FIP0102 XR 3,492,370 CROSS REFERENCE SEARCH ROOM

Dec. 9, 1969 H. BRUECKMANN 3,482,370

METHOD OF INSTALLING SUBTERRANEAN ANTENNA

Filed June 6, 1967

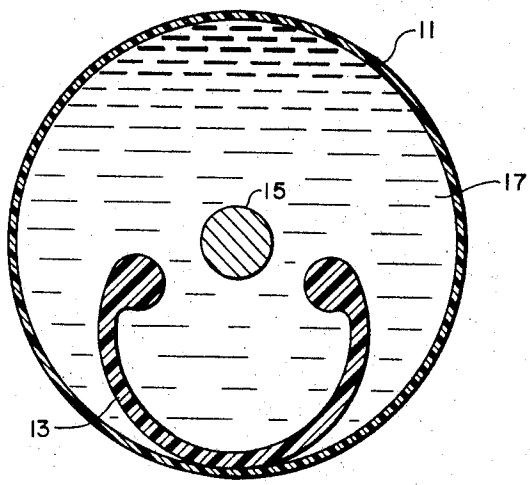


FIG. 2

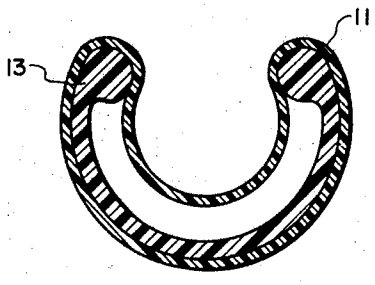


FIG. 1

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3482370
OR IN 52/741

United States Patent Office 3,482,370 Patented Dec. 9, 1969

3,482,370

METHOD OF INSTALLING SUBTERRANEAN ANTENNA

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Filed June 6, 1967, Ser. No. 644,463
Int. Cl. E04b 1/00; E04g 21/00
U.S. Cl. 52—741 2 Claims

ABSTRACT OF THE DISCLOSURE

This disclosure relates to means for constructing a subterranean antenna which includes the steps of lowering a plastic tube closed at one end and in a longitudinally folded state until it reaches the bottom of the hole and then filling the tube with an insulating liquid until it unfolds over its entire length. The antenna body is then lowered into the tube.

BACKGROUND OF THE INVENTION

Subterranean antennas are known in art as are shown in the patents to Murgas #860,051 and 915,993. Disclosed in each of said patents are antennas confined within casings and wherein in each instance the antenna is first inserted into the casing prior to the addition of the insulating oil. Such practice is shown in the 860,051 patent at FIGURE 2 and page 1, lines 105, et seq. Substantially the same technique is shown in the 915,993 patent as indicated in page 1, lines 73, et seq. of the patent. In each instance it is noted that the antenna is inserted into the casing before any protective or insulating material is provided. By such method it is apparent that the fragile components of the antenna structure can be damaged on contacting the inner surface of the casing. There is likewise the possibility of jamming of the antenna when inserted in the ground in the manner indicated above.

One way to "harden" antennas is to install them below the surface of the earth. The earth has a relatively high conductivity and permittivity which increase the losses reflected into the antenna circuit and hence lowers its efficiency.

One object of the present invention is to minimize such losses without raising the cost prohibitively.

Another object of the invention is to eliminate the need for waterproofing the antenna and feed cable in instances, which is most common, where vertical holes drilled into the earth to a great depth are substantially filled with water of subsurface origin.

Another object of the present invention is the prevention of corrosion and deterioration of below surface antennas.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 shows in cross section the outer tube and supporting element in folded initial state; and

FIGURE 2 shows in cross section the tube and antenna element therein in its final state.

DESCRIPTION OF THE PREFERRED EMBODIMENT

To initiate the assembly of a subterranean antenna of the kind described herein a vertical hole is drilled in the ground to the depth desired, dependent upon the type and nature of the antenna to be utilized. It is to be assumed that most of the terrain and ground where such antennas may be used have water beneath the ground surface and a ground hole so bored would be filled over a substantial portion of its length or depth with water of subsurface origin.

There is then lowered into the hole a plastic tube, such

as made of Mylar, closed at one end, i.e., the end initially lowered into the hole. The full extended length of the plastic tube should be such that it can accommodate the antenna therein, and at the same time extend the full length of the hole. However the plastic tube is lowered into the hole in an empty folded or pleated state until the closed end reaches the bottom of the hole.

The manner in which the plastic tube is folded is critical to the practices of the invention in that the tube is folded or pleated longitudinally. The manner in which such folding is accomplished is not critical to the invention. For ease and convenience, one suggested manner is to accomplish the folding by any appropriate means immediately prior to the introduction of the plastic tube into the ground hole. To assist and insure that the folded plastic tube will reach the bottom of the hole, a weight, for example, a lead ball is attached to the closed end of the tube. Such weight whose negative buoyancy is somewhat greater than the buoyancy of the plastic tube will insure that the end of the tube reaches the bottom of the hole.

The plastic tube is then filled with an insulating liquid, pumped under pressure, until the tube is completely unfolded or filled out over its entire length and the tube rests against the walls of the hole. The physical characteristics of the insulating liquid are of considerable import to the successful assembly of the antenna and should have the following characteristics. The liquid should have a low permittivity and electric loss factor, and also a specific gravity close to that of water. It should have a low relative dielectric constant in the neighborhood of 2, a loss factor in the order of 10^{-4} or less and a relative specific gravity of about 0.9, or more. It will be obvious that as the insulating liquid medium is being pumped into the plastic tube, the subsurface water within the ground hole so displaced may be evacuated by any suitable means. As a further precaution to prevent any possible breakage of the tube along its longitudinal creases while subjected to high water pressure in its empty condition, it is proposed to install a strip of fairly rigid plastic or rubber of a substantially U-shaped rib configuration, having bulbous ends, that extends the full length of the tube. Such means will prevent the formation of sharp creases developing during the stage of lowering the tube in its empty condition in to the hole.

After the tube is lowered to its desired depth and filled with the insulating liquid as described above the antenna is then lowered into the filled tube. Such antenna may be in the form of coaxially fed dipole or loop antenna or colinear array of such dipoles or loop antennas. Under certain circumstances it may be more practical to insert the antenna into the plastic tube prior to the tube being inserted into the ground.

In further clarification of the method of assembling a subterranean antenna reference is made to the drawing herein. FIGURE 1 portrays a plastic tube **11** that is folded or pleated as shown. Such fold in the tube is accomplished prior to the introduction of the tube into a previously dug deep hole. Confined within the tube **11** throughout its entire length is a U shaped strip **13** of fairly rigid plastic or rubber. After the tube **11** is lowered to its full length and reaches the bottom of the ground hole, the tube **11** is inflated with an insulating liquid **17** as heretofore described. There is then introduced into the tube the antenna element **15**.

What is claimed is:

1. The method of assembling a subterranean antenna including the steps of inserting into a ground hole a pliable plastic tube closed at its lower end and longitudinally folded throughout its entire length, inflating said tube, under pressure, with an insulating liquid having a low

relative dielectric constant of about 2, a loss factor in order of substantially 10^{-4} and a relative specific gravity of about 0.9 and subsequently inserting an antenna into said liquid filled tube.

2. The method of assembling a subterranean antenna as set forth in claim 1 including the further step of incorporating into said plastic tube a rib of substantially U-shaped configuration throughout its entire length.

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U.S. Cl. X.R.

52—2, 169, 297; 325—26; 343—719