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(54) **CAPACITIVE CROSS-COUPLING STRUCTURE AND CAVITY FILTER**

(57) A capacitive cross-coupling structure and a cavity filter are disclosed in the present disclosure, which can enhance the coupling amount and expanding the capacitive coupling adjustable range. The capacitive cross-coupling structure is used for coupling energies of a first resonator and a second resonator, and includes : an insulating support base disposed between the first resonator and the second resonator; and a coupling fly bar disposed on the insulating support base, the coupling fly bar including a first coupling part disposed between the first resonator and the insulating support base and a second coupling part disposed between the second resonator and the insulating support base; one end of the first coupling part being far away from the insulating support base is grounded, and one end of the second coupling part being far from the insulating support base is suspended and spaced apart from the second resonator at an interval.

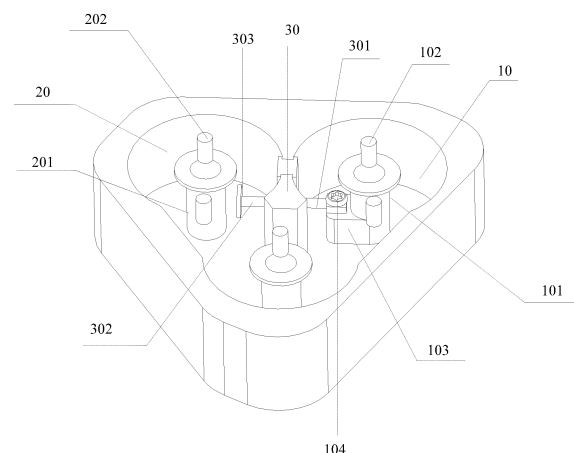


Figure 2

Description**Field of the Invention**

5 [0001] The present invention relates to the field of communication technology, in particular, to a capacitive cross-coupling structure and a cavity filter.

Background

10 [0002] Generally, the suppression of the filter is improved by adding a coupling structure in the cavity filter. At present, most of the coupling structure of the cavity filter is a "U" shaped structure or a "flying bar with disks at both ends". However, due to the limited space, the "U"-shaped structure is not suitable for the cavity of a resonator with a flange.

[0003] Please refer to FIG. 1, which is a prior art cavity filter. In Fig. 1, a cavity filter with a resonant cavity is taken as an example. A resonator is set inside each resonant cavity. As shown in FIG. 1, a coupling structure 300 is a structure of "a flying bar 400 with coupling discs 500 at both ends". The coupling structure 300 is installed in the cavity filter. For any resonator 200, in order to achieve a strong capacitive cross-coupling, the coupling discs 500 need to be very close to the resonator 200, which causes assembly difficulties. In addition, the coupling amount must be adjusted by adjusting the distance between the resonator 200 and the coupling disc 500. As the coupling disc 500 is very close to the resonator 200, the adjusting distance is limited, so that the adjustable range of the coupling amount between the coupling structure 300 and the resonator 200 is limited, and thus cannot be adapted to many application scenarios.

20 [0004] It is obvious that the current coupling structure makes the cavity filter unable to adapt to many application scenarios.

SUMMARY OF THE INVENTION

25 [0005] The embodiments of the present invention provide a capacitive cross-coupling structure and a cavity filter, which can enhance the coupling amount and increase the adjustable range of the capacitive coupling.

[0006] In a first aspect, the embodiment of the present invention provides a capacitive cross-coupling structure for coupling the energy of the first resonator and the second resonator.

30 [0007] The capacitive cross-coupling structure includes:

an insulating support base disposed between the first resonator and the second resonator; and
a coupling fly bar disposed on the insulating support base, the coupling fly bar comprising a first coupling part disposed between the first resonator and the insulating support base and a second coupling part disposed between
35 the second resonator and the insulating support base.

[0008] Here, one end of the first coupling part far away from the insulating support base is grounded, and one end of the second coupling part far away from the insulating support base is suspended and spaced apart from the second resonator at an interval.

40 [0009] In the two coupling parts of the coupling structure of the embodiment of the present invention, the first coupling part is grounded, and the distance between the end of the second coupling part far away from the insulating support base and the second resonator is maintained, so as to realize adjustment of the distance between an end of the second coupling part away from the insulating support base and the second resonator, according to the required coupling amount. As the first coupling part is grounded, even if the distance between the second coupling part and the second resonator is relatively short, the coupling amount between the coupling fly bar and the resonator can be made larger. Compared with the prior art, in the embodiment of the present invention, the coupling structure is adjusted by adjusting the distance between the second coupling part and the second resonator, so that the resulting coupling range between the flying bar and the resonator is larger, which can be applied to a variety of different application scenarios.

[0010] Optionally, the coupling fly bar is detachably disposed on the insulating support base.

50 [0011] In the embodiment of the present invention, the coupling flying bar is detachably disposed on the insulating support base, then the coupling flying bar can be used in different coupling structures to obtain a variety of coupling structures and have a wider application range.

[0012] Optionally, the interval between the end of the second coupling part far away from the insulating support base and the second resonator is greater than 1mm.

55 [0013] In the embodiment of the present invention, the interval between the end of the second coupling part far away from the insulating support base and the second resonator is greater than 1mm. This can ensure that the distance between the end of the second coupling part far away from the insulating support base and the second resonator is not too small to adjust the coupling amount. Therefore, when the coupling structures are mass-produced, the coupling

consistency of the mass-produced coupling structures can be ensured as much as possible.

