(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 3 985 791 A1

(12) # EUROPEAN PATENT APPLICATION
published in accordance with Art. 153(4) EPC

(43) Date of publication:
20.04.2022 Bulletin 2022/16

(21) Application number: **20837338.1**

(22) Date of filing: **13.07.2020**

(51) International Patent Classification (IPC):
H01P 1/208 *(2006.01)* ***H01P 1/20*** *(2006.01)*

(52) Cooperative Patent Classification (CPC):
H01P 1/20; H01P 1/208

(86) International application number:
PCT/CN2020/101619

(87) International publication number:
WO 2021/004544 (14.01.2021 Gazette 2021/02)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **11.07.2019 CN 201921083271 U**

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(54) **FILTER COUPLING UNIT AND FILTER**

(57) Embodiments of the present disclosure provide a filter coupling unit and a filter. The filter coupling unit comprises sub-resonant cavities, a shielding layer, tuning holes, a capacitive coupling hole and an inductive coupling hole, wherein the shielding layer is arranged on an outer surface of the coupling unit; a plurality of sub-resonant cavities are provided in the coupling unit, and the-sub resonant cavities are distributed in the coupling unit; each of the tuning holes is formed in an end face of the corresponding sub-resonant cavity and is used for adjusting the frequency of the filter; there is at least one capacitive coupling hole located between at least two of the sub-resonant cavities and used for generating a capacitive coupling effect; and there is at least one inductive coupling hole arranged between adjacent sub-resonant cavities and used for generating an inductive coupling effect. Cross-coupling of the filter is achieved, the structure thereof is simple, and same is easily implemented.

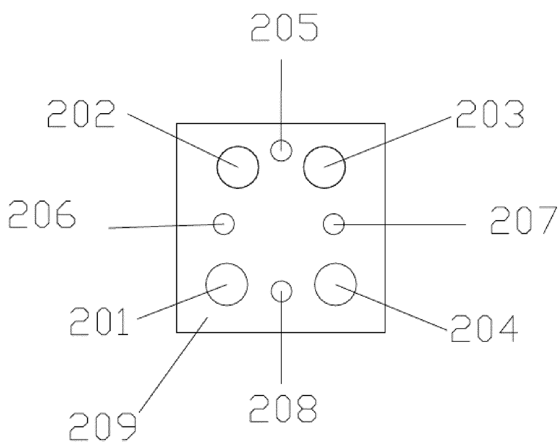

FIG. 1

Description

TECHNICAL FIELD

[0001] The embodiments of the present disclosure relate but are not limited to the field of communication, and in particular, relate but are not limited to a filter coupling unit and a filter.

BACKGROUND

[0002] The wavelength of an electromagnetic wave may be shortened when the electromagnetic wave propagates in a material having a high dielectric constant. By virtue of that theory, under a condition of the same indexes, the size of a filter can be reduced by using a dielectric material in replacement of a conventional metal material. The research on dielectric filters has always been a hot spot in the communication industry. As filters are important components in wireless communication products, dielectric filters are of particular significance to the miniaturization of communication products.

[0003] The significance of cross-coupling lies in that the phase and polarity of an electromagnetic wave are reversed after the electromagnetic wave passes through different coupling links, thereby infinitesimal notch points (i.e., transmission zeros) are generated outside the filter band. Thus, the out-of-band rejection of a filter is improved without increasing the number of resonant cavities.

[0004] Out-of-band zeros are generated on either or both sides of the high end and the low end of the working passband of a filter. A type of cross-coupling in which two out-of-band zeros are at both sides of the passband of a filter respectively and have different intensities (i.e., at different distances from the frequency of the channel) is referred to as unbalanced cross-coupling. Another type of cross-coupling in which two out-of-band zeros are at both sides of the passband of a filter respectively and have the same intensity (i.e., at the same distance from the frequency of the channel) is referred to as balanced cross-coupling. Both of the above-mentioned types of cross-coupling can be realized easily with conventional metal resonant cavities, because these metal resonant cavities have a large adjustment space. However, it is quite difficult to create a form of cross-coupling between two resonant cavities of a dielectric filter, because the dielectric filter is fully filled with solid ceramics and consequently has poor plasticity and adjustability.

SUMMARY

[0005] The embodiments of the present disclosure provide a filter coupling unit and a filter, to mainly solve a technical problem of providing a cross-coupling structure in a dielectric filter.

[0006] In order to solve the above-mentioned technical problem, the embodiments of the present disclosure provide a filter coupling unit, the filter coupling unit includes a plurality of sub-resonant cavities provided and distributed in the coupling unit; a shielding layer arranged on an outer surface of the coupling unit; a plurality of tuning holes, each of the tuning holes being respectively formed in an end face of a respective one of the sub-resonant cavities and configured for adjusting a frequency of a filter; at least one capacitive coupling hole arranged between at least two of the sub-resonant cavities and configured for generating a capacitive coupling effect; and at least one inductive coupling hole arranged between adjacent sub-resonant cavities and configured for generating an inductive coupling effect.

[0007] The embodiments of the present disclosure further provide a filter, the filter includes a power supply unit and at least one filter coupling unit described above.

[0008] The present disclosure has the following beneficial effects.

