Oct. 31, 1939. W. MENNERICH ET AL 2,177,835

ARRANGEMENT FOR VARYING THE BAND WIDTH IN HIGH-FREQUENCY CIRCUITS

Filed March 26, 1937 2 Sheets-Sheet 1

Fig. 1

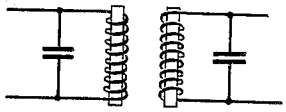


Fig. 2

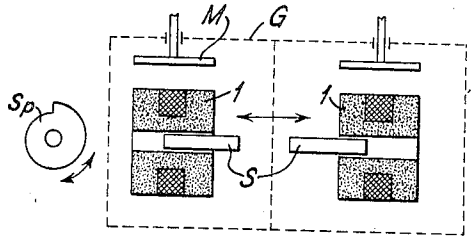


Fig. 3

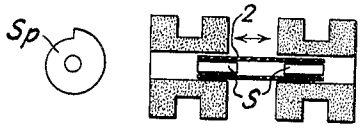


Fig. 4

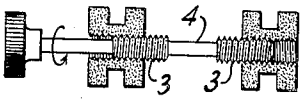


Fig. 5

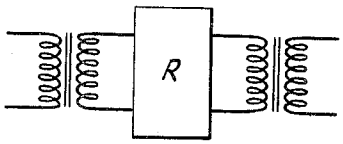


Fig. 7

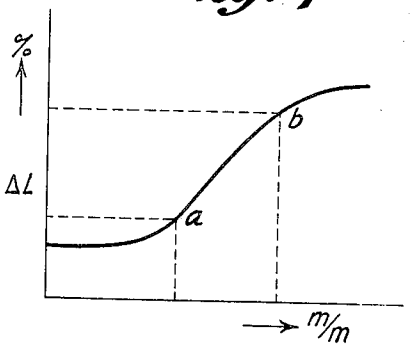
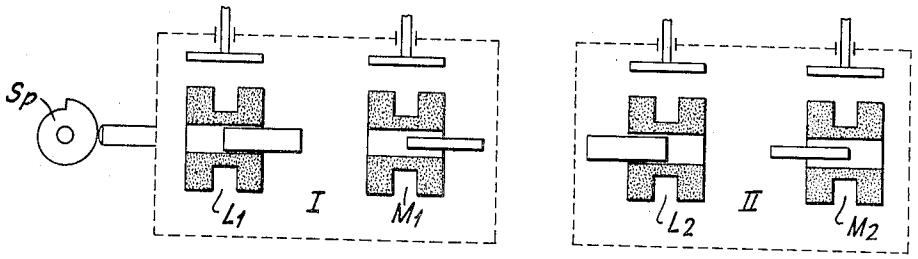


Fig. 6



INVENTORS
WILHELM MENNERICH, OTTO SIEPKE
AND ALEXANDER SCHAAF
BY
H. S. Grover
ATTORNEY

Oct. 31, 1939. W. MENNERICH ET AL 2,177,835

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Filed March 26, 1937 2 Sheets-Sheet 2

Fig. 8

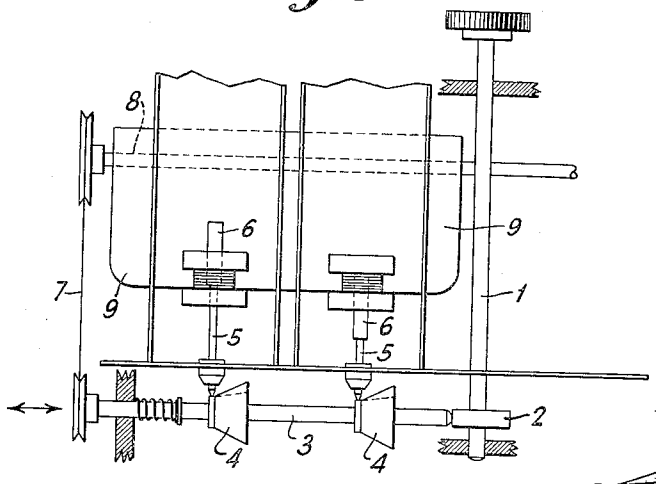


Fig. 10

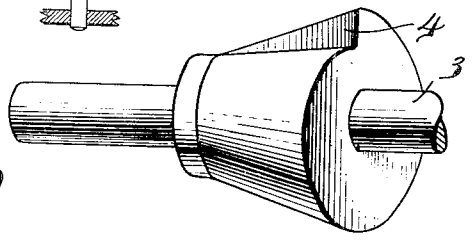
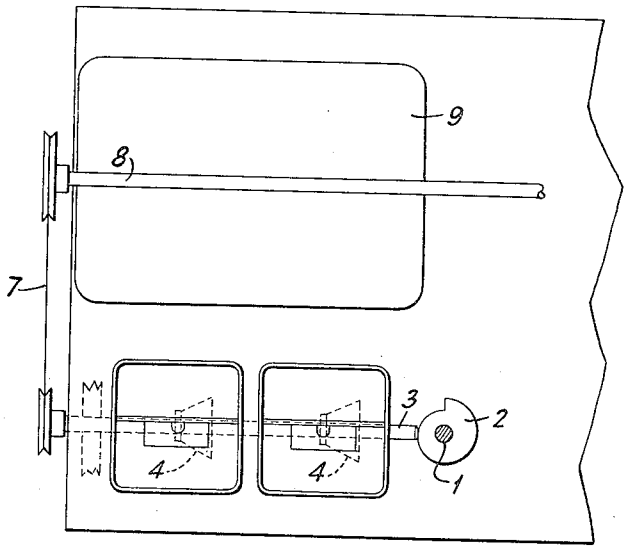


