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(54) **Input coupling adjustment arrangement for radio frequency filters**

Justiervorrichtung für die Kopplungseinstellung von Funkfrequenzfilter

Dispositif d'ajustement de couplage d'entrée de filtres à fréquence radio

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(73) Proprietor: **ALCATEL**
75008 Paris (FR)

(72) Inventors:
• **Pelz Dieter,**
Victoria 3136 (AU)
• **Trembath, Natalie**
North Croydon, 3136, Victoria (AU)

(74) Representative: **Rausch, Gabriele, Dr. et al**
Alcatel
Intellectual Property Department, Stuttgart
70430 Stuttgart (DE)

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Description

[0001] The invention is concerned with a radio frequency filter according to the preamble of claim 1 (DE 30 28 925 A).

[0002] The invention hence relates to radio frequency bandpass filters that incorporate resonator elements, and in particular to an adjustable coupling arrangement for adjustably coupling the filter's input means to the filter's first resonator element to obtain optimum impedance matching between elements of the input means and elements of the bandpass filter for maximum transfer of energy.

[0003] It is known, for example from US 5,389,903 A, to couple the input means of a bandpass filter of the aforementioned type to a first co-axial resonator element via a loop of wire. One end of the loop is connected to the filter's input terminal within the filter housing. The other end of the loop is connected to an internal surface of the housing. The loop inductively couples the filter's input terminal to the first resonator element.

[0004] The above mentioned DE 30 28 925 A discloses a filter arrangement incorporating an inductive loop coupling means. The known filter has a housing means with six resonator elements and an input port means and at least one output port means. The filter further includes an arrangement for adjustably coupling the input port means to one resonator element and the arrangement comprises an elongated resilient conductor element of a predetermined dimension arranged to couple the input port means to the one resonator element's field zone.

[0005] GB 849 490 A describes a coupling device for coupling a high impedance narrow band signal source to a low impedance transmission line in an RF amplifier, which is an active device. The coupling device is in the form of a capacitive probe inside a resonator-like structure of a tube-type RF-amplifier.

[0006] It is an object of the invention, to improve the radio frequency filter mentioned above.

[0007] To meet this object the invention is characterised by the characterising features of claim 1.

[0008] The electrical properties of the coupling arrangement according to the invention are generally equivalent to, and in some cases better than those of loop coupling, while avoiding the inherent disadvantages of loop coupling.

[0009] In order that the invention may be readily carried into effect, embodiments thereof will now be described in relation to the accompanying drawings, in which:

Figure 1 shows a top view of the mechanical structure of a bandpass filter incorporating the adjustable coupling arrangement of the present invention.

Figure 2 shows a cross-sectional view of the mechanical structure shown in Figure 1.

Figure 3 shows a top view of the mechanical struc-

ture of a diplexer filter incorporating the adjustable coupling arrangement of the present invention.

Figure 4 shows a side view of a conductive element of the coupling arrangement shown in Figure 3.

[0010] Referring to Figures 1 -2, the radio frequency bandpass filter 1 comprises a rectangular block of conductive material in which are formed four aperture coupled co-axial resonators (2, 3, 4 and 5) of predetermined dimensions, each comprising a resonator rod (6, 7, 8 and 9) within a cavity having a side wall 10, a bottom wall 11, and a top wall (not shown); the latter wall being formed by a removable plate common to all cavities. Adjacent resonators are coupled by an aperture 12, 13 and 14 in the side wall.

[0011] An input port 15 comprising a conductor 16 which extends into resonator 2 to couple the input port to the filter. An output port 17 comprises a conductor 18 which extends into resonator 5 to couple the filter to the output port.

[0012] From the end of conductor 16 there extends a flat resilient conductor 19 which is provided with a bend intermediate its length such that its free end resiliently abuts the point 20 of an adjustment screw 20a which extends into resonator 2. The shaft and point of screw 20 are made of suitable electrical insulating material such as, for example, aluminium oxide.

[0013] Resilient conductor 19 acts electrically like a transmission line and its end section couples input port 15 to the electric field of resonator 2.

[0014] Optimum coupling is obtained by operating screw 20a to move conductor 19 in relation to resonator rod 6, and using a return loss measurement means or any other known means for measuring the reflection factor to find optimum impedance match over a given bandwidth.

