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(12) # EUROPEAN PATENT SPECIFICATION

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(54) **Telescoping lightweight antenna tower assembly and the like.**

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Description

The present invention relates to antenna tower assemblies or masts and the like, being particularly directed to lighweight structures of the telescoping type, readily raised and lowered in a portable manner.

Various types of telescoping antenna rods and mast structures have been used in various fields to take advantage of the portability of relatively short structures which may, on site, be extended into relatively long or high structures. The problem of providing a very lightweight, but structurally strong, telescoping tower for an antenna or similar rig that may be erected and collapsed in a portable manner has not, however, been satisfactorily addressed in terms of each of weight, numbers of different types of parts (and consequent complexity and cost), simplicity for tall structures, and guy wire requirements.

In this connection reference may be had to French patents 2446907 and 2476727 which disclose telescoping antenna structures and cable means co-operating with pulleys for raising and lowering the structures.

An object of the present invention is to provide a novel telescoping antenna tower assembly that in large measure obviates the above-discussed problems and provides a lightweight, structurally sound tower or mast assembly emboding many common or identical lightweight parts and simple raising and lowering mechanism, enabling portability and ease of operation.

STATEMENT OF INVENTION

According to the present invention there is provided a telescoping antenna tower assembly comprising a plurality of hollow equilateral triangular aluminium tubular sections bounding successively diminishing areas, one nested within the other(s) in parallel longitudinal coaxial relationship, sliding means disposed between the succesive tubular sections to permit sliding longitudinal axial relative movement, pulley means mounted on the tubular sections, and winch means disposed near the bottom of the outer tubular section and connected with a cable link longitudinally harnessed over the pulley means to permit raising and lowering of the tubular sections by the cable in order to erect and lower the tower, characterised in that said sliding means is in the form of guide rollers disposed at the corners of the sections, said cable link being disposed within said sections and that a retraction cable is connected within the sections between said winch means and that inner tubular section which forms the top of the tower for applying a pulling force to lower the tower.

The invention will now be described by way of example with reference to the accompanying drawings wherein:

Figs 1A and 1B are side elevational views of an antenna tower constructed in accordance with the invention in collapsed or retracted position and elevated position respectively;

Figs 2A and 2B are isometric views of successive sections of the tower, upon an enlarged scale, with preferred equilateral triangular tubular elements;

Fig 3 is a transverse section near the bottom of the mast;

Fig 4 is a fragmentary top elevation of the telescoped mast of Figs 2A and 2B, upon a larger scale.

Referring to Figs 1A and 1B of the drawings, the mast or tower structure of the invention is shown constructed of a plurality of hollow equilateral triangular aluminium or similar thin-walled tubular sections 1, 2, 3, 4, 5, ... enclosing successively diminishing areas (for structural rigidity), one nested within the other(s) in parallel longitudinal successive coaxial relationship. To achieve light weight and component or part similarity or identity, portability, and easy assembly and disassembly, the tubes are preferably formed of similar aluminium sheet sections S, Fig. 4, bolted, swedged or otherwise edge-secured at B to similar extruded aluminum corner brackets 5'; but the embodiment of Figs. 2A-B and 3 are shown for illustrative purposes as having extruded integral tubular sides.

At or near the corners or vertices of successively adjacent tubes 1, 2, 3, 4, etc., are pairs of externally mounted upper and lower pulley wheels P, more particularly shown in Figs. 2A and 2B, receiving a cable harness C from a winch W (Figs. 1B and 3) preferably disposed at the bottom of the outer tube 1 for ready hand, foot-pedal or other operation. The cable harness is designed to enable the tubular sections to be elevated one within the other, along rollers R in the corner, Fig. 3, for erection of the tower, and also for positive cable control in lowering the same.

A suitable cable harness arrangement is shown schematically in Fig. 1B, and portions in Figs. 2A and 2B.

