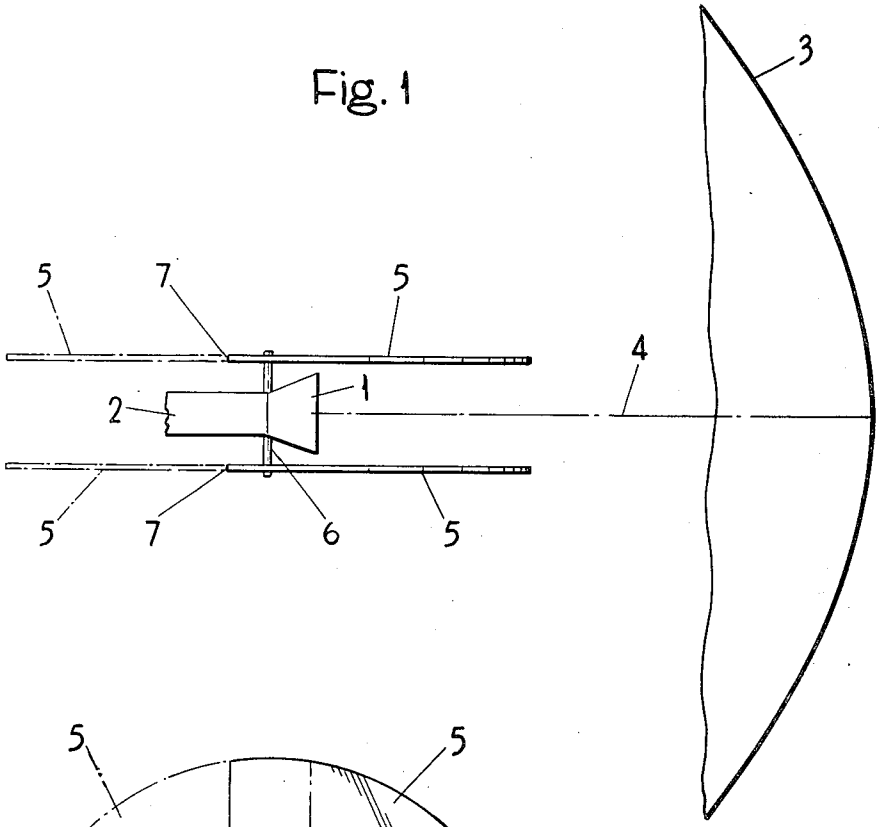
July 10, 1962 P. C. BUTSON 3,044,067

AERIAL SYSTEM HAVING VARIABLE DIRECTIONAL PROPERTIES

Filed Nov. 30, 1959

Fig. 1



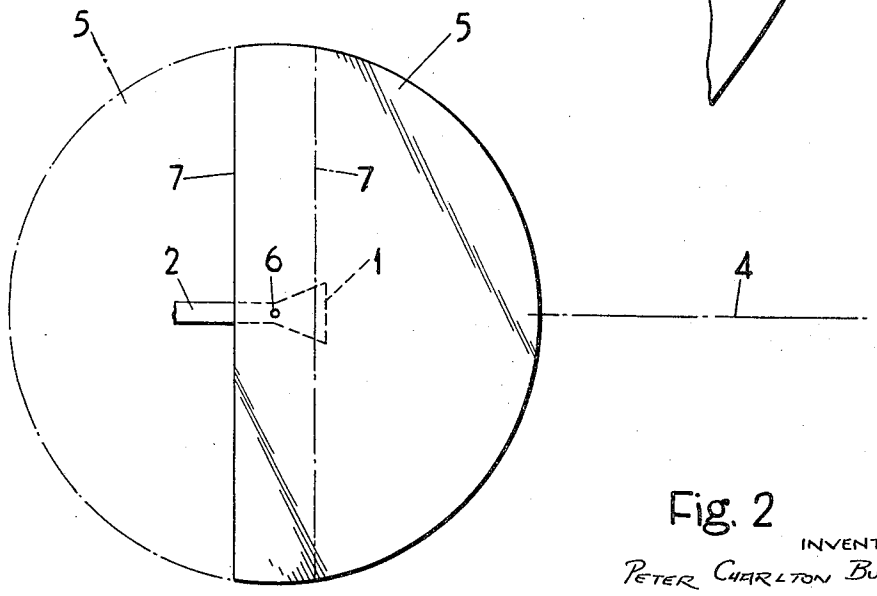


Fig. 2

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United States Patent Office 3,044,067 Patented July 10, 1962

3,044,067

AERIAL SYSTEM HAVING VARIABLE DIRECTIONAL PROPERTIES

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Filed Nov. 30, 1959, Ser. No. 856,247
Claims priority, application Great Britain Dec. 3, 1958
6 Claims. (Cl. 343—781)

This invention relates to aerial systems.

