NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546

REPLY TO ATTN OF: GP

November 6, 1970

TO: USI/Scientific & Technical Information Division
Attention: Miss Winnie M. Morgan

FROM: GP/Office of Assistant General Counsel for Patent Matters

SUBJECT: Announcement of NASA-Owned U. S. Patents in STAR

In accordance with the procedures agreed upon by Code GP and Code USI, the attached NASA-owned U. S. Patent is being forwarded for abstracting and announcement in NASA STAR.

The following information is provided:

U. S. Patent No. : 3,509,578

Government or Corporate Employee : U.S. Government

Supplementary Corporate Source (if applicable) : NA

NASA Patent Case No. : XKS-08485

NOTE - If this patent covers an invention made by a corporate employee of a NASA Contractor, the following is applicable:

Yes ☐ No ☒

Pursuant to Section 305(a) of the National Aeronautics and Space Act, the name of the Administrator of NASA appears on the first page of the patent; however, the name of the actual inventor (author) appears at the heading of Column No. 1 of the Specification, following the words ". . . with respect to an invention of . . ."

Elizabeth A. Carter

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Enclosure
Copy of Patent cited above

COSATI 09E

N71-19493

April 28, 1970 H. E. CRIBB 3,509,578

WEATHERPROOF HELIX ANTENNA

Filed June 21, 1967 2 Sheets-Sheet 1

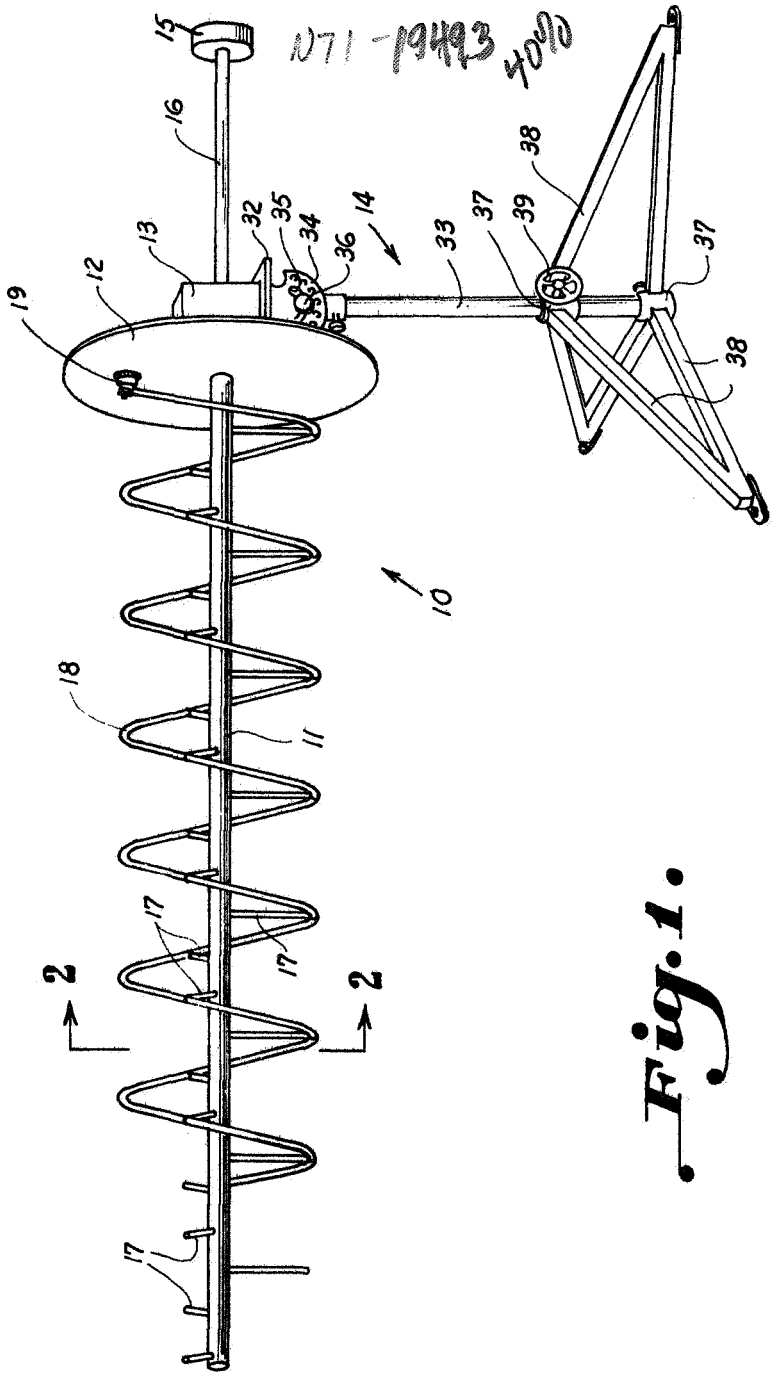

Fig. 1.

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April 28, 1970 H. E. CRIBB 3,509,578

WEATHERPROOF HELIX ANTENNA

Filed June 21, 1967 2 Sheets-Sheet 2

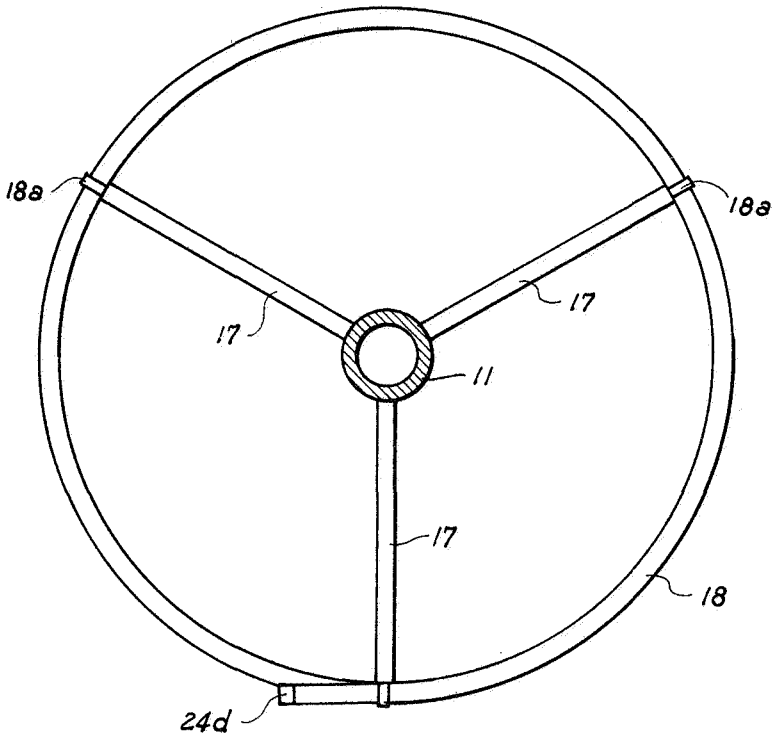
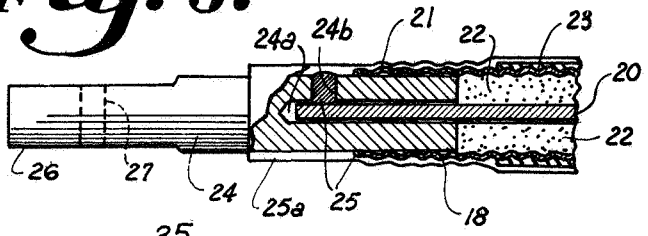


Fig. 2.

Fig. 3.



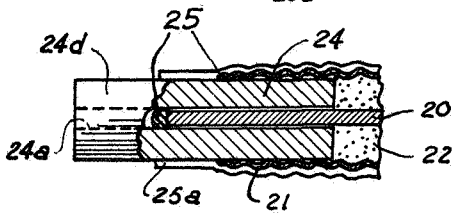


Fig. 5.

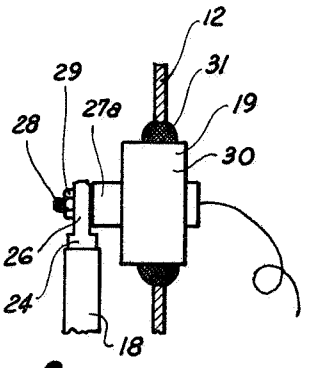


Fig. 4.

