Jan. 16, 1968 L. J. PERENIC ET AL 3,364,488

INFLATABLE PORTABLE ANTENNA SYSTEM

Filed Oct. 1, 1965 2 Sheets-Sheet 1

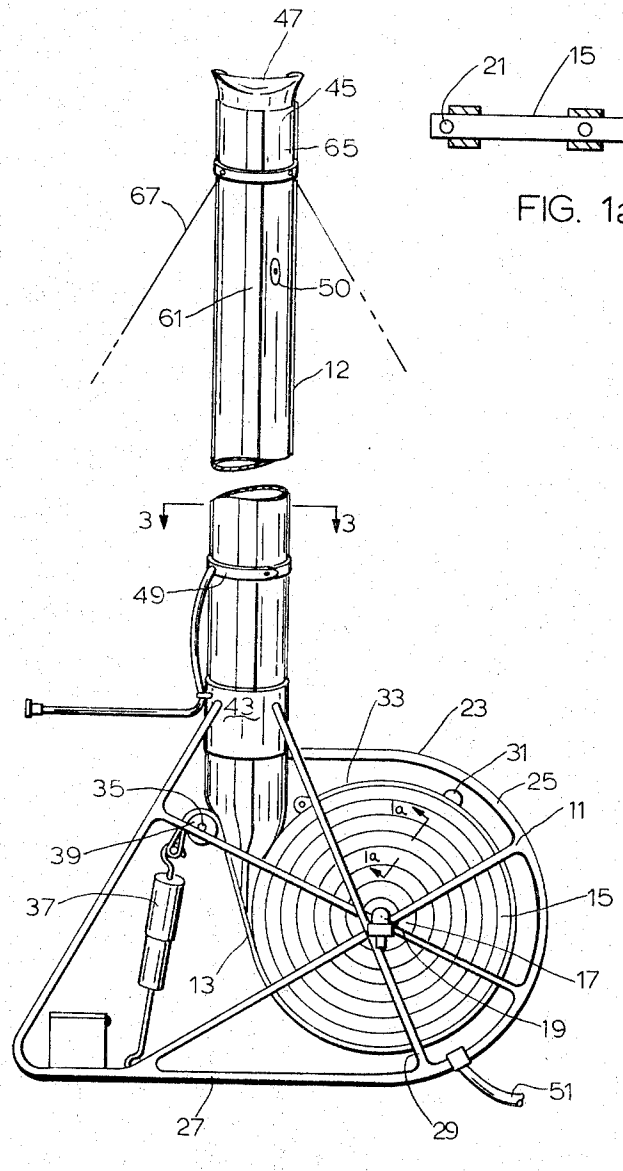


FIG. 1

FIG. 1a

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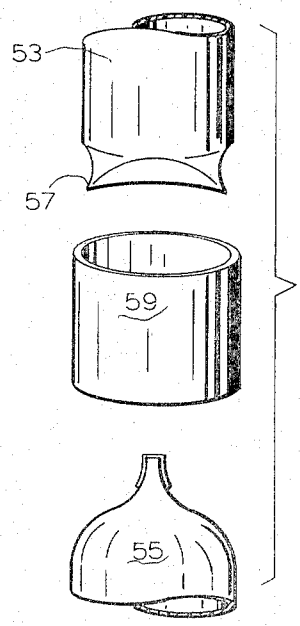


FIG. 2

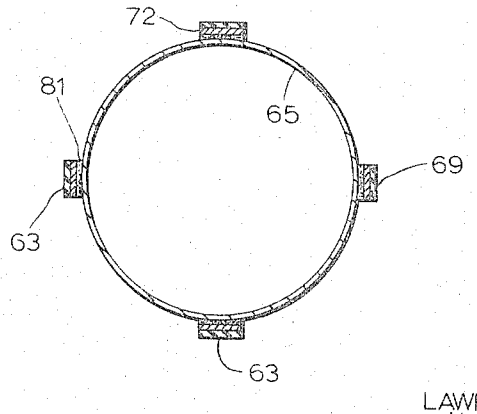


FIG. 3

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INFLATABLE PORTABLE ANTENNA SYSTEM

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5 Claims. (Cl. 343—723)

The present invention relates to antenna systems and more particularly to portable systems suitable for field use by construction gangs, military units, geological survey parties, and other highly mobile types of operations.

Inflatable antennas are known in the art and have been described, for example, in the Ewald Richter, U.S. Patent No. 2,212,128. Also, in the C. E. Hendershot U.S. Patent No. 3,178,568, an inflatable support mast for a lamp is shown. However, when attempts have been made to use such structures in jungle terrain, inflatable antennas have not been very successful. To permit a fairly long, i.e., tall mast, attempts were first made to roll an extended length of inflatable fabric on a payoff, unreel the payoff and try to inflate the mast as the fabric was unrolled. This proved impractical. Inflation from the center of the reel would not penetrate to the outer free end. Inflation from the free end required an inflation hose the length of the mast which weighed more than the mast itself. Furthermore, at times, additional lengths would have to be coupled to the mast. In other instances, an antenna mast was required from separate lengths of inflated pieces. Coupling was extremely difficult. It was also found that often some rigidity or semi-permanent features were required, otherwise, the mast would collapse when punctured, e.g., by bullets, animals, thorns, sharp stones, etc.

