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## (54) Noise cancelling in antennae and the like.

(57) This invention relates to an antenna which is capable of cancelling long field noise. The antenna is split in to an even number of portions, for example 2, 4, 6, etc., and half of the portions are phase rotated, typically by 180° relative to the other halves of the portions. The long field noise intercepted by the antenna is essentially cancelled by the antenna arrangement. In addition the signal to noise ratio is dramatically improved when compared with that of the prior cut antennae.

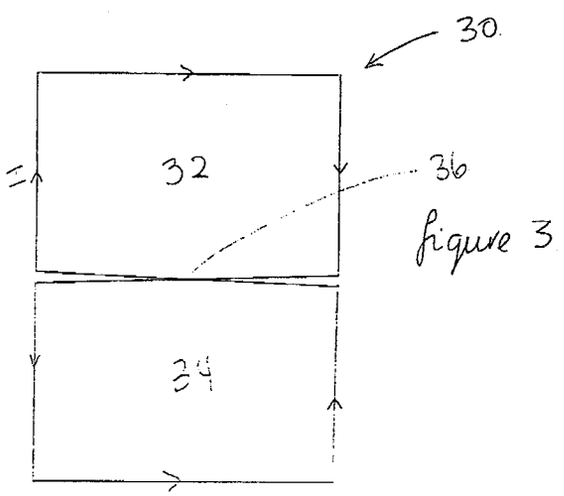


figure 3

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This invention relates to a method and apparatus for cancelling noise in antennae and the like.

Antennae [of all sorts] suffer from the problem that they pick up long distance noise which can interfere with the signal that the antennae is supposed to pick up. In this specification antennae is intended to include all types of antennae, such as for example, relatively inefficient antennae which comprise merely a loop of wire.

When an antenna picks up this long distance noise it is necessary to find a way of removing the noise and improving the signal to noise ratio. Generally the problem is handled by signal processing the received signals in the signal processing circuits of the antennae system. The handling of noise in the signal processing circuits can often result in lowering of the sensitivity of the system ie: reduced signal to noise ratio. In addition some knowledge of the nature of the noise is often required to ensure accurate compensation for the noise.

One object of the present invention is to overcome at least some of the problems and disadvantages of known solutions and to provide a solution in which the signal to noise ratio of the antenna is optimised.

According to one aspect of the present invention there is provided an antenna system having improved noise cancelling properties comprising an antenna which is split into an even number of equal portions, wherein one half of the portions are phase rotated relative to the other half of the portions.

This has the advantage that the effect of the long field noise is cancelled out by the antenna but the effect of near field noise or signal is not. This ensures good signal to noise ratio.

Reference will now be made, by way of example, to the accompanying drawings, in which:

Figure 1 is a schematic view of a known standard gate antenna;

Figure 2 is a side view of the figure 1 antenna showing a source of interest and two noise sources;

Figure 3 is a schematic view of a balanced antenna according to one aspect of the present invention;

Figure 4 is a side view of the figure 3 antenna showing a source of interest and two noise sources;

Figures 5a to 5d are isofield diagrams for both the standard antenna and the balanced antenna; and

Figure 6 is an alternative embodiment of an antenna according to another aspect of the present invention.

A basic antenna 10 as is shown in figure 1, suffers badly from the effect of long distant noise. Refering to figure 2, the antenna 10 receives two noise signals 20, 22 from distance noise sources (not shown). The field lines of each noise signal are substantially parallel as "seen" by the antenna. The antenna also receives field lines 24, from a source 20. Clearly the antenna is unable to distinguish the difference between the signal field lines and the noise field lines, and accordingly the signal to noise ratio is very poor. There is now way for the antenna to differentiate between signal and noise since the current I generated in the loop of the antenna is caused by all the field lines passing through antenna 10.

