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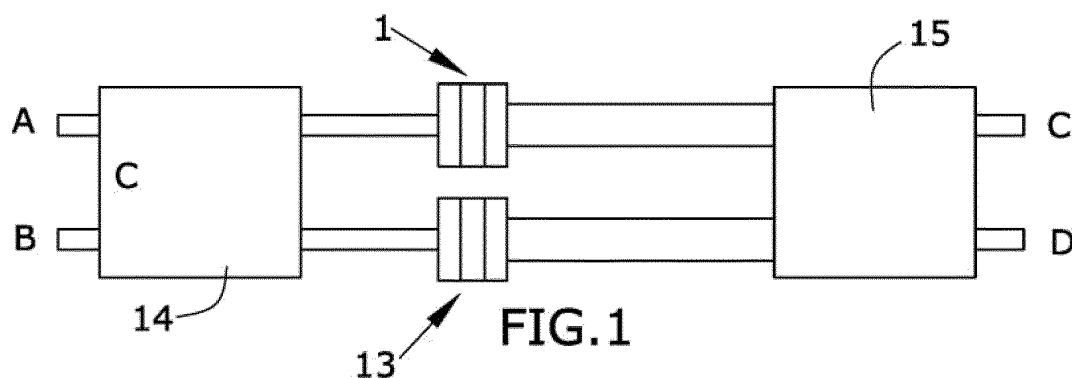
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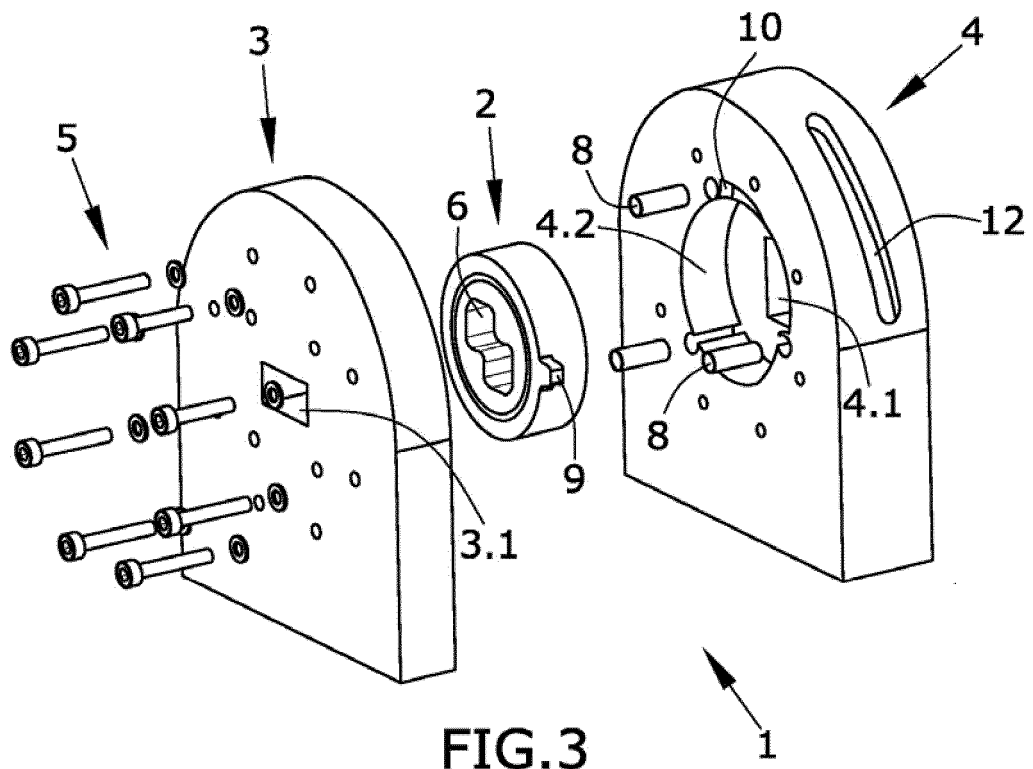
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(54) **SWITCHING DEVICE FOR PARALLEL OR HYBRID TRANSMISSION**

(57) Device comprising: two identical quadrature couplers, (14) and (15), a rotary gyrator (1) disposed between the two couplers, (14) and (15), and a fixed gyrator (13) disposed between the two couplers, (14) and (15), which can be disposed one on each coupler interconnection branch or both on the same branch. The rotary gyrator comprises: an internal rotary disk (2), having a groove gap that defines a waveguide, a housing, wherein the rotary disk (2) is housed, means for actuating the rotation of the rotary disk and means for radially and axially centering the rotary disk (2) on the housing. The practical application of the device relates to the manufacture of switchable polarisation antenna feeders, enabling the configuration of an orthomode transducer for either linear polarisation or circular polarisation.





