

Dec. 21, 1937.

D. E. O'DONOVAN

2,102,805

ELECTRICAL TUNED CIRCUIT

Filed Sept. 7, 1935

2 Sheets-Sheet 1

Fig. 1

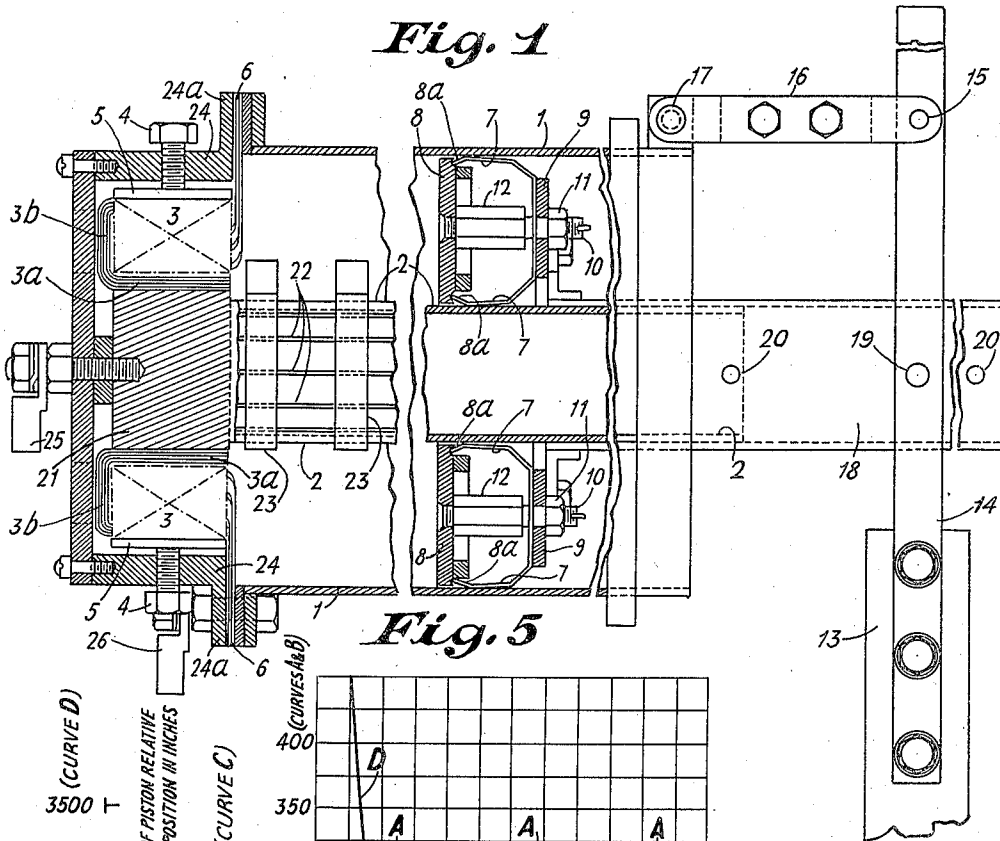
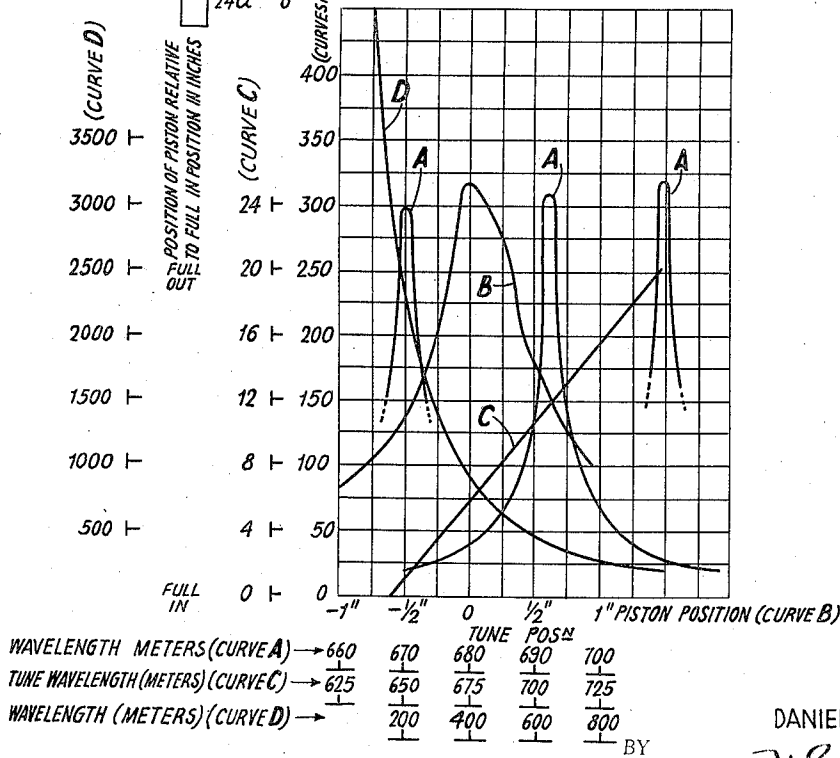


