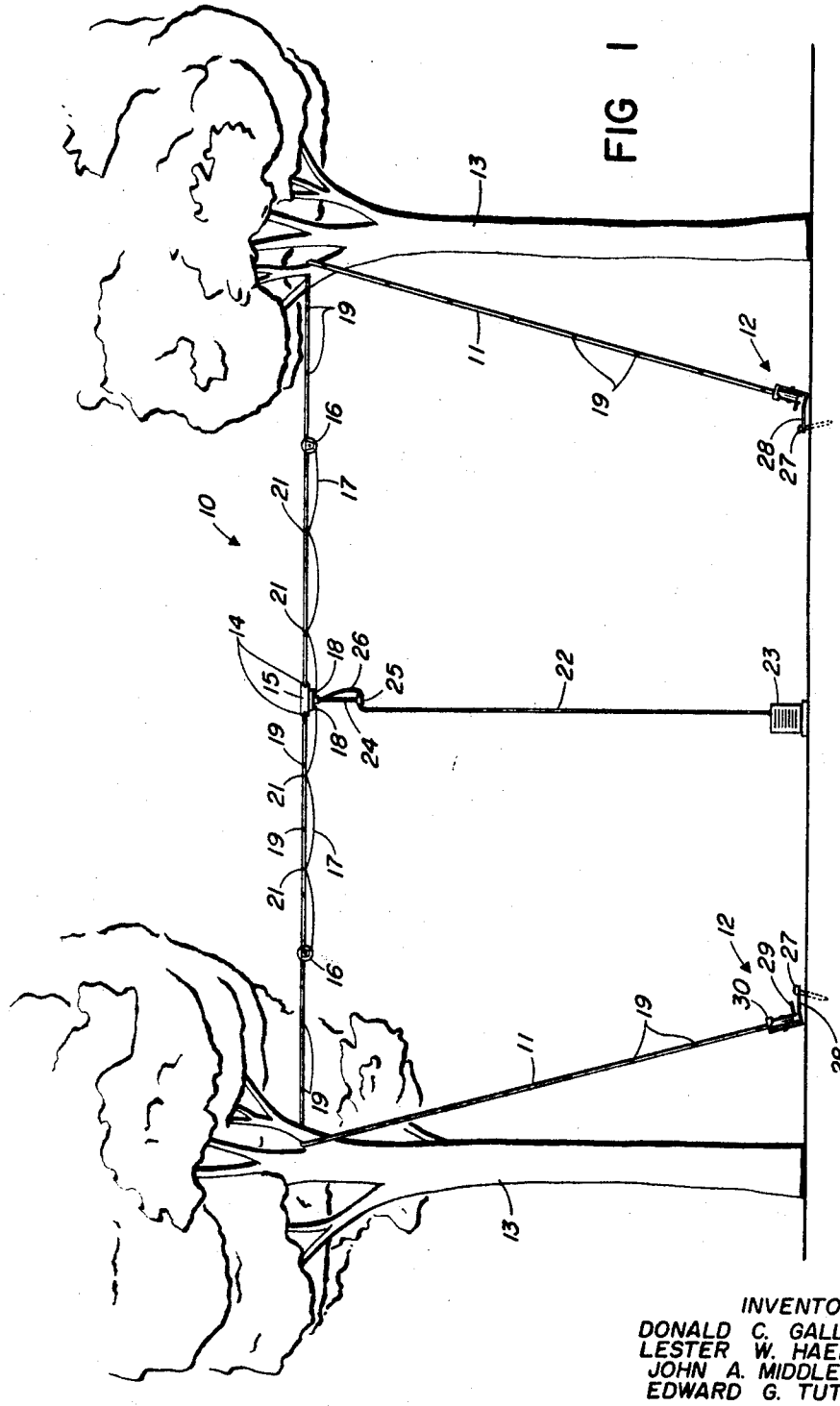
Sept. 3, 1968 D. C. GALLAGHER ETAL 3,400,402