Description

OBJECT OF THE INVENTION

[0001] The object of the present invention, as established in the title, is a switching device for parallel or hybrid transmission, i.e. a device that forms two parallel lines in one state while forming a -3dB hybrid coupler in another state.

[0002] The practical application of the device relates to the manufacture of switchable polarisation antenna feeders, enabling the configuration of an orthomode transducer for either linear polarisation or circular polarisation.

[0003] The switching device has four ports, two input and two output, and two states, one that forms two parallel lines and another that forms a hybrid coupler.

[0004] Switching between the two polarisation states can be achieved manually or by means of an electromechanical actuator.

[0005] The present invention is characterised in that the polarisation switching system achieved is simple and robust.

[0006] Therefore, the present invention falls within the field of switching systems or means applicable to orthomode transducers.

BACKGROUND OF THE INVENTION

[0007] An orthomode transducer is a device having a common circular or square waveguide port (output) and two rectangular waveguide input ports. The common port is connected mainly to a horn-type antenna.

[0008] There are two electromagnetic propagation modes at the common port, for example, a vertical linear polarisation mode and a horizontal linear polarisation mode. The input ports excite each of the linear polarisations at the common port.

[0009] Another form of polarisation is circular polarisation, in such a manner that there is clockwise circular polarisation mode and an anti-clockwise circular polarisation mode at the common port, the input ports being associated to the polarisation generated at the common port.

[0010] Orthomode transducers for linear and circular polarisation have physically different designs and may only be used for one type of polarisation, either linear or circular.

[0011] However, the known forms of embodiment of orthomode transducers having configurable polarisation are based on switching at the common port or switching at the input ports.

[0012] Switching at the input ports is based on the use of a quadrature coupler (-3dB hybrid) and a phase splitter composed of a switch with phase-shifted lines.

[0013] Switching at the common port is carried out by adding a polariser between two rotary junctions.

[0014] All known polarisation switching systems are

complex as a result of the pooled arrangement of several devices, wherein the phase error obtained is clearly improvable.

[0015] Therefore, the object of the present invention is to design a simple polarisation mode switching system, integrated in a single device, where the phase error is less than that achieved to date by developing a polarisation switching system such as that described below, the essentiality of which is reflected in claim one.

DESCRIPTION OF THE INVENTION.

[0016] The object of the invention is a switching device for parallel or hybrid transmission for use in polarisation switching devices, the practical application of which relates to the manufacture of switchable polarisation antenna feeders.

[0017] The switching device integrates the functions of creation of two parallel lines, creation of hybrid lines and a phase splitter or switcher.

[0018] The device comprises two gyrators, one rotary and another fixed for offset, disposed between two chained couplers, one of which is the input coupler where to the input ports are connected, while the other coupler is the output coupler where to the output ports are connected.

[0019] The rotary gyrator disposed between the two couplers is a 90° gyrator. The other gyrator is a fixed gyrator, used for offset, which can be mounted on the same branch on which the rotary gyrator is mounted or on the other coupler interconnection branch.

[0020] When the position of the two gyrators, rotary and fixed, is equal, the relative phase shift is zero and the device is converted into a coupler, while if the gyrator differs in phase by 90 physical degrees, the relative insertion phase between the two paths is 180 electrical degrees, creating two phase-shifted lines.

EXPLANATION OF THE FIGURES

[0021] In order to complement the description being made and with the object of helping to better understand the characteristics of the invention, the present specification is accompanied by a set of drawings where, in an illustrative and non-limiting manner, the most significant details of the invention have been represented:

Figure 1 shows a first embodiment of the switching device for parallel or hybrid transmissions.