Fig. 9



INVENTORS
WILHELM MENNERICH, OTTO SIEPKE
AND ALEXANDER SCHAAF
BY
H. S. Grover
ATTORNEY

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2,177,835

ARRANGEMENT FOR VARYING THE BAND WIDTH IN HIGH-FREQUENCY CIRCUITS

Wilhelm Mennerich, Berlin-Spandau, Otto Siepke, Berlin-Staaken, and Alexander Schaaf, Berlin-Charlottenburg, Germany, assignors to Siemens & Halske, Aktiengesellschaft, Siemensstadt, near Berlin, Germany, a corporation of Germany

Application March 26, 1937, Serial No. 133,138
In Germany March 26, 1936

2 Claims. (Cl. 178—44)

Our invention relates to an arrangement for varying the band width in high-frequency circuits.

Nowadays, it is frequently necessary, particularly in radio receiving apparatus, to vary the band width of the tuning devices or of the band filters. This is accomplished in a manner well known in the art by detuning the tuning circuits with respect to one another. For instance, the band width of the circuit is adjusted and the degree of coupling or the inductance of the tuning coils remains the same. The width of the band width will nevertheless vary with tuning of the oscillatory circuits. While an oscillatory circuit may be adapted to be adjusted for tuning from one frequency band to another by adjustments of either the capacity or the inductance, it is usual to change the inductance for this purpose, inasmuch as this results in a simpler and less expensive arrangement. The band width of filters may be varied by the insertion of copper discs between coupled coils. The present invention uses a method which is particularly advantageous if the oscillatory circuits of the tuning device are decoupled by the interposition of elements, such as tubes, and if the parts of the tuning device are placed in different containers.

According to the present invention an arrangement for varying the band width of tuning devices in high-frequency circuits, particularly with compressed iron powder cores, is provided, preferably in the case of an inductive decoupling of the tuning circuits, by continuously varying the inductance of at least two coils in such a manner that the inductance of one coil is reduced the same amount as the inductance of the other coil is increased.

For a better understanding of the invention reference may be had to the following description and to the instances illustrated therein. The detuning of the individual tuning circuits towards both sides of the relative zero line is to be uniformly effected. If, for instance, the band width is to be varied in a three tube set, two tuning circuits are displaced in the tuning with respect to the third circuit tuned to a fixed value. In the event that a detuning effect of 3 k. c. on either side of the frequency to which the third circuit is tuned is desired, a variation of the capacitance or of the inductance of the oscillatory circuits in the following manner will be necessary as regards the wave ranges:

	Percent
In the case of 150 k. c	4
In the case of 250 k. c	2.4
In the case of 600 k. c	1
In the case of 1330 k. c	0.46

Since an influence of the capacitance of these oscillatory circuits is difficult owing to the great differences of the detuning necessary between the standard and long wave range as will be apparent from the above table and the above considerations, the inductance of these circuits should be influenced according to the invention, high-frequency compressed iron powder core coils being employed for this instance in which besides the continuous variation of the inductance for regulating the band width, also a possibility of equalizing the leakages due to manufacture is required.

The invention, therefore, presupposes two or more compressed iron powder core coils for the formation of an adjustable band filter. By the invention the symmetrical adjustment of the band width is obtained by varying the inductances of the single band filter coils in such a manner that the inductance of one coil when being varied is reduced by such an amount by which the inductance of the other coil is increased.

In the drawings, Fig. 1 illustrates schematically a simple band filter arrangement in which two coupled coils are provided with cores; Fig. 2 illustrates schematically a pair of coils which are not coupled but which are arranged for simultaneous variations of the inductances thereof; Fig. 3 illustrates a method of movably mounting the cores of several coils for simultaneous adjustment; Fig. 4 illustrates another arrangement for mounting the cores of adjacent coils; Fig. 5 illustrates schematically a circuit arrangement wherein two tuned circuits are separated by a circuit including at least one thermionic tube; Fig. 6 is a schematic showing of an arrangement wherein separate coils are provided for long wave and short wave reception; Fig. 7 is a curve sheet used to illustrate certain features of the invention; Fig. 8 is a diagrammatic representation of a portion of radio ap-

paratus utilizing means for varying the inductance of coils of the circuit; Fig. 9 is another view of the arrangement shown in Fig. 8; and, Fig. 10 is a detailed showing of one of the cone spiral devices.

