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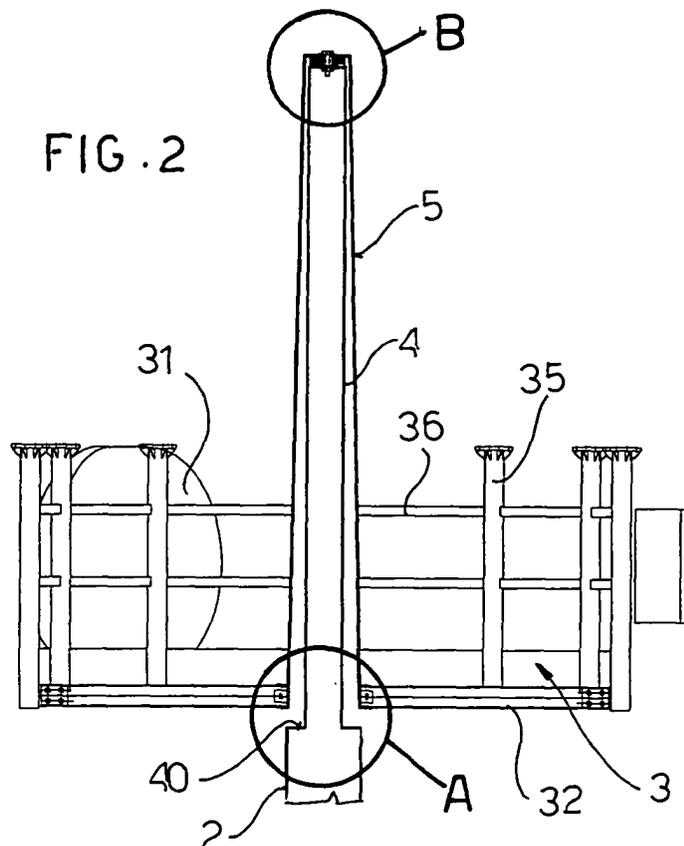
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(54) **Mounting system with a compensated rotation for broadcasting antennas**

(57) A mounting system for broadcasting antennas (30, 31) disposed in a platform (3) mounted at the top of a mast (2) is described. The platform (3) is made integral with the base of a bell or outer tube (5) which is

mounted on a head or inner tuber (4) integral with the top part of the mast (3), by means of interposition of elastic bearing or spring means (6, 37) disposed between said outer tube (5) and said inner tube (4) or said mast (2).



Description

[0001] The present invention refers to a mounting system with a compensated rotation for broadcasting antennas.

[0002] Broadcasting antennas comprise mounts consisting of masts or pylons of iron or steel at the top of which is integrally mounted a platform on which the antennas proper and dishes for connection to base radio stations are installed. The height of the masts varies according to the position of the antennas, generally reaching 30-35 m.

[0003] To ensure the precision of the signal transmission and of the connection, the antennas must not rotate significantly due to wind thrust on their supporting masts. Telephone company specifications impose an antenna rotation that does not exceed the value of 1°.

[0004] For the highest masts, this condition leads to the need for overdimensioning of the sections with respect to those that would be necessary because of allowable steel tensions. However, the greater diameter of the mast leads to a larger surface exposed to the wind and a further thickening of the section necessary.

[0005] Masts of the prior art generally have a frustoconical shape with a base diameter of about 1.067 m and a top section diameter of about 0.609 m. This results in large, heavy masts with an unpleasant environmental impact.

[0006] The object of the present invention is to overcome the drawbacks of the prior art by providing a mounting system for antennas that is able to compensate for the rotation due to wind thrust on the mounting mast.

[0007] Another object of the present invention is to provide such a mounting system for antennas that is suitable to be applied to masts with a reduced cross section.

[0008] Yet another object of the present invention is to provide such a mounting system for antennas that is easy to assemble, cheap and simple to make.

[0009] These objects are achieved in accordance with the invention with the characteristics listed in appended independent claim 1.

[0010] Advantageous embodiments of the invention are apparent from the dependent claims.

[0011] The mounting system according to the invention is suitable for mounting of broadcasting antennas disposed on a platform mounted at the top of a mast. The platform is made integral with the base of a bell or outer tube which is mounted on a head or inner tube integral with the top part of the post. Elastic or spring means are disposed between the outer tube and the inner tube or the post.