More particularly the invention is concerned with aerial systems of the kind comprising a primary aerial, such as a horn radiator, in combination with a focussing device for concentrating the electromagnetic waves radiated by the primary aerial in a required direction or directions. The focussing device may, for example, be a paraboloidal reflector or a lens, the primary aerial being located in the region of the focus of the reflector or lens. Such an aerial system, in the absence of any other elements, is highly directional and in fact the main lobe of the radiation pattern thereof in each of two planes, which are mutually at right angles and each of which contains the axis of the reflector or lens, subtends a relatively small angle. Thus such an aerial system may be considered as being highly directional in each of said two planes.

One object of the present invention is to provide an improved aerial system of the kind specified which enables the directional properties of the system in one of said planes to be modified, that is to say selectively rendered less or more directional, without any corresponding change in the directional properties of the system in the other plane.

According to the present invention, in an aerial system of the kind specified there is provided a moveable part which constitutes a screen to electromagnetic waves and which may be brought into a position to lie between said primary aerial and a portion of said focussing device, the arrangement being such that movement of said part enables the directional properties of the system to be modified in one plane without any corresponding change in the directional properties of the system in another plane in which the aerial system is highly directional and which is at right angles to the previously mentioned plane.

The part may be a flat metal plate and preferably two similar parts are provided in like manner, one on either side of the primary aerial, for the purpose of modifying the directional properties of the aerial system in one plane as aforesaid.

One example of an aerial system which is in accordance with the present invention will now be described with reference to the accompanying drawing in which:

FIGURE 1 shows a plan view of the aerial system, and

FIGURE 2 shows a side elevation of part of the aerial system of FIGURE 1.

Referring now to FIGURE 1 of the drawing, the aerial system is arranged to be highly directional in both the vertical and horizontal planes but provision is made, in accordance with the invention, for it to be made less directional in the horizontal plane. The aerial system comprises a primary aerial formed by a horn radiator **1**, which terminates a feeder waveguide **2**, in combination with a dish-shaped reflector **3**. The reflector **3** has a paraboloidal reflecting surface the axis **4** of which is horizontal while the edge of the reflector lies in a vertical plane. The longitudinal axis of the feeder waveguide **2** at the end thereof that is terminated by the horn radiator **1** is coincident with the axis **4** of the reflector **3** and the horn radiator **1**, which points towards the reflector **3**, is located in the region of the focus of the reflector **3**.

The horn radiator **1**, acting as a transmitting aerial, radiates a wave which is substantially spherical, that is to say the phase centres in the horizontal plane and in the

vertical plane which contains the axis **4** are roughly coincident, these phase centres being close to the focus of the reflector **3**. The effect of this is that the aerial system, which is quite conventional as so far described, is highly directional in both the horizontal and the vertical planes.

Referring now to FIGURE 2 of the drawing also, for the purpose of modifying the radiation pattern of the system in, for example, the horizontal plane there are provided two flat metal plates **5** symmetrically disposed on either side of the horn radiator **1**. The plates **5** lie in parallel vertical planes and are mounted for rotation about a horizontal axis **6** that is normal to the plates **5**. In one position of the plates **5** (shown in full lines in the drawing), the primary radiation from the horn radiator **1** has to travel between the plates **5** in order to reach the reflector **3**. The effect of this is to separate the phase centres in the vertical and horizontal planes, the phase centre in the vertical plane remaining substantially unchanged but that in the horizontal plane being moved towards the reflector **3** and so defocussing the beam in that plane. The amount of this defocussing is a function of the extension of the plates **5** from the horn radiator **1** towards the reflector **3**.