WIRE ANTENNA EXTENSIBLE ALONG CALIBRATED SUPPORT MEANS

Filed March 12, 1965 2 Sheets-Sheet 1

FIG 1



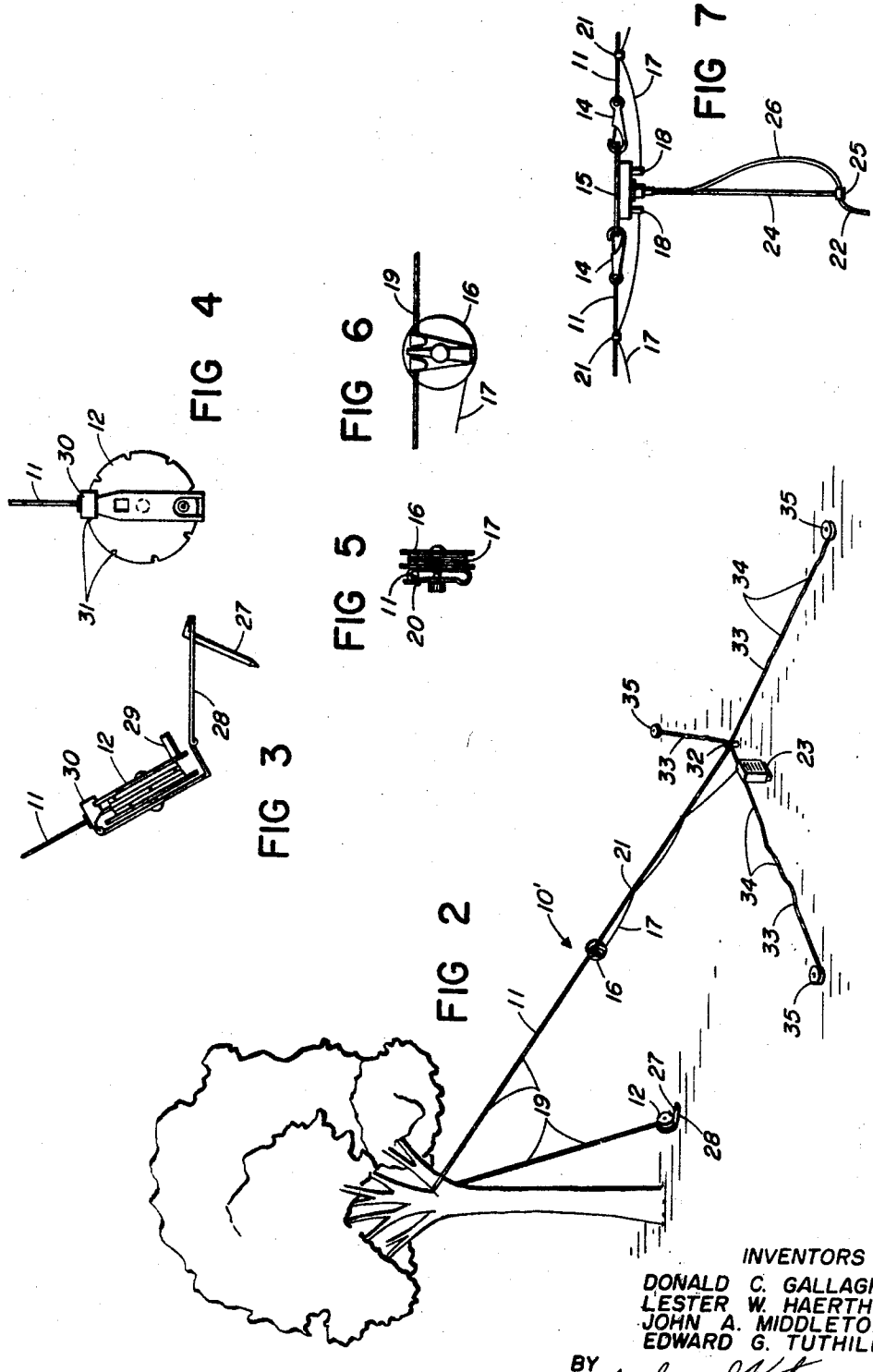

INVENTORS
DONALD C. GALLAGHER
LESTER W. HAERTHER
JOHN A. MIDDLETON
EDWARD G. TUTHILL

BY Moody and Kintzinger
ATTORNEYS

Sept. 3, 1968 D. C. GALLAGHER ETAL 3,400,402

WIRE ANTENNA EXTENSIBLE ALONG CALIBRATED SUPPORT MEANS

Filed March 12, 1965 2 Sheets-Sheet 2




INVENTORS
DONALD C. GALLAGHER
LESTER W. HAERTHER
JOHN A. MIDDLETON
EDWARD G. TUTHILL

BY Moody and Kintzinger
ATTORNEYS

United States Patent Office 3,400,402
Patented Sept. 3, 1968



3,400,402

# WIRE ANTENNA EXTENSIBLE ALONG CALIBRATED SUPPORT MEANS

Donald C. Gallagher, Marion, Lester W. Haerther, Cedar Rapids, and John A. Middleton and Edward G. Tuthill, Marion, Iowa, assignors to Collins Radio Company, Cedar Rapids, Iowa, a corporation of Iowa

