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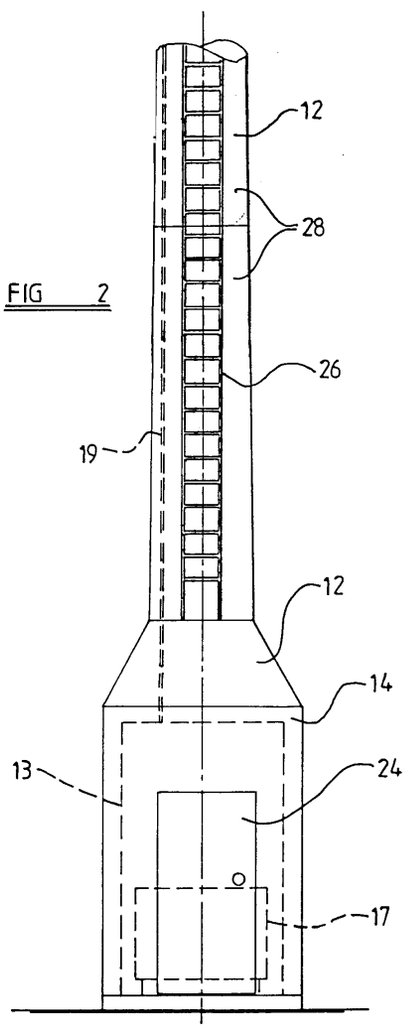
(54) An aerial mast

(57) An aerial mast comprising an upstanding mast part having communication means at or adjacent the top of the mast part for receiving and/or transmitting electromagnetic signals such as analogue and/or digital radio signals and/or microwave signals, and a chamber within a lower region of the mast part.

FIG 2



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Description

[0001] The present invention relates to an aerial mast.

[0002] Aerial masts, comprising an upstanding mast part having communication means for receiving and/or transmitting electromagnetic signals such as analogue and/or digital radio signals and/or microwave signals at or adjacent the top of the mast part, require operating equipment which comprises, for example, a transceiver system and a power supply unit. Conventional aerial masts have the operating equipment located in an equipment housing, which is separate from the mast part.

[0003] Due to the fact that the equipment housing is separate from the mast part, often separate foundations are required for the equipment housing and the mast part. Consequently, it is necessary for radio frequency cabling to extend between the mast part and the equipment housing to connect the communication means and the operating equipment. This requires expensive glands for the cabling to pass through and means for supporting the cabling. Furthermore, it is necessary for earthing strips made from, for example, copper to be provided around the perimeter of the foundations of both the mast part and the equipment housing.

[0004] Another problem encountered with aerial masts is that of security. With conventional aerial masts, it is necessary to provide a perimeter fence and gates, which enclose a site on which the mast part and equipment housing are installed, to deter an unauthorised person from gaining access to the mast part and equipment housing, as well as the radio frequency cabling.

[0005] An object of the present invention is to overcome or reduce the problems relating to aerial masts as described above.

[0006] According to a first aspect of the present invention there is provided an aerial mast comprising an upstanding mast part having communication means at or adjacent the top of the mast part for receiving and/or transmitting electromagnetic signals such as analogue and/or digital radio signals and/or microwave signals, and a chamber within a lower region of the mast part.

[0007] The mast part preferably comprises an upper region generally of smaller cross-section than the lower region.

[0008] The cross-section of a lower end of the upper region of the mast part may be smaller than the cross-section of an upper end of the lower region of the mast part, such that the lower region is visually distinct from the upper region.

[0009] The mast part may comprise a middle region having an upper end adjacent the lower end of the upper region of the mast part, and a lower end adjacent the upper end of the lower region of the mast part.

[0010] The middle region of the mast part may be tapered such that its upper end has a cross-section substantially equal to that of the lower end of the upper region of the mast part, and its lower end has a cross-section substantially equal to that of the upper end of the lower region of the mast part.

[0011] The upper region of the mast part preferably extends substantially from the top of the mast part downwards towards the lower region.

[0012] The chamber is preferably adapted to house operating equipment, and operating equipment may be housed within the chamber.

[0013] The operating equipment preferably comprises a transceiver system capable of receiving and/or transmitting electrical signals such as analogue and/or digital radio frequency signals and/or microwave frequency signals.