[0015] Referring to Figures 3-4, the high frequency diplexer 21 comprises a rectangular block of conductive material in which is formed a high bandpass filter A and a low bandpass filter B. Each filter comprises four aperture coupled co-axial resonators of predetermined dimensions. The resonators are similar to those described above in relation to Figures 1 and 2. The diplexer 21 includes a single input port 22 comprising a conductor 23 which extends into a passage 24 connecting the first resonator of filter A to the first resonator of filter B, and two output ports 25 and 26. Output port 25 comprises a conductor 27 which extends into the last resonator of filter A, and output port 26 comprises a conductor 28 which extends into the last resonator of filter B.

[0016] Conductor 23 of input port 22 is connected to a flat elongated resilient conductor 29 at a point intermediate the length of the conductor. The length of the conductor is such that each end thereof resiliently abuts the point of a respective adjustment screw 30 and 31, adjustment screw 30 extending into the first resonator

of filter A and adjustment screw 31 extending into the first resonator of filter B. The shaft and point of adjustment screws 30 and 31 are made of suitable electrical insulating material such as, for example, aluminium oxide.

[0017] Optimum coupling of the input port to filters A and B is obtained by operating screws 30 and 31 to move the ends of conductor 29 in relation to the resonator rods of the first resonators, and using a return loss measurement means or any other known means for measuring the reflection factor to locate optimum impedance match between elements connected to the input port and filters A and B.

Claims

1. A radio frequency filter comprising a housing means containing a plurality of co-axial resonator elements (2,3,4 and 5), an input port means (15,30,31) and at least one output port means (17,25 and 26), the filter further including an arrangement for adjustably coupling the input port means to at least one resonator element (2), the arrangement comprising an elongated resilient conductor element (19) of predetermined dimensions that is arranged to couple the input port means (15,30,31) to the electric field zone of a first one of a plurality of coupled resonator elements, **characterized in that** the resilient conductor element (19) is arranged to capacitively couple the input port to the respective electric field zone and co-operates with lever means (20) of electrical insulating material that can be manually activated by a connected actuating means (20a) mounted externally in a wall of the housing means, to move the resilient conductive element (19) thereby adjusting capacitive coupling between the input port means (15,30,31) and the resonator element's electric field.
2. A radio frequency filter as claimed in claim 1, **characterised in that** the housing means contains a first array of coupled resonator elements (A) and an adjoining second array of coupled resonator elements (B), the input port means (22) being common to both arrays and respective output port means (25,26) for each array.
3. A radio frequency filter as claimed in claim 2, **characterised in that** each end portion of said resilient conductor (29) is relatively wider than the portion therebetween.

Patentansprüche

1. Ein Hochfrequenzfilter bestehend aus Gehäuse-Mitteln, die eine Vielzahl von Co-Resonator-Elementen (2, 3, 4 und 5) enthalten, aus Eingangsanschluss-Mitteln (15, 30, 31) und mindestens einem Ausgangsanschluss-Mittel (17, 25 und 26), das Filter enthält weiterhin eine Anordnung zur einstellbaren Kopplung der Eingangsanschluss-Mittel mit mindestens einem Resonatorelement (2), wobei die Anordnung aus einem länglichen elastischen Leiterelement (19) mit vorher festgelegten Abmessungen besteht, das so angeordnet ist, dass es die Eingangsanschluss-Mittel (15, 30, 31) mit der Zone des elektrischen Feldes eines ersten aus einer Vielzahl gekoppelter Resonatorelemente koppelt, **dadurch gekennzeichnet, dass** das elastische Leiterelement (19) so angeordnet ist, dass der Eingangsanschluss kapazitiv mit der entsprechenden Zone des elektrischen Feldes gekoppelt wird und mit Hebel-Mitteln (20) aus elektrisch isolierendem Material zusammenarbeitet, die manuell durch ein verbundenes Betätigungsmittel (20a) aktiviert werden, das extern in einer Wand des Gehäuse-Mittels montiert ist, um das elastische leitfähige Element (19) zu bewegen und dadurch die kapazitive Kopplung zwischen den Eingangsanschluss-Mitteln (15, 30, 31) und dem elektrischen Feld des Resonatorelementes einzustellen.