Filed Mar. 12, 1965, Ser. No. 439,235
2 Claims. (Cl. 343—723)

## ABSTRACT OF THE DISCLOSURE

A wire antenna system dependent in part on terrain features or structures such as existing trees or buildings for antenna support, and utilizing electrically nonconductive glassline cord with spaced frequency markings with relatively light wire as an antenna radiation element strung therealong and supported by the cord. Further, in a short wire version a plurality of counterpoise wires with spaced frequency markings are unreeled to desired frequency tuned lengths in diverse directions along the ground and with the partially unreeled reel ends left laying on the ground in their extended diverse positions.

This invention relates in general to field antenna systems, and in particular, to an antenna system capable of quick, easy erection in the field as a simple, lightweight, and rugged quarter-wave short wire antenna or a half-wave doublet antenna when there is sufficient time and facility therefor.

Prospecting teams, exploration parties, surveying teams, and the military utilize various field antenna systems in meeting various communication operational requirements. Obviously, weight as well as complexity of various antenna systems can be a problem in field operations. Furthermore, field use requirements impose stringent factors of ruggedness and reliability in operation for successfully meeting field operational requirements. Cost also becomes a significant factor where many antennas are likely to be used in the field and/or where various antennas are likely to be left in place for future use or abandoned in location after use.

It is, therefore, a principal object of this invention to provide a small and lightweight antenna equipment kit that lends itself to quick and easy erection of a short wire quarter-wave antenna primarily for ground wave propagation and for some long sky-wave propagation, and the erection of a half-wave doublet field antenna using some components common to both antennas when a little more time is available for antenna erection and the primary use is to be for sky-wave propagation over long distances.

Another object is to provide an antenna structure utilizing glassline antenna supporting cord equipped with ¼ mc. frequency markings starting from the free end of cord reels, and small diameter light antenna wire adjustably unrolled from reels along frequency marked glassline cord for approximate frequency length matched antenna turned settings.

Features of this invention useful in accomplishing the above objects include, in a lightweight antenna equipped erection kit for alternate erection of a short wire quarter-wave wire antenna and a half-wave doublet field antenna, reels of electrically nonconductive glassline cord having ¼ mc. frequency markings starting from each reel free end, two of which are utilized in the erection of the half-wave doublet field antenna and one of which is used in erecting the short wire quarter-wave antenna. Two small reels of relatively light lusterless copperweld wire are also included in the kit, two being used as antenna wires with the half-wave doublet field antenna and only one being used with the short wire quarter-wave antenna, and with, in each instance, the antenna wire being unreeled along the frequency marked glassline cord to desired frequency tuned lengths from short high-frequency lengths to longer low-frequency lengths. Three reels of covered and frequency marked copperweld wire are also included for use as counterpoised wires for the short wire quarter-wave antenna with the frequency markings of the counterpoise wires facilitating unreeling of these wires to approximately the desired frequency tuned lengths of the antenna in divergent directions along the ground. Equipment of the antenna erection kit useful in one and/or the other of the antennas also includes a weatherproof antenna feed plate, a length of coax conductor, a tie down stake and an additional supply of ground stakes, and casting weights for the throwing of antenna supporting glassline cord over an elevated supporting feature of the environment, for example, the branch of a tree.

Specific embodiments representing what are presently regarded as the best modes of carrying out the invention are illustrated in the accompanying drawings.

In the drawings:

FIGURE 1 represents a side view of a half-wave doublet field antenna installation;

FIGURE 2, a perspective view of a short wire quarter-wave antenna installation;

FIGURE 3, a partial view of a glassline reel as fastened down with a ground stake and with glassline cord extended therefrom for use in an antenna installation;

FIGURE 4, a crank face view of the glassline cord reel of FIGURE 3;

FIGURE 5, a view of an antenna reel as mounted in place on a glassline cord;

FIGURE 6, a side view of the antenna reel of FIGURE 5 with antenna wire and antenna reel positioned at a tuned frequency length on a glassline cord; and,

FIGURE 7, a center interconnection feed plate of the half-wave doublet field antenna.