Figure 2 shows a second embodiment for parallel or hybrid transmission.

Figure 3 shows a detailed view of the rotary gyrator used in the device.

Figure 4 shows a detailed view of the internal rotary disk of the rotary gyrator.

PREFERRED EMBODIMENT OF THE INVENTION

[0022] In light of the figures, following is a preferred embodiment of the proposed invention.

[0023] Figure 1 shows a first embodiment of the switching device for parallel or hybrid transmission, while figure 2 shows a second embodiment. Both embodiments are characterised in that they comprise:

- Two identical quadrature couplers, an input coupler (14) whereto input ports (A) and (B) are connected, and an output port (15) whereto output ports (C) and (D) are connected.
- A rotary gyrator (1) disposed between the two couplers (14) and (15).
- A fixed gyrator (13) disposed between the two couplers (14) and (15).

[0024] Where in the first embodiment the rotary gyrator (13) is disposed on one of coupler interconnection branches (14) and (15) while the other fixed gyrator (13) is disposed on the other branch.

[0025] In the second embodiment, shown in figure 2, the two gyrators, rotary (1) and fixed (13), are disposed on one of the two coupler interconnection branches (14) and (15).

[0026] When the position of the two gyrators, rotary (1) and fixed (13), is equal, the relative phase shift is zero and the device is converted into a -3dB coupler (hybrid transmission), the coupling value being -8.2dB in the two couplers, while if the gyrator differs by 90 physical degrees, the relative insertion phase between the two paths is 180 electrical degrees, whereupon two decoupled lines are created in parallel transmission.

[0027] The configuration described enables the obtainment of a switching device that integrates the functions of creation of two parallel lines and creation of hybrid lines.

[0028] The rotary gyrator, in a possible embodiment, comprises, as shown in figure 3:

- An internal rotary disk (2), having a groove gap defining a waveguide.
- A housing, wherein the rotary disk is housed (2).
- Means for actuating the rotation of the rotary disk.
- Means for radially and axially centering the rotary disk (2) on the housing.

[0029] Said housing, according to the embodiment shown in figure 3, has two attachable casings (3) and (4), one of which, particularly casing (4), has a ring-shaped recess (4.2) wherein the rotary disk is housed (2).

[0030] Casings (3) and (4) are joined by means of fixing means, which in the embodiment shown are screws (5) that, penetrating one of the casings, are threaded onto the other casing.

[0031] The waveguide shown in the rotary disk (2) is a bow-tie shaped guide, although any other adapted

waveguide geometry may be used. The waveguide seeks to achieve a good adaptation and a complete transmission.

[0032] Figure 4 shows that the internal rotary disk (2), in addition to having a groove gap corresponding to the waveguide, has concentric ring-shaped recesses (7) disposed around the waveguide, called "chokes" in the industry, intended for redirecting the signal and avoid dispersion thereof.

[0033] Casing (3) has a horizontal input guide (3.1), while casing (4) has a vertical output guide (4.1).

[0034] In a possible embodiment of the adjustment means between the internal rotary disk (2) and the casing, bearings (8) may be used which, in the case represented, are housed along the edge of the ring-shaped recess (4.2) wherein the internal rotary disk (2) is housed.

[0035] Switching of the rotary gyrator, in particular that of the internal rotary disk (2), can be achieved in multiple ways, either manually or by means of an electromechanical actuator, or even through voltage polarisation. Figure 3 shows a possible embodiment wherein the internal rotary disk (2) has a protuberance (9) on its edge which can move along a perimeter recess (10) having a length such that it limits the rotation of the internal rotary disk (2).

[0036] In another possible embodiment, the actuation on the internal rotary disk (2) is performed by means of a rod, not represented, which would be fixed to the internal rotary disk (2) in a perforation (11) (figure 4) and would emerge through the grooving, which can be actuated by means of a worm gear.

[0037] Having sufficiently described the nature of the present invention and embodiment method thereof, it is hereby stated that, within its essentiality, it may be carried out in other embodiments that differ in detail from that indicated by way of example, and which will also fall under the protection being requested, provided that it does not alter, change or modify its basic principle.