[0014] The operating equipment preferably further comprises a power supply unit, and may also comprise a back up power supply from a battery.

[0015] Furthermore, the operating means may comprise means for controlling the environmental conditions within the chamber.

[0016] The communication means may comprise at least one antenna and/or one microwave dish.

[0017] The mast part preferably comprises means capable of relaying signals between the operating equipment and the communication means. The relaying means may comprise radio frequency cabling, for example coaxial cable.

[0018] The chamber is preferably adapted to accommodate, and provide access for, at least one person to carry out maintenance on the operating equipment.

[0019] The mast part is preferably prefabricated.

[0020] The mast part may comprise a generally circular cross-sectional configuration.

[0021] Alternatively the mast part may comprise a generally polygonal cross-sectional configuration, for example a sixteen sided polygonal cross-sectional configuration.

[0022] The mast part may be provided with means for a person to carry out maintenance on the communication means, for example a ladder located on an outer surface of the mast part.

[0023] The mast part may have a height of up to fifteen metres.

[0024] Alternatively the mast part may have a height of up to twenty two and a half metres.

[0025] Alternatively still the mast part may have a height of up to thirty or even forty five metres.

[0026] According to a second aspect of the present invention there is provided an installation comprising a single foundation having mounted thereon an aerial mast as described above wherein the installation has no separate structure mounted thereon for housing operating equipment.

[0027] An advantage of the present invention is that the operating equipment may be housed within the chamber of the mast part, and so no separate equipment housing is required. Consequently there is no need for radio frequency cabling to extend between the mast part and the equipment housing to connect the op-

erating equipment and the communication means, and so no corresponding glands or means for supporting the cabling are required.

[0028] Furthermore, due to there being no connecting cables, and only one structure, the problems of security are reduced. The mast part itself substantially provides sufficient security for the operating equipment, and so there is no need for security fencing and gates to be provided around the perimeter of a site on which the mast is installed.

[0029] Another advantage of there being no separate structures is that earthing strips are only required around the perimeter of the single, relatively small foundation, rather than around a plurality of foundations, or a relatively large foundation upon which both the mast part and the separate equipment housing are installed.

[0030] Further advantages of the present invention are that a smaller site is required, shorter cabling is required between the operating equipment and the communication means, a controlled environment within the chamber and maintenance access in dry conditions in all weather.

[0031] The present invention will now be described, by way of example only, with reference to the accompanying drawings, wherein:

Figure 1 is a side view of an aerial mast according to the present invention;

Figure 2 is a fragmented side view, to an enlarged scale, of a lower region of the aerial mast of Figure 1; and

Figure 3 is another fragmented side view, to an enlarged scale, of the lower region of the aerial mast of Figure 1 with an access door partly open.

[0032] Referring now to Figure 1, there is shown an aerial mast 10 mounted on a single foundation 15 comprising an upstanding mast part 11 having an upper region 12 and a lower region 14. Substantially at a top end of the upper region 12 there is provided communication means 16 for receiving and transmitting electromagnetic signals such as digital and/or analogue radio signals and microwave signals. The communication means 16 illustrated in Figure 1 comprises antennae 18 and microwave dishes 20, although any other suitable form of aerial may be provided.

[0033] The upper region 12 generally comprises a smaller cross-section than the lower region 14, and the mast part 11 further comprises a middle region 22, between a lower end and an upper end of the upper and lower regions 12, 14 respectively. The cross-section of the middle region 22 is tapered such that the upper end of the middle region 22 has a cross-section substantially equal to that of the lower end of the upper region 12, and the lower end of the middle region 22 has a cross-section substantially equal to that of the upper end of the lower region 14.

[0034] Referring now to Figures 2 and 3, a chamber 13, generally illustrated by a first set of broken lines, is provided within the lower region 14 of the mast part 11, and is adapted to house operating equipment 17, generally illustrated by a second set of broken lines.

[0035] The lower region 14 is bolted to the foundation 15, the foundation bolts being within the chamber for increased security. The chamber 13 preferably comprises no floor to allow easy location of, and access for torquing down, the foundation bolts.