Fig. 5



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Fig. 2

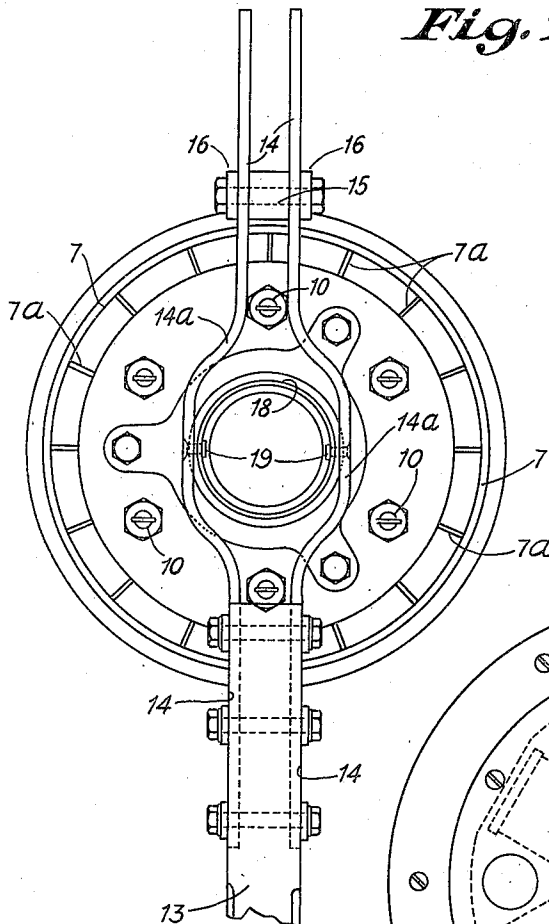


Fig. 3

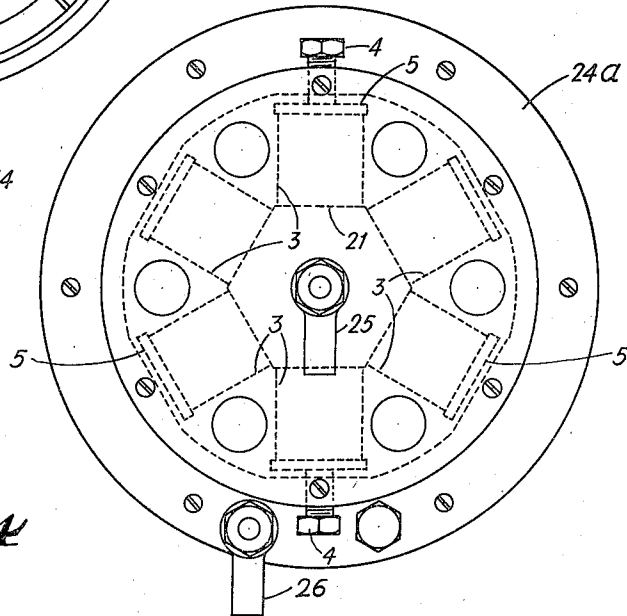
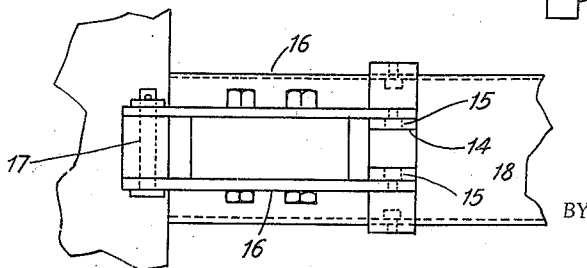


Fig. 4



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2,102,805

ELECTRICAL TUNED CIRCUIT

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Application September 7, 1935, Serial No. 39,583
 In Great Britain July 21, 1934

6 Claims. (Cl. 178-44)

This invention relates to electrical tuned circuit arrangements and has for its object to provide improved mechanical constructions of electrical tuned circuits of the parallel type, i. e. of the type in which the inductive is in parallel with the capacitive portion.