Claims

1. Switching device for parallel or hybrid transmission, **characterised in that** it comprises:

- Two identical quadrature couplers, an input coupler (14) whereto input ports (A) and (B) are connected, and an output coupler (15) whereto output ports (C) and (D) are connected.
- A rotary gyrator (1) disposed between the two couplers (14) and (15).
- A fixed gyrator (13) disposed between the two couplers (14) and (15).

2. Switching device for parallel or hybrid transmission, according to claim 1, **characterised in that** the rotary gyrator (13) is disposed on one of the coupler interconnection branches, (14) and (15), while the other fixed gyrator (13) is disposed on the other

branch.

3. Switching device for parallel or hybrid transmission, according to claim 1, **characterised in that** the two gyrators, rotary (1) and fixed (13), are disposed on one of the two coupler interconnection branches, (14) and (15). 5

4. Switching device for parallel or hybrid transmission, according to any of claims 1 to 3, **characterised in that** the rotary gyrator comprises: 10
 - An internal rotary disk (2), having a groove gap that defines a waveguide.
 - A housing, wherein the rotary disk (2) is housed. 15
 - Means for actuating the rotation of the rotary disk.
 - Means for radially and axially centering the rotary disk (2) on the housing. 20

5. Switching device for parallel or hybrid transmission, according to claim 4, **characterised in that** the housing of the internal rotary disk (2) has two attachable casings (3) and (4), one of which has a ring-shaped recess (4.2) wherein the rotary disk (2) is housed, whereupon casings (3) and (4) are joined together by means of screws (5) which, penetrating one of the casings, are threaded onto the other casing, where casing (3) has a horizontal waveguide (3.1), while casing (4) has a vertical waveguide (4.1). 25 30

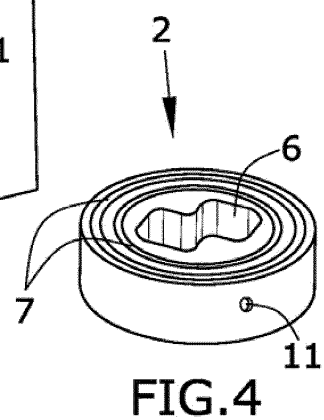
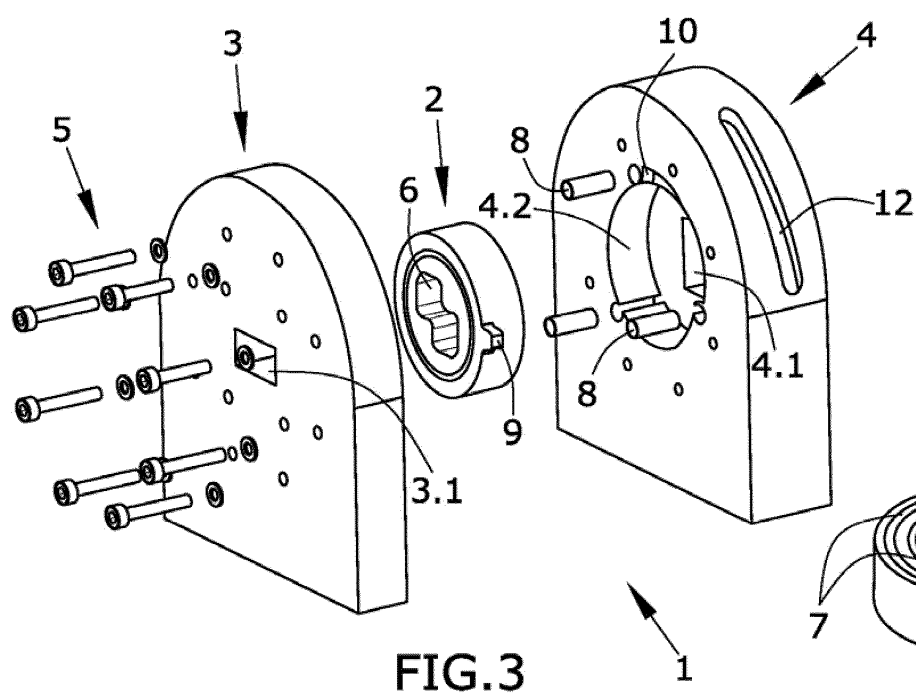
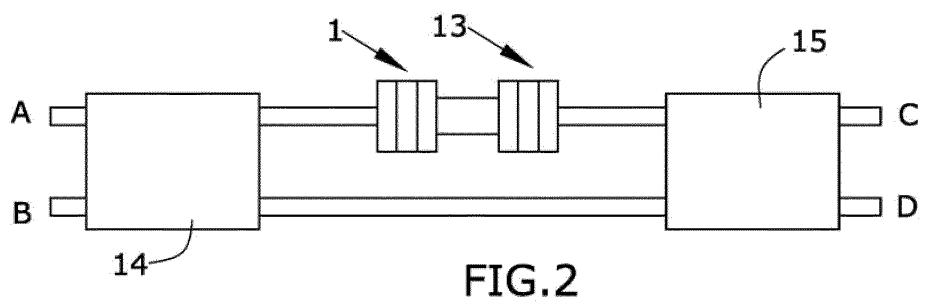
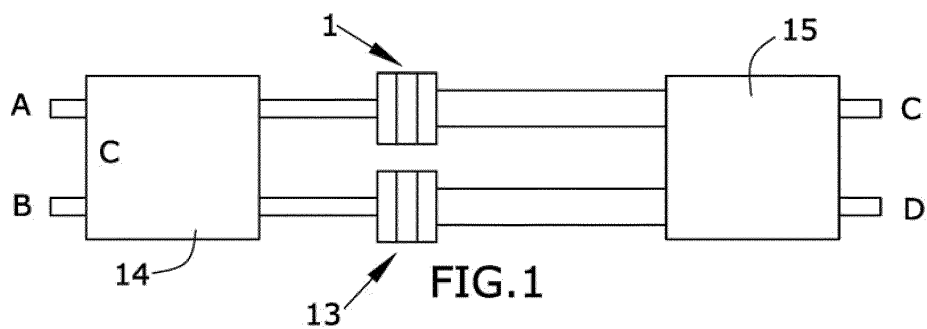
6. Switching device for parallel or hybrid transmission, according to claim 4, **characterised in that** the waveguide of the internal rotary disk (2) is a bow-tie shaped guide having concentric ring-shaped recesses (7) disposed surrounding the waveguide, called "chokes" in the industry, intended for redirecting the signal and avoiding dispersion thereof. 35 40