[0036] The operating equipment 17 is preferably wall mounted to keep it clear of the ground, and comprises a transceiver system, capable of transmitting and receiving electrical signals such as digital and/or analogue radio frequency signals and microwave frequency signals. The operating equipment further comprises a power supply unit to provide an interface between a power supply, such as a mains power supply or a power supply from an on site generator, and the rest of the operating equipment 17. The operating equipment 17 may also comprise any other equipment required, e.g. a back up power supply from a battery.

[0037] The operating equipment 17 preferably also comprises means for controlling the environmental conditions within the chamber 13, for example air-cooling means, heating means and/or refrigeration means. Such environmental controlled means may utilise a chimney effect provided by the mast part 11.

[0038] Preferably the chamber 13 is provided with thermal insulation in order to assist in the control of the environmental conditions within the chamber 13.

[0039] Due to the fact that the operating equipment 17 is housed within the chamber 13, no separate structures are required. Thus, only the single foundation 15 is required for the aerial mast 10, and so it is only necessary for earthing strips to be provided around the perimeter of the foundation 15. There is also no cabling between separate structures to connect the communication means 16 and the operating equipment 17, and so there is no need for expensive glands to be provided for the cabling to pass through, nor any means for supporting the cabling. The mast part 11 is capable of providing sufficient security for the operating equipment 17 and so no fencing or gates are required around the perimeter of a site on which the aerial mast 10 is installed.

[0040] The aerial mast 10 is also provided with a means 19, generally illustrated by a third set of broken lines, for relaying signals between the operating equipment 17 and the communication means 16. Such relaying means 19 may be in the form of radio frequency cabling, e.g. coaxial cable, which extends up the inside of the mast part 11.

[0041] Thus, electromagnetic signals are transmitted/received by the communication means 16, which converts them from/to electrical signals which are relayed from/to the operating equipment 17.

[0042] Cable management is preferably provided, such that the cabling is routed within the mast part 11, and hatches are provided in the mast part 11, at strategic

points along the mast part 11, allowing access and inspection tasks to be performed in relation to the cabling. Mounting brackets are provided to support the cabling, and earthed outer sheaths are provided for the cabling to reside therein.

[0043] An access door 24 is provided in the lower region 14 of the mast part 11 to allow a person 21 access to the chamber 13 so that maintenance may be carried out on the operating equipment 17 by the person 21. The access door 24 is preferably provided with means for it to be securely locked to prevent unauthorised access. Preferably, internal lighting is provided within the chamber 13 to aid the person 21 in carrying out the maintenance on the operating equipment.

[0044] Means to allow access to the communication means 16 for maintenance to be carried out is also provided, which for the embodiment illustrated in Figure 2 is in the form of a ladder 26, which is located on an outer surface of the mast part 11 and extends substantially to the top of the upper region 12, where the communication means 16 is located.

[0045] In order to prevent an unauthorised person ascending the ladder 26 and obtaining access to the communication means 16, the lower end of the ladder 26 is located at a distance above the ground, out of reach of the unauthorised person. Anti-climb means, e.g. anti-climb paint, may be provided on the outer surface of the mast part 11, beneath the lower end of the ladder, to hinder an unauthorised person trying to reach the ladder. For further security, an intruder alarm may also be provided.

[0046] For the purpose of safety, foot holds, hand holds and lashing points are preferably provided at or adjacent the top of the mast part 11 for an authorised person to secure himself to when carrying out maintenance to the communication means 16. Preferably a fall arrest system is provided on the ladder 26 to increase the safety of the authorised person when ascending and descending the ladder 26. External lighting is preferably also provided to assist in poor light conditions when maintenance work is being carried out on the communication means 16.

[0047] The mast part 11 may have a height of up to fifteen meters, although it may alternatively have a height of up to twenty two and a half meters, or even thirty meters, or even forty five metres.

[0048] The mast part 11 is preferably prefabricated, in particular for mast lengths of twenty two and a half metres or more, comprising a plurality of sections 28. Sections 28 of the mast part 11 are fitted together by virtue of the upper end of one section 28a tapering inwardly and being received within the lower end of the upwardly adjacent section 28b, and forced together causing them to lock, in a similar fashion as a Morse taper system. The lower and middle regions 14, 22 may be provided by separate sections 28, or alternatively may be provided by a single section 28. Alternatively, the top end of the middle region 22 may be welded to the bottom end of the upper region 12, whilst the bottom end of the middle region 22 is bolted, for example, to the top end of the lower region 14.