[0014] Optionally, the end of the first coupling part far away from the insulating support base is connected to the first resonator for being grounded; or, the end of the first coupling part far away from the insulating support base is connected to a bottom of a cavity defined between the first resonator and the insulating support base for being grounded; or, the end of the first coupling part far away from the insulating support base is connected to a cover plate on the first resonator for being grounded.

[0015] In the embodiment of the present invention, the first coupling part can be grounded in any one of the above three ways, which is relatively flexible.

[0016] Optionally, a coupling disc is provided at the end of the second coupling part far away from the insulating support base.

[0017] In the embodiment of the present invention, when a cavity filter with a coupling structure is used, the distance between the coupling disc and the second resonator can be adjusted, or the diameter of the coupling disc can be adjusted. As a result, the coupling amount between the first coupling part and the first resonator and the coupling amount between the second coupling part and the second resonator are greater than the preset coupling amount, thereby realizing adjustment of the coupling amount in different ways.

[0018] Optionally, it also includes a support disposed between the insulating support base and the first resonator, and the end of the first coupling part far away from the insulating support base is disposed on the insulating support base for being grounded.

[0019] In the embodiment of the present invention, the first coupling part can be grounded with the first resonator through an intermediate piece, that is, a support piece, in a flexible manner.

[0020] Optionally, the supporting piece and the first resonator are of an integral structure; or, the supporting piece and the first resonator are of a separated structure.

[0021] In the embodiment of the present invention, the supporting piece and the first resonator may be of an integrated structure, which reduces the difficulty of adjustment, ensures the consistency of the production and assembly process, and improves the production efficiency.

[0022] Optionally, the end of the first coupling part far away from the insulating support base is fixed on the support through a threaded connective member.

[0023] Optionally, the coupling fly bar is plated with a metal material.

[0024] In the embodiment of the present invention, the coupling fly rod may be plated with a metal material to ensure that it has good conductivity as much as possible.

[0025] In a second aspect, an embodiment of the present invention provides a cavity filter, including a cavity in which the capacitive cross-coupling structure as described in the first aspect is provided.

[0026] Optionally it further includes a third resonator and a fourth resonator, wherein a center line between the third resonator and the fourth resonator is perpendicular to a center line between the first resonator and the second resonator.

[0027] In the embodiment of the present invention, the coupling structure can also be applied to a filter with four resonant cavities to realize dual transmission zeros at the low end of the passband. Compared with the existing cavity filter, the coupling structure in the embodiment of the present invention can achieve a larger adjustment range of the coupling amount of the cavity filter, and can meet the existing cavity filter suppression requirements.

[0028] In the two coupling parts of the coupling structure of the embodiment of the present invention, the first coupling part is grounded, and the distance between the end of the second coupling part far away from the insulating support base and the second resonator is maintained, to adjust the distance between the end of the second coupling part away from the insulating support base and the second resonator according to required coupling amount the requirement. Since the first coupling part is grounded, even if the distance between the second coupling part and the second resonator is relatively short, the coupling amount between the coupling fly bar and the resonator can be made larger. Compared with the prior art, in the embodiment of the present invention, the coupling structure is adjusted by adjusting the distance between the second coupling part and the second resonator, and the obtained coupling amount between the flying bar and the resonator has a larger range, and accordingly it can be applied to a variety of different application scenarios.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029]

FIG. 1 is a schematic structural diagram of a cavity filter provided by prior art;

FIG. 2 is a schematic diagram of a structure of a cavity filter provided by an embodiment of the present invention;

FIG. 3 is a schematic diagram of a structure of a cavity filter provided by an embodiment of the present invention;

FIG. 4 is a schematic diagram of a prior art cavity filter model;

FIG. 5 is a schematic diagram of a model of a cavity filter provided by an embodiment of the present invention;

Fig. 6 is a simulation diagram of the coupling range of a prior art cavity filter; and

FIG. 7 is a simulation diagram of the coupling amount range of a cavity filter provided by an embodiment of the present invention.

DETAILED DESCRIPTION

[0030] In order to make the objectives, technical solutions and advantages of the present invention clearer, the technical solutions in the embodiments of the present invention will be described clearly and completely in conjunction with the accompanying drawings in the embodiments of the present invention.

[0031] At present, a coupling structure 300 of a cavity filter as shown in FIG. 1 is "a flying bar 400 with coupling discs 500 at both ends". It adjusts the coupling amount by adjusting the distance between the resonator 200 and the coupling disc 500. Since the coupling disc 500 is very close to the resonator 200 and the adjustment distance is limited, the adjustable range of the coupling amount between the coupling structure 300 and the resonator 200 is limited, and it cannot be adapted to many application scenarios.

[0032] In view of this, the embodiments of the present invention provide a capacitive cross-coupling structure and a cavity filter. Among the two coupling parts of the coupled flying bar of the capacitive cross-coupling structure, the first coupling part is grounded, and one end of the second coupling part away from the insulating support base is separated from the second resonator. This realizes that the distance between the end of the second coupling part away from the insulating support base and the second resonator can be adjusted according to the required coupling amount. Since the first coupling part is grounded, even if the distance between the second coupling part and the second resonator is relatively short, the coupling amount between the coupling fly rod and the resonator can be made larger, that is, the coupling amount of the cavity filter is large. Compared with the prior art, in the embodiment of the present invention, the coupling structure is adjusted by adjusting the distance between the second coupling part and the second resonator, and the obtained coupling amount between the flying bar and the resonator has a larger range, that is, the range of the coupling amount of the cavity filter is larger, so that it can be applied to a variety of different application scenarios.

