube 12 is coupled to the inner conductor 17 through connector 44. Cathode ring 21 of mixer tube 12 is coupled to the inner conductor 17 through connector 44. Cathode ring 24 is connected to the inside wall of outer conductor 25 of line 14 at 43. The amplified voltage at plate 16 of tube 11 is coupled directly to grid 21 of the mixer tube 12 through the coaxial line 14.

In the operation of the circuit, the output from the local oscillator 13 is coupled through an iris 26, formed in the common wall member 35, to the mixer 12, and the intermediate frequency output from the mixer is developed across transformer 27.

The transverse cross section of coaxial line 14 in Fig. 2 further illustrates the connections for tube 12. As already noted, grid ring 21 is connected to the outside of the inner conductor 17, and cathode ring 24 is connected to the inside of outer conductor 25.

Although the arrangement of R.-F. components herein described illustrates the coupling of an amplifier to a mixer, it could be used as well to couple an amplifier to another amplifier.

Although I have shown only certain and specific embodiments of the present invention, it is to be expressly understood that many modifications are possible thereof without departing from the true spirit of the invention.

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

What is claimed is:

1. In combination a section of coaxial line including inner and outer conductors, a first vacuum tube having at least cathode, grid and plate

elements with annular contact rings attached thereto, means for longitudinally supporting said vacuum tube in one end of said coaxial line, means for capacitively coupling said plate to the inner conductor and means for connecting said grid to the outer conductor of said line; a second vacuum tube also having at least a cathode, grid and plate elements with annular rings attached thereto, means for transversely supporting said second vacuum tube in said line, means connecting the grid of said second vacuum tube to the inner conductor and the cathode of said second vacuum tube to the outer conductor of said coaxial line and output means connected to the plate of said second vacuum tube for receiving an output therefrom.

2. In combination a first and second section of coaxial line each including inner and outer conductors, the outer conductor of each section having a rectangular cross-section the outer conductors of said line sections being disposed in contiguous relation with a common side joining the line sections, a first and second vacuum tube, means for longitudinally supporting each of said tubes in one end of said first and second sections of coaxial line, a third vacuum tube, means for transversely supporting the same in said second section of coaxial line in direct contact with the inner and outer conductors thereof, means for capacitively coupling one electrode of said second vacuum tube to the inner conductor of said second section of coaxial line for coupling the output therefrom to said third vacuum tube and an iris in the common side of the two lines for coupling the output from said first vacuum tube to the third vacuum tube.

3. A converter unit comprising a first and second section of coaxial line, the outer conductor of each line being rectangular in cross section, the outer conductors of said line sections being disposed in contiguous relation with a common side joining the two line sections, an amplifier tube having at least cathode, grid and plate electrodes with annular contacts attached thereto, means for longitudinally supporting said tube in the first coaxial line section, means for capacitively coupling the plate of said tube to the inner conductor of said first line section and means for connecting the grid of said tube to the outer conductor of said first line section, a mixer tube also having at least cathode, plate and grid electrodes with annular contacts attached thereto, means for transversely supporting said mixer tube in said first coaxial line section, means connecting the grid of said mixer tube to the inner conductor of said first line section, an oscillator tube longitudinally supported in the second line section, and an iris coupling slot formed in the common side which joins said first and second line sections for coupling the oscillator signal to the mixer.

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The following references are of record in the file of this patent:

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