Therefore, although attempts may have been made to provide an inflatable antenna system, which can readily be carried about, rapidly assembled, and which can be made semi-permanent, *none*, as far as we are aware, have been successful when reduced to practice.

The present invention is directed to such a system and the objects and advantages thereof will be better understood from the following description when taken together with the accompanying drawing, in which:

FIG. 1 is a perspective side view of a deflated length of tubing wound on a payoff relating to part of the inventive concept;

FIG. 1*a* represents a sectional view along a portion of the tubing cut in line 1*a*—1*a* of FIG. 1;

FIG. 2 provides an exploded view of the assembling of two lengths of inflatable tubing; and

FIG. 3 is a cross-sectional view along lines 3—3 of FIG. 1.

The inflatable antenna mast structure **12** contemplated herein is supplied as a flat hose, with air exhausted, and is wound on a payoff reel **11**, shown in FIG. 1. Since this mast will rise vertically, the outer turn **13** of the wound flat tubing **15** must be fed an inflating fluid, e.g., gas, air, or hardenable foam. To accomplish this fluid feed, the inner turn **17** is connected to a swivel fluid valve **19**. However, as previously mentioned, the fluid, such as air, cannot pass to the outer turn **13** and there is a strong tendency to burst any of the intermediate turns. Therefore, a passage must be provided in the flat wound tubing, and this is done by using resilient, helically wound plastic **21** (FIG. 1*a*) the same as used for wrapping around electrical conductors in a harness. This resilient, helically wound plastic **21** is routed parallel to both edges and may also be routed parallel to the longitudinal axis of the tubing. This configuration provides sufficient space for the fluid, e.g., air or foam to penetrate through to the outer turn **13** from fluid valve **19**. The payoff reel **11** has an outer frame **23** which also has a circular portion **25** and

a flat bottom portion **27**. The frame is held rigid by spokes **29**. The deflated mast is wound on the payoff by a hand crank **31**. As the mast is inflated, there is the possibility of back pressure which would distort the inner turns making it impossible to unwind the payoff. To prevent this distortion, a Mylar brake band **33** is coiled around the outer turn and attached to biased tensioning spring **37**. Brake band **33** is bolted by a bolt **35** to one of the spokes on the frame **23**. The inner end of the band **33** is affixed to an adjustable spring **37** over a pulley **39**. As shown in the drawing, on the inner end of the Mylar brake band **33** a spring **37** is attached by means of a rod engaged by a hook. Adjustable spring **37** can be stored in a box **41** when the unit is in knocked-down condition. Now, the tubing, when deflated, is wrapped around the payoff. To erect the mast, the outer turn **13** is pulled through a cylindrical support and ground connection **43**, held by spokes **29**. Air is fed through the fluid valve **19** and, since the helically wound plastic **21** provides vent openings inside the deflated tubing along its entire length, the air swirls around all the turns until it reaches the outer turn **13**. The outer end **45** is sealed with sealing means **47** and the antenna mast is pulled up through the cylindrical mast support and ground connection **43**. A radio-frequency feed collar **49** is provided one-quarter of a wavelength from the cylindrical mast support and ground connection. A ground connection **51** can be affixed to the flat bottom portion of reel **11**.

Since the length of deflated tubing around the payoff reel may be insufficient for the size of antenna desired, it may be necessary to provide additional lengths of inflated tubing. This is done by cutting off lengths of tubing from other reels and coupling them to the mast. A square cut is made in a separate length of tubing and held flat. A first strip of tape is cut to the width of the tubing. This tape is then folded lengthwise across its width and applied inside the tubing end so that the sealing material contacts the tubing inner wall thus sealing the end. Then, a second strip of tape is cut and folded as the first strip and placed over the sealed end on the outside of the tubing. The ends of the tape strip are then trimmed. The final end has a sort of highly desirable triple concave wedge shape.

Another way of sealing the end is to fold the end inwardly and squeeze the end into a flattened shape. A strip of sealing tape with sealing material on both sides if fitted between the inwardly folded end. The flattened end is squeezed against the tape and a second strip of tape with sealing material only on one side is then fastened across the top. The tape ends can then be trimmed. In both cases, the sealing can be either a heat seal or cold seal, depending on the material used and the situation.

Taking two lengths having end seals, i.e., ends **53** and **55** (FIG. 2), these ends can now be connected by fitting them into a firm plastic cylindrical sleeve about the same cylindrical diameter as the tubing. The ends are inserted in a partly inflated condition at right angles to each other. Because of the triple concave edge shape, the pieces nest well together and the points **57** will engage the inside of the cylindrical sleeve **59**. When inflated, the junction will be rigid, as though of one piece. It is also possible to make the junction permanent by placing hardenable sealing foam in the sleeve.

