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(54) **Antenna arrangements.**

(57) In an antenna arrangement, a main reflector (1) and a sub-reflector (2) are supported by a common supporting strut (3) which also acts as a waveguide and which may house components of a receiving arrangement.

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This invention relates to antenna arrangements and more particularly to arrangements which are suitable for the reception of signals transmitted by a satellite.

Satellite signals may be received by directing a reflector dish towards the source of the signals and focussing them onto a feed. However, the resulting structure is often unwieldy, having a large moment of inertia which makes accurate positioning and tracking of the antenna dish difficult. Also, the receiving assembly tends to appear unattractive and can be intrusive.

The present invention arose from an attempt to provide an improved antenna arrangement.

According to the invention there is provided an antenna arrangement comprising a main reflector and a sub-reflector, the reflectors being supported by a common supporting strut which also acts as a waveguide. Preferably, sub-components are located within the supporting strut such as, for example, a waveguide filter section. It is preferred that a polariser arrangement is also located within the supporting strut. This may be a linear polariser alone or, say, a circular depolariser in combination with a linear polariser.

In a preferred embodiment of the invention components of the receiving arrangement are located behind the front surface of the main reflector. Preferably, a low noise block down converter (LNB) is located behind the reflector surface. By locating the mass of the LNB, or LNBs where more than one is used, near the main reflector and behind its front surface, the moment of inertia of the complete assembly may be minimised. Thus, vibration and movement of the assembly arising from gusts of wind or accumulation of snow will also be minimised. As the supporting frame is therefore not required to resist relatively large bending stresses it may be made compact, lightweight and rigid. Installation and alignment of the assembly may be performed with relative ease because the back feed assembly may be almost balanced if the centre of gravity is arranged to be near the supporting frame of the main reflector. Thus, this configuration is particularly advantageous where it is wished to use low density dish materials, for example, glass reinforced plastic and other rigid plastic or glass materials which utilize thin metallic reflecting surface coatings.

The back feed configuration offers a lower profile with minimal projection from the front reflecting surface. It is therefore particularly suitable for transparent dish materials such acrylic or glass, reducing the intrusive nature of the installed assembly. This advantage is obtained even if a second LNB is included in the arrangement. Back feed Cassegrain or Gregorian reflector assemblies are particularly suitable for the application of opaque or transparent radome covers because of their low profile.

By locating the LNB, or LNBs, behind the reflecting antenna surface, they are therefore shielded from direct sunlight and thus are less affected during adverse weather conditions.

In an advantageous embodiment of the invention, the common supporting strut supports two sub-reflectors. In order to maintain the low noise properties of dual reflector antennas, the feed is directed away from the ground surface to reduce noise. The supporting strut may be located either centrally or offset from the centre of the main reflector.

The invention may be advantageously applied to both receiving and transmitting arrangements.

Some ways in which the invention may be performed are now described by way of example with reference to the accompanying drawings in which;

Figure 1 is a schematic sectional view of part of a satellite receiving arrangement;

Figure 2 schematically illustrates another satellite receiving arrangement;

Figures 3A and 3B illustrate an antenna arrangement having an offset strut feed; and

Figures 4A and 4B illustrate an antenna having a central strut.

With reference to Figure 1, a satellite receiving arrangement includes a main reflector 1 having a parabolic surface and sub-reflector 2 located at its focus to reflect incoming radiation along a waveguide 3 in the direction shown by the arrow. The sub-reflector 2 may be of the Cassegrain type or the Gregorian type. The waveguide 3 acts as a central supporting strut for the main reflector 1 and sub-reflector 2, extending through the centre of the main reflector 1. The waveguide also 3 houses some components of the receiving arrangement.

A polyrod feed 4 is located at the end of the waveguide 3 nearest the sub-reflector 2 and receives radiation illuminating the sub-reflector 2 from the main parabolic reflecting surface 1. The polyrod 4 is surrounded by a dielectric support cone 5 which also locates the sub-reflector 2 in respect of the polyrod phase centre and diffuses heat from the sun which might otherwise damage the polyrod feed 4. The support cone 5 also protects the sub-reflector 2 and polyrod feed 4 from adverse effects of water, dew, ice and snow. The shape of the dielectric support cone 5 reduces diffraction losses associated with small sub-reflectors and improves the illumination efficiency of the composite waveguide feed. The polyrod 4 and dielectric cone 5 together provide a method of sealing the waveguide 3 from water which might otherwise drain into electronic circuitry at the far end of the waveguide 3. The sub-reflector 2 and the polyrod feed 4 offer very low feed "blockage" compared to a metal horn type feed and therefore the polyrod feed 4 may be positioned relatively close to the sub-reflector 2.