[0049] A separate mast head may be provided on top of the mast part 11, which is suitable for mounting thereon a dual polar and/or cross polar antenna arrangement, along with any other alternative communication means 17 required. This provides the further advantage of mounting the communication means 17 at ground level, prior to the head mast being located at the top of the mast part 11.

[0050] The cross-section of the mast part 11 is intended to have a sixteen sided polygonal simulating a substantially circular configuration, although the cross-section of the mast part 11 may have any other suitable configuration, e.g. any polygonal configuration of at least three sides, or a substantially oval configuration.

[0051] The mast part 11 is not limited to the configuration illustrated in the drawings. Any other configuration capable of providing a chamber in a lower region of the mast part may alternatively be provided, such as a mast part comprising a cross-section which increases substantially evenly from a smaller cross-section at the top of the mast part to a larger cross-section at the bottom of the mast part. In this case there are no separately identifiable upper, middle and lower regions.

[0052] A further alternative would be where the mast part comprises no middle region such that the upper end of the lower region is adjacent the lower end of the upper region, and the cross-sections of the lower and upper ends of the upper and lower regions respectively being such that the lower region is visually distinct from the upper region due to a discontinuity in the mast part, forming a generally step shaped configuration which may be of generally annular shape.

[0053] There are numerous advantages provided by the present invention, for example, it provides a controlled environment within the chamber 13 for the operating equipment 17, it allows full maintenance access to the operating equipment 17 in dry conditions in all weathers, smaller installation sites, no perimeter fences, smaller foundations, shorter radio frequency cabling required between operating equipment 17 and communication means 16, and higher level of security than conventional sites.

[0054] When installing the aerial mast 10, the mast part is preferably factory finished and shipped to the site, ready for site assembly in the case of the mast being prefabricated. On site the communication means 16 and cabling can be installed at ground level. The chamber 13 is factory fitted with the operating equipment 17. Lifting points at the top of the lower region 14 of the mast part 11 allows it to travel to the site and be manoeuvred by a crane directly into position over the prepared foundation 15. After securing the lower region 14 to the foundation 15, the remainder of the mast part 11 can be elevated into position.

[0055] The features disclosed in the foregoing de-

scription, or the following claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, as appropriate, may, separately or in any combination of such features, be utilised for realising the invention in diverse forms thereof.

Claims

1. An aerial mast comprising an upstanding mast part having communication means at or adjacent the top of the mast part for receiving and/or transmitting electromagnetic signals such as analogue and/or digital radio signals and/or microwave signals, and a chamber within a lower region of the mast part.

2. An aerial mast according to claim 1 wherein the mast part comprises an upper region generally of smaller cross-section than the lower region.

3. An aerial mast according to claim 2 wherein the cross-section of a lower end of the upper region of the mast part is smaller than the cross-section of an upper end of the lower region of the mast part, such that the lower region is visually distinct from the upper region.

4. An aerial mast according to claim 3 wherein the mast part comprises a middle region having an upper end adjacent the lower end of the upper region of the mast part, and a lower end adjacent the upper end of the lower region of the mast part.

5. An aerial mast according to claim 4 wherein the middle region of the mast part is tapered such that its upper end has a cross-section substantially equal to that of the lower end of the upper region of the mast part, and its lower end has a cross-section substantially equal to that of the upper end of the lower region of the mast part.

6. An aerial mast according to any one of claims 2 to 5 wherein the upper region of the mast extends substantially from a top end of the mast towards the lower region.

7. An aerial mast according to any one of the preceding claims wherein the chamber is adapted to house operating equipment, and wherein operating equipment is housed within the chamber.

8. An aerial mast according to claim 7 wherein the operating equipment comprises a transceiver system capable of receiving and/or transmitting electrical signals such as digital and/or analogue radio frequency signals and/or microwave frequency signals.

9. An aerial mast according to claim 7 or claim 8 wherein the operating equipment comprises a power supply unit.

10. An aerial mast according to any one of claims 7 to 9 wherein the operating equipment comprises means for controlling the environmental conditions within the chamber.

11. An aerial mast according to any one of the preceding claims wherein the communication means comprises at least one antenna and/or at least one microwave dish.

12. An aerial mast according to any one of the preceding claims wherein the mast part comprises means capable of relaying signals between the operating equipment and the communication means.