[0009] According to the embodiments of the present disclosure, a filter coupling unit and a filter are provided. The filter coupling unit includes a plurality of sub-resonant cavities provided and distributed in the coupling unit; a shielding layer arranged on an outer surface of the coupling unit; a plurality of tuning holes, each of the tuning holes being respectively formed in an end face of a respective one of the sub-resonant cavities and configured for adjusting a frequency of a filter; at least one capacitive coupling hole arranged between at least two of the sub-resonant cavities and configured for generating a capacitive coupling effect; and at least one inductive coupling hole arranged between adjacent sub-resonant cavities and configured for generating an inductive coupling effect. Thus, cross-coupling of the filter is achieved, the structure is simple, and the cross-coupling is easy to implement.

[0010] Other features and corresponding beneficial effects of the present disclosure will be described in the following part of the description. In addition, it should be understood that at least some of the beneficial effects become obvious from the description of the present disclosure.

BRIEF DESCRIPTION OF DRAWINGS

[0011]

Fig. 1 is a schematic structural diagram of the filter coupling unit according to the embodiments of the present disclosure;

Fig. 2 is a schematic diagram of the offset of the tuning holes according to the present disclosure;

Fig. 3 is a schematic structural diagram of the filter coupling unit according to the embodiments of the present disclosure;

Fig. 4 is a schematic structural diagram of the filter coupling unit according to the embodiments of the present disclosure;

Fig. 5 is a structural perspective view of the filter coupling unit according to Embodiment three of the present disclosure; and

Fig. 6 is a schematic diagram of the waveform at the symmetrical zeros according to Embodiment three of the present disclosure.

DETAILED DESCRIPTION

[0012] To make the object, technical scheme and advantages of the present disclosure understood more clearly, hereunder the present disclosure will be further detailed in specific embodiments with reference to the accompanying drawings. It should be understood that the embodiments described herein are only intended to explain the present disclosure, but do not constitute any limitation to the present disclosure.

Embodiment one

[0013] Referring to Fig. 1, in this embodiment, a filter coupling unit is provided. The filter coupling unit includes sub-resonant cavities 209, a shielding layer, tuning holes 201-204, a capacitive coupling hole 205 and inductive coupling holes 206-208. The shielding layer is arranged on an outer surface of the coupling unit; a plurality of sub-resonant cavities 209 are provided in the coupling unit, and the sub-resonant cavities 209 are distributed in the coupling unit; each of the tuning holes 201-204 is respectively formed in an end face of a corresponding sub-resonant cavity and is configured for adjusting the frequency of the filter; there is at least one capacitive coupling hole 205, the capacitive coupling hole is arranged between at least two of the sub-resonant cavities and configured for generating a capacitive coupling effect; and there is at least one inductive coupling hole 206-208, the inductive coupling hole is arranged between adjacent sub-resonant cavities and configured for generating an inductive coupling effect.

[0014] In some embodiments, the filter coupling unit is in a rectangular shape, and has four sub-resonant cavities that are in the same rectangular shape and distributed in four directions of the filter coupling unit. The filter coupling unit is made of a ceramic medium, and the four sub-resonant cavities of the filter coupling unit are integrally formed, and the four resonant cavities are respectively located at four corners and arranged into a square structure. For example, in Fig. 1, the filter coupling unit includes: sub-resonant cavities 209 made of a ceramic material; tuning holes 201, 202, 203 and 204 arranged in the sub-resonant cavities respectively; a capacitive coupling hole 205 arranged between the sub-resonant cavities; and inductive coupling holes 206, 207 and 208 arranged between the sub-resonant cavities. The function of a resonant cavity is to perform frequency filtering, so that useful frequencies can pass through the resonant cavity by resonance, while useless frequencies are suppressed. While the distribution of four sub-resonant cavities is described as an example in this embodiment, it is known to those skilled in the art that the sub-resonant cavities may be distributed and arranged in a different way according to the shape of the resonant cavity if there are more than or less than 4 sub-resonant cavities.

[0015] In some embodiments, the tuning holes are blind holes. A blind hole means that a hole formed in one of the surfaces of a device only extends into the interior of the device but doesn't penetrate through the device completely. A tuning hole is provided in a surface of each sub-resonant cavity for the purpose of tuning the frequency by means of the depth of the blind hole. Alternatively, the frequency may be tuned by adjusting the area of a metal grounding layer inside the blind hole.

[0016] In some embodiments, at least one tuning hole is arranged at a non-central position of a corresponding sub-resonant cavity, that is to say, the tuning hole is offset. Please see Fig. 2, Fig. 2 shows a concept of the offset of a tuning hole. In Fig. 2, it is assumed that the coordinates of a circle center of the bottom surface of a tuning hole 101 are right located at the center of a plane of the sub-resonant cavity 104, then the position of the circle center of the bottom surface of the tuning hole 101 is defined as a base point. The tuning hole 101 is offset by a certain distance in any direction within a range of 360 degrees from the base point as the circle center, and the offset blind hole is denoted by a reference number 102. Now, the tuning hole is asymmetric with respect to another tuning hole 103 on the right along the central axis.

