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DEVICE FOR RADIATION OF RADIO WAVES

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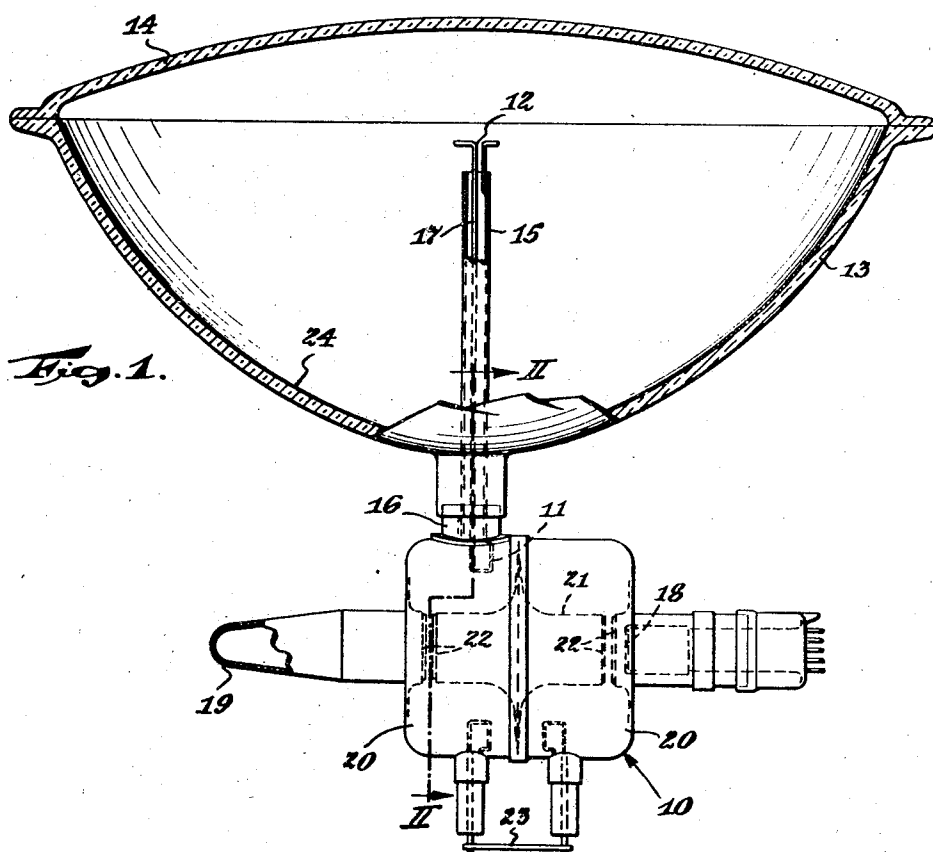
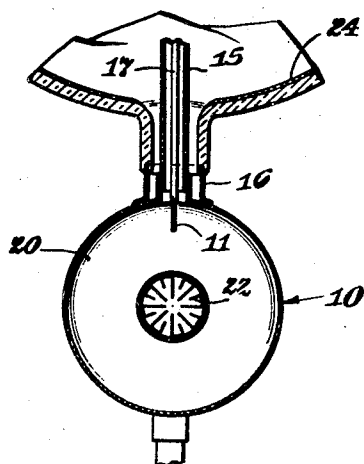


Fig. 2.



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DEVICE FOR RADIATION OF RADIO WAVES

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2 Claims. (Cl. 250—11)

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This invention relates to radiation of radio waves, and more particularly to means for directional propagation of ultra high frequency radio waves into space.

It is a well established fact that radio energy may be directed in a beam, the directional characteristic being more pronounced as the wave length employed enters the range of commonly termed "micro waves," a term indicative of wave lengths of the order conveniently and normally designated in centimeters. Ultra short waves thus characterized have been generated, carried to antennae situated in parabolic reflectors and thereby directed into space as relatively concentrated beams. Systems of the prior art have been found deficient in several respects such as inability to present voltages of desired magnitude to the antenna, losses in and mechanical difficulties in transmission instrumentalities, stray transmission, bulkiness and other electrical and mechanical troubles.

Accordingly, an object of the present invention is to overcome the deficiencies of prior art directional propagation of ultra high frequency or micro waves.

More specifically, an object of the present invention is to improve character, efficiency and range of directional propagation mechanism for transmitting radio beams into space.

Another object of the invention is to provide for application of maximum voltage from an ultra high frequency generator to the antenna.

A further object is to utilize that energy which heretofore was lost in transmission systems to useful purpose.

A still further object is to vacuum enclose the antenna, and also to provide a common vacuum enclosure for generation and transmission mechanisms to and with the antenna.

Again, an object of the invention is to eliminate usual transmission line ceramics and apply the generated wave energy directly to the antenna.

Other objects of the invention are to avoid use of coaxial terminals, obtain a unified, compact and complete generating and propagating mechanism, avert stray transmission, provide for vacuum insulation throughout, and to obtain other advantages and results which will in part appear by direct mention thereof hereinafter and in part by implication from the context.

In the accompanying drawing wherein like numerals of reference indicate similar parts in the two views thereof,

Figure 1 is a representation partly in elevation and partly in section, of ultra high frequency

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generating, directing and propagating mechanism in accordance with the present invention; and

Figure 2 is a sectional view on line II—II of Fig. 1.

