Nov. 24, 1953 L. A. G. TER VEEN 2,660,714

HIGH-FREQUENCY VARIABLE COUPLING STRUCTURE

Filed June 11, 1951

Fig. 1

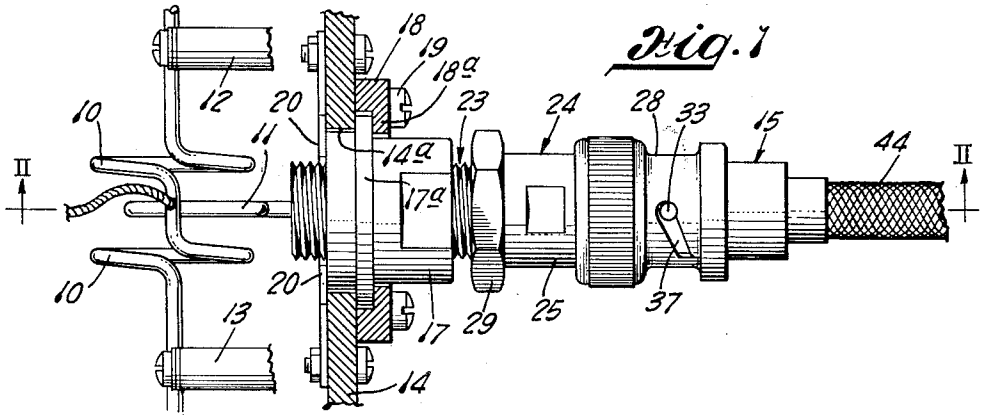


Fig. 2

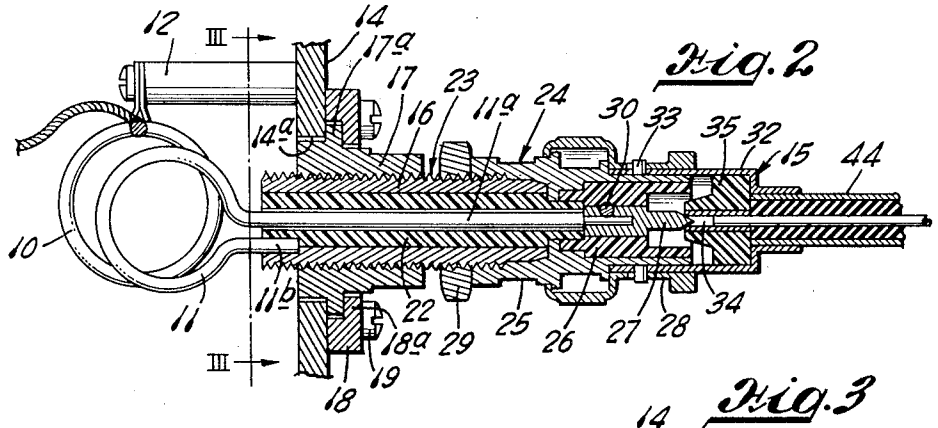


Fig. 3

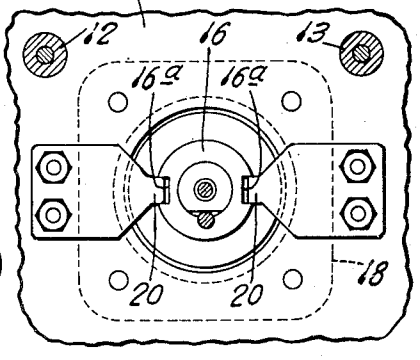
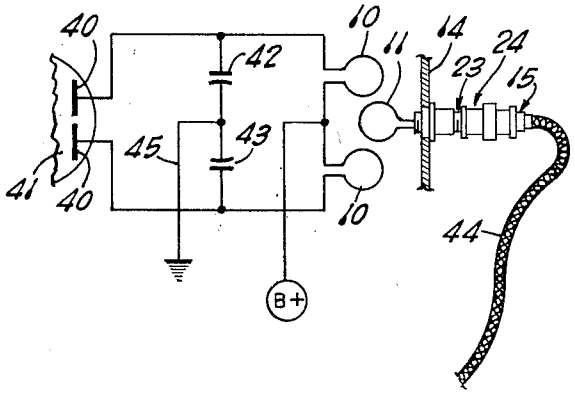


Fig. 4



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HIGH-FREQUENCY VARIABLE COUPLING STRUCTURE

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2 Claims. (Cl. 336—125)

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This invention relates to high frequency transformers such as are used in radio circuits and the like, and more particularly to transformers having separate relatively movable primary and secondary coils whereby the coupling can be adjusted to match the impedances of the coils to those of the circuits to which they are connected.