2. Ein Hochfrequenzfilter wie in Anspruch 1 beansprucht, **dadurch gekennzeichnet, dass** die Gehäuse-Mittel eine erste Anordnung von gekoppelten Resonatorelementen (A) und eine angrenzende zweite Anordnung von gekoppelten Resonatorelementen (B) enthält, wobei die Eingangsanschluss-Mittel (22) beiden Anordnungen gemeinsam sind und für jede Anordnung jeweilige Ausgangsanschluss-Mittel (25, 26) vorhanden sind.

3. Ein Hochfrequenzfilter wie in Anspruch 2 beansprucht, **dadurch gekennzeichnet, dass** jeder Endabschnitt des elastischen Leiters (29) breiter ist als der Teil dazwischen.

Revendications

1. Filtre radiofréquence comprenant des moyens formant boîtier contenant une pluralité d'éléments résonants coaxiaux (2, 3, 4 et 5), des moyens formant port d'entrée (15, 30, 31) et au moins un moyen formant port de sortie (17, 25 et 26), le filtre comprenant en outre un agencement pour coupler de manière ajustable les moyens formant port d'entrée à au moins un élément résonant (2), l'agencement comprenant un élément conducteur élastique allongé (19) de dimensions prédéterminées qui est agencé de manière à coupler les moyens formant port d'entrée (15, 30, 31) à la zone de champ électrique d'un premier d'une pluralité d'éléments résonants couplés, **caractérisé en ce que** l'élément

conducteur élastique (19) est agencé pour coupler de manière capacitive le port d'entrée à la zone de champ électrique respective et coopère avec des moyens formant levier (20) en matériau électriquement isolant qui peuvent être actionnés manuellement par des moyens d'actionnement connectés (20a) montés extérieurement dans une paroi des moyens formant boîtier, pour déplacer l'élément conducteur élastique (19), ajustant de ce fait le couplage capacitif entre les moyens formant port d'entrée (15, 30, 31) et le champ électrique de l'élément résonnant.

2. Filtre radiofréquence selon la revendication 1, **caractérisé en ce que** les moyens formant boîtier contiennent un premier agencement d'éléments résonnants couplés (A) et un deuxième agencement contigu d'éléments résonnants couplés (B), les moyens formant port d'entrée (22) étant communs aux deux agencements, et des moyens formant port de sortie respectifs (25, 26) pour chaque agencement.
3. Filtre radiofréquence selon la revendication 2, **caractérisé en ce que** chaque partie d'extrémité dudit conducteur élastique (29) est relativement plus large que la partie entre celles-ci.

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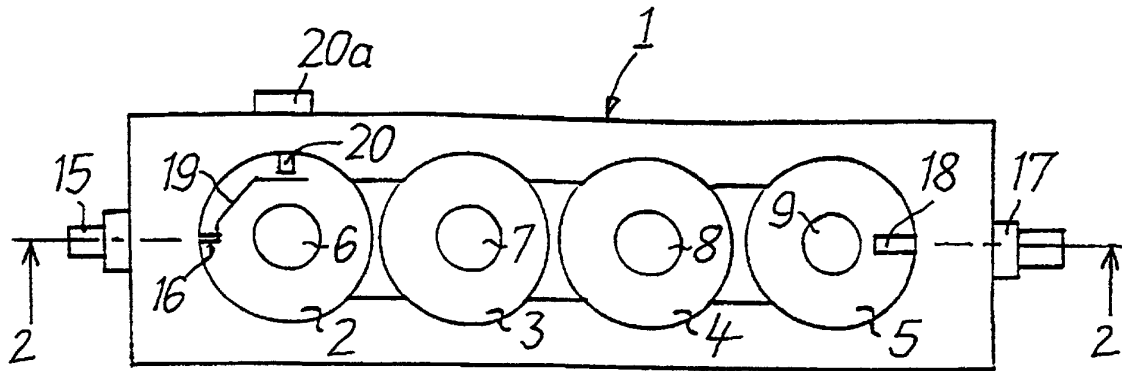