[0012] These elastic or spring means provide a reactive force on the bell compensating for the active force of the wind, allowing bending of the mast and of the inner tube due to the wind force and maintaining the bell in position with the axis substantially vertical.

[0013] The mounting system according to the invention presents the following advantages:

- 5 - it allows thinner, more slender, lighter mounting masts to be produced with an appreciable cost saving and at the same time a better aesthetic appearance and a reduced environmental impact;
- 10 - rotation of the antenna supporting platform due to the effect of the wind is reduced with the result of an improvement in the precision of transmission; and
- 15 - the shock-absorbing effect of the elastic and spring means on the bell reduces the dynamic amplification induced by the wind thrust.

[0014] Further characteristics of the invention will be made clearer by the detailed description that follows, referring to a purely exemplary and therefore non-limiting embodiment thereof, illustrated in the appended drawings, in which:

25 Figure 1 is a side elevational view illustrating an antenna mounting system according to the invention, applied to a mounting mast shown partially broken off;

30 Figure 2 is an enlarged view, partially in axial section, illustrating the mounting system of Figure 1;

35 Figure 2A is an enlarged detail, enclosed in the circle A of Figure 2, illustrating the base of the antenna mounting system according to the invention;

40 Figure 2B is an enlarged detail enclosed in the circle B of Figure 2, illustrating the top part of the antenna mounting system according to the invention;

45 Figure 3 is a plan view illustrating the platform of the antenna mounting system according to the invention.

50 Figure 4 is an axial sectional view illustrating the antenna mounting system in conditions of absence of wind;

55 Figure 4A is an axial sectional view illustrating the antenna mounting system in conditions of presence of wind;

Figure 5 is a diagrammatic axial sectional view illustrating the reactive forces of the antenna mounting system; and

Figure 6 is a graph illustrating the movement of the top of the mast according to the frequency of vibration.

[0015] The antenna mounting system according to the invention, denoted as a whole with reference numeral 1, is described with the aid of the figures.

[0016] The mounting system 1 is applied to a mast or tube 2 hollow on the inside, having a substantially frusto-conical or frusto-pyramid shape. By way of example, the mast 2 has a height comprised between 30 m and 35 m, a base diameter of about 0.7 m and a diameter of its top part of about 0.4 m.

[0017] A ladder 20 is fixed to the mast 2 to access a platform 3 disposed on the top part of the mast 2. A plurality of broadcasting antennas, such as parallelepiped antennas 30 for mobile phones, antenna dishes 31 for satellite and terrestrial signals, etc. are mounted in the platform 3.

[0018] As shown in Figures 2 and 2A, a head or inner tube 4 in the form of a substantially cylindrical tube is fixed by means of a base flange 40 to the top end 21 of the mast 2. The cylindrical head 4 is disposed coaxially with respect to the mast 2 and has a smaller bottom diameter than the top part of the mast 2. For example the head 4 can have a height of about 3.5 m and a diameter of 19.3 cm. Clearly the head 4 can be made in a single piece with the mast 2.

[0019] An outer bell or tube 5 having a substantially frusto-conical or frusto-pyramid shape which essentially follows the profile of the mast 2 is fitted onto the head 4. By way of example the base diameter of the bell is about 40 cm and the top diameter is about 25 cm. In this manner a certain clearance 50 is left between the outer surface of the head 4 and the inner surface of the bell 5 to allow movement of the head 4 with respect to the bell 5. The height of the bell 5 is slightly smaller than that of the head 4, so that the bottom end of the bell 5 is situated slightly above the top end 21 of the mast 2.

[0020] Beams 32 are mounted in the bottom part of the bell 5 and protrude radially therefrom. Each radial beam 32 is mounted between a bottom flange 51, a top flange 52 and respective angular supports 53 integral with the bell 5.

[0021] As shown in Figure 3, six beams 32 are mounted disposed angularly equidistant from each other. A truss system 33 which forms the base of the platform 3 is mounted between the radial beams 32. Two hatches 34 for access to the platform from the stairs 20 are mounted in the platform 3. Uprights 35 (Figure 2) which support a peripheral railing 36 are mounted at the end of each radial beam 32 and of the truss system 33.

[0022] As shown in Figure 2B, a bottom transverse plate 41 is welded to the top end of the head 4 and a top transverse plate 55 is welded to the top end of the bell 5. Elastic or spring means are sandwiched between the bottom plate 41 and the top plate 45. The elastic means 6 are preferably bearings 60 of rubber or neoprene. By way of example, three bearings 60 are disposed stacked in a pack on top of one another, separated from each other by two galvanized sheet plates.