In very high frequency circuits every conducting element has appreciable inductive and capacitive reactance, and any movement or change in dimension of a part may effect sufficient change in reactance to upset the balance of the circuit. Thus as ordinarily constructed, movable coils of transformers have flexible leads extending thereto from fixed terminals. Movement of the coil for adjustment purposes shifts the leads; furthermore, the flexible leads may be shifted by vibration to which the equipment is subjected. Any such shifts can change the reactance of the circuits sufficiently to deleteriously affect the operation of the equipment.

An object of the invention is to provide an electrical device, one element of which can be physically adjusted as to position without altering the reactance of the circuit to which it is connected.

Another object is to rigidly support an electrical element in a position of adjustment.

Another object is to provide convenient adjustment of the position of an electrical element located back of a mounting plate, from the front of the mounting plate.

Other more specific objects and features of the invention will appear from the description to follow.

Briefly, the invention, as applied to a high frequency coupling transformer, comprises a construction in which one coil of the transformer is fixedly mounted with respect to a panel, and another adjustable coil is fixedly mounted on the end of a coaxial cable terminal which is adjustable with respect to the panel. The coaxial cable and terminal and the adjustable coil constitute a unit the reactance of which is unaffected by change of position, so that shifting of the unit varies the coupling between the coils without producing undesirable results. Fine adjustment can be effected by a screw connection between the coaxial terminal and the panel. There are no flexible individual leads that could be misplaced by shock or vibration.

The invention will be further explained by describing in detail, with reference to the drawing, a structure incorporating the invention for

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coupling a radio transmitter to an external load circuit, such as an antenna.

In the drawing:

Fig. 1 is a plan view, with a portion shown in section, of a coupling structure in accordance with the invention;

Fig. 2 is a section taken in the plane II—II of Fig. 1;

Fig. 3 is an elevation in the plane III—III of Fig. 2; and

Fig. 4 is a schematic diagram of a portion of the circuit related to the structure disclosed.

Referring to Figs. 1 and 2, there is disclosed a high frequency transformer having a primary coil 10 consisting of two turns and a secondary coil 11 consisting of a single turn. The primary coil 10 is stationary and is supported at its opposite ends by pillars 12 and 13 extending from a supporting panel 14. In the particular instance shown, the pillars 12 and 13 would be of insulating material. However, the particular structure used to support the coil 10 is immaterial so long as it suffices to rigidly support the latter.

In the particular apparatus shown, the primary coil 10 constitutes the output element of a high frequency transmitter, and the secondary coil 11 constitutes a rigid electrical element to be connected to a load such as a transmitting antenna, over a transmission line consisting of a coaxial cable 44. In order to obtain maximum efficiency, it is found that a particular critical degree of coupling between the primary coil 10 and the secondary coil 11 is necessary. This desired degree of coupling is obtained by shifting the secondary coil 11 relative to the primary coil 10.

Heretofore it has been the practice to terminate the coaxial cable 44 in rigid or fixed terminals with respect to the panel 14, and movably support the secondary coil 11, employing flexible leads to connect the coil to the coaxial cable terminals. With that arrangement, adjusting movement of the coil 11 changed the positions of the flexible leads connecting it to the coaxial cable, which changed the capacitive and/or inductive reactance of the leads and introduced undesirable changes in tuning.

The present invention overcomes these defects of prior equipment by mounting the coil 11 rigidly with respect to the coaxial cable, and movably mounting the latter with respect to the panel 14, so that the cable and the coil 11 can be shifted as a unit to move the coil 11 into the position for optimum coupling with the coil 10. This elimi-

nates any changes of reactance in the circuit associated with the coil 11, and has the further advantage of providing a simple and rigid mechanical structure for supporting the coil.