Fig. 1

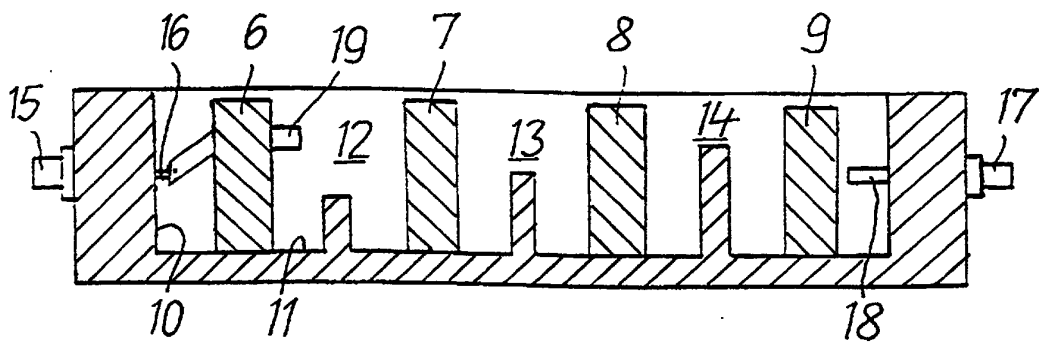


Fig. 2

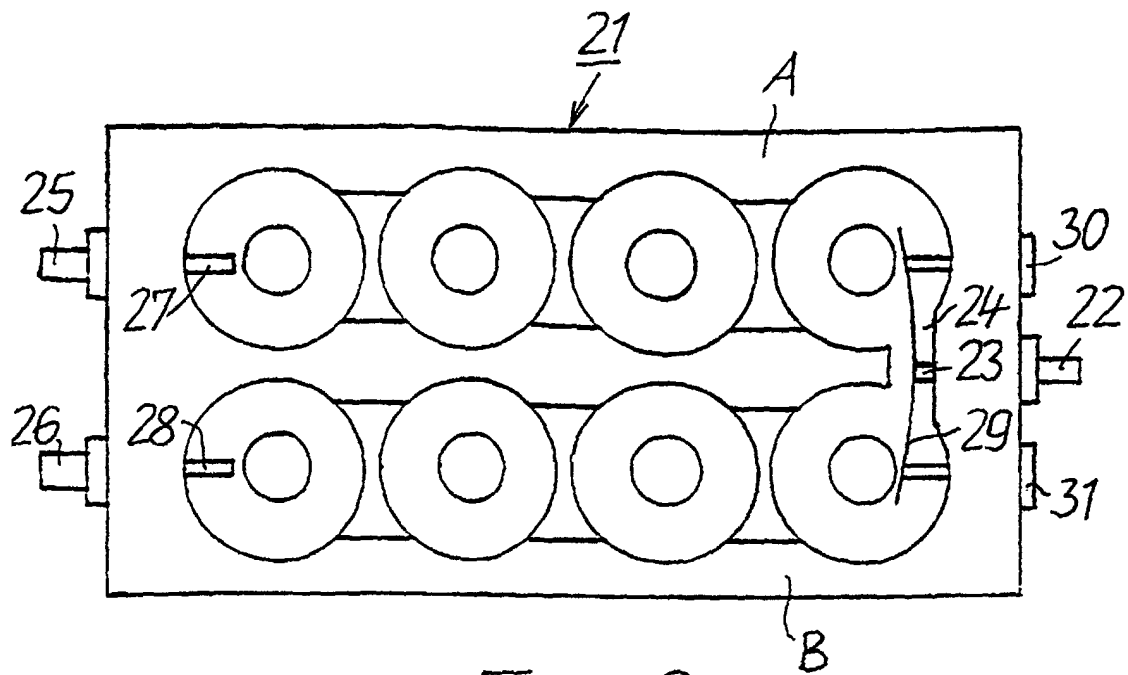


Fig. 3

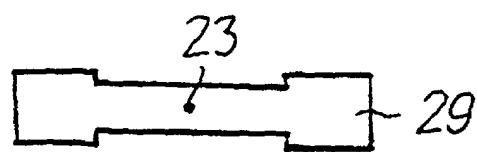


Fig. 4