[0033] Referring to FIG. 2, an embodiment of the present invention provides a capacitive cross-coupling structure, which is used to couple the energy. Here, the first resonator 101 is in a first resonant cavity 10, and the second resonator 201 is in a second resonant cavity 20. The capacitive cross-coupling structure includes an insulating support base 30 and a coupling flying bar. Here, the insulating support base 30 is arranged between the first resonator 101 and the second resonator 201. The coupling flying bar is arranged on the insulating support base 30, and it includes a first coupling part 301 arranged between the first resonator 201 and the insulating support base 30, and a first coupling part 301 arranged between the second resonator 201 and the insulating support base 30. The second coupling part 302. Here, the first resonator 101 is provided with a first metal tuning screw 102, and the second resonator 201 is provided with a second metal tuning screw 202. The first coupling part 301 is used for coupling with the first resonator 101, and the second coupling part 302 is used for coupling with the second resonator 201.

[0034] It should be noted that, in the embodiment of the present invention, the first coupling part 301 and the second coupling part 302 are not limited, as long as any one of the coupling parts in the coupling structure is grounded, and the distance between the other coupling part and the closer resonator is within a certain range. In the following, the first coupling part 301 is grounded for description.

[0035] In the embodiment of the present invention, the capacitive cross-coupling structure can be applied to a cavity filter. When the capacitive cross-coupling structure is installed in the cavity of the cavity filter, the first coupling part 301 is connected to the ground in the cavity filter, the end of the first coupling part 301 away from the insulating support base 30 is grounded. A distance is maintained between the end of the second coupling part 302 away from the insulating support base 30 and the second resonator 201. It can also be understood that the distance between the end of the second coupling part 302 away from the insulating support base 30 and the second resonator 201 can be adjusted within a certain range to achieve at least two different coupling amounts.

[0036] In the embodiment of the present invention, when the cavity filter is produced, the initial distance between the end of the second coupling part 302 away from the insulating support base 30 and the second resonator 201 is greater than 1 mm. During production, due to fabrication errors, assembly errors, etc., the initial distance between the end of the second coupling part 302 away from the insulating support base 30 and the second resonator 201 may be smaller. However, if the distance between the end of the second coupling part 302 away from the insulating support base 30 and the second resonator 201 is small, it is difficult to adjust other resonators by adjusting one or some resonators of the cavity filter, and so, adjustment is more difficult. Therefore, the initial distance between the end of the second coupling part 302 away from the insulating support base 30 and the second resonator 201 is greater than 1 mm, so as to ensure that distance of the end of the second coupling part away from the insulating support base and the second resonator is not too small, otherwise it is difficult to adjust the coupling amount. In this way, it can be ensured that when the coupling structures are mass-produced, the coupling consistency of the mass-produced coupling structures is better.

[0037] A prior art cavity filter is shown in Fig. 1. To achieve strong capacitive cross-coupling, for any resonator 200, the distance between the coupling disc 500 and the resonator 200 needs to be very close, which leads to limited

adjustment distance. As a result, the adjustable range of the coupling amount between the coupling structure 300 and the resonator 200 is limited, and the obtained coupling amount range is also limited. Comparatively, in the embodiment of the present invention, since the first coupling part 301 is grounded, if the coupling amount is to be the same as that in FIG. 1, then, relative to FIG. 1, the distance between the end of the second coupling part 302 far away from the insulating support base and the second resonator 201 will increase, which makes it easier to assemble and improves assembly efficiency. However, if the distance between the end of the second coupling part 302 away from the insulating support base 30 and the second resonator 201 is the same as that between the coupling disc 500 and the resonator 200 shown in FIG. 1, then compared with the coupling amount between the coupling disc 500 and the resonator 200 shown in FIG. 1, in the embodiment of the present invention, the coupling amount between the second coupling part 302 and the second resonator 201 is larger, so that the coupling structure provided by the embodiment of the invention can further expand the range of the coupling amount and apply to more different application scenarios.

[0038] In the embodiment of the present invention, the second coupling part 302 may be provided with a coupling disc 303, and the diameter of the coupling disc 303 may be within a certain range. When using a cavity filter, the distance between the coupling disc 303 and the second resonator 201 can be adjusted, or the diameter of the coupling disc 303 can be adjusted to make the coupling amount between the first coupling part 301 and the first resonator 101 and the coupling amount between the second coupling part 302 and the second resonator 201, are greater than the preset coupling amount, so as to adjust the coupling amount in various ways.

[0039] In the embodiment of the present invention, the first coupling part 301 may be grounded in various ways. In a possible implementation manner, an end of the first coupling part 301 away from the insulating support base 30 may be connected to the first resonator 101 to be grounded. Alternatively, the end of the first coupling part 301 away from the insulating support base 30 may be connected to a bottom of the cavity between the first resonator 201 and the insulating support base 30 to be grounded. Since there is a certain height difference between the bottom of the cavity and the first coupling part 301, and the bottom of the cavity is located between the first coupling part 301 or the first resonator 201 and the insulating support base 30, this makes it difficult to assemble when the first coupling part 301 is connected to the bottom of the cavity. In a possible implementation manner, the first coupling part 301 may be connected to a cover plate of the first resonator 201 to be grounded. Since the cover plate and the first coupling part 301 have a certain height difference, when the first coupling part 301 is connected to the cover plate, there is also a problem of difficulty in assembly.