13. An aerial mast according to claim 12 wherein the relaying means comprises radio frequency cabling or coaxial cable.

14. An aerial mast according to anyone of the preceding claims wherein the chamber is adapted to accommodate, and provide access for, at least one person to carry out maintenance on the operating equipment.

15. An aerial mast according to any one of the preceding claims wherein the mast part is prefabricated.

16. An aerial mast according to any one of the preceding claims wherein the mast part comprises a generally circular cross-sectional configuration.

17. An aerial mast according to any one of claims 1 to 16 wherein the mast part comprises a generally polygonal cross-sectional configuration.

18. An aerial mast according to any one of the preceding claims wherein the mast part is provided with means for a person to carry out maintenance on the communication means, said means comprising a ladder located on an outer surface of the mast part.

19. An aerial mast according to any one of the preceding claims wherein the mast part has a height of up to fifteen metres, or up to twenty two and a half metres, or up to thirty metres, or up to forty five metres.

20. An installation comprising a single foundation having mounted thereon an aerial mast according to any one of the preceding claims wherein the installation has no separate structure mounted thereon for housing operating equipment.

FIG 1

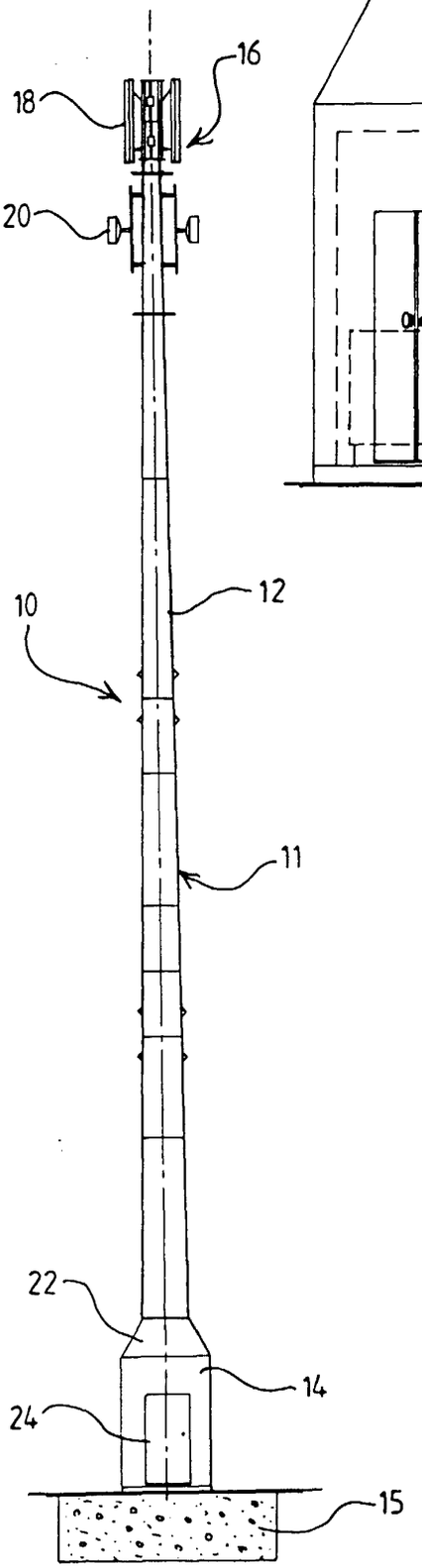

FIG 3

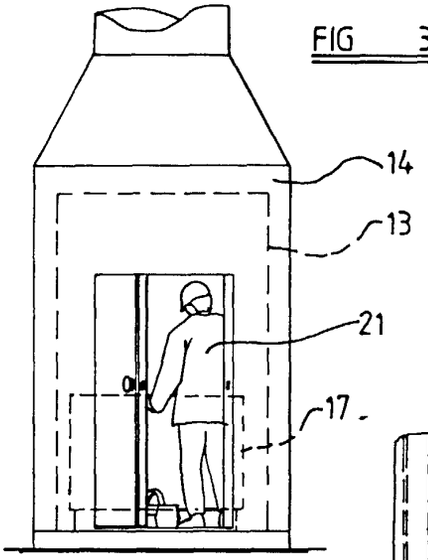

FIG 2