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(12) # EUROPEAN PATENT APPLICATION

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(54) **Spacecraft antenna system.**

(57) A spacecraft antenna system has feed means, preferably two separate feeds (6,7), a single shaped main reflector (3) and at least two, preferably two, shaped sub-reflectors (4,5) which are operable simultaneously to provide coverage to or from more than one coverage area. One sub-reflector (4,5) thus covers one specific coverage area.

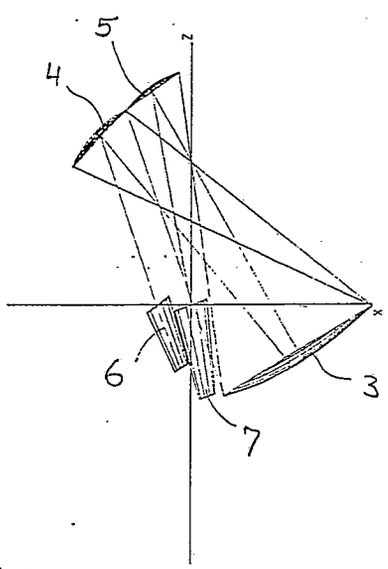

Fig1

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Description

SPACECRAFT ANTENNA SYSTEM

This invention relates to a spacecraft antenna system capable of passing radiation to or from more than one coverage area.

Obtaining several (specifically two) non-identical antenna patterns from a single antenna has previously required the very large number of feeds associated with a multiple beam antenna technique.

There is thus a need for a generally improved and simpler antenna system for applications where several coverages are required from a single antenna, and where it is not required to change the individual pattern shapes while the satellite is in orbit. A good example is the INTELSAT hemi coverages of Earth, as shown in the accompanying Figure 2 in which it is necessary to cover areas 1 and 2 as bounded by lines 1a and 2a respectively. In the past such patterns could only be obtained from multi-feed antennas system, at the cost of greater mass, microwave losses and mechanised complexity.

According to the present invention there is provided a spacecraft antenna system capable of passing radiation to or from more than one coverage area, characterised by including feed means, a single shaped main reflector and at least two shaped sub-reflectors which are operable simultaneously, one for each coverage area.

Preferably the system has two shaped sub-reflectors and the feed means provides two feeds, one for each said sub-reflector.

For a better understanding of the present invention, and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying drawings, in which:-

Figure 1 is a diagrammatic side view of a spacecraft antenna system according to the present invention, and

Figure 2 is a general view of the planet Earth showing two coverage areas.

A spacecraft antenna system of the invention, as shown in Figure 1 of the accompanying drawings has feed means, a single shaped main reflector 3 and at least two, in this case only two, shaped sub-reflectors 4,5.

In this invention, the shaped reflector concept, as disclosed in our European Patent Application No. 219321 and our co-pending UK Patent Application No. 8813655-1 of even date herewith is used to shape the main reflector 3 and two sub-reflectors 4,5.

In the example illustrated in Figure 1 the feed means provides two feeds 6 and 7, with the feed 6 and sub-reflector 4 providing the coverage area 1 of Figure 2 and with the feed 7 and sub-reflector 5 providing the coverage area 2 of Figure 2. The feeds 6,7 and sub-reflectors 4,5 are operable simultaneously. Thus the antenna system has two feeds rather than about 140 which would be needed for a multiple feed unshaped single reflector antenna of the same diameter.

The sub-reflectors 4,5 may alternatively be mounted side by side, i.e. along a line perpendicular to the plane of Figure 1, or alternatively separated in any direction to enable the antenna system to be mounted most conveniently on a spacecraft.

The shaped reflector optimisation technique used is based on iterative use of analysis software within a standard minimax algorithm. Essentially any parameter describing an antenna system may be optimised in an attempt to drive the antenna gains, evaluated at the set of observations points, towards a specified target template. In this case the optimisation parameters are sets of biharmonic distortions on all three reflectors. At each iteration both dual reflector systems are analysed in order to compare the two sets of gains with the target values. There are over 100 optimisation variables.