[0023] The bearings 60 are substantially ring-shaped

with an outside diameter slightly smaller than that of the top end 41 of the head 4.

[0024] The bolt 7 is fixed above the top plate 55 of the bell 5, by means of a nut 72 and a counternut 71. Two washers 73 and two Teflon gaskets 74 are interposed between the nut 72 and the top plate 55 of the bell 5 and between the head of the bolt 7 and the bottom plate 41. The surface of nut 72 and of the head 70 of the bolt facing the plate preferably has a slightly convex surface, with a spherical cap shape, to allow small relative rotations.

[0025] The head of the system according to the invention is protected from rain by means of a cap-type cover 75, of galvanized sheet, mounted on the protruding end of the bolt 7.

[0026] The bolt 7 is tightened with a dynamometric key so as to give the bearings 6 a uniform compression of such a degree as to compensate for the greater traction induced on the top end 41 of the inner tube by the bending moment caused by wind thrust. The elastic bearings 60 are sized so as to be deformed by the shear and moment induced by the wind, to an extent which is summed with the bending of the inner tube 4, producing a rotation of the outer tube 5 and of the platform 3 equal and opposite to that of the bottom portion of the mast 2.

[0027] As shown in Figures 2A e 3, elastic or spring means 37, such as piston shock absorbers 37, are interposed between the top part 21 of the mast and the radial beams 32 of the platform 3. By way of example, three piston shock absorbers 37, disposed equidistant at an angle of 120° from each other and protruding radially from the mast 2, are used.

[0028] With reference to Figures 4 and 4A, it is considered that the bell 5 and the inner tube 4 are constrained to each other at the point of hinging C coinciding with the bearings 6 and the bolt 7. As shown in Figure 4, in the absence of wind, the axis of the bell 5 coincides with the axis of the inner tube 4. Through the effect of wind thrust (static effect), as shown in Figure 4A, the bell 5 undergoes a rotation around the hinge C, in the opposite direction to that undergone by the head 4.

[0029] If the bell 5 were free to rotate, the point of equilibrium would occur when its rotation was of such an entity as to bring the centre of gravity of the weights outside the vertical axes drawn from the centre of the hinge C, so that the weight generates a moment equal to and opposite that induced by the wind thrust. In this manner the antennas on the platform 3 integral with the bell 5 would rotate excessively.

[0030] An elastic recall force that compensates that of the wind, keeping the bell 5 vertical as shown in Figure 4 B, must therefore be caused.

[0031] According to the invention, this result is obtained in two simultaneous or alternative ways:

- a) By giving the hinge C an elastic reaction to the relative rotation between the head of the mast 4 and the bell 5 integral with the antenna mounting plat-

form 3. The connection at the top between the two tubes 4 and 5 is made with an elastic joint formed by two iron plates 41, 55 welded to the ends of the two masts 4 and 5 with a suspension bearing 6 of elastic material (for example neoprene) interposed. The two plates 41, 55 are connected to each other with a central bolt 7.

b) By disposing at the base of the bell 5 three substantially horizontal springs 37, disposed at 120° from each other, applied between the base of the platform 3 and the bottom mast 2. As shown in Figure 5, the stiffness of the springs 3 is calculated to produce reactive forces F_A which give as their resultant a force that generates a moment on the upper hinge C equal and opposite to that induced by the wind thrust F_v on the bell 5, with a movement of the bell 5 with respect to the inner tube 4 such as to annul the rotation of the bell 5 and keep it vertical.

[0032] The wind thrust causes an oscillation on the tip of mounting system 1. The compensation system according to the invention can be exploited to reduce these oscillations by integrating the springs of the elastic means 6 with linear oil-bath piston shock absorbers 37 (of the automobile type), and varying the mass of the platform 3.

[0033] From the dynamic point of view, the tip of the mounting system then acts as an "inertia damper". In fact, as shown by the graph of Figure 6, in masts without this damping device, all the energy transmitted by the wind is accumulated in oscillations around the single dominating frequency of the mast W_0 (which by nature is damped little). With the tip of the mounting system connected with elastic means 6 and shock absorbers 37, the system has two frequencies of its own W_1 and W_2 (in general: one higher and one lower than the single mast): the energy of the wind is distributed around the two frequencies. The response of the system in terms of movements and rotations is reduced, also because of the effect of the greater dissipation of energy produced by the added dampener.