Referring to Fig. 2, the coaxial cable connector comprises tubular member 16 exteriorly threaded for screw connection with a supporting bushing 17, which is internally threaded and has an external flange 17a whereby it may be clamped against the panel 14 by a clamping plate 18 having an internal flange 18a which overlaps the flange 17a. The clamping plate 18 is secured to the panel 14 by screws 19. The bushing 17 is of circular cross-section, and its inner end extends into a circular aperture 14a in the panel 14. With this construction, it will be observed that, when the screws 19 are loosened, the bushing 17 is rotatable in the panel aperture 14a and is rotatable on the threads of member 16. The tubular member 16 is restrained from rotation with respect to the panel 14 by a pair of tongue members 20 (Fig. 3) secured to the inner face of the panel 14, which tongue members extend into longitudinal grooves 16a formed in the exterior surface of the member 16 at diametrically opposed points thereon. Since the member 16 is thereby restrained from rotation, rotation of the bushing 17 on the threaded surface of the member 16 shifts the latter in one direction or the other with respect to the panel 14. When the member 16 has been properly positioned, it is locked against further movement by tightening the screws 19, which lock the flange 18a of the clamping plate 18 against the flange 17a on the bushing 17, thereby clamping the latter tightly against the panel 14.

The tubular member 16 constitutes the outer conductor of a coaxial fitting 23, the inner conductor of which is constituted by an extended end 11a of the coil 11. The other end 11b of coil 11 is soldered or brazed to the member 16 at the inner end of the latter. The inner conductor 11a is supported in electrically insulated relation to the tube 16 by a suitable bushing 22 of insulating material.

The outer end of the coaxial fitting 23 receives a standard coaxial cable connector 24, consisting of a sleeve member 25, an insulator 26, a central conductor prong 27, and a swivel bayonet sleeve 28. The sleeve member 25 is internally threaded at the left end to screw onto the tubular member 16, and is locked in place by a lock nut 29. The insulator 22 of fitting 23 extends into a counterbore in the insulator 26, and the tip of the central conductor 11a is reduced in size and extends into a hole provided for in the base of prong 27. The tip of the conductor 11a, the prong 27, and the insulator 26 are locked together by a cross pin 30.

The coaxial cable terminal fitting 15 is of standard construction designed to work with the connector 24, and comprises an outer conducting sleeve 32 having bayonet pins 33, an inner conducting sleeve 34, and an insulator 35 between the inner and outer sleeves. Connection is made by sliding the fitting 15 into the connector 24 and rotating the swivel sleeve 28 to lock the bayonet pins 33 in the inner ends of bayonet slots 37 in the swivel sleeve.

Obviously the particular construction of the coupling used to connect the fitting 23 to the coaxial cable is not important insofar as the present invention is concerned.

Fig. 4 shows a typical circuit in which the invention may be used. In Fig. 4 the terminals of the primary coil 10 are connected to the anodes 40 of a push pull output tube 41 and are tuned by a pair of condensers 42 and 43 which are connected in series between the terminals of the coils 10, the mid connection between the condensers being shown connected to ground by a lead 45. The secondary coil 11 is connected by the structure described with reference to Figs. 1 and 2 to a cable 44, that may be of any desired length, extending to an antenna.

With the coupling construction described with reference to Figs. 1 and 2, the coil 11 can be adjusted toward or away from the coils 10 to secure the desired degree of coupling without altering the reactance characteristics of the circuit extending from the coil 11 to the antenna.

Furthermore, adjustment of the coupling between the coil 11 can be made entirely by operations exterior of the wall 14 so that access does not have to be had to the interior of the housing of which the wall 14 may form a part.

Although for the purpose of explaining the invention, a particular embodiment thereof has been shown and described, obvious modifications will occur to a person skilled in the art, and I do not desire to be limited to the exact details shown and described.

I claim:

1. An electrical connecting structure for a rigid electrical element having two electrical terminals comprising: a coaxial cable fitting having inner and outer rigid conductors fixed with respect to each other and having one end adapted to be rigidly connected to a flexible coaxial cable, means rigidly attaching said element to the other end of said fitting for movement in unison therewith and electrically connecting said element terminals to said fitting conductors, and means movably supporting said element and fitting as a unit whereby the position of said element can be adjusted without altering the electrical characteristics of the circuit conductors connected to said element.

2. The structure of claim 1 in which said supporting means comprises a wall having a hole therein through which said fitting extends and means securing said fitting to said wall in movably adjustable relation thereto, said element being on one side of and the cable-connecting end of the fitting being on the other side of said wall.

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