

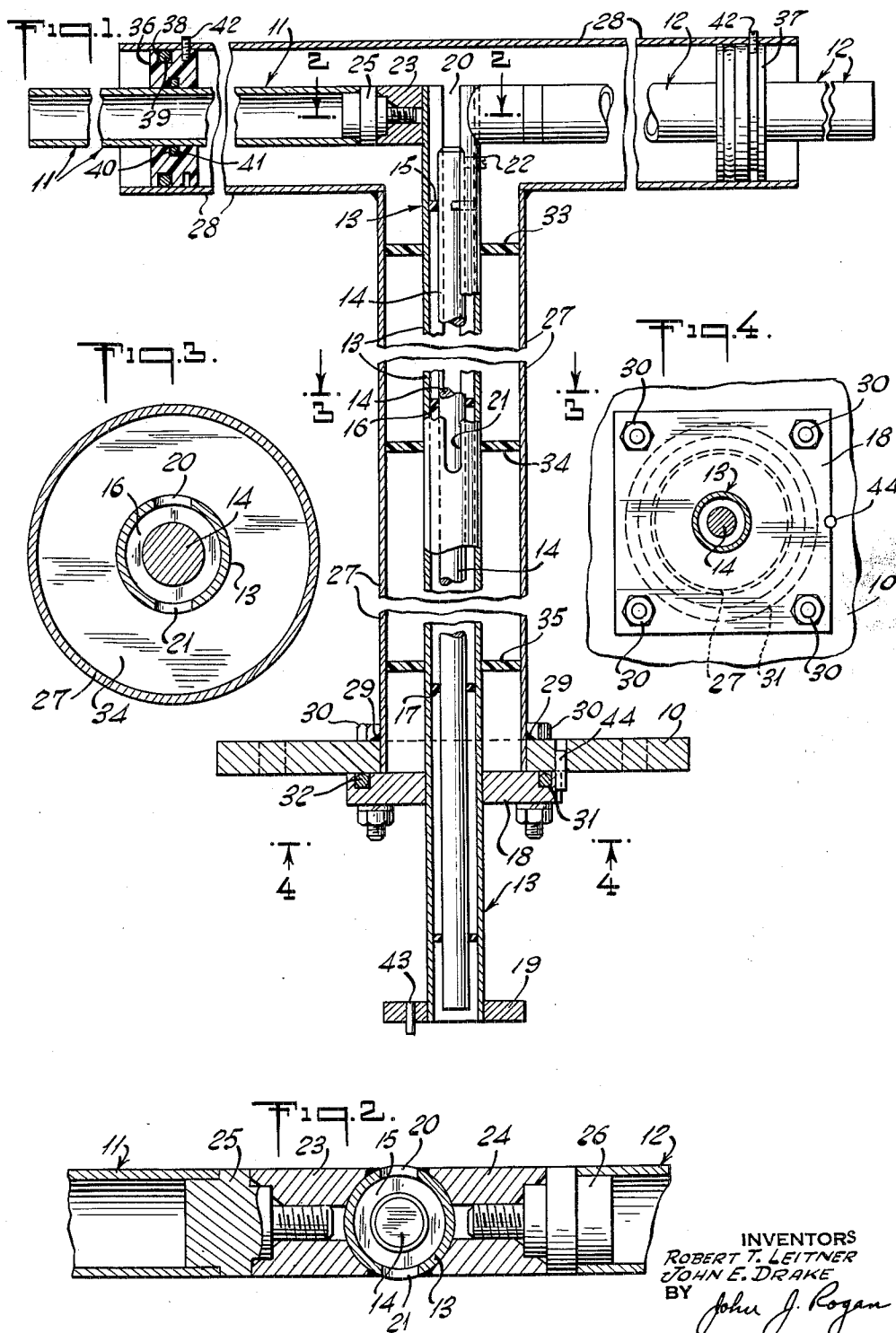
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DIPOLE ANTENNA PROVIDED WITH GAS-TIGHT HOUSING

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DIPOLE ANTENNA PROVIDED WITH GAS-TIGHT HOUSING

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This invention relates to antennas and more especial-
ly it relates to antennas of the dipole kind.

A principal object of the invention is to provide an
improved dipole antenna which is capable of use under
widely varying atmospheric conditions with a high de-
gree of stability in electrical characteristics.

Another object is to provide a dipole antenna which
is provided with a pressurized assembly.