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United States Patent Office 3,509,578 Patented Apr. 28, 1970

3,509,578

WEATHERPROOF HELIX ANTENNA

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Filed June 21, 1967, Ser. No. 649,078
Int. Cl. H01q 1/36
U.S. Cl. 343—873 3 Claims

ABSTRACT OF THE DISCLOSURE

A helical antenna constructed of a flexible weatherproof cable which is flexible enough to be bent into the shape of a helix about standoff insulators, yet substantially rigid enough to retain such shape after so bending. The weatherproof helical antenna is movably mounted on a stand for appropriate orientation in any direction.

The invention described herein was made by an employee of the United States Government and may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

This invention relates to an antenna, and more particularly to a weatherproof helix antenna which can be utilized where corrosion is a major factor, such as at island and seacoast facilities, or on range tracking ships.

Heretofore, helical antennas constructed for use in installations where corrosion is a major factor, such as on island and seacoast facilities, or on range tracking ships, were very expensive. The antenna helix was formed from soft copper tubing using a mandrel to shape such. The mandrel had to be custom machined so that the copper tubing would stretch out to the proper helix diameter and pitch for the operating frequency of the antenna. Calculating mandrel dimensions and machining the mandrel on a lathe took many hours of a machinist's time. Furthermore, the copper tubing had to be weatherproofed by silver plating and painting it. Such antennas are very expensive plus, they required a considerable amount of maintenance in order to maintain them in the proper operating condition.

It is desired that a reliable, rugged, inexpensive and weatherproof antenna be utilized, which is capable of withstanding corrosive weather conditions, and can be constructed by relatively inexperienced personnel. Moreover, it is desired to provide an antenna which can be easily assembled so that such can be transported to a desired location unassembled. This is particularly important for use on range tracking ships which are strategically located at different locations for monitoring a space flight.

In accordance with the present invention, it has been found that the foregoing difficulties encountered in helical antennas may be overcome by providing a novel helix for the antennas. An antenna constructed in accordance with the present invention includes the following basic parts: (1) an elongated supporting shaft, (2) a plurality of circumferentially and longitudinally spaced standoff insulators extending radially from the supporting shaft, (3) the length of the standoff insulators determining the diameter of the helix and the orientation of the standoff insulators determining the pitch angle for the helix, (4) a base member carried adjacent one end of the supporting shaft, (5) a flexible cable having one end secured to the base member and being secured to the standoffs defining a helix, (6) the cable having a unitary elongated central conductor extending longitudinally therethrough, (7) an elongated unitary tubular conductor of a greater diameter than the central conductor encompassing the central conductor defining a space between the inner surface of the tubular conductor and the periphery of the central conductor, (8) a foam dielectric carried in the space between the central conductor and the tubular conductor permitting the cable to be flexible enough to be bent into a helix and rigid enough to hold the shape after bending, a non-metallic sheath carried on the outer surface of the tubular conductor weatherproofing such from the elements, and (10) an electrically conductive member carried adjacent each end of the cable for electrically connecting the tubular conductor to the central conductor.

Accordingly, it is an important object of the present invention to provide an inexpensive weatherproof helix antenna which requires a minimum amount of maintenance.

Another important object of the present invention is to provide an antenna which can be readily assembled by relatively inexperienced personnel.

Still another important object of the present invention is to provide a helical antenna in which the helix is formed from a cable having a central conductor encompassed by a tubular conductor with a foam dielectric interposed therebetween so that the cable is flexible enough to be bent into the proper shape and rigid enough to maintain the shape.

A further important object of the present invention is to provide a helical antenna which can be transported disassembled and subsequently readily assembled at a desired location.