The Figure 3 antenna is shown generally at 30. The antenna is divided into two halves 32 and 34 respectively. Each half is of substantially equal surface and winding. However, half 32 is 180 degrees phase rotated relative to half 34. The "twist" 36 in the antenna produces a marked reduction in the ability of the antenna to pick up long distance, or far field noise such as, for example, interfering TEM (Transverse electromagnetic) waves. Typically a reduction of about 30 to 40 dB can be expected relative to the standard antenna shown in Figure 1. In addition to the reduction in TEM coupling, the balanced antenna also experiences a reduction in its inductive coupling.

Refering to figure 4, the reduction in long distance pick-up is illustrated. The field lines 40, 42 from two distance noise sources (not shown) are illustrated as is a near source 44 which generates field lines 46. The two halves of the antenna 32 and 34 are out of phase with each other by 180°. As such the current generated by one antenna half (32) as a result of field lines 40 and 42 is equal and opposite to that generated by the other half (34). In otherwords, the effect of the long distance noise is essentially compensated for by the antenna of the present invention. The total current I generated in the antenna is as a result of the near source. The current produced by the noise sources is equal and opposite in each of the halves of the antenna.

The field lines 46 intercepting the antenna from the near source 44 are not cancelled out by the antenna since equal field lines do not pass through each half of the antenna. As such, the current produced by each half of the antenna are not equal and opposite and are therefore not cancelled out. Thus this arrangement improves the signal to noise ratio of antenna.

The result of the system that the long field noise is cancelled out, is ensured by the fact that the antenna has two equal halves each phase rotated by 180° with respect to the other. It is possible to implement this effect by for example splitting the antenna into four equal quarters, two of which are phase rotated by 180° with respect the other two. This is shown is figure 6. This may be further expanded in certain circumstances to an antenna

with six sixths and eight eighths, etc..

Figures 5a and 5b show the charge up profiles for the balanced antenna of the present invention. Figures 5c and 5d show the charge up profile for the standard antenna. The main field lobe for the balanced antenna is perpendicular to the frame plane of the antenna when compared to the standard antenna. This is clearly an advantage in certain applications. One of the main examples may be in ground loops used to read transponders on vehicles, for example. In this case the antenna is used as a transceiver to detect the presence of a vehicle on a highway. The vehicle may be fitted with an identification and registration transponder as described in our co-pending patent application GB 9220409.8 (TI-16812). Obviously other transponders may also be used depending upon the requirements of the system. The antenna transmits a signal which is received and returned by the transponder. The antenna then enters a receive mode and receives the returned transponder signal. From the returned signal the vehicle on which the transponder was mounted may be identified, its speed logged or some other variable monitored, depending on the requirements of the system. For transponders which are generally mounted horizontally; the balanced antenna is a prefered choice.

The balanced antenna is less sensitive to detuning effects than standard antennae and also does not suffer from the same degree of Q-drop caused by metal objects, due to the fact that all noise is effectively cancelled by the antenna.

The balanced antenna may be used in any identification, registration or tagging applications. One particular such application is in AVI (automatic vehicle identification) systems This is described in the following co-pending applications of the present applicant GB 9220413.0 (TI-16815) and GB 9220412.2 (TI-17341).

The antenna shown is substantially rectangular, however, other shapes and sizes of loop are equally applicable to the present invention assuming that a half of the loop/antenna is phase rotated by 180° relative to the other half.

The present invention has shown phase rotation of 180° of one half of an antenna to the other. There may be systems in which phase rotation is at a value other than 180°. In these circumstances some signal processing may be necessary to cause cancelling out of the effect of noise sources.

## Claims

1. An antenna system having improved noise cancelling properties comprising an antenna which is split into an even number of equal portions, wherein one half of the portions are phase rotated relative to the other half of the portions.

2. An antenna system according to claim 1, wherein the one half of the portions are phase rotated by 180° relative to the other half of the portions.

3. An antenna system according to claim 1 or claim 2, wherein there are two equal portions.

4. An antenna system according to claim 1 or claim 2, wherein there are four equal portions.

5. An antenna system according to any preceding claim, for use in registration and identification systems.

6. An antenna system according to any preceding claim, for use in auto-vehicle identification systems.

7. An antenna system according to any preceding claim, wherein the antenna is a loop antenna.

8. A registration and identification system including an antenna system according to any preceding claim.

9. A registration and identification system according to claim 8, wherein the system is an auto-vehicle identification system.