A feature of the invention relates to a pressurized di-
pole antenna wherein the transmission line to the arms
of the dipole is constituted of a tubular outer conductor
and a concentric inner conductor, the outer conductor
adjacent the point of attachment to the dipole arms be-
ing provided with a slotted section which provides a balun
coupling between the dipole proper and the transmission
line.

Another feature relates to the novel organization, ar-
rangement and relative location and interconnection of
parts which constitute an improved dipole antenna.

In the drawing, which shows one typical example,

FIG. 1 is a vertical elevational view, partly sectional,
of a dipole antenna embodying the invention;

FIGS. 2, 3 and 4 respectively are sections along the
lines 2-2, 3-3, and 4-4 of FIG. 1.

Referring more particularly to FIG. 1, the numeral 10
represents a rigid metal mounting plate which supports
the antenna assembly. That assembly consists, in gen-
eral, of a dipole with the dipole arms 11, 12 fastened to
a tubular upright 13 which constitutes the outer conduc-
tor of a transmission line. The center conductor 14 of
that line is in the form of a solid metal rod which is
held concentrically within but insulated from the mem-
ber 13 by a series of insulator washers 15, 16, 17 of a
suitable insulation such for example as "Teflon." Pref-
erably the member 13, as well as the dipole arms 11 and
12, are of a light weight tubular metal stock such as
aluminum. The member 13 adjacent its lower end is
aluminum brazed to a pair of spaced aluminum flanges
18, 19.

The upper end of member 13 is provided with a pair
of oppositely disposed longitudinal slots 20, 21. Each
of these slots has a length which is approximately equal
to a quarter wavelength at the mid-point frequency for
which the antenna is designed. At high frequencies these
slotted upper end portions of member 13 constitute a
short circuited quarter wavelength transmission line
which, by reason of the connection thereto of the dipole
arms, provides a "balun" coupling between the balanced
portion of the system, represented by the symmetrical
dipole arms, and the unbalanced transmission line 13, 14.
The two dipole arms are attached on opposite sides of the
open end of the slot. Since the slot is a quarter wave-
length long, effectively there is across the dipole terminals
a transmission line stub which is shorted at the far end
and is resonant by virtue of its length, and it presents to
the dipole an infinite or very high impedance. Further-
more, each dipole terminal is now balanced with respect
to ground, thus providing a balanced (dipole terminals)
to unbalanced (coaxial line) transformation. Energy is
fed to the dipole by connecting the center conductor of
the coax to one dipole terminal and the outer conductor
to the other.

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The tubular transmission line conductor 13 is con-
nected to the concentric transmission line conductor 14,
for direct current, by means of a bolt or screw 22 close-
ly adjacent the point of connection of the dipole arms
to the member 13. Welded or brazed to the extreme
upper end of the member 13 in alignment and diametri-
cally opposite to the slots 20, 21 are metal bosses 23,
24, into which are screwed the plugs 25, 26 that are rig-
idly united respectively to the dipole arms 11 and 12.

We have found that more stable and reliable results
are obtained from the antenna by providing a pressurized
T-shaped housing consisting of the vertical tubular por-
tion 27 and the horizontal tubular portion 28. The ver-
tical portion 27 at its lower end is welded around its
periphery to the upper face of the mounting plate 10, as
indicated by the numeral 29, thus forming a sealed joint
between the members 10 and 27. The flange 18 of the
dipole assembly is fastened against the under face of
member 10 by a series of bolts 30, and in order to pro-
vide a gas-tight seal, the face of flange 18 is provided
with an annular groove 31 in which is mounted the pres-
sure deformable sealing ring 32 so that when the members
10 and 18 are bolted together, a gas-tight joint is pro-
vided. In order to maintain the elements 13 concentric
within the member 27, a plurality of insulator washers
33, 34, 35 may be provided. These washers may be of
the same material as the above described washers 15, 16
and 17. In order to maintain the housing formed of the
members 27, 28 gas-tight, annular insulator bushings 36,
37 are provided between the dipole arms 11, 12 and the
inner surface of the member 28. Each of these bushings
has on its outer peripheral surface a groove 38 in which
is seated a pressure deformable sealing ring 39 for ex-
ample of "neoprene." Likewise, the inner peripheral sur-
face of each of the bushings is provided with a groove 40
in which is seated a pressure deformable sealing ring 41.
The bushings 36, 37 can be fastened in place by suitable
screws 42.