Referring to the drawings:

The half-wave doublet field antenna **10** of FIGURE 1 is used primarily for sky-wave radio frequency wave propagation over long distances. Radiation efficiency of this antenna **10** is very good where it can be erected over heights of 30 feet even though radiation from the antenna will be partially vertically polarized since a balun is not used at the antenna feed point in the interest of saving weight, simplicity, and reliability in the field. However, the slight loss in the horizontally polarized radiated signal, as required by a partially vertically polarized emission, does not justify the extra weight and complication incumbent with inclusion of a balun for field use.

With erection of the half-wave doublet antenna **10** to heights of over 30 feet two separate glassline cords **11** unrolled from reels **12** are thrown over relatively high limbs of appropriately spaced trees **13**. This is accomplished with casting weights (not shown) fastened to the free ends of glassline cord **11** unraveled from the respective reels **12** for such casting purposes over high tree limbs. The feed ends of the glassline cords **11** are fastened (as shown in FIGURE 7) by clasps **14** to opposite ends of center interconnection feed plate **15**. Two antenna reels **16** (refer also to FIGURES 5 and 6) are used with the half-wave doublet field antenna **10** with the free ends of the two antenna wires **17** fastened to center feed terminals **18** of the center feed plate **15**. The antenna wires **17** of reels **16** are unrolled along the respective glassline cords **11** to the desired quarter-wave frequency tuned lengths, as gauged by frequency markings **19** in each respective direction along the glassline cords **11** and fastened in place on the cords **11** as by reel clasps **20**, and the two quarter-wave lengths of antenna wire **17** together provide the half-wave doublet field antenna **10** lengths.

With increasing antenna lower frequency lengths tape wrappings **21** may be employed at reasonable spacings along the glassline cords **11** to support the relatively fine light antenna wire **17** on the cords **11**.

A coaxial conductor feed line **22** may be fastened to the antenna input-output connection of the receiver-transmitter unit **23** and the antenna feed plate **15**. A strain relief cord **24** is extended from the antenna feed plate **15** to a fastening clamp **25** on the coax feed cable **22**, which may be, for example, a 40 foot length of polyfoam filled coaxial conductor line, in order that a free non-weighted coaxial line loop **26** may be provided for non-weighted connections between the coaxial feed line and the antenna feed plate **15**.

The glassline reels **12** have, in the interim, been anchored to the ground in appropriate locations by ground stakes **27** driven into the ground through anchor extensions **28** of the respective glassline reels **12**. Referring also to FIGURES 3 and 4, slack is removed from the antenna assembly by rewinding glassline cord **11** onto reels **12** by manually rotating the crank arms **29** until the glassline cord is taut to the desired degree, and then locking the reel in position by spring loaded locking clasps **30** which are devised to engage and lock with various grooves **31** around the parameter of flanges of the reels **12**.

This provides a half-wave doublet field antenna useful primarily for sky-wave propagation over long distances, the radiation efficiency of which is very good when it is erected to heights over 30 feet. The transmitter **23** output circuits are normally capable of tuning the relatively low VSWR impedance presented by the antenna system. With the transmitter-receiver operating in the receive mode it generally operates at optimum impedances with the half-wave doublet field antenna.

Please refer to the short wire quarter-wave antenna **10'** installation of FIGURE 2 for an antenna utilizing many components of an antenna erection kit common to corresponding components used in the erection of the half-wave doublet field antenna **10** of FIGURE 1 with corresponding components numbered the same as a matter of convenience. In this antenna the free end of a glassline cord **11** from a glassline reel **12** is cast over a suitable elevated support, a branch of a tree for example, and the free end is attached to a support stake **32** driven into the ground at an appropriate distance from the suitable elevated support. The free end of an antenna wire **17** from an antenna reel **16** is fastened to the input-output terminal of receiver-transmitter **23** located closely adjacent the ground stake **32**. The reel **16** is next unreeled to the desired frequency length as indicated by the frequency markings on the glassline cord **11** and then the antenna reel **16** is clipped to the glassline cord **11**, as illustrated in FIGURE 5 and as described hereinbefore with respect to the embodiment of FIGURE 1. The slack from the antenna assembly **10** may then be removed to the desired degree of tautness by rewinding and locking the glassline reel **12** in the rewound position, as has been described with respect to the embodiment of FIGURE 1 and as illustrated in FIGURES 3 and 4. The free ends of, preferably, at least 3 counterpoise wires **33** are connected to the support stake **32** and the wires are unreeled in divergent directions to lengths approximating the selected frequency determined length of antenna wire **17**, or more. This is facilitated with the aid of ¼ mc. frequency markings **34** on the covering of counterpoise wires **33** of counterpoise wire reels **35**, and the wires **33** and the reels **35** are left laying in the divergent extended positions on the ground.