[0017] In some embodiments, the tuning holes are circular holes, at least one of the tuning holes has a circle center located at a position offset from the center of a corresponding sub-resonant cavity in a horizontal direction and/or vertical direction. The so-called horizontal direction and/or vertical direction is defined with respect to the cavity plane of a sub-resonant cavity. In an embodiment, the tuning hole may be offset by a certain distance in any direction within a range of 360 degrees from the cavity center of the corresponding sub-resonant cavity.

[0018] In some embodiments, the circle center of at least one of the tuning holes is offset from the center of the corresponding sub-resonant cavity by an absolute distance of 0 mm to 30 mm, where 0 mm offset distance means that there is no offset.

[0019] In some embodiments, the capacitive coupling hole is a blind hole or a through-hole. A through-hole is contrary to a blind hole. A through-hole is a hole penetrating through two opposing sides of a device.

[0020] In some embodiments, in response to the capacitive coupling hole being a blind hole, the hole depth of the capacitive coupling hole is 1.1 to 1.95 times that of an adjacent tuning hole, and the bottom area of the capacitive coupling hole is 0.3 to 1.8 times that of the adjacent tuning hole; each capacitive coupling hole produces two transmission zeros.

[0021] In some embodiments, the inductive coupling hole is a through-hole, and the cross section of the inductive coupling hole is in a regular shape or an irregular shape. A regular shape means that the shape of the inductive coupling hole is regular, such as circle, square, rectangle or ellipse, etc., while an irregular shape means that the shape of the inductive coupling hole is irregular, such as T-shape or L-shape, etc.

[0022] In some embodiments, there are three inductive coupling holes, each of the inductive coupling holes is arranged between different adjacent tuning holes. There is one capacitive coupling hole, the capacitive coupling hole is arranged between the other two adjacent tuning holes. That is to say, in this embodiment, there are four coupling holes, the coupling holes are respectively arranged between every two tuning holes, including three inductive coupling holes and one capacitive coupling hole.

[0023] According to this embodiment, the filter coupling unit includes sub-resonant cavities, a shielding layer, tuning holes, a capacitive coupling hole and an inductive coupling hole. The shielding layer is arranged on an outer surface of the coupling unit. A plurality of sub-resonant cavities are provided in the coupling unit, and the sub-resonant cavities are distributed in the coupling unit. Each of the tuning holes is respectively formed in an end face of a corresponding sub-resonant cavity and is configured for adjusting the frequency of the filter. The capacitive coupling hole includes at least one capacitive coupling hole, and the capacitive coupling hole is arranged between at least two of the sub-resonant cavities and configured for generating a capacitive coupling effect. The inductive coupling hole includes at least one inductive coupling hole, and the inductive coupling hole is arranged between adjacent sub-resonant cavities and configured for generating an inductive coupling effect. Thus, cross-coupling of the filter is achieved, the structure is simple, and the cross-coupling is easy to implement.

[0024] This embodiment further provides a filter, which includes a power supply unit and at least one filter coupling unit described in the embodiments.

Embodiment two

[0025] This embodiment provides a cross-coupling unit of an all-dielectric filter. The cross-coupling unit includes four cavities arranged in a clockwise or counterclockwise direction into a square shape or rectangular shape. For example, in Fig. 1, the cross-coupling unit includes: dielectric resonant cavities 209 formed by a ceramic body of the dielectric filter; tuning holes 201, 202, 203 and 204 of the dielectric filter; a capacitive coupling hole 205 of the dielectric filter; and inductive coupling holes 206, 207 and 208 of the dielectric filter.

[0026] Hereunder the cross-coupling unit will be detailed with reference to Figs. 1, 2, 3 and 4.

[0027] In Fig. 1, the main body of a dielectric filter has dielectric resonant cavity 209 made of solid ceramics, which has a high relative dielectric constant and may be configured as desired, for example, the relative dielectric constant may be 15, 20, 35, or 40, etc. The ceramic material is formed by sintering through a specific process, and electromagnetic wave energy can be transmitted inside the dielectric material, for example, from a cavity containing a tuning hole 201 to another cavity containing a tuning hole 202. A metal grounding layer is further formed on the outer surface. The metal grounding layer may be formed through various processes, among which, the most common process is silver-plating or copper-plating.

[0028] In Fig. 2, the concept of the offset of a tuning hole is illustrated. In Fig. 2, it is assumed that the coordinates of a circle center of the bottom surface of a tuning hole 101 is right at the center of a plane of the sub-resonant cavity 104, then the circle center of the bottom surface of the tuning hole 101 is defined as a base point. The tuning hole 101 is offset by a certain distance in any direction within a range of 360 degrees from the base point as the circle center, and the offset blind hole is denoted by a reference number 102. Now, the tuning hole is asymmetric with respect to another tuning hole 103 on the right along the central axis.

[0029] The function of a dielectric resonant cavity is to perform frequency filtering, so that useful frequencies can pass through the resonant cavity by resonance, while useless frequencies are suppressed. A blind hole is provided in a surface of each sub-resonant cavity for the purpose of tuning the frequency by means of the depth of the blind hole. Alternatively, the frequency may be tuned by adjusting the area of a metal grounding layer inside the blind hole. In this figure, the four tuning blind holes corresponding to the four cavities are blind holes 201, 202, 203 and 204 respectively. In this example shown in the figure, signals pass through the cavities containing the tuning blind holes 201, 202, 203 and 204 sequentially in a clockwise direction.