Therefore, gas under pressure, for example five pounds
per square inch, is in the complete cavity enclosed by O
rings 32, 39 and 41 as in the interior of the transmis-
sion line which connects to the dipole at flange 19. This
is the feed point and critical areas of the dipole where
moisture and other foreign matters might collect and
make the antenna inoperative or reduce its efficiency es-
pecially when it is subjected to high power as in a trans-
mitting antenna. For this same reason, it is also com-
mon to pressurize the transmission line. It is impractical
to preclude all moisture by sealing alone but by introduc-
ing a dry gas it is impossible for any moisture to accumu-
late. It is unnecessary to have the exterior conductor of
a coax line pressurized since there are no voltages or
currents exterior to a line of this type. It is unnecessary
to pressurize the extreme ends of the dipole since they
are far removed (physically) from ground and foreign
matter or moisture will not adversely affect them.

It will be clear from the foregoing that the dipole anten-
na provides its own inherent "balun" coupling by means
of the slots 20, 21 and the antenna proper is enclosed
within a sealed housing constituted of the members 27
and 28. It will be understood, of course, that the dipole
arms 11 and 12 extend outwardly beyond the ends of the
member 29 to any desired extent determined by the
frequency at which the antenna is intended to be operated.
For example, each dipole element is a quarter wavelength
and about two-thirds of this length is exposed from out-
side the sleeve 28. The foregoing described assembly can
be coupled to any well known hollow concentric trans-
mission line of the pressurized gas filled kind, and for
that purpose the flange 19 may carry a locating pin 43
whereby the flange 19 can be located gas-tight coupled

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to a corresponding sealed flange on the end of any well known gas filled concentric transmission line (not shown). As is well known, such a line contains a suitable gas, for example nitrogen under a predetermined pressure, and this gas, by reason of the tubular member 13 and the upper open end thereof and the slots 20, 21, fills the entire T-shaped housing comprised of the members 27, 28 and respective ends of which are sealed as above described. We have found that this manner of assembling within a pressurized housing improves the operation and stability of the antenna particularly at very high frequencies of the order of 50 megacycles and up.

When the dipole is used in an array with others of the same kind, the screw 22 establishes a polarity of the dipole and it is physically impossible to see to which dipole arm the screw is associated after the unit is assembled. The pin insures that all units are assembled consistently the same and provides an outward identifying mark to be used at installation to insure that the units will be arrayed with the same phase polarity.

Various changes and modifications may be made in the disclosed embodiment without departing from the spirit and scope of the invention.

What is claimed is:

1. A dipole antenna comprising a T-shaped tubular metal housing having a tubular horizontal metal portion joined to a tubular vertical portion to form a structurally rigid T-shaped hollow tubular unit, a dipole having a pair of dipole arms joined to a tubular metal member, said arms extending interiorly through the horizontal portion of said housing but circumferentially spaced therefrom and said tubular metal member extending through the vertical portion of said housing, the ends of said housing being gas-tight sealed, said housing having a filling of an inert gas under pressure and means including a hollow concentric transmission line sealed through the lower end of the vertical portion of the T-shaped housing to maintain the same pressure in the transmission line and in the said housing.

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2. A dipole antenna comprising a tubular vertical metal member constituting one of the conductors of a concentric transmission line, a pair of tubular dipole arms connected to said vertical member, and means to enclose a portion of the length of said vertical member and a portion of each of said dipole arms within a sealed T-shaped housing, the said dipole arms extending laterally from said housing through respective gas-tight seals in the ends of the horizontal portion of said housing and means to seal in a gas-tight manner said tubular vertical metal member through the lower end of the vertical portion of said T-shaped housing.

3. In combination a T-shaped tubular metal housing arranged to receive a gas under pressure, insulator sealing rings closing off the ends of the cross top portion of said housing, sealing means closing off the open end of the leg of the T-shaped housing, a transmission line extending through the last mentioned sealed end of said housing, said transmission line comprising a tubular metal member and a concentric conductor, and a pair of dipole arms having their inner spaced ends connected to the upper end of said tubular metal member and extending outwardly beyond the sealed ends of said cross top portion of said housing, said tubular member being sealed in a gas-tight manner to the lower end of the vertical portion of said housing whereby the same gas pressure is automatically maintained within said transmission line and within said housing.

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