The short wire antenna **10'** of FIGURE 2 is used primarily for ground wave RF signal propagation to approximately 25 mile distances and, to some extent, for long sky-wave propagation when there is insufficient time or field facility for erection of a doublet antenna **10** of FIGURE 1. The short wire antenna with counterpoise, as shown in FIGURE 2, is found to have an RF radiation



efficiency of approximately 75%, and is quite capable of providing reliable 24 hour communication in a Single Sideband (SSB) mode of operation when the equipment is used over poor ground, in jungle, and in desert terrain. It should be noted that the frequency markings **19** on the glassline antenna support cords **11** are optimized for free space electromagnetic wave signal propagation conditions, and as such, the doublet and the short wire antenna systems will not be perfectly resonant in many situations. However, the tuning range of the transmitter output network of the receiver-transmitter **23** will generally tune and load to the variations in impedances for the typical field variations encountered. Actually, operation of the receiver-transmitter **23** in the receive mode generally provides operation under nearly optimum conditions with applicants' antennas.

Whereas, this invention is here illustrated and described with respect to specific embodiments thereof, it should be realized that various changes may be made without departing from the essential contribution to the art made by the teachings hereof.

We claim:

**1.** In a field wire antenna system, an electrically nonconductive antenna supporting cord equipped with frequency markings at predetermined frequency spacings from a first end of the cord the other end of which is an anchor end; radio frequency utilizing means; cord end connective and support means to which said first end of the cord is connected with the cord having been cast over an elevated structural support; means anchoring the anchor end of said nonconductive cord; antenna feed signal connective means connected to said R-F utilizing means; antenna wire means connected to said antenna feed means and extendable along said nonconductive cord from adjacent said first end of the cord to a predetermined desired frequency length as facilitated by the frequency markings on the nonconductive cord; means mounting said antenna wire on said nonconductive cord; wherein the antenna is a short wire antenna, useful for ground wave electromagnetic signal propagation to moderate distances, and to some extent, for long sky-wave electromagnetic signal propagation, with said cord end connective and support means being a ground stake driven into the ground; said antenna wire means being a single antenna wire connected to said antenna feed means and extendable along the nonconductive cord to a predetermined desired frequency length; with the antenna feed means being a feed terminal of said R-F utilizing means with the R-F utilizing means placed in position on the ground adjacent said ground stake; counterpoise wires with predetermined frequency spacing markings from common ends attached to said ground stake with said wires being extendable over and laying along ground surface in diverse directions from said ground stake and with these counterpoise wires being unreeled from counterpoise wire reels that are unreeled and left laying on the ground in their extended diverse positions.

**2.** The short wire antenna system of claim **1**, wherein said short wire antenna system includes at least three counterpoise wires with frequency markings spaced from adjacent ends connected to said ground stake with the counterpoise wires extending in diverse directions over the ground to approximately the frequency selected length of said antenna wire along said nonconductive cord, or to a greater length.


**References Cited**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 1,438,290 | 12/1922 | Beakes | 343—877 XR |
| 1,895,493 | 1/1933 | Sherman | 343—877 |
| 2,569,810 | 10/1951 | Hamel et al. | 343—823 |
| 2,778,017 | 1/1957 | Dorcsjak | 343—823 |
| 3,025,524 | 3/1962 | Thies | 343—823 |


**(Other references on following page)**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 3,189,906 | 6/1965 | Kulik et al. | 343—710 |
| 3,271,774 | 9/1966 | Justice | 343—891 XR |
| 3,273,156 | 9/1966 | Doundoulakis | 343—886 XR |
| 3,308,470 | 3/1967 | Bell | 343—886 XR |

FOREIGN PATENTS

| | | |
|---|---|---|
| 525,571 | 5/1931 | Germany. |
| 806,793 | 5/1951 | Germany. |

OTHER REFERENCES

"Technical Data Report," The Hy-Gain Reel Tape Doublet Antenna System Model TD–1, Hy-Gain Antenna Products, Lincoln, Nebr., IEEE Convention, Mar. 25, 1963.

The A.R.R.L. Antenna Book, eighth edition (second printing), The American Radio Relay League Inc., West Hartford, Conn., copyright 1956, TK6565A6, pp. 190–191.



HERMAN KARL SAALBACH, *Primary Examiner.*

M. NUSSBAUM, *Assistant Examiner.*