The entire mast structure may also be made semi-permanent by filling the partly inflated mast with a hardenable foam. For this purpose, a polyurethane (isocyanate) foamable resin is mixed with a polyhydric alcohol and fed into the tubing. This mixture will produce a foam which will harden in a short time. The necessary materials are available commercially under trade names, e.g., Isonate brand made by Upjhon and Nopcofoam brand made by Nopco Chemical Co. Preferably, a hole

is punched into the tubing and a seal 50 is inserted in the hole. The foamable ingredients are then fed through the seal into the tubing and the seal this then closed. Gas pressure must be maintained as the tubing hardens, otherwise, the mast will be bent.

The mast may also include an electrical section comprising elongated electrical conductor strips 61, 63 as an integral part of the inflatable structure 65. Structure 65 which is a non-conductive container, then has a deflated, collapsed portion wound on payoff reel 11 and an inflated column-shaped portion, vertically disposed to form a mast.

The column requires guy means 67 for resisting wind loads and similar forces. For making an interconnection between the column and a transmitter or receiver (not shown), connection 43 is used. In the embodiment shown, the column is a cylindrical structure with a height-to-diameter ratio of over 100. The walls are composed of a non-porous, flexible material, such as a high-strength plastic, e.g., such as sold commercially as (Mylar Dacron Mylar brand) laminate so that the cavity therein is substantially air-tight for containing a suitable gas or foam. The walls have sufficient strength and thickness to withstand a substantial inner pressure. In one embodiment, the thickness was 0.003 inch. The column will have a plurality of axially-spaced inflation seals 50 for filling the cavity with gas. The electrical conductor strip used on the mast is preferably a flat metal strip, such as a thin-film copper strip. The strip may have a non-conductive corrosion-inhibiting coating 69 on its radially outer side and has a radially inner side 72 bonded to the outer surface of the mast by an adhesive 81. The strip has a rectangular cross-section and the width remains substantially constant in dimension in an axial direction along the column.

It is to be observed, therefore, that the present invention provides for an inflatable antenna system having a payoff reel on which to wind deflated tubing including crank means for winding the payoff reel. Inflatable non-conductive plastic tubing having inner and outer turns is wound around the payoff reel. Passing lengthwise through the tubing is a helically wound plastic cord which supplies a lengthwise fluid passage through the tubing. A valve means is connected to the tubing inner turn for feeding fluid therethrough. To prevent fluid back pressure from distorting the turns such as to prevent proper unreeling, brake band means are wound at least partially around the outer turn. Extending from the payoff are structural support and electrical connection means to support the tubing vertically and at the same time permit its use as an antenna mast when filled with fluid. Elongated electrical conductor strips are disposed longitudinally along the outside of the tubing and guy means are affixed to the mast for resisting wind loads.

While there has been described what at present are believed to be the preferred embodiments of this invention, it will be obvious to those skilled in the art that various modifications can be made therein within the scope of the invention, and it is intended that the appended claims cover all such modifications.

What is claimed is:

1. In an inflatable antenna system, in combination, a payoff reel on which to wind deflated tubing; inflatable non-conductive plastic tubing wound around said payoff reel including inner and outer turns, said outer turns being adapted to form a column when inflated; plastic cord means passing lengthwise through said inflatable plastic tubing supplying a lengthwise passage therethrough from the inner to the outer turn; valve means connected to said tubing inner turn for feeding fluid therethrough; brake band means at least wound partly around said outer turn spring tensioned to prevent fluid back pressure; and support means extending from the payoff to support said tubing vertically as a column when filled with fluid.

2. An inflatable antenna system, comprising in combination, a payoff reel on which to wind deflated tubing including crank means for winding the payoff reel; inflatable non-conductive plastic tubing wound around said payoff reel including inner and outer turns, said outer turns being adapted to form a column when inflated; helically wound plastic cord means passing lengthwise through said inflatable plastic tubing supplying a lengthwise passage therethrough from the inner to the outer turn; valve means connected to said tubing inner turn for feeding fluid therethrough; spring means at least wound partly around said outer turn inwardly biased to prevent fluid back pressure; electrical support and connection means extending from the payoff to support said tubing vertically as an antenna mast column when filled with fluid; and elongated electrical conductor strips disposed longitudinally along the outside of said tubing.

3. An inflatable antenna system as claimed in claim 2, said conductor strips being flat strips.

4. An inflatable antenna system as claimed in claim 3, including guy means for affixing to the mast column for resisting wind loads.

5. An inflatable antenna system as claimed in claim 4, including at least one additional length of inflated tubing sealed at one end and added to the upper end of said formed column by a coupling sleeve, which coupling sleeve is joined to the two coupled sections by air pressure alone, thus providing ready means for disassembly.

No references cited.

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