With the mast assembly fully retracted as shown in Fig. 1A, and with winch W, Fig. 1B, hand cranked by the operator, a tension is developed within the cable of the harness arrangement which tension, due to the low frictional resistance of the sheaves, is the same throughout the system. This cable tension is

transmitted first from the winch drum affixed to the side of outermost section 1 upward to and around the sheave affixed near the upper edge of this outermost section. It then continues downward to and around the sheave affixed near the lower end of the next inner section 2, then upward to and around a sheave affixed near the upper end of section 2. This connective means is continued through the successively inwardly located mast sections until the cable is finally terminated by means of a fixed connection to the lower end of the innermost (top) mast section.

As the tension in the cable is increased, all mast sections remain stationary until sufficient tension is developed to raise the lightest, innermost mast section 5 in Fig. 1B. This section extends upward, out of the next innermost section 4, until it reaches the limit of its travel and becomes locked in section 4. As the cable tension is increased and becomes sufficient to raise the combined weights of sections 5 and 4, this sequence is repeated, with section 4 extending upward, out of section 3; and so on.

When the rotation of the winch is reversed, the lower mast section 2, Fig. 1B, will retract into section 1 under the influence of gravity, and when fully seated, mast section 3 will retract into section 2, etc., until all sections are nested as shown in FIG. 1A. However, when the winds are sufficienly strong, friction between the mast sections can prevent the smooth and orderly retraction just described. To avert the undesirable consequences resulting from such a situation, a retraction cable 6, Fig. 1B, is provided. This consists of a cable connected from the lower end of the uppermost section 5, extending directly downward to a sheave in the base of lowermost section 1, and thence to a drum on the winch W.

A satisfactory telescoping, mast or tower of this type has been constructed with the following section dimensions:

Length, Retracted- - - - - - - - - - - -	**- 177.8cm (70 IN)**
Length, Fully Extended---(NOT INCL. ANTENNA-	**7.16m (23 Ft. 6) IN.**
Width, Triangular, each side dimension- - - - - -	**19.8cms 7.8 IN.**
Total Weight, Operating- - - - - - - - - - - - -	**19.6kgs 40 LBS.**
Total Weight, Transport- - - - - - - - - - - - -	**22.5kgs 46 LBS.**
Max. Cable Tension, To Extend- - - - - - - - -	**21.5kgs 44LBS.**
Max. Guy Tension, 90 M.F.R. Wind,	
Upper Guy- - - - - - - - - - - - - -	**136kgs 300 LBS.**
Lower Guy- - - - - - - - - - - - - -	**54.5kgs 120 LBS.**

For light weight construction, the sheet walls of the triangular tubular members may be apertured as by punched holes H, the inner punching of which adds structural reinforcement, or by other perforations or lattice structures.

If desired, the inner tubular sections may initially be raised together before telescopically raising the successive inner tubes to successively higher elevation, and further modifications will also occur to those skilled in this art, and such being considered to fall within the spirit and scope of the invention as defined in the appended claims.

Claims

1. A telescoping antenna tower assembly comprising a plurality of hollow equilateral triangular aluminium tubular sections (1,2,3,4,5) bounding successively diminishing areas, one nested within the other(s) in parallel longitudinal coaxial relationship, sliding means (R) disposed between the succesive tubular sections (1,2,3,4,5) to permit sliding longitudinal axial relative movement, pulley means (P) mounted on the tubular sections, and winch means (W) disposed near the bottom of the outer tubular section (1) and connected with a cable link (C) longitudinally harnessed over the pulley means (P) to permit raising and lowering of the tubular sections (1,2,3,4,5) by the cable (C) in order to erect and lower the tower, characterised in that said sliding means is in the form of guide rollers (R) disposed at the corners of the sections (1,2,3,4,5), said cable link (C) being disposed within said sections (1,2,3,4,5) and that a retraction cable (6) is connected within the sections (1,2,3,4,5) between said winch means (W) and that inner tubular section (5) which forms the top of the tower for applying a pulling force to lower the tower.

2. An assembly as claimed in claim 1 wherein said tubular sections are formed of similar thin planar aluminium sheets edge-mounted in similar extruded aluminium corner sections (5').

3. An assembly as claimed in claim 2 wherein said sheets (S) are perforated for low weight and structural

reinforcement.

4. An assembly as claimed in claim 1 wherein said pulley means (P) comprises a pair of upper and lower pulleys mounted near a corner externally of said tubular section.