This optimisation procedure allows suppression of gain in specified regions as well as enhancement in others.

Claims

1. A spacecraft antenna system capable of passing radiation to or from more than one coverage area, characterized by including feed means (6,7), a single shaped main reflector (3) and at least two shaped sub-reflectors (4,5) which are operable simultaneously, one for each coverage area.

2. A system according to claim 1, having two shaped sub-reflectors (4,5) and wherein the feed means provides two feeds (6,7), one for each said sub-reflector (4,5).

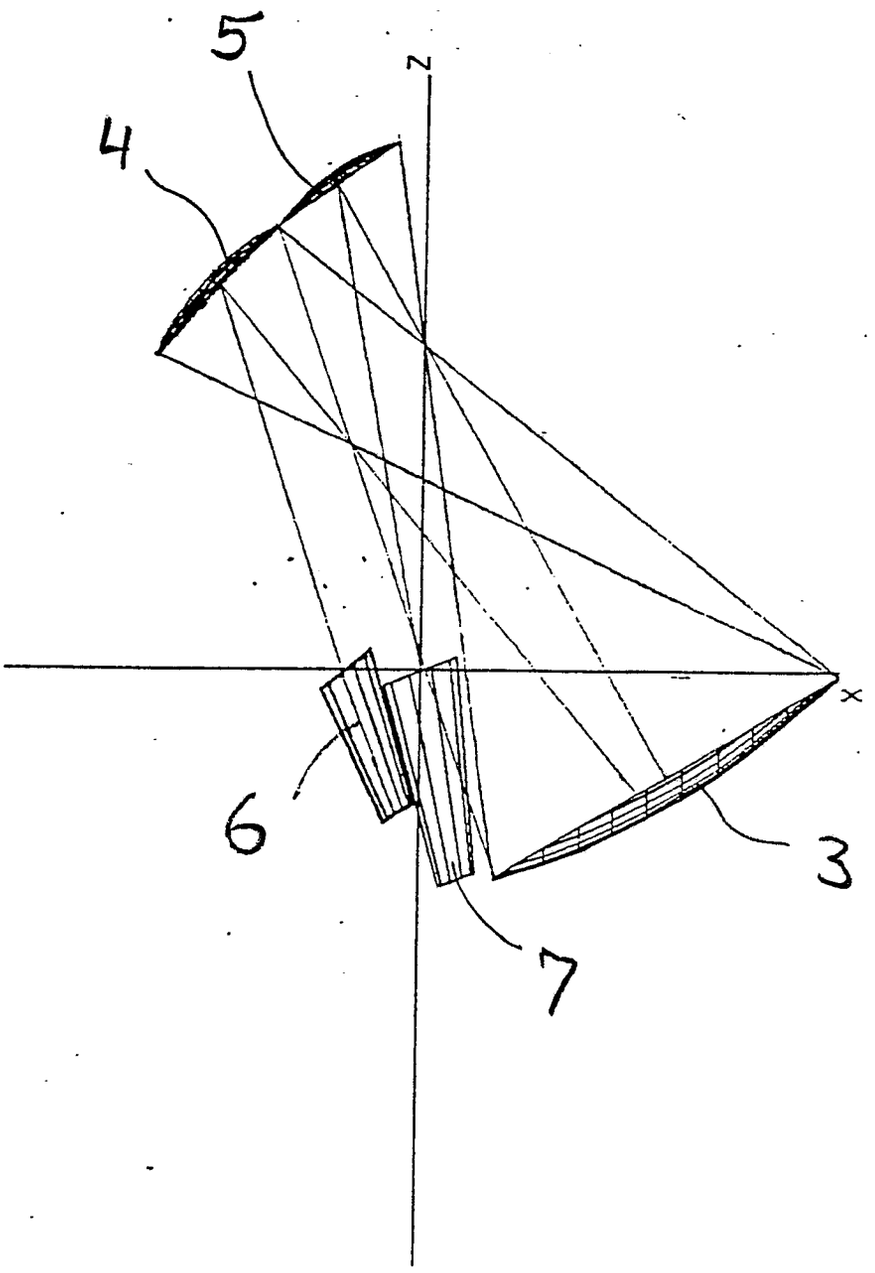

Fig1

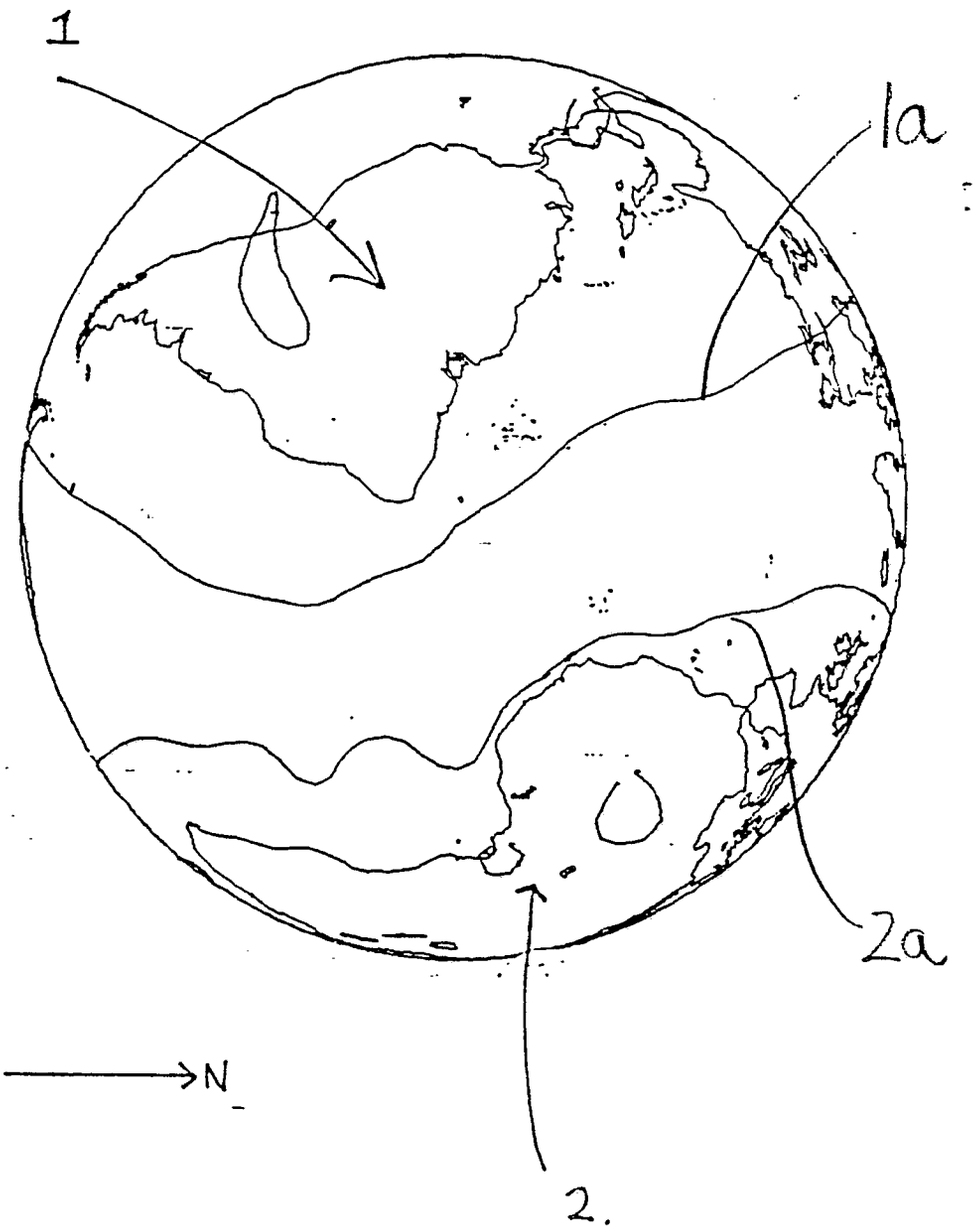

Fig 2.