[0040] In view of this, in the embodiment of the present invention, a support piece 103 may be further provided inside the first resonant cavity 10, and the support piece 103 and the first resonator 101 are commonly grounded. In this way, by connecting the first coupling part 301 to the support piece 103, grounding can be achieved. In order to save space and to make the structural components in the cavity filter more stable, the support piece 103 can be fixed on the first resonator 101. If the support piece 103 and the first resonator 101 are of separate structure, the support piece 103 can be adhered to the first resonator 101 by possible fixing methods, for example, glue. Or, in order to be more stable, the support piece 103 and the first resonator 101 may be of an integral structure. The integrated design reduces the difficulty of adjustment and solves the industry's shortcomings, that is, during the adjustment process, due to assembly errors, the first resonator 101 is pulled to adjust the coupling amount. This ensures the consistency of the production assembly process, improves production efficiency, and is suitable for mass production.

[0041] In the embodiment of the present invention, the support piece 103 may be a columnar body adapted to the shape of an outer wall of the first resonator 101, or the support piece 103 may be of a convex structure or other possible support structures. The first coupling part 301 may be fixed on the support piece 103 by a threaded connective member 104. If the threaded connective member 104 is made of metal material, the threaded connective member 104 needs to be plated with a certain thickness of metal material to ensure good conductivity. In the embodiment of the present invention, the inside of the first resonant cavity 10, the second resonant cavity 20, the coupling fly rod, etc. may be plated with a certain thickness of metal material, such as gold, silver or copper, to maintain good conductivity as much as possible.

[0042] Referring to FIG. 3, the capacitive cross-coupling structure provided by the embodiment of the present invention can be applied to a cavity filter with four resonant cavities. As shown in FIG. 3, a third resonant cavity 40 includes a third resonator 401, and a fourth resonant cavity 50 includes a fourth resonator 501. A center line of the third resonant cavity 40 and the fourth resonant cavity 50 and is perpendicular to that of the first resonant cavity 10 and the second cavity 20. The coupling structure can be placed in the middle of the four resonators to achieve dual transmission zeros at the low end of the passband. Compared with a prior art cavity filter, the coupling structure in the embodiment of the present invention can achieve a larger adjustment range of the coupling amount of the cavity filter, and can meet the suppression requirements that the prior art cavity filter is difficult to achieve.

[0043] In order to facilitate understanding, the following experimental data illustrates that the coupling structure provided by the embodiment of the present invention makes the adjustment range of the coupling amount of the cavity filter larger. As shown in FIG. 4, the cavity filter provided by the embodiment of the present invention is simulated while keeping the cavity size of the cavity filter and the frequency point of the communication center the same. The simulation result is shown in Fig. 5. As shown in Fig. 6, a prior art cavity filter is simulated, and the simulation results are shown in Fig. 7. The distance between the end of the second coupling part 302 away from the insulating support base 30 and the second

resonator 201 is adjusted to obtain the coupling amount of the cavity filter provided by the embodiment of the present invention and that of the prior art cavity filter, as shown in Table 1.

[0044] Table 1 Data table of the prior art coupling amount and the coupling amount of the embodiment of the present invention

Distance (mm)	Realized frequency band (MHz)	Center frequency (MHz)	Prior art coupling amount	Coupling amount of the embodiment of the present invention	Increase ratio of coupling amount
3	790-862	776	0.00773	0.02835	266.8%
2	790-862	776	0.01030	0.03727	261.8%
1.5	790-862	776	0.01418	0.04382	209.0%
1	790-862	776	0.01933	0.05799	200.0%

[0045] It can be seen from Table 1 that when the distance between the end of the second coupling part 302 away from the insulating support base 30 and the second resonator 201 is the same, the coupling amount of the embodiment of the present invention is at least 2 times greater than the conventional coupling amount. For example, when the distance between the second coupling part 302 and the second resonator 201 is 1mm, the coupling amount in the embodiment of the present invention is 0.05799, while the prior art coupling amount is 0.01933. That is, the coupling amount of the embodiment of the present invention is three times the prior art coupling amount.

[0046] In summary, among the two coupling parts of the coupling structure of the embodiment of the present invention, the first coupling part is grounded, and the end of the second coupling part away from the insulating support base is spaced from the second resonator to realize: adjustment of the distance between the end of the second coupling part away from the insulating support and the second resonator. Since the first coupling part is grounded, even if the distance between the second coupling part and the second resonator is relatively short, the coupling amount between the coupling fly rod and the resonator can be made larger. Compared with the prior art, in the embodiment of the present invention, the coupling structure is adjusted by adjusting the distance between the second coupling part and the second resonator, and the obtained coupling amount between the flying bar and the resonator has a larger variation range, so as to meet the requirements of the coaxial cavity for the coupling amount, achieve different frequency bands and performance and quality assurance requirements, it can be applied to a variety of different application scenarios, and reduces costs.

[0047] Those skilled in the art can clearly understand that for the convenience and conciseness of the description, only the division of the above-mentioned functional modules is used as an example. In actual applications, the above-mentioned functions can be allocated by different functional modules as required, namely the internal structure of the device is divided into different functional modules to complete all or part of the functions described above.

[0048] Obviously, those skilled in the art can make various changes and modifications to the present invention without departing from the spirit and scope of the present invention. In this way, if these modifications and variations of the present invention fall within the scope of the claims of the present invention and their equivalent technologies, the present invention is also intended to include these modifications and variations.

