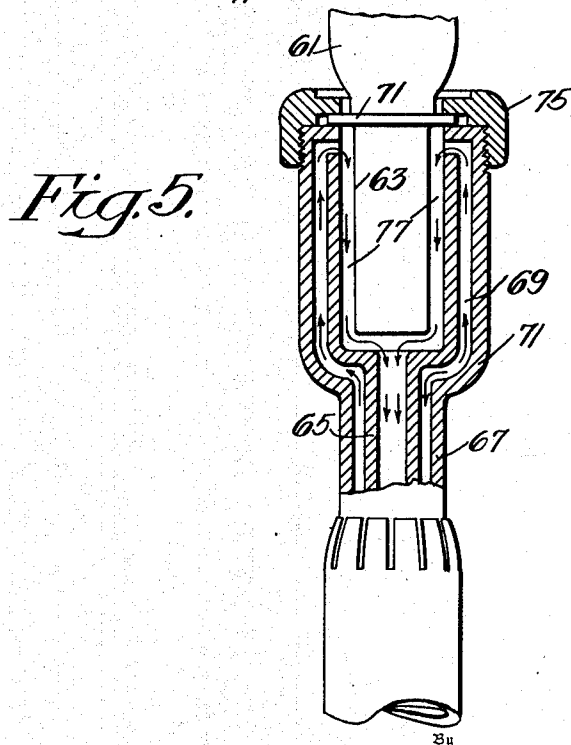
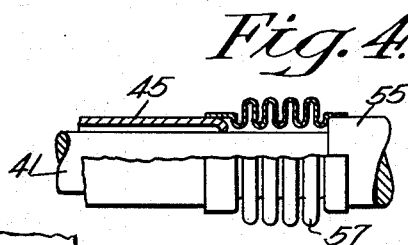
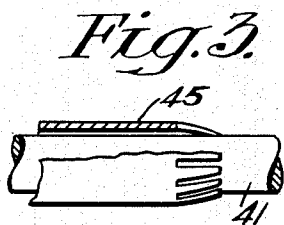
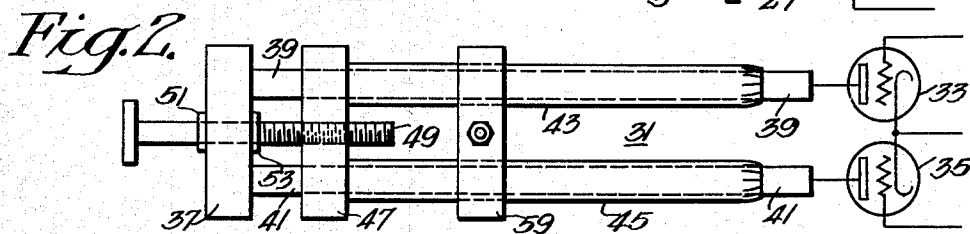
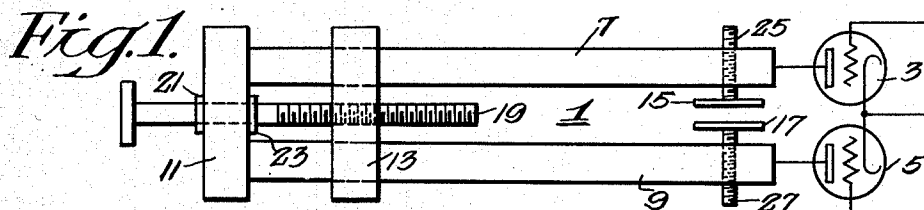


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J. W. CONKLIN ET AL
HIGH FREQUENCY CIRCUITS

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HIGH FREQUENCY TANK CIRCUITS

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4 Claims. (Cl. 178-44)

Our invention relates to high frequency tank circuits in which an adjustable transmission line forms the resonant circuit. More specifically, the adjustable elements of the line are so constructed and arranged that the line has both coarse and fine adjustments; that the distributed capacities are minimized; and that the losses due to adjustable contacts are made very low.

One of the objects of our invention is to provide coarse and fine adjustments for tuning a transmission line.

Another object is to provide means for tuning a resonant line over a wide range of frequencies due to a minimization of distributed capacities.

An additional object is to provide a transmission line with adjustable contacts which insure low losses.

In the accompanying drawing,

Figure 1 is a schematic diagram representing two known methods of adjusting a transmission line,

Figure 2 is a schematic diagram illustrating one embodiment of our invention.

Figures 3 and 4 are elevational views partly in section of two forms of adjustable contact, and

Figure 5 is an elevational view of an element of our invention applied to the water cooled anode of a thermionic tube.

Referring to Fig. 1, a transmission line 1 is connected to a pair of thermionic tubes 3, 5. The transmission line includes a pair of conductors 7, 9, a mounting and supporting member 11, an adjustable shorting bar 13, and a pair of adjustable armatures 15, 17. The shorting bar 13 is actuated by a screw 19 which is threaded into the bar. The screw is mounted within the member 11 and is provided with thrust collars 21, 23.