The polyrod feed 4 is followed in the waveguide 3 by a filter section 6 which consists of a series of irises projecting from the inner surface of the waveguide 3. The filter increases the system image projection and reduces any re-radiated signals produced by active electronic elements located further along the receiving system.

A circular depolariser 7 is located after the waveguide filter section 6 and comprises a dielectric wedge which tapers from the front of the feed outwardly to contact the inner surfaces of the waveguide 3. The circular depolariser 7 converts circularly polarised waves, which may be left or right handed, into linearly polarised waves. The circular depolariser 7 is followed by a ferrite linear polariser 8 which consists of a ferrite rod 9 surrounded by a bias coil 10. In this arrangement, the ferrite linear polariser 8 and the circular depolariser 7 are combined into a single component, the circular depolariser material being extended along the waveguide 3 to act as a former for the coil 10 and locate the ferrite rod 9 along the axis of the waveguide 3.

After transmission through the circular depolariser 7 and ferrite linear polariser 8, the received radiation is transmitted via a circular to rectangular waveguide transition 11 to a low noise block down converter (LNB) 12 which includes electronic receiving components. The circular to rectangular waveguide transition 11 includes one or more quarter wave transformers or taper sections to convert the circular waveguide mode to a rectangular mode for good matching at the LNB input.

The LNB 12 is positioned behind the main reflector surface 1 and is therefore shielded from direct sunlight. This ensures that the gain and noise parameters of the LNB 12 are relatively unaffected during hot weather conditions. The LNB 12 may have additional protective covering without "blocking" any incoming signals.

As the LNB 12 is located near the supporting structure of the reflectors 1 and 2 and the support strut, the moment of inertia of the complete assembly is minimised.

Circular depolarisation may be achieved by using a circular depolarising grid rather than the dielectric wedge shown at 7. In this case, a grid array is included at the sub-reflector plane.

With reference to Figure 2, another arrangement in accordance with the invention is similar to that described with reference to figure 1 but includes two LNB's 13 and 14 located behind the front surface of the main reflector 15. The arrangement includes an ortho-mode transducer 16 which enables the two LNB's 13 and 14 to be connected to the waveguide.

With reference to figures 3A and 3B an offset signal support strut feed is used in conjunction with a dual reflector offset antenna. Dual satellite reception is achieved from the fixed dish assembly by using a secondary feed 17 to supplement the primary feed 18.

With reference to figures 4A and 4B, another dual reflector offset antenna arrangement is illustrated in which a single support strut configuration is used. In this arrangement, the support strut is located centrally through the main reflector 19, the major axis of the elliptical reflector 19 being aligned in the horizontal axis as illustrated.

The back feed assembly may be used in a multiple feed configuration whereby two or more satellites may be received from one fixed antenna using the "beam steering" principal for two or more feeds. These additional back feeds can be offset or central and may be used with either back feed or forward feeds.

Claims

1. An antenna arrangement comprising a main reflector and a sub-reflector, the reflectors being supported by a common supporting strut which also acts as a waveguide.

2. An arrangement as claimed in claim 1 and including at least one component of a receiving system is located within the supporting strut.

3. An arrangement as claimed in claim 2 wherein a polariser arrangement is located within the supporting strut.

4. An arrangement as claimed in any preceding claim and including at least one component of a receiving system located behind the front surface of the main reflector.

5. An arrangement as claimed in claim 4 and including a low noise block down converter located behind the main reflector front surface.

6. An arrangement as claimed in any preceding claim wherein the sub-reflector is located within a housing carried by the supporting strut.

7. An arrangement as claimed in claim 6 wherein the housing and supporting strut have a substantially watertight join.

8. An arrangement as claimed in any preceding claim wherein the supporting strut is extensive through an aperture positioned substantially at the centre of the main reflector.