Claims

1. A capacitive cross-coupling structure for coupling energy of a first resonator and a second resonator, comprising:

an insulating support base disposed between the first resonator and the second resonator; and
a coupling fly bar disposed on the insulating support base, the coupling fly bar comprising a first coupling part disposed between the first resonator and the insulating support base and a second coupling part disposed between the second resonator and the insulating support base;
wherein one end of the first coupling part far away from the insulating support base is grounded, and one end of the second coupling part far away from the insulating support base is suspended and spaced apart from the second resonator at an interval.

2. The capacitive cross-coupling structure of claim 1, wherein the coupling fly bar is detachably disposed on the insulating support base.

3. The capacitive cross-coupling structure of claim 1, wherein the interval between the end of the second coupling part

far away from the insulating support base and the second resonator is greater than 1 mm.

4. The capacitive cross-coupling structure of claim 1, wherein the end of the first coupling part far away from the insulating support base is connected to the first resonator for being grounded; or
 5 the end of the first coupling part far away from the insulating support base is connected to a bottom of a cavity defined between the first resonator and the insulating support base for being grounded; or
 the end of the first coupling part far away from the insulating support base is connected to a cover plate on the first resonator for being grounded.

10 5. The capacitive cross-coupling structure of claim 1, wherein a coupling disc is provided at the end of the second coupling part far away from the insulating support base.

6. The capacitive cross-coupling structure of claim 1, further comprising:
 15 a support disposed between the insulating support base and the first resonator, wherein the end of the first coupling part far away from the insulating support base is disposed on the insulating support base for being grounded.

7. The capacitive cross-coupling structure of claim 6, wherein the end of the first coupling part far away from the insulating support base is fixed on the support through a threaded connective member.

20 8. The capacitive cross-coupling structure of claim 1, wherein the coupling fly bar is plated with metal material.

9. A cavity filter comprising a cavity, wherein the capacitive cross-coupling structure according to any one of claims 1 to 8 is provided within the cavity.

25 10. The cavity filter of claim 9, further comprising:

a third resonator; and
 a fourth resonator,

30 wherein a center line between the third resonator and the fourth resonator is perpendicular to a center line between the first resonator and the second resonator.