5. An assembly as claimed in claim 1 wherein an antenna (A) is disposed within the innermost tube (5) to be raised and lowered therewith.

Revendications

1. Ensemble de pylone d'antenne télescopique comprenant plusieurs sections en tube d'aluminium creux en forme de triangles équilatéraux (1, 2, 3, 4, 5) entourant des surfaces en diminutions successives, chaque section étant logée à l'intérieur de la ou des autre(s) avec une relation coaxiale parallèle longitudinale, des moyens de glissement (R) intercalés entre les sections tubulaires successives (1, 2, 3, 4, 5) pour permettre un mouvement de glissement relatif dans la direction axiale longitudinale, des moyens de poulie (P) installés sur les sections tubulaires, et des moyens de treuil (W) placés à proximité de la partie inférieure de la section tubulaire extérieure (1) et reliés au moyen d'une liaison par câble (C) passant longitudinalement sur les moyens de poulie (P) afin de pouvoir monter et descendre les sections tubulaires (1, 2, 3, 4, 5) au moyen du câble (C) pour ériger et abaisser le pylone, caractérisé en ce que lesdits moyens de glissement prennent la forme de galets de guidage (R) installés aux angles des sections (1, 2, 3, 4, 5), ladite liaison par câble (C) étant placée à l'intérieur desdites sections (1, 2, 3, 4, 5) et en ce qu'un càble de retrait (6) est relié à l'intérieur des sections (1, 2, 3, 4, 5) entre lesdits moyens de treuil (W) et la section tubulaire intérieure (5) qui constitue le faite du pylone afin d'appliquer une force de tirage pour abaisser le pylone.

2. Ensemble selon la revendication 1, dans lequel lesdites sections tubulaires sont constituées de tôles d'aluminium planes, minces semblables montées sur les bords dans des cornières d'aluminium extrudé (5').

3. Ensemble selon la revendication 2, dans lequel lesdites tôles (S) sont perforées afin de réduire le poids et de renforcer la structure.

4. Ensemble selon la revendication 1, dans lequel ledits moyens de poulie (P) comprennent une poulie supérieure et une poulie inférieure montées extérieurement à proximité d'un angle de ladite section, tubulaire.

5. Ensemble selon la revendication 1, dans lequel une antenne (A) est placée à l'intérieur du tube le plus central (5) pour être hissée et abaissée avec lui.

Patentansprüche

1. Teleskopartige Antennenmastanordnung mit einer Vielzahl von Abschnitten (1, 2, 3, 4, 5), die jeweils von gleichseitigen dreieckförmigen Aluminiumrohrabschnitten mit schrittweise abnehmendem Querschnitt gebildet und ineinander in paralleler und koaxialer Anordnung vorgesehen sind, mit Gleitmittel (R), die zwischen den aufeinanderfolgenden Rohrabschnitten (1, 2, 3, 4) vorgesehen sind, um eine gleitende axiale Relativbewegung zu ermöglichen, mit Rollenmitteln (P), die an den Rohrabschnitten montiert sind, sowie mit Windenmitteln (W), die in der Nähe des Bodens des äußeren Rohrabschnittes (1) vorgesehen sind und mit einem Verbindungskabel (C) verbunden sind, welches in Längsrichtung derart über die Rollenmittel (P) geführt ist, um ein Anheben und Absenken der Rohrabschnitte (1, 2, 3, 4, 5) mit Hilfe des Kabels zum Aufrichten und Absenken des Mastes zu ermöglichen, dadurch gekennzeichnet, daß die erwähnten Gleitmittel Führungsrollen (R) sind, die an den Ecken der Rohrabschnitte (1, 2, 3, 4, 5) vorgesehen sind, daß das Verbindungskabel (C) innerhalb der Abschnitte (1, 2, 3, 4, 5) vorgesehen ist, und daß ein Kabel (6) zum Einziehen innerhalb der Abschnitte (1, 2, 3, 4, 5) mit den Windenmittels (W) und mit dem die Spitze des Mastes bildenden inneren Abschnitt (5) verbunden ist, um eine Zugkraft zum Absenken des Mastes zu erzeugen.