7. Switching device for parallel or hybrid transmission, according to claim 4, **characterised in that** the adjustment means between the internal rotary disk (2) and the casing are bearings (8) housed along the edge of the ring-shaped recess (4.2) wherein the internal rotary disk (2) is housed. 45

8. Switching device for parallel or hybrid transmission, according to claim 4, **characterised in that** the means for actuating and switching the rotary gyrator, particularly the internal rotary disk (2), comprise a protuberance (9) disposed along the edge of the internal rotary disk (2) that can move along a perimeter recess (10), having a length such that it limits the rotation of the internal rotary disk (2). 50 55

9. Switching device for parallel or hybrid transmission, according to claim 4, **characterised in that** the

means for actuating and switching the rotary gyrator, particularly the internal rotary disk (2), comprise a rod that is fixed to the internal rotary disk (2) in a perforation (11) and that would emerge through a grooving (12), which can be actuated by means of a worm gear.



INTERNATIONAL SEARCH REPORT

International application No

PCT/ES2013/070533

A. CLASSIFICATION OF SUBJECT MATTER

INV. H01P1/10 H01P1/165
ADD.

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 H01Q

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)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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A	----- NIEHENKE E C ET AL: "A planar 94-GHz transceiver with switchable polarization", MICROWAVE SYMPOSIUM DIGEST, 1993., IEEE MTT-S INTERNATIONAL ATLANTA, GA, USA 14-18 JUNE 1993, NEW YORK, NY, USA, IEEE, US, 14 June 1993 (1993-06-14), pages 167-170, XP010068249, DOI: 10.1109/MWSYM.1993.276918 ISBN: 978-0-7803-1209-8 abstract; figure 1 ----- -/-	1-9

☒ 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

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23/04/2014

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INTERNATIONAL SEARCH REPORT

International application No
PCT/ES2013/070533

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
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Information on patent family members

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