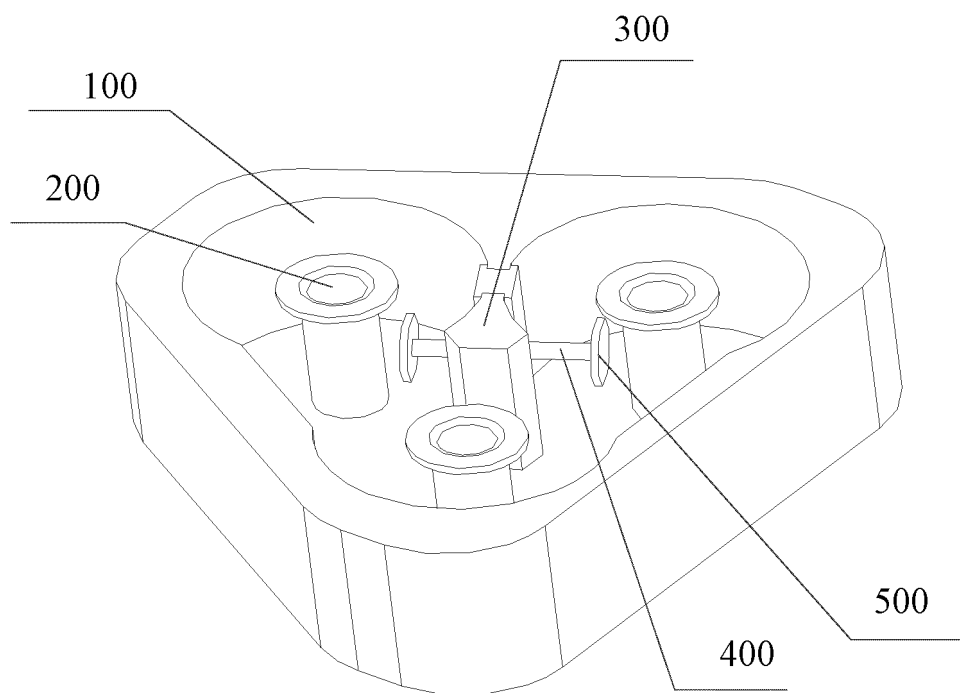


Figure 1

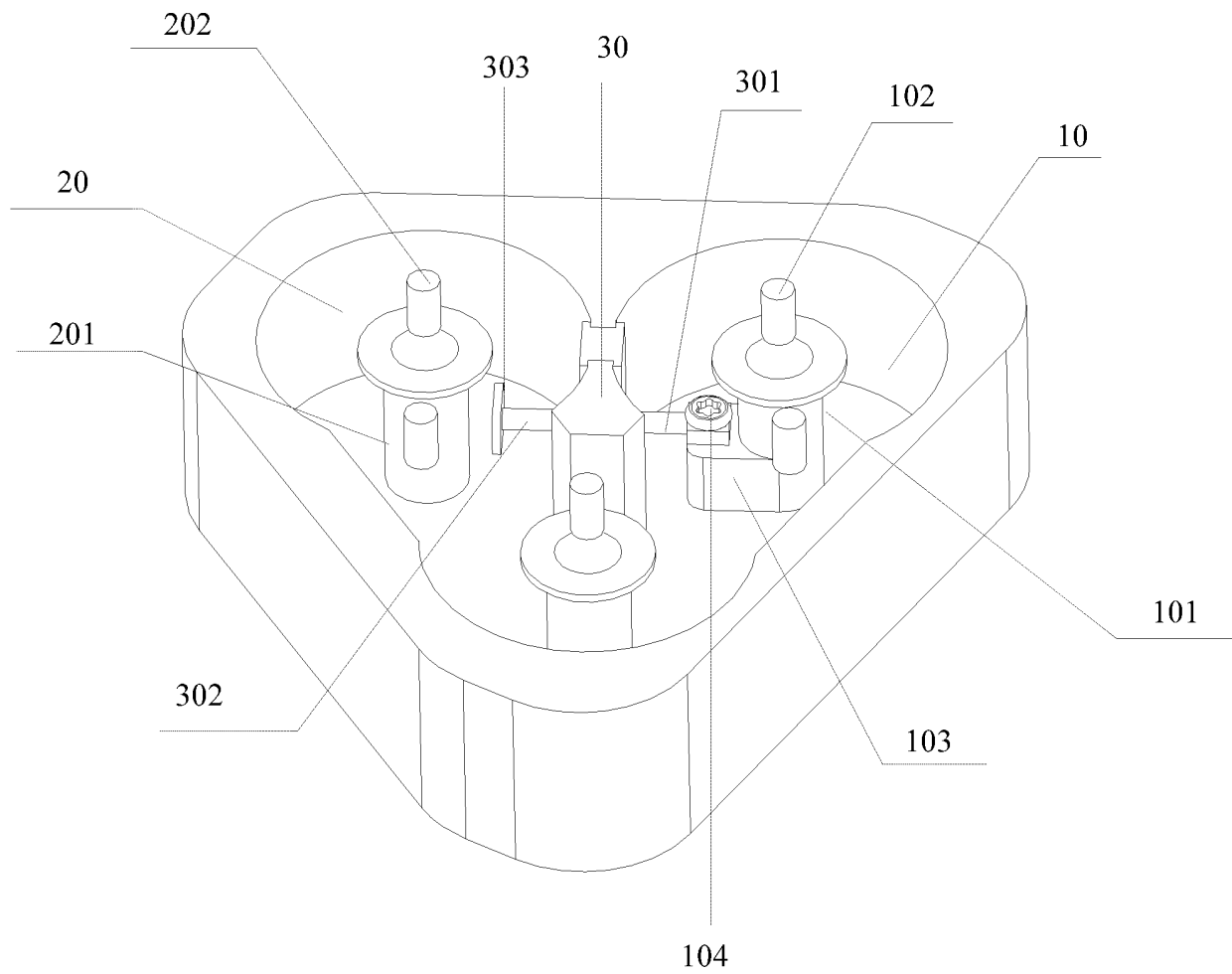


Figure 2

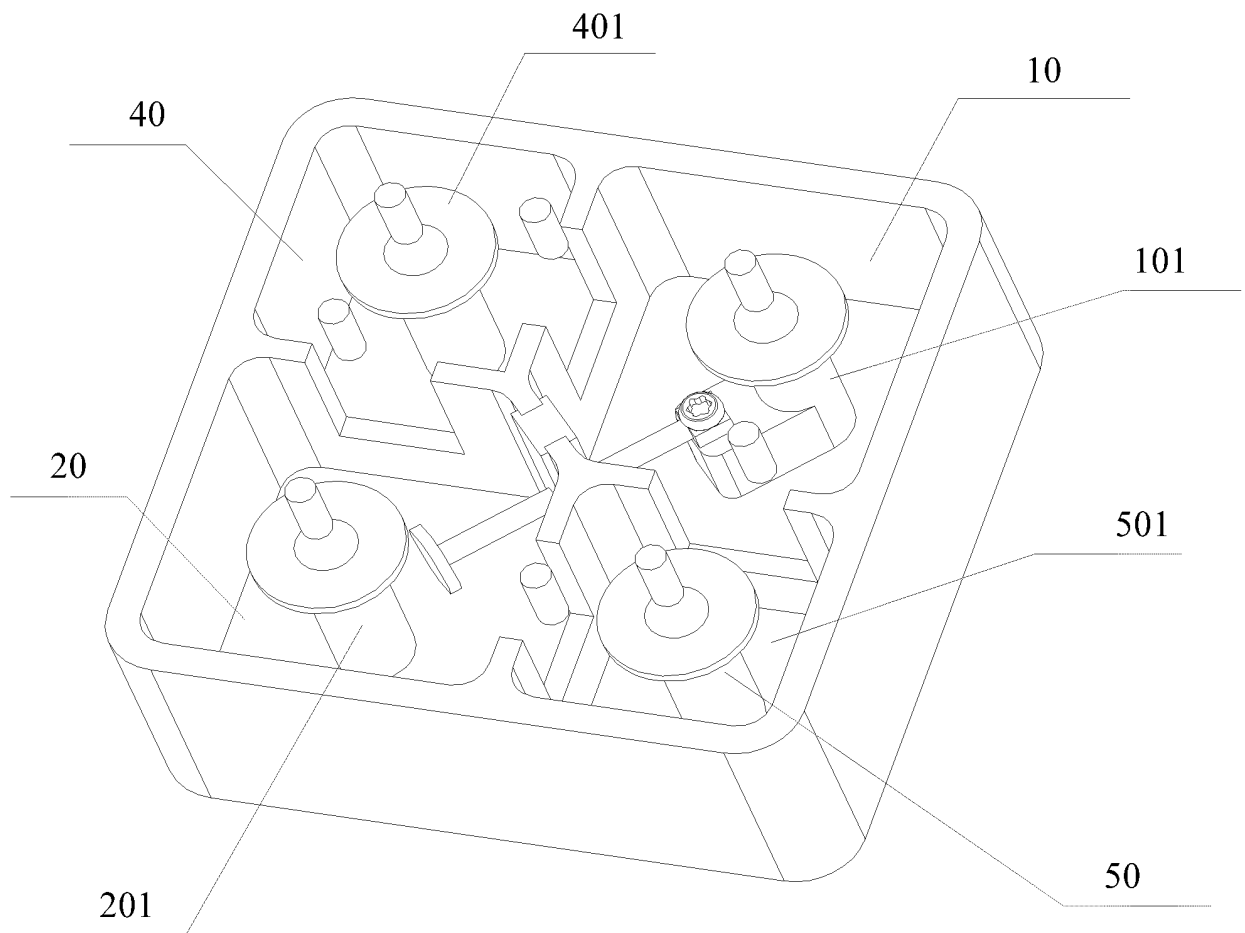


Figure 3

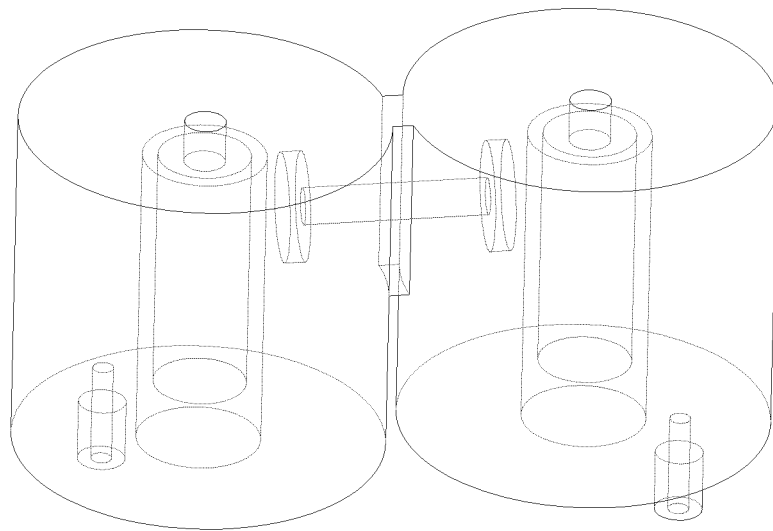


Figure 4

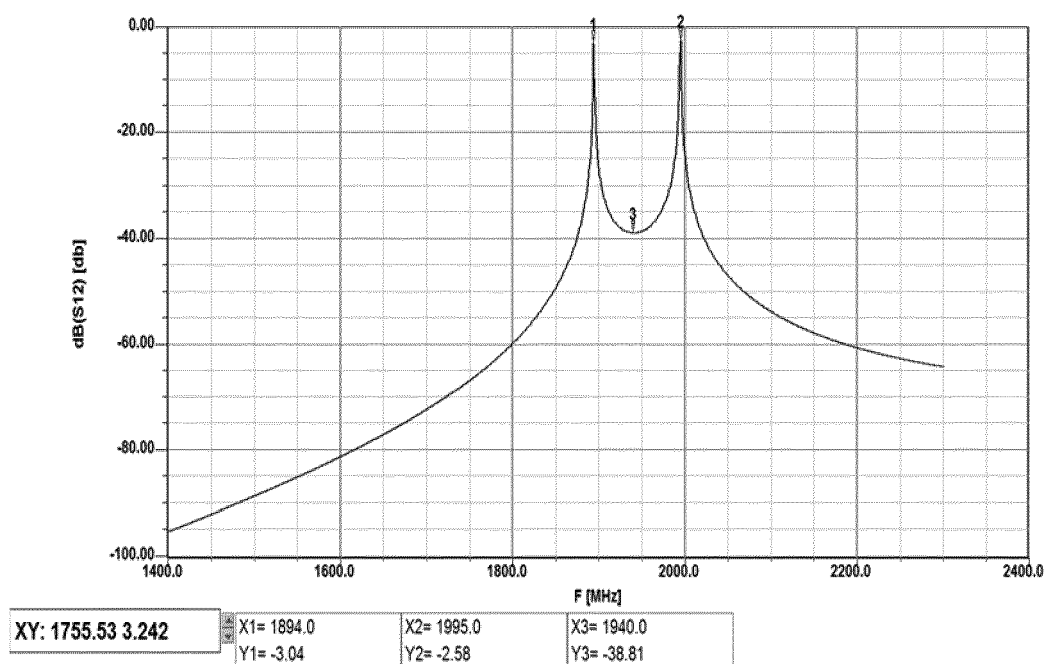


Figure 5

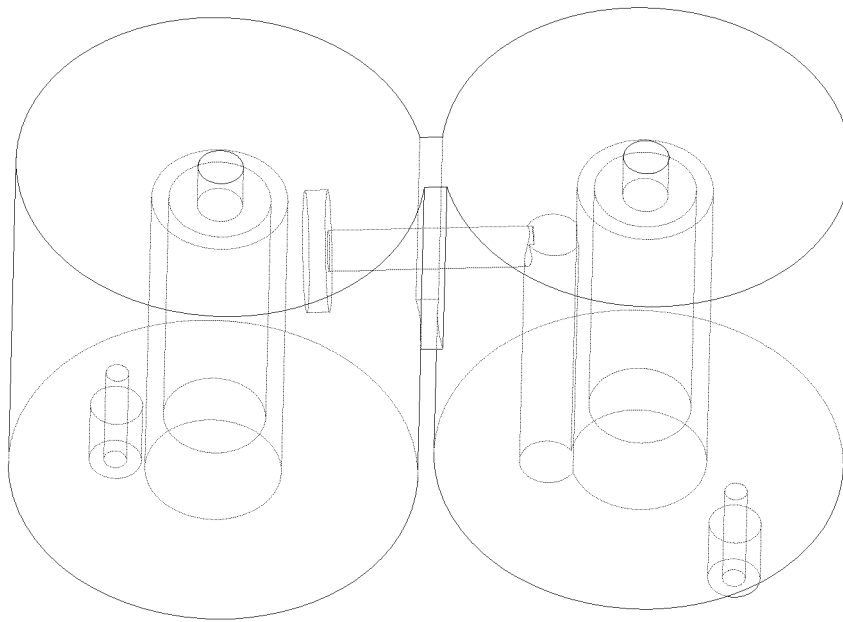


Figure 6

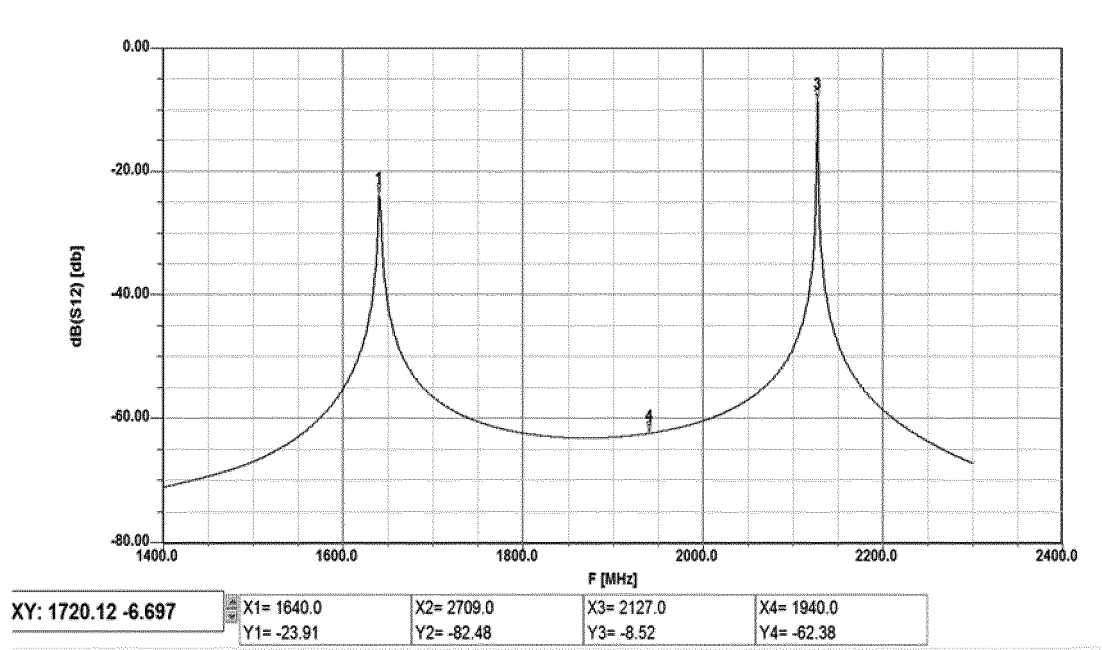


Figure 7

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2019/090793

5	A. CLASSIFICATION OF SUBJECT MATTER H01P 1/208(2006.01)i	
	According to International Patent Classification (IPC) or to both national classification and IPC	
	B. FIELDS SEARCHED	
10	Minimum documentation searched (classification system followed by classification symbols) H01P	
	Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched	