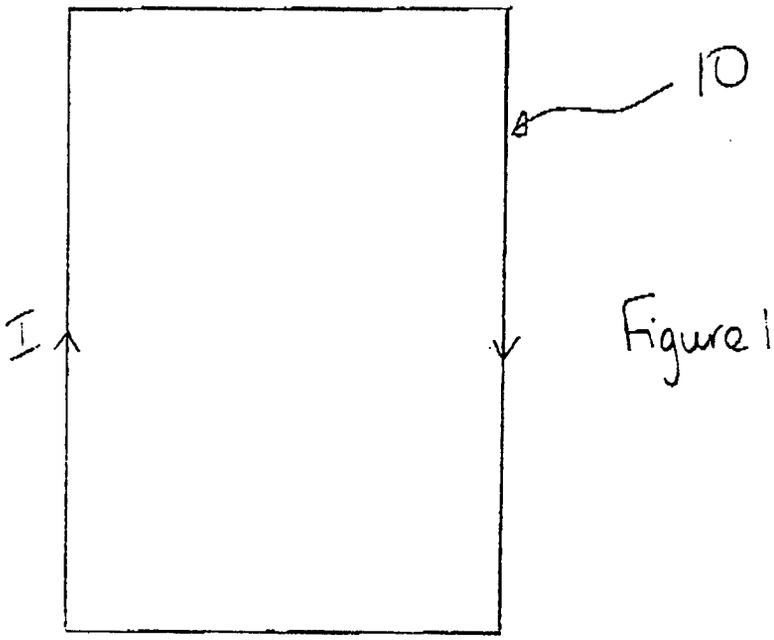


Figure 1

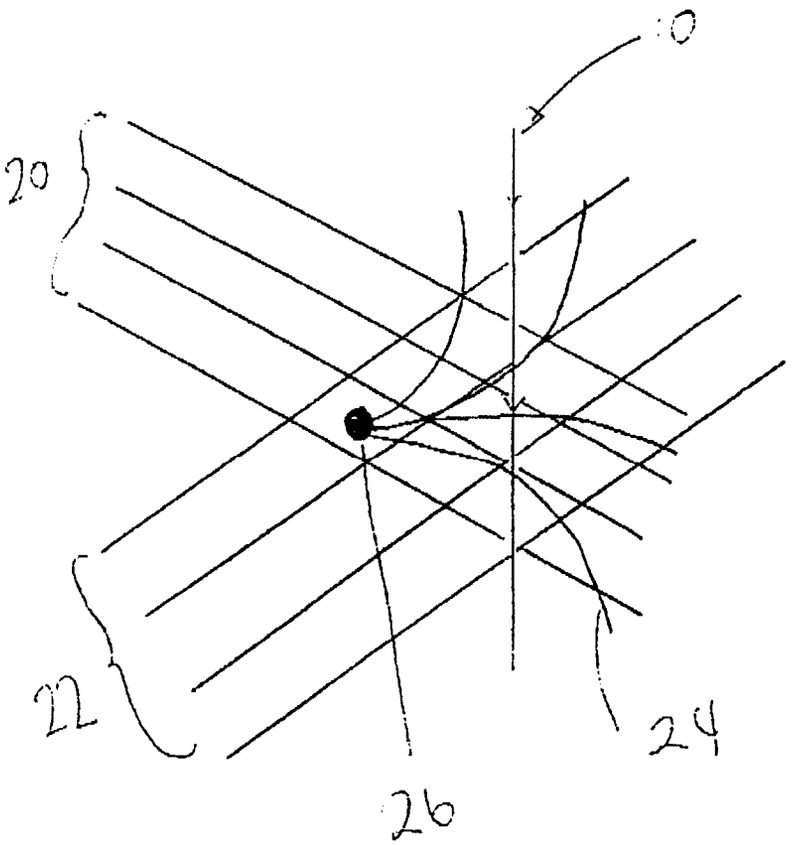


Figure 2.