[0030] In order to achieve an electrical effect of balanced out-of-band zeros of the filter, the tuning blind holes are not at the centers of the square resonant cavities, but should be at specially specified positions. In the example shown in Fig. 1, the position of the tuning blind hole 202 is offset by a certain distance in a horizontal direction from the base point. The tuning blind hole 202 is offset in a horizontal direction toward the tuning blind hole 203, and the horizontal offset of the circle center of the bottom surface of the tuning blind hole 202 from the base point is 0 mm to 30 mm. The position of the tuning blind hole 203 is offset by a certain distance in a horizontal direction from the base point. The tuning blind hole 203 is offset in a horizontal direction toward the tuning blind hole 202, and the distance of the circle center of the bottom surface of the tuning blind hole 203 with respect to the circle center of the bottom surface of the tuning blind hole 201 is 0 mm to 30 mm.

[0031] The inductive coupling holes 206, 207 and 208 are through-holes, and their inner surfaces are metallized. The distance of the edge of the through-hole from the edge of the dielectric ceramic body 209 is greater than 0.5 mm. The inductive coupling holes are located in the regions between the tuning blind holes, and there is at least one inductive coupling hole between every two tuning blind holes. The cross section of the inductive coupling hole may be in a circular shape, rectangular shape, elliptical shape, or other irregular shapes.

[0032] In Fig. 1, the function of the capacitive coupling hole denoted by a reference number 205 is to generate notch points (i.e., transmission zeros) outside the passband of the filter by virtue of a principle that the phases of signals transmitted in different paths is destructive when they are reversed to each other. The capacitive coupling hole may be in various forms, for example, it may be a blind hole, a U-slot or a through-hole.

[0033] Fig. 3 is different from Fig. 1 in that the offset direction of the tuning blind holes is different. The dielectric resonant cavity is denoted by a reference number 309, the tuning blind holes are denoted by reference numbers 301-304, the inductive coupling holes are denoted by reference numbers 206-208, and the capacitive coupling hole is denoted by a reference number 205. The position of the tuning blind hole 302 is offset from the position of the base point by a certain distance in a non-horizontal direction. The tuning blind hole 302 is offset at a certain angle toward the tuning blind hole 304. The circle enter of the tuning blind hole is offset from the base point by a distance of 0-30 mm.

[0034] Fig. 4 is different from Fig. 3 in that there is more than one capacitive coupling hole, and the capacitive coupling holes are denoted by reference numbers 401 and 402 respectively. The capacitive coupling hole 402 is located in a region between the inductive coupling holes 403 and 404. The capacitive coupling hole 402 exists in this structure for a purpose of achieving symmetric and asymmetric adjustment of the zeros by adjusting the capacitance of the capacitive coupling hole 402. The capacitive coupling hole 402 may have various cross-sectional shapes, such as the straight shape shown in the figure.

Embodiment three

[0035] The following embodiment is provided for applications in filters.

[0036] This embodiment shows how the basic unit of the topological structure of the present disclosure and its peripheral resonant cavities form an entire filter. However, filters may have various overall structures. Obviously, this embodiment is only one of possible embodiments.

[0037] Fig. 5 is a perspective view of an embodiment, which will be described in detail below.

[0038] A tuning blind hole denoted by a reference number 501 is located in an end face of a corresponding ceramic resonant cavity. In this embodiment, there are altogether 10 tuning blind holes, and a function of frequency selection is completed after signals pass through the frequency-tuning blind holes of 10 ceramic resonant cavities sequentially. Not all the circle centers of the bottom surfaces of the tuning blind holes 501 are located at the centers of the corresponding ceramic resonant cavities, but should be offset from the base points by a certain distance, as described above.

[0039] The inductive coupling holes denoted by a reference number 502 are through-holes with a metallized inner surface respectively, and are located between some of the tuning blind holes 501. In this embodiment as shown in Fig. 4, the inductive coupling holes 502 are located between the tuning blind holes at the lower left end and between the tuning blind holes at the upper right end of the filter respectively. There is an inductive coupling hole 502 between two tuning blind holes 501. Correspondingly, the four groups of cavities at the lower left end and the four groups of cavities at the upper right end constitute the topological cross-coupling units of the present disclosure respectively. The cross-sections of the inductive coupling holes 502 may have various shapes, and are circular and rectangular in this embodiment.

[0040] The capacitive coupling hole denoted by a reference number 503 has a metallized or partially metallized inner surface. It is located between specific tuning blind holes 501. One capacitive coupling hole 503 is arranged between two tuning blind holes 501. In this embodiment as shown in Fig. 4, two capacitive coupling holes 503 constitute a lower left topological cross-coupling unit and an upper right topological cross-coupling unit respectively. The capacitive coupling hole 503 may be in various forms. In this embodiment, a through-hole and a blind hole are used respectively.

[0041] An inductive coupling slot denoted by a reference number 504 is provided. In this embodiment, the inductive coupling slot is located in the central area of the filter. The inductive coupling slot has a function of separating the cavities and forming inductive coupling, and adopts the form of a traditional coupling window.