[0034] Numerous variations and modifications of detail, within the reach of a person skilled in the art, can be made to the present embodiment of the invention without departing from the scope of the invention as set forth in the appended claims.

Claims

1. A mounting system (1) for broadcasting antennas (30, 31) disposed in a platform (3) mounted at the top of a mast (2), **characterised in that** said platform (3) is made integral with the base of a bell or outer tube (5), which is mounted on a head or inner tube (4) integral with the top part of the mast (2), by means of interposition of elastic or spring

means (6, 37) disposed between said outer tube (5) and said inner tube (4) or said mast (2).

2. A mounting system according to claim 1, **characterised in that** said elastic or spring means comprise an elastic joint (6) disposed between the top end of said inner tube (4) and the top end of said outer tube (5).

3. A mounting system according to claim 2, **characterised in that** said elastic joint (6) comprises a pack of neoprene bearings (60) compressed in a sandwich between a bottom transverse plate (41) integral with the top end of the inner tube (4) and a top transverse plate (55) integral with the top end of said outer tube (5).

4. A mounting system according to claim 3, **characterised in that** said elastic bearings (6) are compressed by means of a bolt (7) which passes axially through said bottom plate (41) and top plate (55).

5. A mounting system according to any one of the preceding claims, **characterised in that** said elastic or spring means comprise shock absorbers (37) disposed between the base of the bell (5) or the platform (3) and the side wall of said mast (2) slightly beneath the platform (3).

6. A mounting system according to claim 5, **characterised in that** said shock absorbers comprise linear piston shock absorbers (37).

7. A mounting system according to claim 5 or 6, **characterised in that** said shock absorbers (37) are three in number and are disposed radially with respect to the mast (2) equidistant at an angle of about 120° from each other.

8. A mounting system according to any one of the preceding claims, **characterised in that** said inner tube (4) has a smaller diameter than said mast (2) and is mounted at the top end (21) of the mast (2) by means of flanges (40).

9. A mounting system according to any one of the preceding claims, **characterised in that** a certain clearance (50) is left between said inner tube (4) and said outer tube (5) to allow movement of the inner tube with respect to the outer tube.

10. A mounting system according to any one of the preceding claims, **characterised in that** said inner tube (4) has a substantially cylindrical shape and said outer tube (5) has a substantially frusto-conical or frusto-pyramid shape.

11. A mounting system according to any one of the pre-

ceding claims, **characterised in that** said platform (3) comprises a plurality of beams (31) fixed radially to the base of said outer tube (5).

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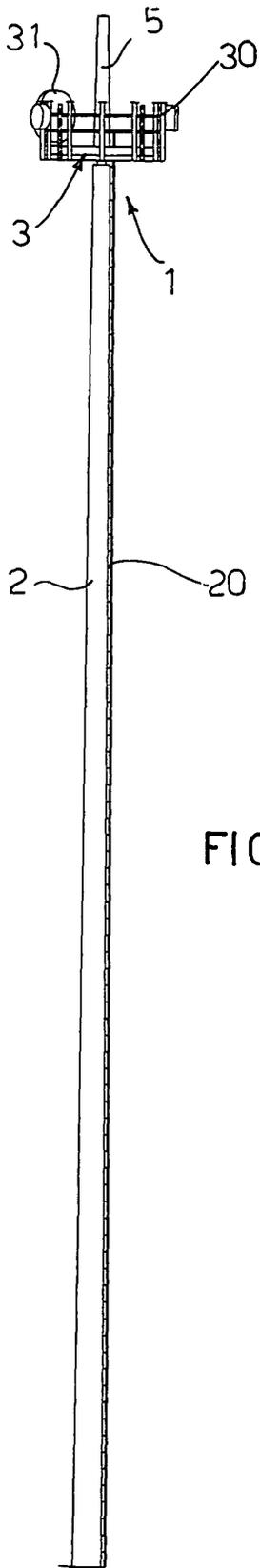