Although not limited to its application thereto, the invention is particularly advantageous for and is primarily intended for application to so-called rejector circuits for rejecting undesired harmonics in radio transmitters.

The practical desiderata of tuned circuit arrangements suitable for use for the above and similar purposes include that they shall be simple and cheap to construct; easy to accommodate; inherently self-screening, i. e., of such construction as to give rise to a minimum of external disturbing fields; adjustable as to natural frequency over a considerable range; of low inductance so that voltage drop and power losses at the fundamental wave length of the transmitter in question (i. e. the wave length which is not to be rejected) shall be low; and of low high frequency resistance, and therefore of high harmonic attenuation.

The present invention provides tuned circuit arrangements which satisfy the above desiderata and have the advantages of low radiation, connection, contact, and inductance losses.

According to this invention, a tuned circuit of the parallel type comprises an outer tubular conductor, a second conductor positioned within said outer conductor, one or more fixed condensers connected between said inner and outer conductors and a bridge member slidably mounted with reference to said conductors and adapted to contact with both of them. With this arrangement, movement of the bridge member longitudinally of the two conductors varies the inductance—which is provided by said conductors—in shunt with said condenser or condensers.

The invention is illustrated in and further explained in connection with the accompanying drawings, in which:

Figs. 1 to 4 show a preferred way of carrying out the said invention, and

Fig. 5 is a set of graphs.

In the drawings: Fig. 1 is a sectional elevation, Fig. 2 a right end view looking towards the handle, Fig. 3 a left or opposite end view, and Fig. 4 a part plan showing the handle link.

Referring to the drawings, the tuned circuit arrangement therein shown comprises a straight circular tubular outer conductor 1 of copper—for example a copper tube of about 7" internal diameter and about 7' long—a second or inner straight tubular copper conductor 2, also about 7' long but of about 2" external diameter, the inner conductor being arranged within and con-

centric with the outer conductor, a piston like member having a central hole adapted to fit over and contact with the inner conductor and being of such size that its periphery contacts with the inner face of the outer conductor, and a plurality of fixed condensers 3 connected between the two conductors 1, 2, at or near one end of the whole tubular conductor structure. At the condenser end of the structure the inner conductor 2 may be formed with a hexagonal outer surface (or a hexagonal nut may be screwed thereon) and the fixed condensers may be arranged radially between the two conductors, one terminal end of each condenser—assuming there are six—resting on and contacting with one of the flats of the hexagon on the inner conductor, the other terminal ends of the condensers being bolted or otherwise fixed to the outer conductor so that the condensers are in parallel with one another and connected between the inner and outer conductors. In the illustrated arrangement, however, the condensers are in a unit assembly comprising a hexagon-ended plug 21 which fits into the end of the tube 2, which is slotted at 22, the cylindrical portion of the plug being gripped by the action of band clamps 23 about the slotted tube end. The terminal lead 3a of each condenser 3 is pressed against a hexagonal face on the plug and (so as to be clamped between said surface and the condenser) by means of a bolt 4 and plate 5 and the other terminal 3b is clamped as shown at 6 against a flange 24a formed on the housing 24 which surrounds the condenser assembly and receives the bolts 4. The terminals are marked 25 and 26. The major portion of the lengths of the conductors are of circular section and the piston, which has a contacting member 7 which is preferably of copper, is slidably arranged and is of sufficient length to make good electrical contact both with inner and outer conductors. The piston comprises two plates 8, 9, which are parallel to one another, the plate 8 being recessed at 8a to receive the ends of the contacting member which is of dish annular form. Screwed into the plate 8 are studs 10, the ends of which pass through the plate 9 and receive nuts 11 so that by screwing up the nuts 11, the plates 8, 9 may be brought closer together (to an extent limited by the collars 12 on the studs 10) thereby expanding the member 7 so as to cause it to press against the tubes 1, 2. Thus when the piston has been moved to any desired position, it may be locked there by the nuts 11. The member 7 is split as at 7a to facilitate expansion and is of springy material. As will be appreciated, that portion of the lengths of the inner and outer conductors between the condensers and the piston, together with the piston itself, constitute a single turn inductance which will give substan-

tially zero external field and which is in parallel with the capacity provided by the condensers. By sliding the piston longitudinally this inductance can be varied. A plurality of ranges of natural frequency can be obtained simply by changing the number and/or size of the shunt condensers. In practice the shunt capacity is chosen at such value that the desired natural frequency is obtained when the piston is about six feet from the condensers. Fine adjustment is then accomplished by moving the piston by means of the handle 13, which is insulated so as to enable this adjustment to be made when the apparatus is in operation in a transmitter. The handle 13 is on the end of a lever system 14 pivoted at 15 to a link system 16 in turn pivoted at 17, the strips comprised in the lever system 14 being bowed out at 14a to surround a sleeve 18 which is fast with the piston and which is engaged by means of pins 19 carried in the bowed out strips and which enter holes 20 in the sleeve 18. As will be seen, the handle and lever mechanism illustrated enables a very fine adjustment to be readily made. There is a plurality of holes 20 spaced along the sleeve 18 so that coarse adjustment of piston position can be obtained by selecting the desired hole 20.