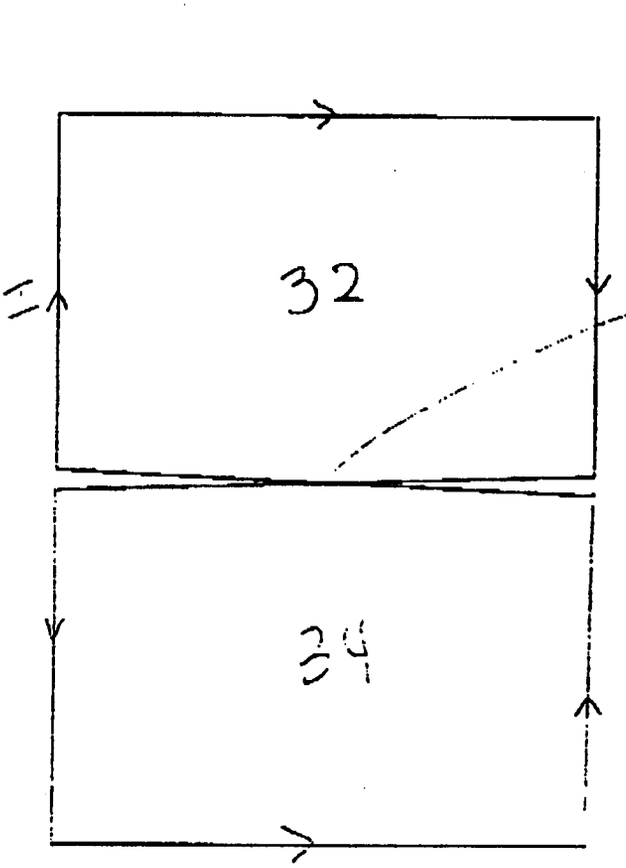


Figure 3.