In practice it is customary to use either an adjustment of the capacity of the armatures 15, 17 or the adjustment of the shorting bar 13 to vary the resonant characteristics of the line. We have found that both of these adjustments offer certain difficulties. The capacity adjustment is objectionable because it is limited in range, due to the fact that the capacity is located near points of maximum potential, and the adjustable screws 25, 27 supporting the armatures increase the distributed capacity of the line. Furthermore, the adjusting screws 25, 27 are at high radio frequency potentials and therefore difficult to adjust, even with an insulated screw driver. The shorting bar is objectionable because the slidable contacts are at a point near the maximum high frequency current flow and therefore cause high losses, and because the portion of the screw 19 between the

shorting bar and the armatures 15, 17 increases the distributed capacity of the line.

In Fig. 2 the transmission line 31 is connected to a pair of thermionic tubes 33, 35. The line 31 is comprised of elements arranged as follows: on a mounting bar 37 are fastened a pair of parallel conductive members 39, 41. A pair of hollow conductors 43, 45 are slidably mounted on the parallel members 39, 41, respectively. The hollow conductors are tied together at one end by a member 47 into which is threaded an adjustment screw 49. The screw is rotatably mounted in the mounting bar 37 and provided with thrust collars 51, 53. The ends of the hollow conductors 43, 45 opposite the member 47 are slotted and turned inwardly to make a low resistance slidably contact as shown in Fig. 3. In place of a sliding contact, the hollow members 45 may be connected to shoulders 55 on the parallel members 41 by metallic expansion joints 57 as shown in Fig. 4. Intermediate the ends of the hollow members 43, 45 is securely clamped a heavy shorting bar 59.

The embodiment of our invention illustrated in Figs. 2, 3 and 4 offers substantial advantages over the prior art transmission lines represented by Fig. 1. In our invention the sliding contacts (see Fig. 3) are arranged at a point near the minimum radio frequency current flow and therefore the losses are minimized. If the expansion joints (see Fig. 4) are used, no losses due to sliding contacts will be experienced. The diameter of the expansion joints is made preferably small to hold the capacity between them as small as possible. A considerable latitude of expansion is not essential as the screw adjustment is only used for fine or vernier tuning. The coarse tuning is effected by moving the shorting bar 59. The shorting bar can be made of copper or the like of sufficient dimensions to insure excellent conductivity. The bar 59 can be made to tightly clamp the hollow members 43-45 over a wide area; thus insuring an excellent high frequency contact.

The shorting bar 59 may be grounded for radio frequency currents. The entire device may be supported by the mounting bar 37.

Our invention may be applied to the water cooled anode of a thermionic tube as shown in Fig. 5. A fragment 61 of the envelope of the thermionic tube terminates in the metal jacket of the anode 63. The inner conductor of a concentric line is made of pipes 65, 67 which are preferably coaxially arranged. The ends 69-71 of the pipes 65, 67 are flared to form jackets around the anode 63. A flange 73 on the anode 63 is clamped to the

flared portion of the pipe 71 by a coupling 75 which makes the jackets water tight. Water is sent through space between the pipes around the jackets and discharged through the inner pipe as shown by the arrow 77. The flow of water, which cools the anode, may be made from the inner pipes to the space between the inner and outer pipes. Fluids other than water may be used.

Thus, we have described an adjustable transmission line with means for obtaining coarse and fine adjustments of the effective length of the line. The transmission line of our invention has low loss adjustable contacts, and a minimum of distributed capacity. The invention may be employed with air or water cooled tubes. In the embodiment illustrated, we have removed the deleterious effect of the adjustable elements from the radio frequency field.

We claim as our invention:

1. A transmission line including a pair of conductors, means for mounting said conductors in spaced and parallel relation, a pair of hollow conductors adjustably mounted over said parallel conductors, semipermanent means for efficiently shorting said hollow conductors at substantially the points of maximum high frequency current flow and to provide a coarse adjustment of said line, means for effectively slidably contacting said parallel and hollow conductors at substantially the points of minimum high frequency current flow, means for adjusting the position of said hollow conductors on said parallel conductors to provide a vernier adjustment of said line.

2. A high efficiency resonant line comprising a pair of conductors substantially more than a quarter wavelength long, means for mounting said conductors in spaced and parallel relation, two hollow conductors, one adjustably enclosing a substantial portion of each of said pair of conductors,

means connecting one pair of adjacent ends of said hollow conductors whereby they may be moved simultaneously along said pair of conductors, semipermanent tuning means efficiently shorting said hollow conductors at substantially the points of maximum high frequency current flow, said tuning means providing a normally fixed connection of low loss, means for effectively contacting said parallel and said hollow conductors at substantially the points of minimum high frequency current flow, and means including said connecting means for adjusting the position of said hollow conductors on said parallel conductors to provide a vernier adjustment of said line.

3. A device of the character of claim 2 in which said means for effectively contacting said parallel and said hollow conductors is an expansion member.

4. A high efficiency resonant line comprising a pair of conductors substantially more than a quarter wavelength long, a first member connecting adjacent ends of said conductors for mounting said conductors in spaced and parallel relation, two hollow conductors, one slidably mounted on and enclosing a substantial portion of the length of each of said pair of conductors; a second member connecting said hollow conductors at the ends which are adjacent said first members; a semipermanent tuning bar efficiently shorting said hollow conductors at substantially the points of maximum high frequency current flow, said tuning bar providing a normally fixed connection of low loss; and an adjusting screw engaging said first and second connecting members for adjusting the position of said hollow conductors on said parallel conductors.

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