[0042] In summary, the cross-coupling units with a special structure described in the present disclosure are a part of the overall topological structure of a filter. In the embodiment as shown in Fig. 5, the cross-coupling units are located at the lower left and upper right of the filter respectively, thereby forming transmission zeros that are symmetrical in a left-right direction and have the same intensity at the high-end side and low-end side of the passband of the filter, i.e., balanced transmission zeros, as shown in Fig. 6. Besides, owing to the special structure of the inductive coupling holes 502, the length of the conventional inductive coupling slot 504 is greatly shortened, thereby solving the problem of fracture of the ceramic body during filter die-casting.

[0043] While the present disclosure is further detailed above in the embodiments, the present disclosure is not limited to the described embodiments. Various simple derivations or replacements may be made by those having ordinary skill in the art without departing from the concept of the present disclosure, but all such simple derivations or replacements shall be deemed as falling within the protection scope of the present disclosure.

Claims

1. A filter coupling unit, comprising:

    a plurality of sub-resonant cavities provided and distributed in the coupling unit;
    a shielding layer arranged on an outer surface of the coupling unit;
    a plurality of tuning holes, each of the tuning holes being respectively formed in an end face of a respective one of the sub-resonant cavities and configured for adjusting a frequency of a filter;
    at least one capacitive coupling hole arranged between at least two of the sub-resonant cavities and configured for generating a capacitive coupling effect; and
    at least one inductive coupling hole arranged between adjacent sub-resonant cavities and configured for generating an inductive coupling effect.

2. The filter coupling unit of claim 1, wherein a dielectric resonant cavity is in a rectangular shape, and the sub-resonant cavities comprise four sub-resonant cavities that are in the same rectangular shape and distributed in four directions of the dielectric resonant cavity.

3. The filter coupling unit of claim 1, wherein the tuning holes are blind holes.

4. The filter coupling unit of claim 3, wherein at least one of the tuning holes is arranged at a non-central position of a respective one of the sub-resonant cavities.

5. The filter coupling unit of claim 4, wherein the tuning holes are circular holes, and the circle center located at a position offset from a center of the respective one of the sub-resonant cavities in a horizontal direction and/or a vertical direction.

6. The filter coupling unit of claim 5, wherein the circle center of the tuning holes is offset from the center of the respective one of the sub-resonant cavities by an absolute distance of 0 mm to 30 mm.

7. The filter coupling unit of any one of claims 1 to 6, wherein the capacitive coupling hole is a blind hole or a through-hole.

8. The filter coupling unit of claim 7, wherein in response to the capacitive coupling hole being a blind hole, a hole depth of the capacitive coupling hole is 1.1 to 1.95 times that of an adjacent tuning hole, a bottom area of the capacitive coupling hole is 0.3 to 1.8 times that of the adjacent tuning hole, and each capacitive coupling hole produces two transmission zeros.

9. The filter coupling unit of any one of claims 1 to 6, wherein the inductive coupling hole is a through-hole, and a cross section of the inductive coupling hole is in a regular shape or an irregular shape.

10. The filter coupling unit of any one of claims 1 to 6, wherein the inductive coupling hole comprises three inductive coupling holes, each of the inductive coupling holes is arranged between different adjacent tuning holes; and the capacitive coupling hole comprises one capacitive coupling hole that is arranged between the other two adjacent tuning holes.