A secondary effect of the plates **5** is to reduce the illumination towards the edges of the reflector **3** in the horizontal plane thereby reducing, to some extent, the effective area of the reflector **3** and thereby contributing to the beam broadening effect.

By rotating the plates **5** about the axis **6** through 180° from the position considered above (as shown by the broken lines in the drawing), the plates **5** can be withdrawn from the cone of primary illumination of the reflector **3**, the plates **5** then having little, if any, effect on the radiation pattern of the aerial system.

It will be appreciated that, in both the positions mentioned, the plates **5** have negligible effect on the secondary radiation of the system.

The plates **5** may be approximately semicircular in shape and the axis **6** about which they rotate preferably passes through the centres of the complete circles of which the semicircles are halves. The axis **6** may also pass through or near the phase centre of the horn radiator **1** so that a 180° rotation of the plates **5** about the axis **6** does remove the plates **5** from the cone of primary illumination.

It will be appreciated that the two positions of the plates **5** considered above are not the only positions that may be utilised. In fact it is possible to position the plates **5** between these two positions to give any desired angle of radiation on the horizontal plane between limiting angles corresponding to the said two positions of the plates **5**. The plates **5** need not, of course, be semicircular and, in order to give a more gradual transition from fan to pencil beam, they may be shaped so as to have a varying radius measured from the axis **6**.

Instead of the plates **5** being mounted for rotation as described above, they could be arranged to move longitudinally in directions parallel to the axis **4**, or they could be rotated about vertical axes containing the straight sides **7** of the plates **5**. However, this latter arrangement suffers from the disadvantage that, in intermediate positions, some obstruction is caused to the secondary radiation. The plates **5** could also be rotated about horizontal axes parallel to the axes **4**.

Although for convenience a transmitting aerial system is described above, it will be appreciated that the invention is also applicable to receiving systems. In fact an aerial system in accordance with the present invention is particularly suitable for picking up electromagnetic waves and passing them to a radio receiver at a ground station since it enables waves from a distant transmitting station

to be received even though the exact position of that distant station is not known.

I claim:

1. An aerial system comprising a primary aerial and a focussing device positioned in such a relationship to one another that, during operation, electromagnetic waves radiated by said primary aerial are concentrated by said focussing device in a highly directional radiation pattern including a main lobe which in two planes that are at right angles to one another and each of which contains the axis of the focussing device subtends a relatively small angle, a movable part of generally planar form separate from said primary aerial, and means to bring said movable part into an asymmetrical position to extend from said primary aerial toward but terminate short of said focussing device and to lie between said primary aerial and a portion only of said focussing device, the arrangement being such that movement of said part enables the directional properties of the system to be modified in one of said planes without any corresponding change in the directional properties of the system in the other of said planes.

2. An aerial system according to claim 1 wherein the movable part is a flat metal plate.

3. An aerial system according to claim 2 wherein two similar plates are provided in like manner, one on each side of said primary aerial, for the purpose of modifying the directional properties of the system in one plane as aforesaid.

4. An aerial system according to claim 3 wherein the two plates are approximately semi-circular in outline and when in position are arranged with their curved edges directed towards said focussing device.

5. An aerial system according to claim 1 wherein the focussing device is a paraboloidal reflector.

6. An aerial system comprising a primary aerial and a focussing device which coacts with said primary aerial, electromagnetic waves radiated by said primary aerial during operation being concentrated by said focussing device in a highly directional radiation pattern including a main lobe which in two planes that are at right angles to one another and each of which contains the axes of the focussing device subtends a relatively small angle, a pair of identical flat metal plates separate from said primary aerial, means to move said plates into positions which are individually asymmetrical and jointly symmetrical relative to said primary aerial and said focussing device so that said plates extend from said primary aerial toward but terminate short of said focussing device and such that portions only of said focussing device are then screened from said primary aerial, the planes of said plates being parallel so that the directional properties of the system are varied in one of said planes but not in the other.

References Cited in the file of this patent

UNITED STATES PATENTS

2,570,197	Bohnert et al.	Oct. 9, 1951
2,680,810	Korman	June 8, 1954
2,721,263	Spencer	Oct. 18, 1955
2,750,588	Hennessey	June 12, 1956

FOREIGN PATENTS

745,038	Great Britain	Feb. 15, 1956