The curves A, B, C of Fig. 5 show practical results which have been achieved with an arrangement such as that illustrated and which tunes at 694.5 metres with the piston at about 6' from the condensers. Curves A show three resonance curves (ordinates-impedance against abscissae-wavelengths) for three positions of the piston; curve B shows impedance (ordinates) against displacements of the piston in inches (abscissae) on either side of a position (O) at which the rejector tunes to 694 metres (this is with the piston at about six feet from the condensers); and curve C shows position of piston (ordinates) against tuning wave length (abscissae). Curve D is a curve of impedance in ohms (ordinates) plotted against wave length (in metres) for a rejector in accordance with this invention and having an effective length of six feet. This curve shows the efficiency of apparatus in accordance with this invention when used for tuned rejector purposes at short wave lengths.

It is not necessary to provide the particular means illustrated for fine tuning for such tuning may be effected by a removable adjustment device such for example as a nut-like member adapted to be attached to one end of the outer tubular conductor and having a bolt-like member threaded therethrough and adapted to engage the piston so that by turning the bolt in the nut the piston may be finely adjusted in position. After adjustment has been made, the removable adjustment member would be removed and the piston firmly clamped in its adjusted position. The illustrated arrangement is, however, preferred.

In practice it is intended to use two rejector units in accordance with this invention to reject each undesired harmonic in a transmitter output.

What is claimed is:

1. A tuned circuit arrangement comprising an outer tubular conductor and a second conductor positioned within said outer conductor, a plurality of fixed condensers in parallel relation connected between said inner and outer conductors, the effective lengths of said outer and inner

conductors determining the inductance of said tuned circuit, and said plurality of condensers together with a capacitance existing between said outer and inner conductors over their effective lengths determining the capacity of said tuned circuit, and a bridge member slidably mounted with reference to said conductors and conductively contacting both of said conductors, whereby the natural frequency of said tuned circuit can be changed with movement of said bridge member over said conductors.

2. An arrangement as claimed in claim 1, characterized in this that the bridge member comprises a substantially circular arrangement conductively coupling the outer surface of the inner conductor and the inner surface of the outer conductor, and including a tube surrounding said inner conductor at one end and connected to said bridge member for adjusting the position of said member with respect to said conductors.

3. A tuned circuit arrangement comprising inner and outer concentric conductors, a plurality of condensers in parallel relation coupling together said conductors at one end of said arrangement, said condensers being symmetrically located around said inner conductor, a bridge member for adjustably coupling said conductors together conductively at points along the lengths of said conductors, means for locking said bridge member in any desired position along said conductors, and means for obtaining a fine adjustment of the movement of said member, whereby the natural frequency of said tuned circuit can be changed with movement of said bridge member over the length of said conductors.

4. A tuned circuit arrangement comprising an outer tubular conductor and a second conductor positioned within said outer conductor, a fixed condenser connected between said inner and outer conductors, and a bridge member slidably mounted with reference to said conductors and adapted to contact with both of them, said bridge member being expandible so that it can be expanded to press against the inner and outer conductors and thus be locked in any desired position of adjustment at the same time giving good contact with the said conductors, whereby the natural frequency of said tuned circuit can be changed with movement of said bridge member over the length of said conductors.

5. A tuned circuit arrangement comprising an outer tubular conductor and a second conductor positioned within said outer conductor, a fixed condenser connected between said inner and outer conductors, and a bridge member slidably mounted with reference to said conductors and adapted to contact with both of them, said bridge member comprising two plates having a dished annular contacting member arranged between them, means being provided for drawing said plates together so as to spring or bow out the contacting member to cause it to press against the inner and outer conductors, whereby the natural frequency of said tuned circuit can be changed with movement of said bridge member over the length of said conductors.

6. A system in accordance with claim 3, including an insulating handle and a mechanical link extending from said handle over said inner conductor to said bridge member for effecting said fine adjustment of said bridge member.

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