11. A filter, comprising a power supply unit and at least one filter coupling unit of any one of claims 1 to 10.

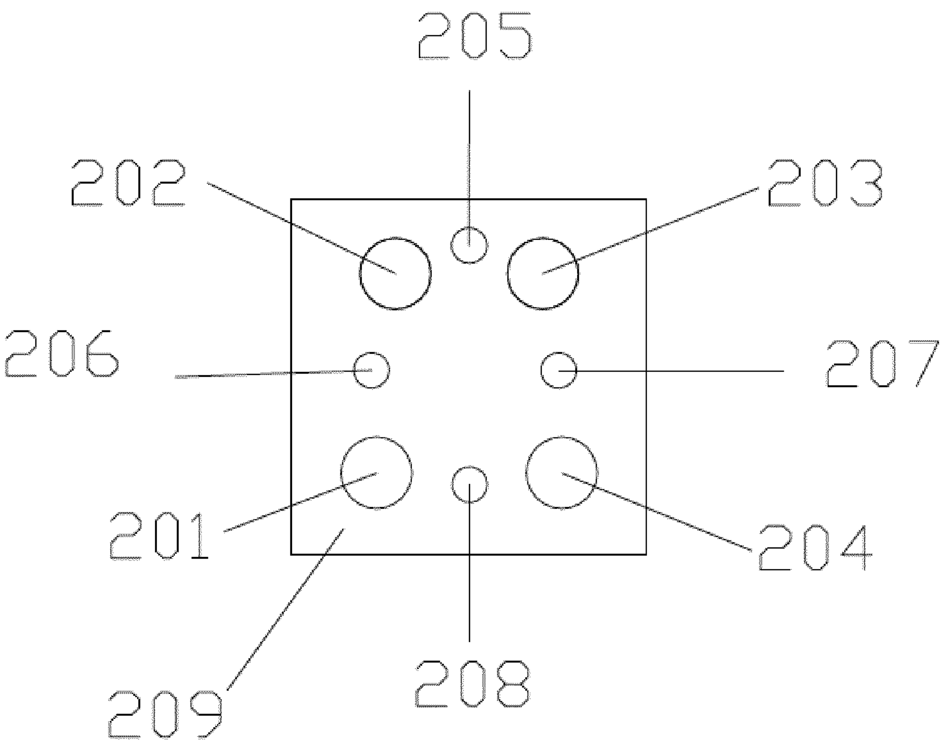

FIG. 1

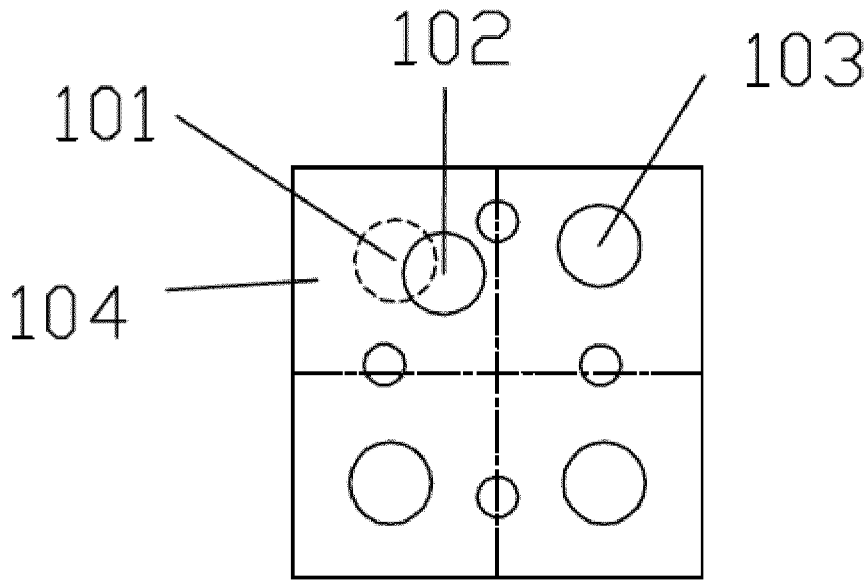