FIG. 1

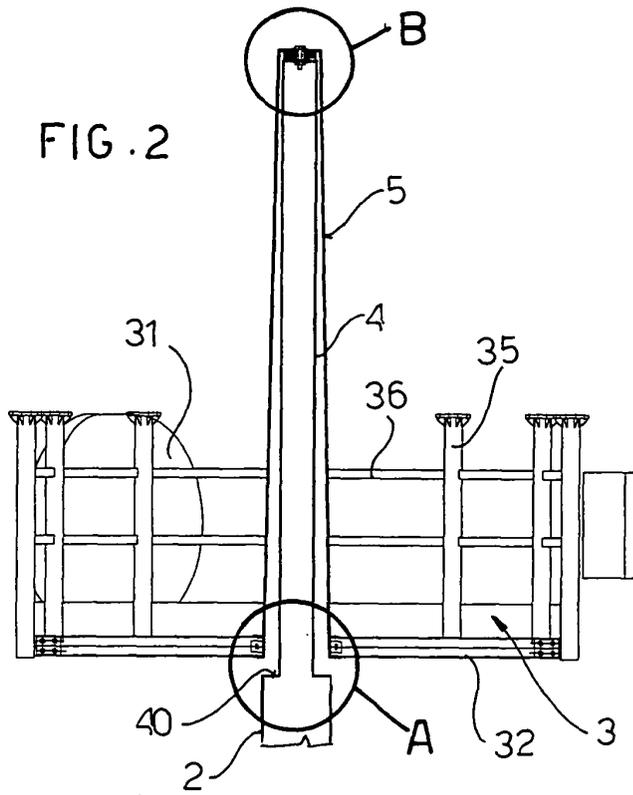


FIG. 2

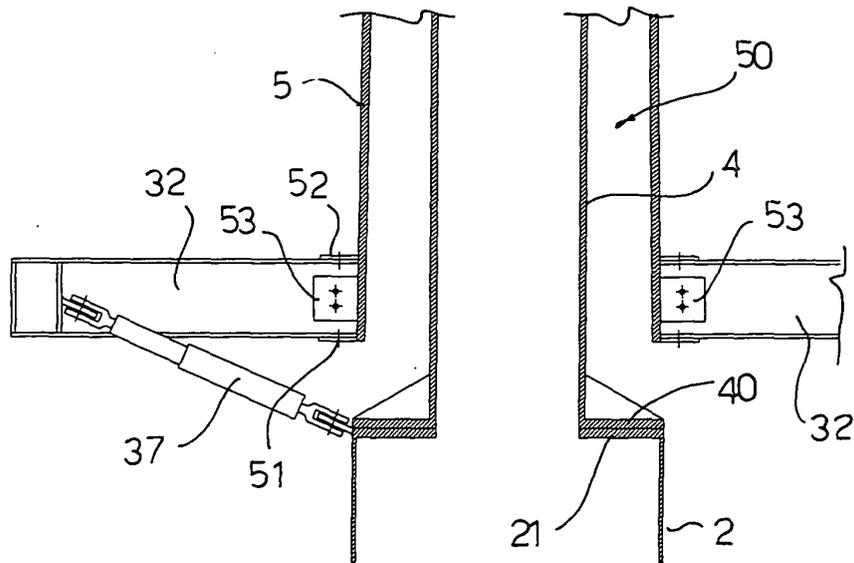


FIG. 2A

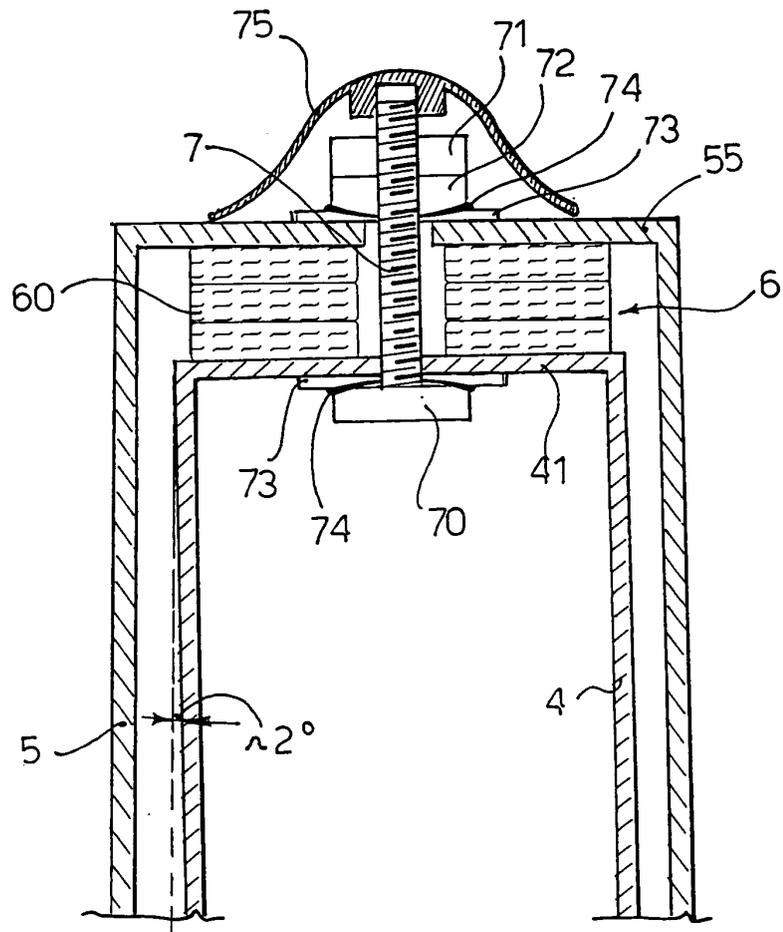


FIG. 2B

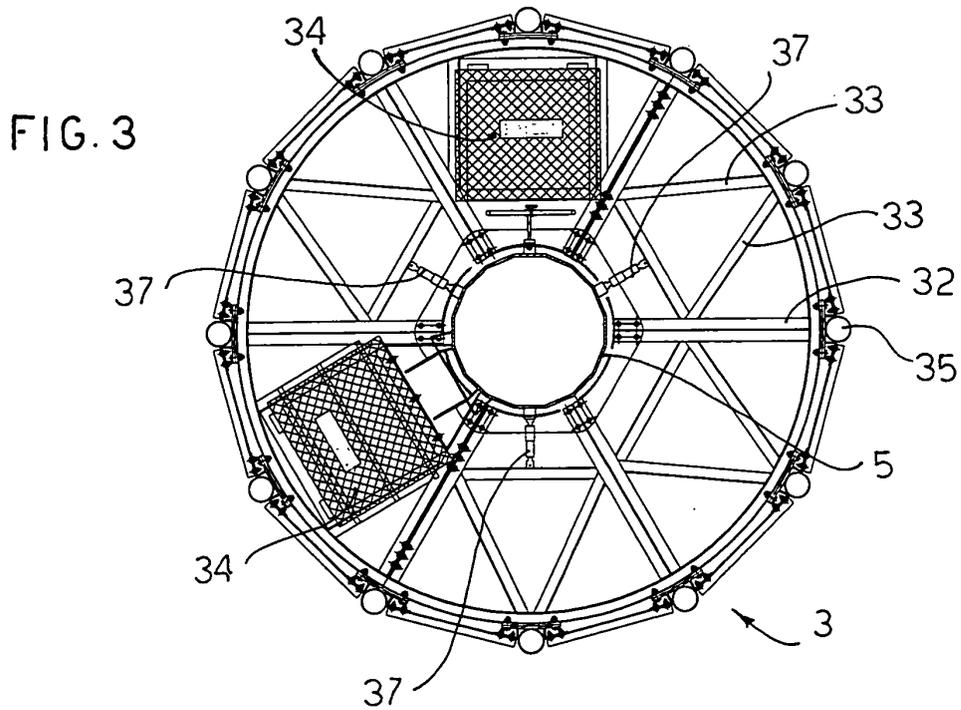


FIG. 3

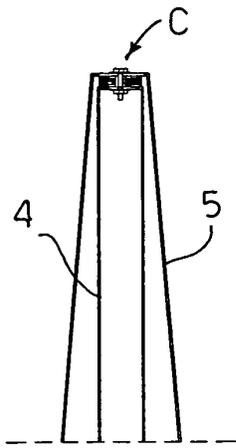


FIG. 4

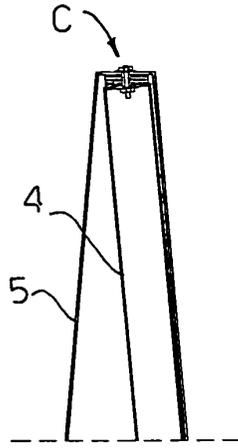


FIG. 4A

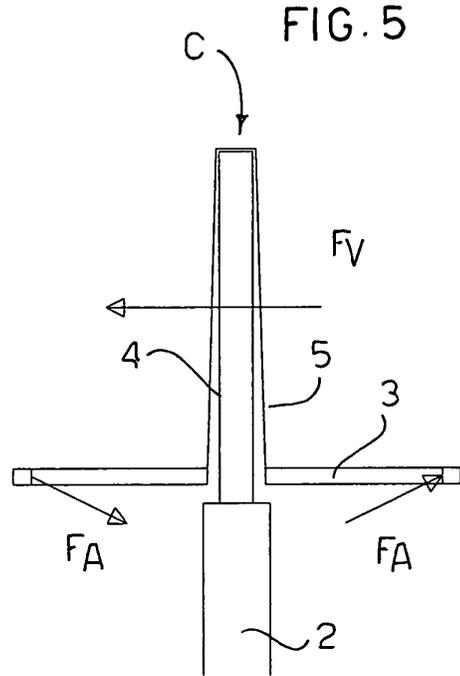
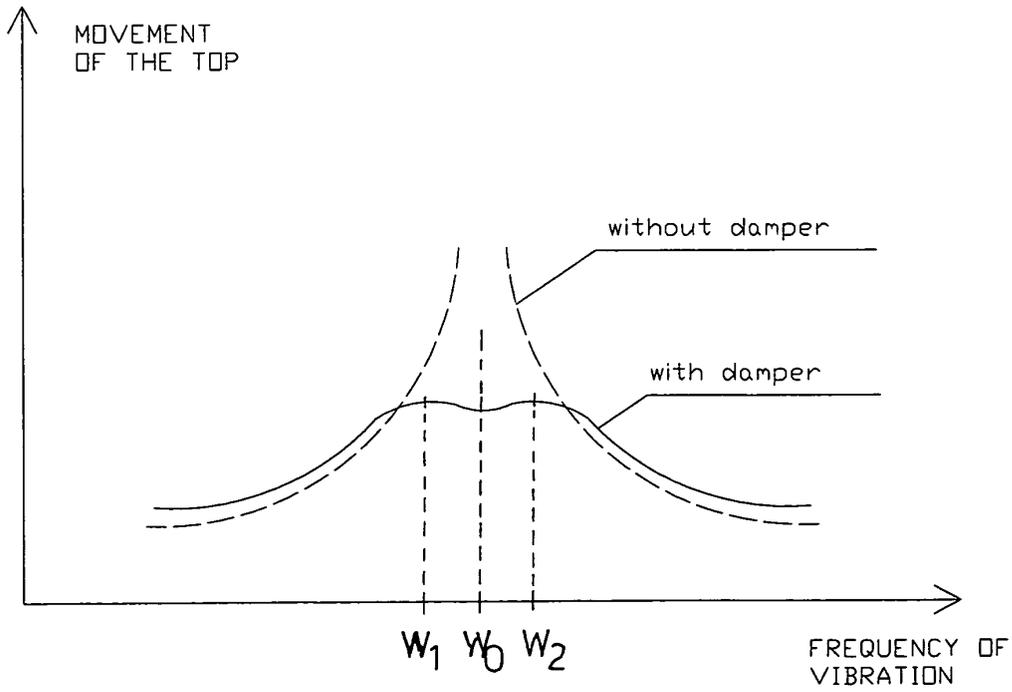


FIG. 6





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EUROPEAN SEARCH REPORT

Application Number
EP 05 01 0570

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.7)
A	US 2 510 059 A (BLACK ERIC A) 6 June 1950 (1950-06-06) * column 1, line 55 - column 3, line 43; figures 3,4 *	1	H01Q1/12 E04H12/00 H01Q1/00
A	US 6 018 325 A (LUNDGREN ET AL) 25 January 2000 (2000-01-25) * column 1, line 9 - line 23 * * column 3, line 33 - column 5, line 55; figures 1,2 *	1	
A	US 3 382 629 A (REUTLINGER WOLF-DIETER) 14 May 1968 (1968-05-14) * column 1, line 29 - line 32 * * column 2, line 68 - column 4, line 2; figure 2 *	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			H01Q E04H
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 7 July 2005	Examiner La Casta Muñoa, S
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 05 01 0570

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07-07-2005

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 2510059	A	06-06-1950	NONE	
US 6018325	A	25-01-2000	WO 9919935 A1	22-04-1999
US 3382629	A	14-05-1968	DE 1559243 A1	04-09-1969

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