2. Anordnung nach Anspruch 1, dadurch gekennzeichnet, daß die Rohrabschnitte aus ähnlichen dünnen ebenen Aluminiumzuschnitten hergestellt sind, die an ihren Kanten in ähnlichen, extrudierten Aluminiu-

meckabschnitten (5') gehalten sind.

3. Anordnung nach Anspruch 2, dadurch gekennzeichnet, daß die Zuschnitte (S) für ein geringes Gewicht und bei struktureller Versteifung perforiert sind.

4. Anordnung nach Anspruch 1, dadurch gekennzeichnet, daß die Scheibenmittel (P) ein Paar bestehend aus oberen und unteren Rollen besitzen, die nahe einer Ecke außerhalb des jeweiligen Rohrabschnittes angeordnet sind.

5. Anordnung nach Anspruch 1, dadurch gekennzeichnet, daß eine Antenne (A) innerhalb des innersten Rohres (5) angeordnet ist, um mit diesem angehoben und abgesenkt zu werden.

FIG. 1A.

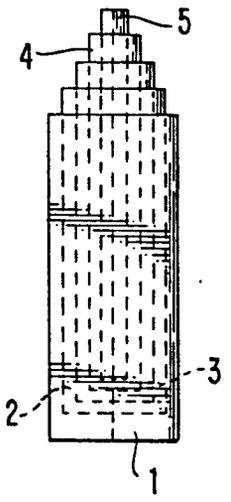

FIG. 1B.

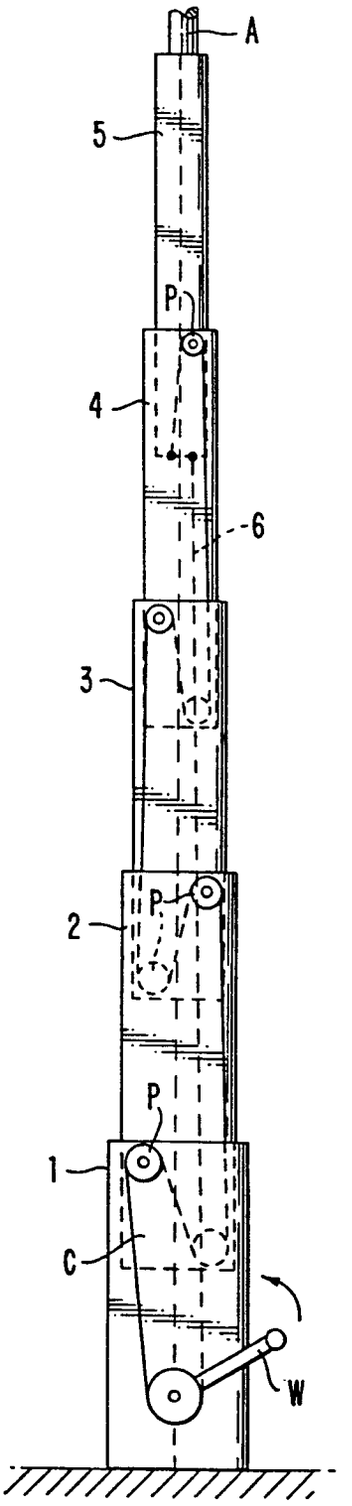

FIG. 4.

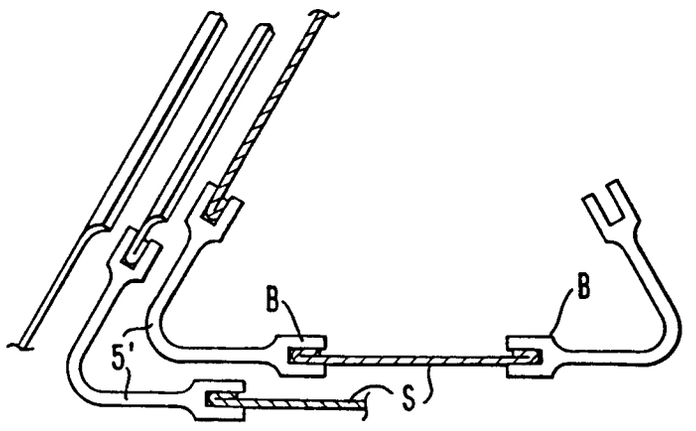

FIG. 2A.