FIG. 2

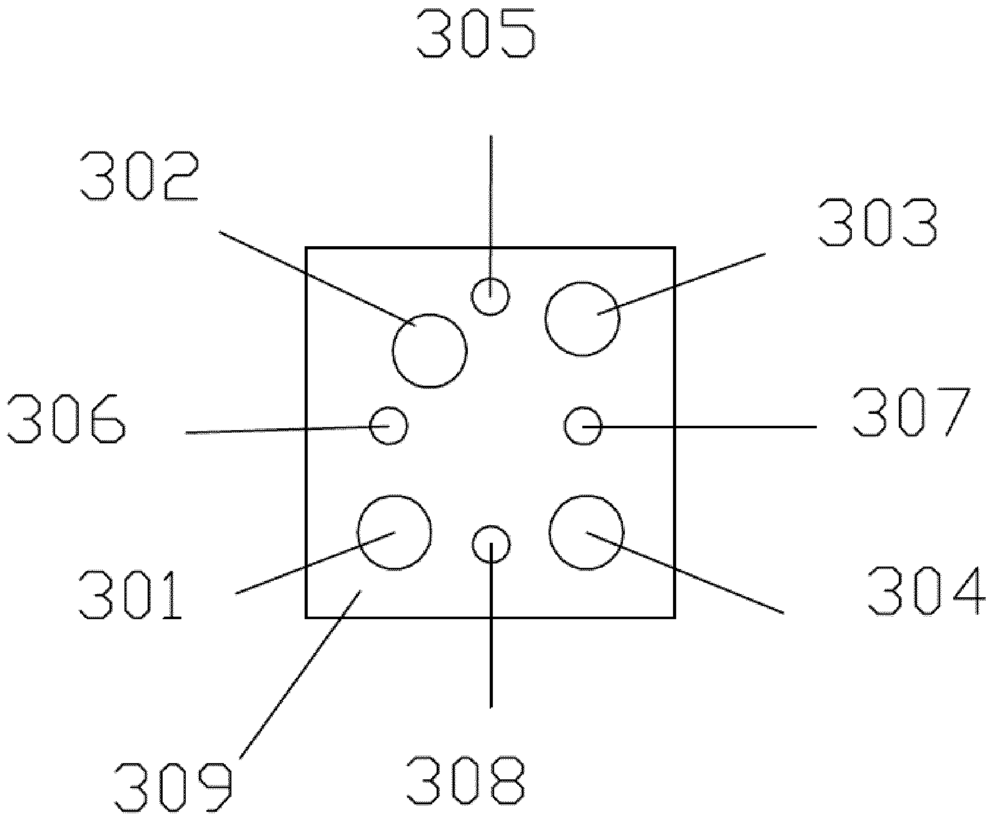

FIG. 3

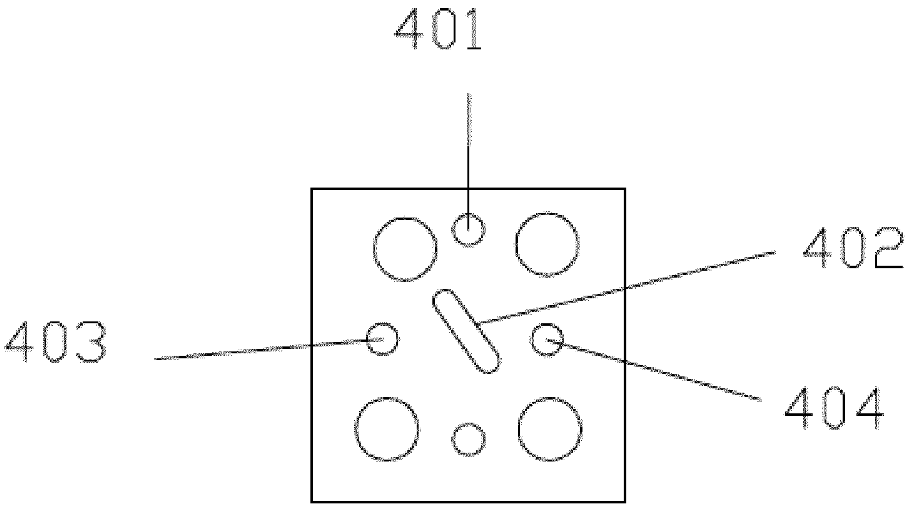

FIG. 4

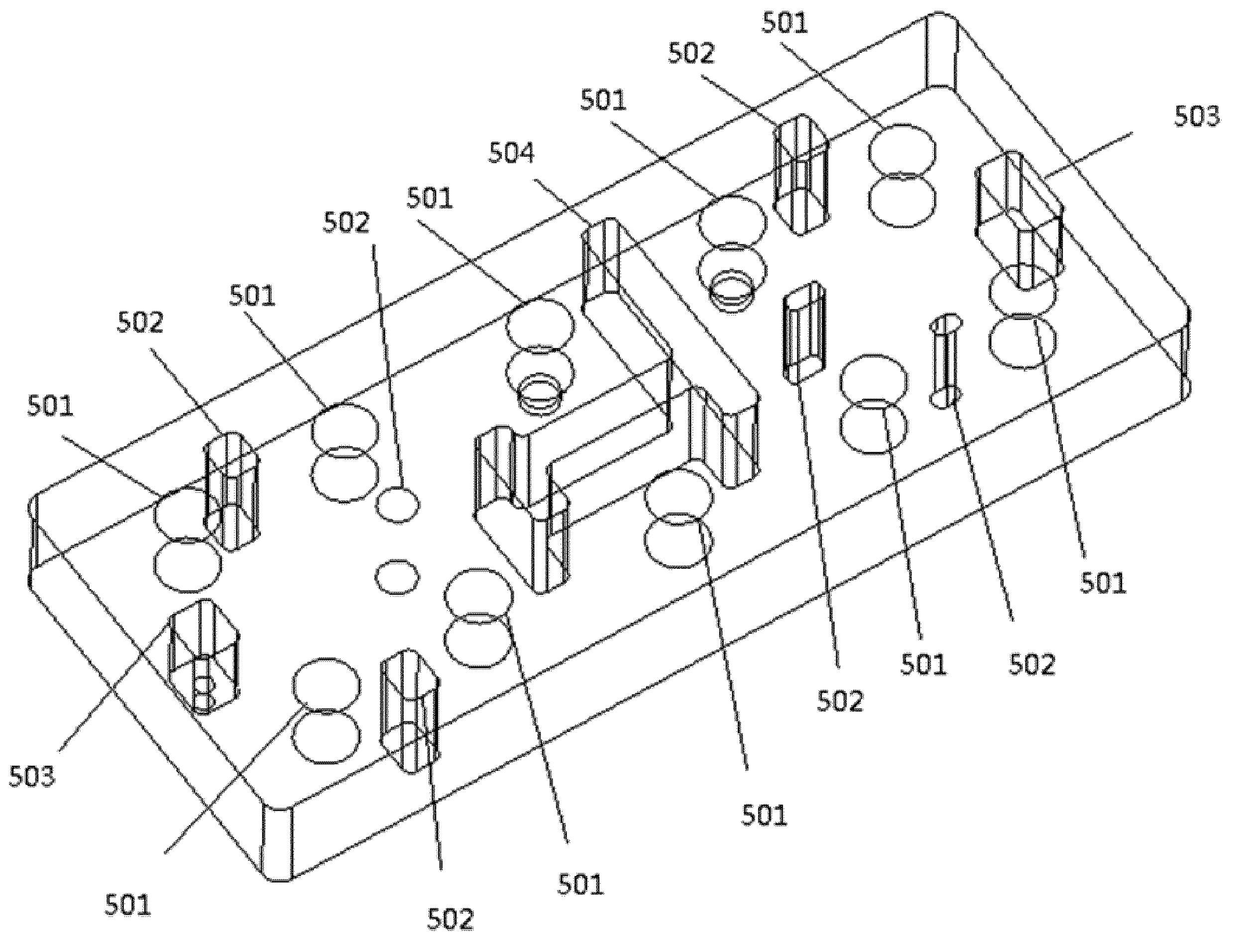
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FIG. 5