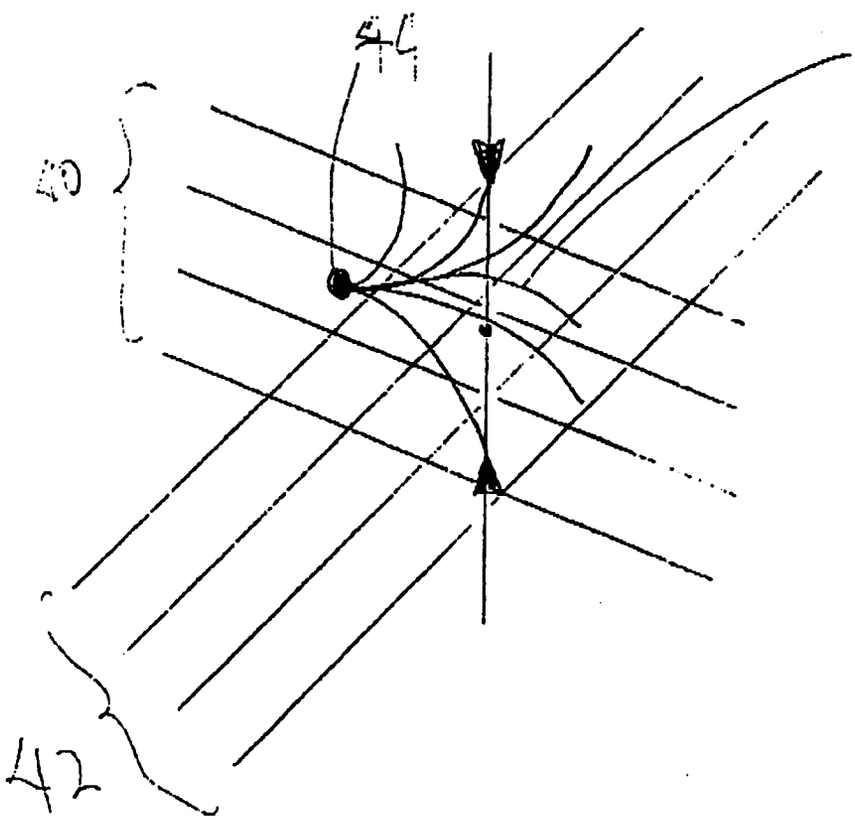


Figure 4

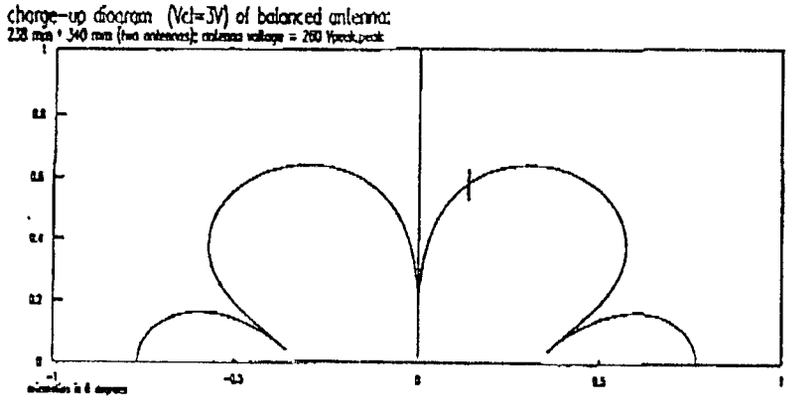


fig 5a

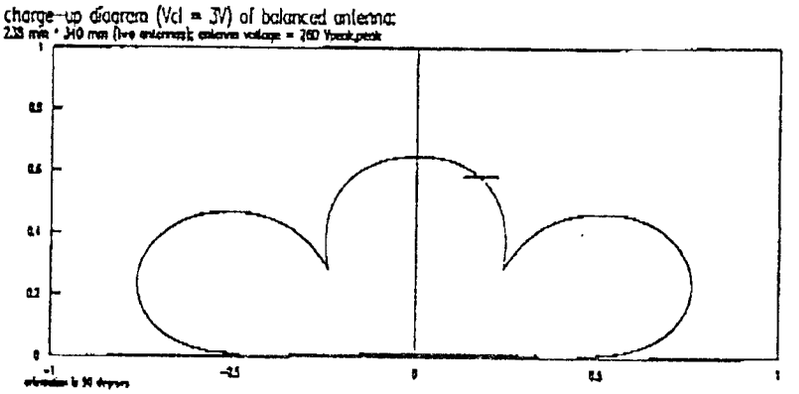


fig 5b

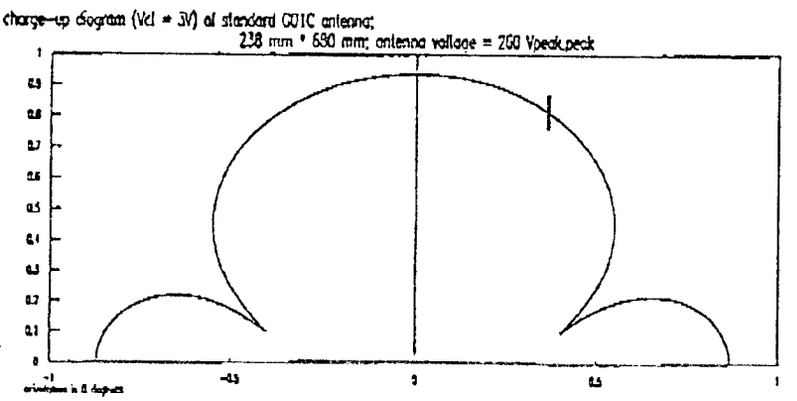


fig 5c

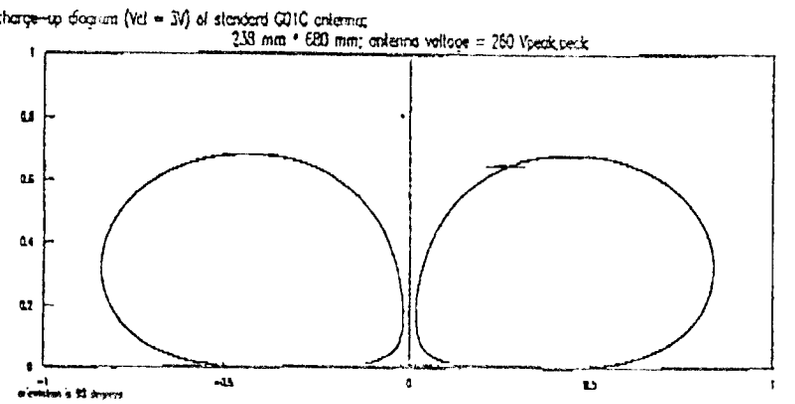


fig 5d

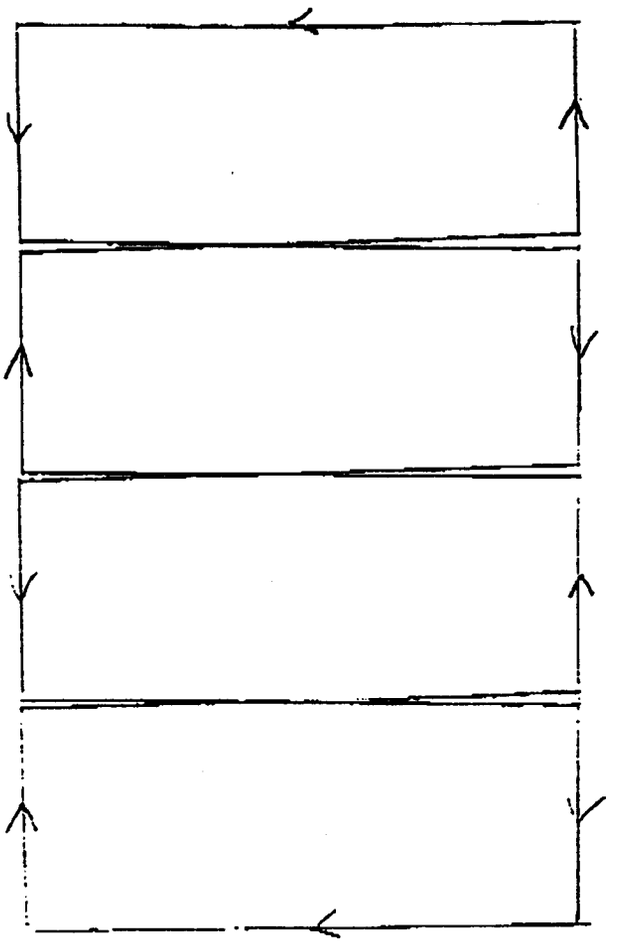

Figure 6

European Patent Office

# EUROPEAN SEARCH REPORT

Application Number

EP 93 11 5619

## 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 | GB-A-2 133 660 (TAG RADIONICS LTD.)<br>* abstract; figures 1,2,5,7 *<br>* page 1, line 114 - line 118 *<br>* page 2, line 23 - line 28 * | 1,6,9 | H01Q7/00 |
| X | WO-A-8 200 378 (VANDEBULT)<br>* abstract; figures 2,4,6,8 *<br>* page 9, line 13 - line 16 *<br>* page 12, line 11 - line 16 *<br>* page 12, line 28 - line 32 * | 1-4,7 | |
| A | US-A-4 872 018 (FELTZ ET AL.)<br>* abstract; figure 4 *<br>* column 7, line 13 - line 19 * | 5,8 | |
| A | US-A-4 243 980 (LICHTBLAU)<br>* the whole document * | | |

| TECHNICAL FIELDS SEARCHED (Int. Cl.5 ) |
|---|
| H01Q |

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| BERLIN | 17 DECEMBER 1993 | DANIELIDIS S. |

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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E : earlier patent document, but published on, or after the filing date
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