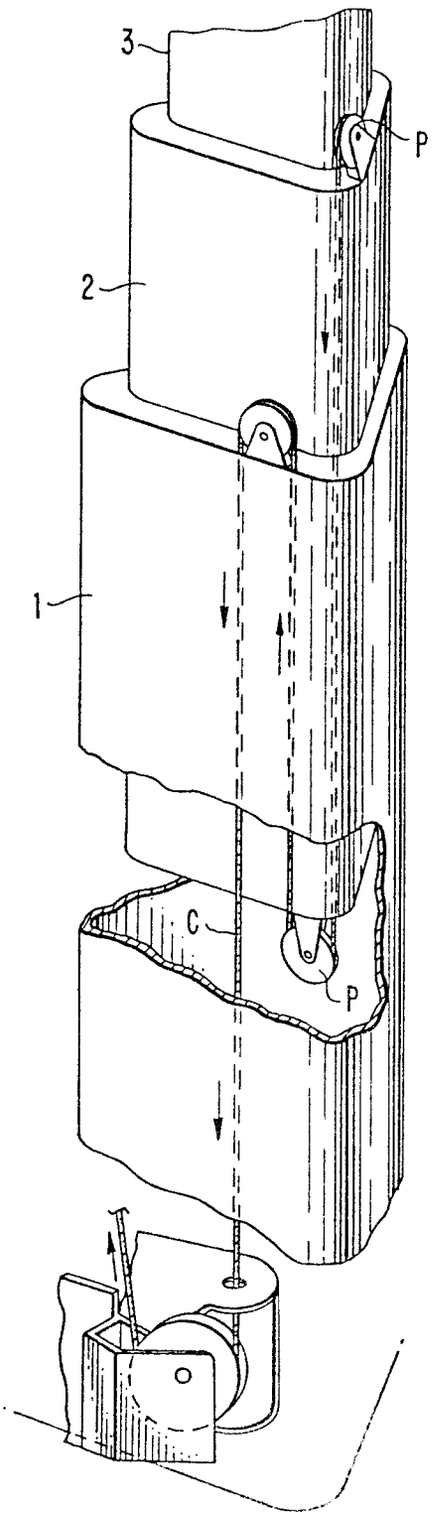

FIG. 2B.

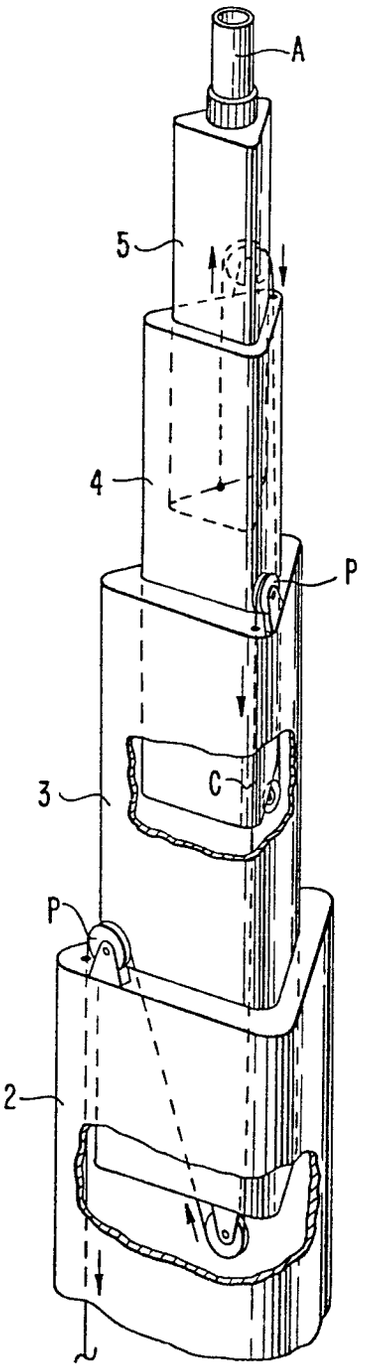

FIG. 3.