Other objects and advantages of this invention will become more apparent from a reading of the following detailed description and appended claims taken in conjunction with the accompanying drawings wherein:

FIGURE 1 is a perspective view illustrating a helical antenna constructed in accordance with the present invention;

FIGURE 2 is an enlarged transverse sectional view taken along line 2—2 of FIGURE 1;

FIGURE 3 is an enlarged longitudinal sectional view illustrating the electrically conductive member carried adjacent one end of the helix for electrically connecting the tubular conductor to the central conductor;

FIGURE 4 is an enlarged fragmentary view, partially in section, illustrating the manner in which an electrical conductor passes through the base member; and

FIGURE 5 is an enlarged longitudinal sectional view illustrating the electrically conductive member carried adjacent the outer end of the helix for electrically connecting the tubular conductor to the central conductor.

Referring now in more detail to the drawings wherein like reference numerals designate identical or corresponding parts throughout the several views, and with special attention to FIGURE 1, reference numeral **10**, generally designates a helical antenna in a horizontal position. The antenna includes an elongated metal supporting shaft **11**. A base member **12** constructed of any suitable material, such as steel, is carried adjacent one end of the supporting shaft **11**, and extends radially outwardly from the supporting shaft. The base plate **12** and the supporting shaft **11** are, in turn, secured to a supporting block **13** which is suitably mounted on a stand generally designated at **14**. A counterbalanced weight **15** is mounted on one end of a horizontal shaft **16** which has its free-end secured by any suitable means to the supporting block **13**. A plurality of circumferentially and longitudinally spaced standoff insulators **17** extend radially from the supporting shaft **11**. The length of the standoff insulators determines the diameter of the helix and the orientation of the standoff insulators determine the pitch angle of such. The standoff insulators may be constructed of any suitable non-conductive material and secured to the supporting shaft by any suitable means, such as screwing

them into threaded holes carried on the shaft. A flexible cable **18** has one end secured to the base member **12**. The main body of the cable is secured to the standoffs **17** in any suitable manner to define a helix. It is noted that the end of the cable is insulated from the base member **12**. One suitable means of securing the cable to the ends of the standoffs incorporates a pin **18***a* having a circular member adjacent one end through which the cable is threaded and a shank adjacent the other end, which is driven into the end of the wooden standoffs. Any suitable connecting means could be utilized. In securing or winding the cable on the standoffs **17** one end of such is coupled to the connector, generally designated at **19**, and such is bent by hand so that it is wound onto the ends of the standoffs.

The cable **18** has a unitary elongated central copper conductor **20** extending longitudinally therethrough. An elongated corrugated tubular copper conductor **21** of greater diameter than the central conductor **20** encompasses the central conductor defining a space therebetween. A foam dielectric **22**, such as foamed polyethylene, is carried in the space between the inner surface of the tubular conductor **21** and the central conductor **20** permitting the cable to be flexible enough to be bent into a helix and rigid enough to hold such shape after bending. A thermoplastic coating or sheath **23** is carried on the outer surface of the tubular conductor **21** waterproofing such from the elements. One suitable cable which has been used to form the helix is manufactured by Andrew Corporation of Los Angeles, Calif., and has a Model No. FHJ4–50A.

An elongated electrically conductive shorting member **24** is carried adjacent the inner end of the cable **18** for electrically connecting the tubular conductor **21** to the central conductor **20**. The shorting member **24** has a drilled axial bore **24***a* which receives the end portion of the central conductor **20**. A lateral bore **24***b* is also drilled in the shorting member **24** and communicates with the axial bore **24***a* so that solder can be poured therein. The solder secures the end portion of the central conductor within the drilled axial bore **24***a*. The copper tubular member **21** also extends over a portion of the shorting member **24** and is soldered thereto by bead **25**. In preparing the cable **18** so that the shorting member **24** can be mounted thereon, first the tubular member **21** and the foam dielectric **22** are stripped off to expose the end portion of the central conductor **20**. Then a sufficient amount of the foam dielectric **22** is removed permitting a portion of the shorting member to be inserted within the tubular copper member **21**. It is noted that the exposed end of the central conductor **20** is inserted within the axial bore **24***a*. Solder **25** is then poured within the lateral bore **24***b* and flows through the axial bore **24***a* securing the end portion of the central conductor **20** within the drilled bore **24***a* upon cooling. When the shorting member is soldered between the tubular conductor **21** and the central conductor **20** such provides a good electrical connection therebetween. Weatherproof adhesive tape **25***a* is wound around the end of the cable **18** and the shorting member **24** for securing such together. The shorting member has a flat reduced end **26** with a hole **27** extending therethrough so that such can be bolted to the connector **19** carried within the base plate **12**. The connector has a central conductive portion **27***a* which is secured to the shorting member by means of a reduced threaded shank **28** which extends through the hole **27** in the shorting member. A nut **29** secures the shorting member **24** onto the shank **28**. The conductive portion **27***a* extends through a main body portion **30** which is secured within the base plate **12** by any suitable means, and is insulated therefrom by insulating material such as rubber **31**. Any suitable connecting element could be utilized.