In the specific embodiment of the invention illustrated in said drawing, the reference numeral 10 designates in general an ultra high frequency generating device having an output means, such as loop 11, directly connected within a common evacuated enclosure therewith, an antenna or propagating means represented by dipole 12. The dipole 12 is situated substantially at the principal focus of a parabolic mirror which constitutes a specific form of directional means 13. In its broad aspect, the invention thus discloses a unified generating, propagating and directing mechanism. Furthermore, the forward part of the parabolic mirror is enclosed by a cover 14 vacuum sealed thereto, said cover being of appropriate material, of which glass is an example, transparent to radio waves.

A feature of the invention resides in the unification of the generating, propagating and directing means within a common evacuated enclosure and in utilizing the vacuum for insulative purposes. It will thus be observed the tubular portion 15 of the dipole structure is physically a part of the generator portion of the device and projects therefrom into the region of the focal point of the mirror, both ends of said tubular portion being open. Those open ends communicate directly with the interior evacuated areas of the generator and mirror, and the mirror being sealed to the generator portion in spaced relation to the tube, as by a nipple 16, the vacuum space between mirror and dipole tube acts as insulation means. Similarly the coaxial line rod 17 extending from loop 11 in the generator and projecting from the forward end of the tubular portion 15 is in vacuum and accordingly insulated from the tubular portion.

The ultra high frequency generating device 10 may be of suitable construction for the desired output. A highly effective generator is exemplified with general showing herein of the hollow-body resonant device greater detail whereof will be found in co-pending application, Serial No. 406,574, filed August 13, 1941, by Ila E. Mourontseff and George M. Dinnick, and assigned to the same assignee as the present case. Briefly, the particular generator shown provides a cathode 18 toward one end of the generator and normal to the longitudinal axis of the generator. In the region of the opposite end, likewise on the axis of the generator, is a collector 19 to which elec-

trons emitted from cathode 18 ultimately arrive. Between the cathode and collector and on a common axis therewith are two spaced hollow circuit members or resonators 20 within which fields, comprising standing electromagnetic oscillations are adapted to be set up by passage of a beam of electrons therethrough from cathode to collector.

In accordance with usual practice, an area 21 between the resonators 20, 20 is provided which is field free but through which the electrons pass in their travel from the first to the second said resonators. Likewise, as usual, the resonators provide gaps or attenuated openings in which are situated grids 22 for maintaining, as far as possible, the continuity of the walls of the resonators. The electrons pass from between one pair of such grids of the first resonator, through the field-free space to the area between the next pair of grids of the second resonator, each electron completing such passage in a predetermined multiple of quarter wave lengths. After the electrons pass the grids of the second resonator, they continue into the collector where remaining energy is dissipated.

As the electron beam passes through the first resonator, referred to as a buncher, a sinusoidal component corresponding to the electrical oscillations existing within the buncher is impressed on the beam of electrons and produces a modulation of velocity of the electrons. The modulation of velocity causes the electrons to bunch or collect in clusters periodically and the second resonator, referred to as the catcher, is so disposed as to absorb energy from the electrons as they pass through it. A small part of this energy is fed back through feed-back means 23 to the first resonator for maintaining oscillation.

The major part of the energy of the second or catcher resonator is transferred by output loop 11 and coaxial line to the dipole or other antenna 12 for discharge into space as micro-wave oscillations. Since the antenna is within the evacuated enclosure, higher voltages than heretofore are permitted. The close association of generator and antenna avoids power loss of transmission lines or leakage and other trouble with ceramics constituting necessary parts of transmission lines. The use of vacuum as insulation and physical compactness of the unitary assembly are conducive to efficiency.

While, for illustrative purposes, specific generating, propagating and directing means have

been shown, each is susceptible to variation or change, thus, a different oscillator than the particular resonant body type shown may be employed. Likewise in place of the dipole antenna, propagation of the oscillations may be by other antenna means such as an open ended hollow wave guide. Then again, the mirror or directional means may be variously constructed with the parabolic body portion thereof rendered reflective directly as a polished metal member or as glass appropriately metalized as at 24 for the purpose. Other detail changes and modifications not specifically mentioned but obvious from the foregoing disclosure may be made without departing from the spirit or scope of the invention, and we do not limit ourselves in such matters except as set forth in the following claims when construed in the light of the prior art.

We claim:

1. An ultra high frequency device comprising in combination an ultra high frequency generator having an envelope defining a chamber therein, said chamber being evacuated, a second envelope protruding from the first said envelope, said second envelope having a rear reflecting wall and a forward wall vacuum sealed therewith thereby defining a chamber therein which said chamber is also evacuated, a tubular connection between said envelopes said tubular connection opening into both said chambers and said chambers being otherwise vacuum sealed, and means within the evacuated chamber of the second said envelope for propagating output of said generator directly into space, said tubular connection constituting part of said means.

2. An ultra high frequency device comprising in combination an ultra high frequency generator having an envelope defining a chamber therein, said chamber being evacuated, a second envelope symmetrical about an axis and defining a second chamber within said second envelope which said second chamber is also evacuated, a tubular connection coaxial with said axis of the second envelope and projecting from the first chamber inwardly of the second chamber and opening into both said chambers and said chambers being otherwise vacuum sealed, and means for propagating output of said generator directly into space in the same general direction as said axis, said tubular connection constituting part of said means.

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