9. An arrangement as claimed in claims 1 to 7 wherein the supporting strut supports the main reflector at its periphery.

10. An arrangement as claimed in any preceding claim wherein the main reflector comprises a

metallic surface coating on a substrate of relatively low density material.

11. An arrangement as claimed in any preceding claim wherein the common supporting strut supports two sub-reflectors.

12. An antenna arrangement substantially as illustrated in and described with reference to Figure 1, Figure 2, Figure 3a and 3b or Figures 4a and 4b.

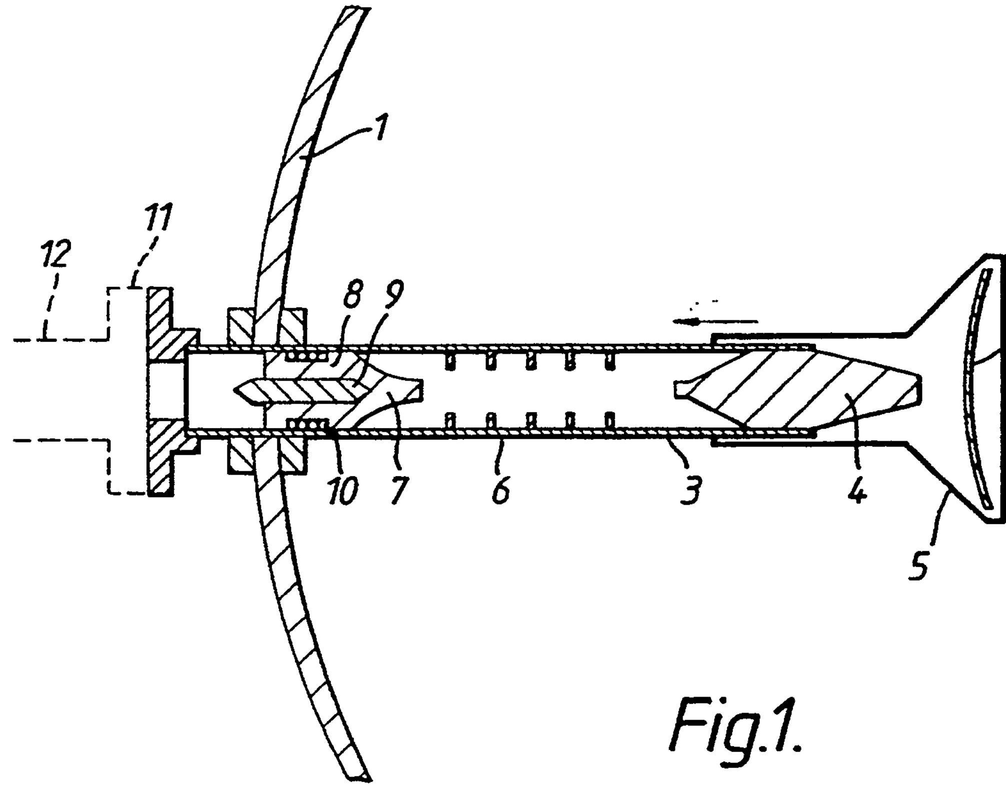

Fig.1.