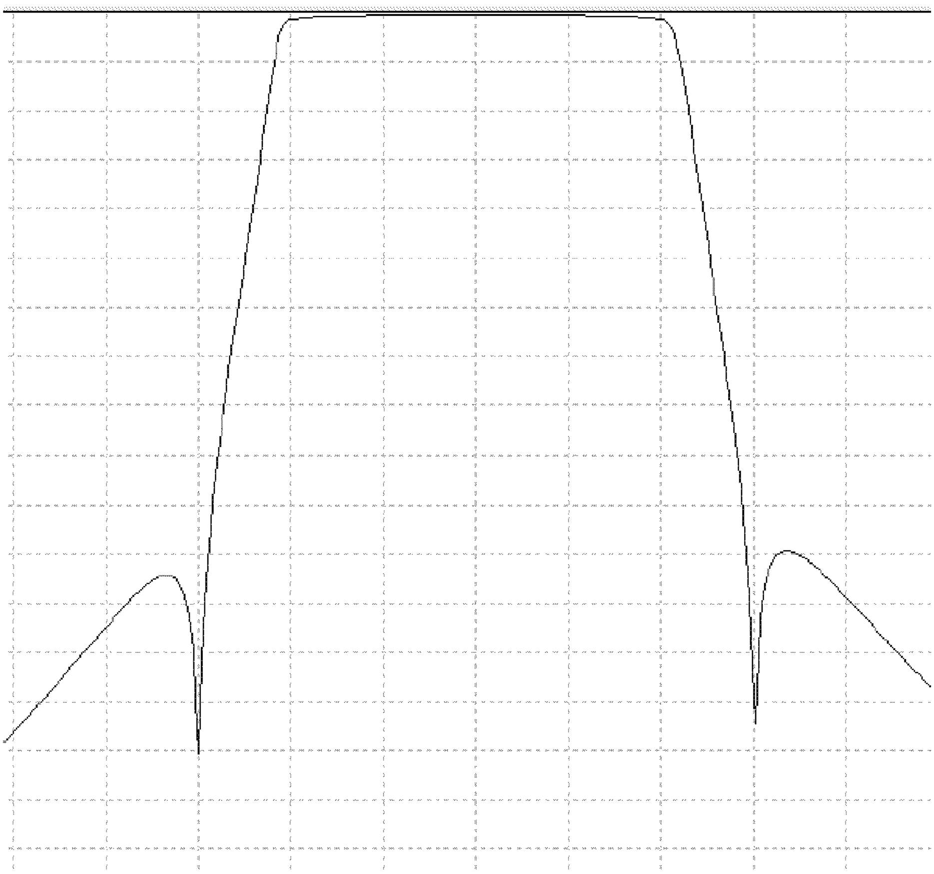

FIG. 6

INTERNATIONAL SEARCH REPORT

International application No. **PCT/CN2020/101619**

A. CLASSIFICATION OF SUBJECT MATTER

H01P 1/208(2006.01)i; H01P 1/20(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNKI; CNPAT; WPI; EPODOC: 滤波器, 耦合, 电感, 电容, 感性, 容性, 孔, 槽, 洞, 谐振, 陶瓷, 介质, filter, couple, induct???, capacit???, hole, cavity, resonant, ceramic, dielectric

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 210778910 U (ZTE CORPORATION) 16 June 2020 (2020-06-16) claims 1-11	1-11
X	CN 109461995 A (SUZHOU RF TOP ELECTRONIC COMMUNICATIONS CO., LTD.) 12 March 2019 (2019-03-12) description, paragraphs 19-22, and figures 1-2	1-11
A	CN 104241798 A (SUZHOU LUOWAN ELECTRONIC TECHNOLOGY CO., LTD.) 24 December 2014 (2014-12-24) entire document	1-11
A	CN 208622915 U (MOBI ANTENNA TECHNOLOGIES (SHENZHEN) CO., LTD. et al.) 19 March 2019 (2019-03-19) entire document	1-11
A	KR 20070114098 A (ACE TECHNOLOGY) 29 November 2007 (2007-11-29) entire document	1-11
A	CN 202678485 U (ANHUI RUITONGDA COMMUNICATION TECHNOLOGY CO., LTD.) 16 January 2013 (2013-01-16) entire document	1-11

☑ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

* Special categories of cited documents:
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Date of the actual completion of the international search	Date of mailing of the international search report
12 September 2020	**10 October 2020**
Name and mailing address of the ISA/CN **China National Intellectual Property Administration (ISA/CN)** **No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088** **China**	Authorized officer
Facsimile No. **(86-10)62019451**	Telephone No.

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

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2020/101619

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 207705363 U (SHENZHEN TATFOOK TECHNOLOGY CO., LTD.) 07 August 2018 (2018-08-07) entire document	1-11

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

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2020/101619

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
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CN	202678485	U	16 January 2013	None			
CN	207705363	U	07 August 2018	None			

Form PCT/ISA/210 (patent family annex) (January 2015)