15	Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) CNPAT, CNKI, WPI, EPODOC: 容性, 交叉, 耦合, 飞杆, 接地, 耦合盘, 滤波器, 腔体, 同轴, capacitive, cross w coupling, cavity, filter, grounding, ground, resonator	
	C. DOCUMENTS CONSIDERED TO BE RELEVANT	
20	Category*	Citation of document, with indication, where appropriate, of the relevant passages
	PX	CN 208298985 U (COMBA TELECOM SYSTEMS (CHINA) CO., LTD. ET AL.) 28 December 2018 (2018-12-28) claims 1-10
25	PX	CN 108649303 A (COMBA TELECOM SYSTEMS (CHINA) CO., LTD. ET AL.) 12 October 2018 (2018-10-12) claims 1-10
	X	CN 201417813 Y (MOBI ANTENNA TECHNOLOGIES (SHENZHEN) CO., LTD.) 03 March 2010 (2010-03-03) description, p. 3, and figures 3 and 4
30	A	CN 101527380 A (COMBA TELECOM SYSTEMS (CHINA) CO., LTD.) 09 September 2009 (2009-09-09) entire document
	A	CN 201877546 U (WUHAN FINGU ELECTRONIC TECHNOLOGY CO., LTD.) 22 June 2011 (2011-06-22) entire document
35	A	EP 1321997 A2 (RADIO FREQUENCY SYSTEMS, INC.) 25 June 2003 (2003-06-25) entire document
	☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.	
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	Date of the actual completion of the international search	Date of mailing of the international search report
	19 August 2019	29 August 2019
50	Name and mailing address of the ISA/CN	Authorized officer
	China National Intellectual Property Administration (ISA/CN) No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088 China	
55	Facsimile No. (86-10)62019451	Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2019/090793

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