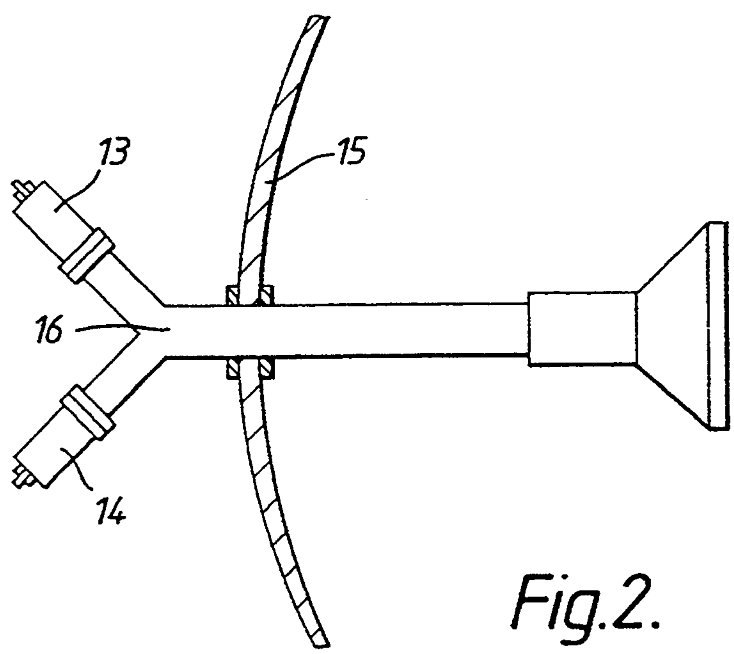

Fig.2.

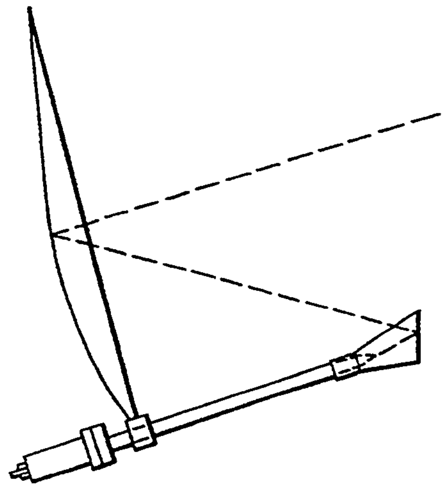

Fig.3a.

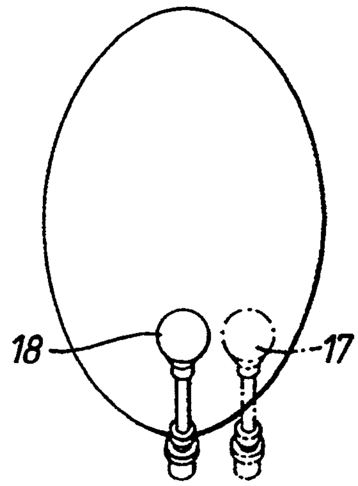

Fig.3b.

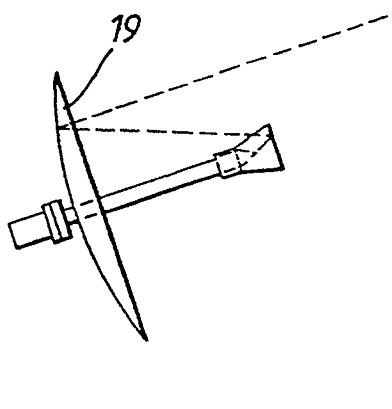

Fig.4a.

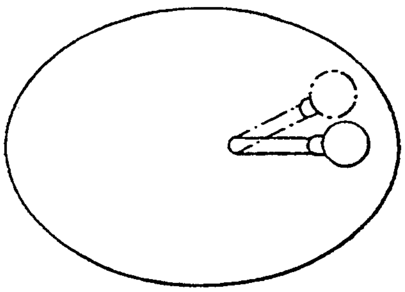

Fig.4b.

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EUROPEAN SEARCH REPORT

Application Number

EP 91 30 3099

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	WO-A-8 200 545 (R. LULY) * figure 3; page 26, line 16 - page 27, line 10 *	1,2	H 01 Q 19/19
Y	GB-A-2 182 240 (RACAL ANTENNAS LTD.) * figure 2, page 1, lines 105-116 *	1	
Y	EP-A-0 304 722 (SIEMENS) * figure 6, column 5, lines 16-34 *	1	
A	* figure 6 *	8	
A	EP-A-0 170 726 (SIEMENS) * figure 1; page 5, lines 3-8; claim 3 *	2,4,10	
A	DE-C-1 092 072 (BENDIX) * figure 2; column 4, line 65 - column 5, line 5 *	3	
A	DE-A-3 231 097 (SIEMENS) * figure 2; page 7, lines 8-23 *	6,7	TECHNICAL FIELDS SEARCHED (Int. Cl.5)
A	DE-A-2 329 555 (PHILIPS) * figure 2; page 5, lines 19-34 *		H 01 Q

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	20-06-1991	BREUSING J

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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