The shorting member **24***d* which is illustrated in FIGURE 5 is provided for shorting the free-end of the helical cable and is identical with the construction of that of the shorting member **24** with the exception that no connecting portion is carried adjacent the end. The cable **18** is stripped in the above-mentioned manner, and the longitudinal axial bore **24***a* slips over the central conductor **20** and solder is poured in the end of the axial bore **24***a* securing the cable to the shorting element **24***d*. The tubular **21** is then soldered to the shorting element **24***d* by means of a bead **25**. Weatherproof adhesive tape **25***a* is then wound around the end of the cable and the shorting member **24***a*.

As previously mentioned, the supporting block is mounted on a suitable stand **14** so that the antenna can be rotated and pivoted vertically. The supporting block **13** is carried on a horizontal plate **32** which is, in turn, mounted in a pivotable manner (not shown) on the top of shaft **33** so that the antenna can be pivoted in a vertical direction. A side plate **34** extends downwardly from the horizontal plate **32** and has an arcuate shaped slot **35** therein through which a locking nut **36** extends. The locking nut **36** engages the shaft **33** so that when such is drawn downward it locks the side **34** in a fixed position. The shaft **33** is allowed to rotate in sleeves **37** carried adjacent the bottom of the supporting frame. Legs **38** extend outwardly from the sleeves for supporting such. A locking screw member **39** is carried on the upper sleeve **37** so that when such is rotated in one direction it locks the shaft **33** in a fixed position so that it cannot rotate.

Since the helix of the antenna is made from a corrosion proof dielectric helix-type transmission line that has been shorted out at each end, very little maintenance is necessary for such. The foam dielectric transmission line is flexible enough so that it can be bent or oriented around the standoff insulators **17** by a relatively inexperienced person to form the desired helix. Since the helix can be formed with relative ease, the antenna can be transported in a disassembled manner and assembled at the desired location.

While a preferred embodiment of the invention has been described using specific terms, such description is for illustrative purposes only, and it is to be understood that changes and variations may be made without departing from the spirit or scope of the following claims.

What is claimed is:

1. A weatherproof helical antenna comprising:

(A) an elongated supporting shaft;

(B) a plurality of circumferentially and longitudinally spaced standoff insulators extending radially from said supporting shaft;

(C) said standoffs being of a predetermined length for defining the diameter of said helical antenna;

(D) a base member carried adjacent one end of said supporting shaft;

(E) a flexible cable having one end secured to said base member and being secured to said standoffs defining a helix;

(F) said cable having a unitary elongated central conductor extending longitudinally therethrough;

(G) a unitary elongated tubular conductor of a greater diameter than said central conductor encompassing said central conductor defining a space between the inner surface of said tubular conductor and the periphery of said central conductor;

(H) a foam dielectric carried in said space between said central conductor and said tubular conductor permitting said cable to be flexible enough to be bent into a helix and rigid enough to hold such shape after bending;

(I) a non-metallic sheath carried on the outer surface of said tubular conductor waterproofing such from the elements; and

(J) an electrically conductive member carried adjacent each end of said cable for electrically connecting said tubular conductor to said central conductor.

2. The helical antenna as set forth in claim 1 further comprising:

(A) a stand for supporting said antenna permitting such to rotate and pivot vertically.

3. The helical antenna as set forth in claim 1 wherein:

(A) said electrically conductive member has an axial bore for receiving said central conductor; and

(B) solder securing said central conductor to the walls of said bore providing electrical connection therebetween.

References Cited

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U.S. Cl. X.R.

343—882, 895