In Figs. 1–3 this inventive idea is shown in principle. Fig. 1 shows schematically a simple band filter arrangement in the form of two coils which may be inductively, capacitively or galvanically coupled with each other. In the case of oscillating coils not coupled with one another an arrangement as shown in Fig. 2 might be employed. In this embodiment, H-shaped or thread spool-shaped compressed iron powder cores of the known type are employed which permit the balance to be effected in two ways. The coil bodies which consist of compressed iron powder core material are bored and are provided with a shiftable pin S. In the casing G there is also a device which permits a further balance and which consists of metal or mass plates M capable of being screwed which when being approached to the coil vary the inductance. Similar devices may, of course, also be employed in air core coils in the form of introduced mass pins, cylinder rings and the like.

The pin balance of the embodiment is so designed that when one pin is being moved from the corresponding core, the pin of the other core is moved into the latter by the same amount and that the pin of the one core is adjusted to its maximum value if the pin of the other core has assumed the minimum value. The pins may be connected with one another by a rod or by a guide tube as shown in Fig. 3 and through a worm with the band width knob to be operated by hand. However, it is also possible to arrange the balance pins as shown, for instance, in Fig. 4, in such a manner that they may be screwed within the coils in either direction.

The case already mentioned as an instance, i. e., that the circuits of the tuning device are separated by tubes, is shown in Fig. 5 with the corresponding Figs. 2 and 6 for compressed iron powder core arrangement. Fig. 2 shows the simple case of two separate oscillatory circuits for one wave range, whereas in Fig. 6 separate coils are provided for the long wave range and the standard wave range.

In Fig. 6, L_1 and L_2 denote the long wave coils, whereas M_1 and M_2 denote the standard wave coils. Each pair of coils consisting of a standard wave coil and a long wave coil is placed in a common casing I and II respectively. In accordance with the percentage of the variation of the band width within the different wave ranges indicated in the above table, balance pins of different diameters are employed in this case in connection with the same core shape. The coils L_1 and L_2 are in the instance shown equipped with pins having a large diameter, whereas pins of smaller diameter are provided for standard wave coils. In Figs. 2, 3 and 6 is indicated a way of adjusting the band width as already mentioned by means of an operating knob through a spiral disc, denoted in these figures by Sp. The balance pin is so adjusted that its balancing movement takes place as far as possible along the straight portion of the balance curve (cf. Fig. 7).

The variation of the band width according to the invention is preferably employed in radio sets, since in this case, as above mentioned, the absolute amount of the band width is varied when tuning the oscillatory circuits. In order to remove this drawback, the correction according to the invention is, therefore, made, i. e., the band width is varied in accordance with the tuning means of the oscillatory circuits. The tuning means is, in general, a variable condenser of the type having a rotor and a stator, hence the variation of the band width depends upon the angular position of the rotor of the variable condenser.

In Figs. 8 and 9 is shown an embodiment for varying the band width in accordance with the angular position of the disc condenser. The figures show in the different views the same form of the invention. The shaft 1 of the band width adjusting knob which is coupled with the adjusting device of the disc condenser carries a spiral disc 2.

By means of the spiral disc the shaft 3 on which two spiral cones 4 are firmly mounted is shifted in the direction shown so that the rods 5 on which the compressed iron powder core balance pins 6 are mounted are displaced. The shaft 3 is connected with the shaft 8 of the disc condenser 9 through a rope drive 7. Consequently, the balance pins 6 of the compressed iron powder core coils are displaced in accordance with the spiral cone, the displacement depending upon the position of the band width knob. The pitch of the spiral cone in the longitudinal direction is dependent upon the amount of the band width variation and in the direction of rotation from the frequency of the disc condenser.

The cone spiral 4 shown in Figures 8 and 9 is shown in perspective in Figure 10. In this way a clearer understanding of the construction of the cone spiral may be had.

We claim as our invention:

1. In radio receiving apparatus, means for tuning the receiving apparatus over a range of frequencies, a band-pass circuit arrangement embodying a plurality of inductance coils provided with movable cores of magnetic material, means connected with the tuning means for varying the inductances of said coils relatively to each other automatically in accordance with the tuning setting of the tuning means so as to maintain a band width which is substantially uniform over a tuning range and adjustable means for determining the amount of said relative variation to thereby determine the band width maintained throughout said tuning range.

2. In radio receiving apparatus, means for tuning the receiving apparatus over a range of frequencies, a band-pass circuit arrangement embodying a plurality of inductance coils provided with movable cores of magnetic material, means including a cam device coupled with said tuning means for varying the inductances over said coils relatively to each other automatically in accordance with the tuning setting of the tuning means so as to provide predetermined band widths over the tuning range and adjustable means operatively connected with the cam device for determining the amount of said relative variations.

WILHELM MENNERICH.
OTTO SIEPKE.
ALEXANDER SCHAAF.