June 28, 1949. D. E. SUNSTEIN 2,474,384

HIGH-FREQUENCY RADIANT ENERGY ABSORBING DEVICE

Filed April 28, 1944

Fig. 1.

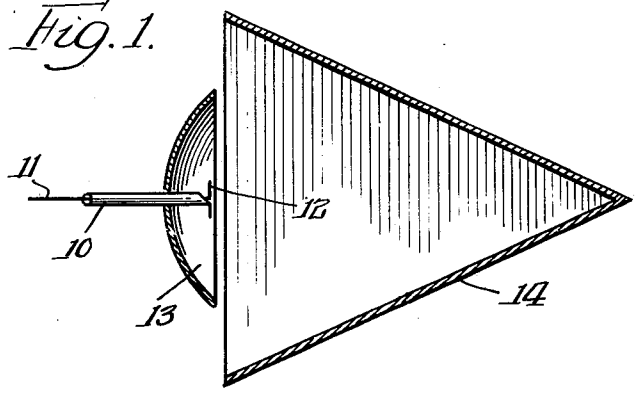


Fig. 2.

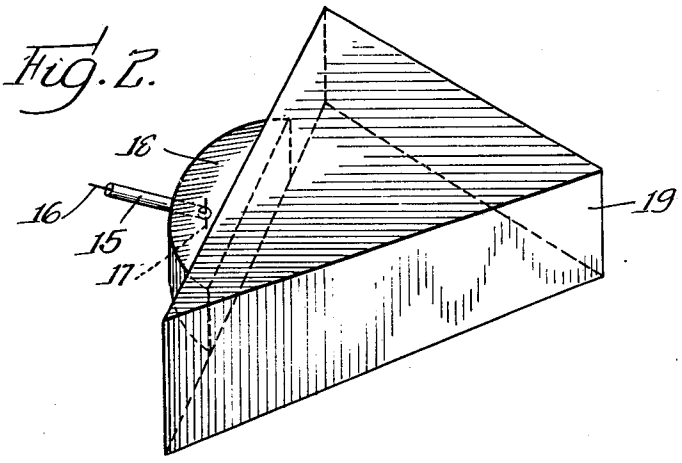
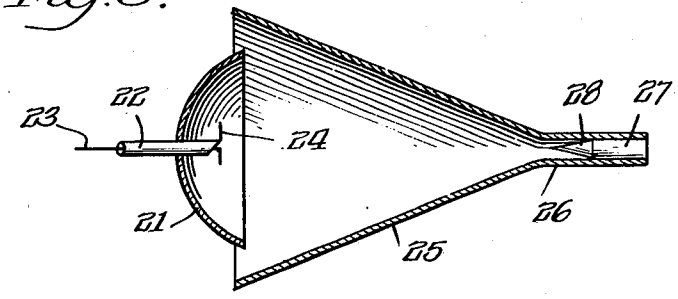


Fig. 3.



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HIGH-FREQUENCY RADIANT ENERGY ABSORBING DEVICE

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3 Claims. (Cl. 250—33.63)

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The present invention relates to a device for absorbing ultra high frequency radiant energy so that ultra high frequency transmitting equipment may be adjusted and calibrated as though operating into free space.

Heretofore, in connection with radio frequency transmitters, it has been common to utilize a dummy antenna in place of the radiating antenna during those times when the radio transmitter is to be adjusted or calibrated. Dummy antenna devices operate satisfactorily in the lower frequency bands, but a comparable device is not obtainable for use with ultra high frequency radio transmitting equipment. In the manufacture of ultra high frequency radio transmitters, it is necessary to test, calibrate, and adjust the transmitters and, because of the critical nature of the circuits and the apparatus, it is necessary to connect the sources of ultra high frequency energy to the radiator or antenna device which is actually used with the apparatus. In order that the radiation from such radiator might not interfere with other equipment in the place where the transmitter is being tested, it is desired to provide a device which will substantially completely absorb the radiated ultra high frequency energy. In accordance with the present invention this is accomplished by positioning a horn adjacent the radiator with its axis substantially in alignment with the direction of the radiated high frequency energy so that transmission into free space is simulated.

It, therefore, is an object of the present invention to provide a method of and apparatus for simulating transmission into free space by ultra high frequency radiant energy apparatus.

It is another object of the present invention to provide a device for absorbing substantially completely the energy radiated by an ultra high frequency radiator.

Other and further objects of the present invention subsequently will become apparent by reference to the following descriptions taken in connection with the accompanying drawing, wherein

Figure 1 is a schematic cross-sectional representation of an ultra high frequency radiator and an absorbing device embodying the present invention; and

Figure 2 is a schematic perspective representation of another form of radiator and absorbing device embodying the present invention; and

Figure 3 is a schematic cross-sectional representation of another form of the invention.

In Figure 1 there is shown a coaxial cable or

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transmission line having an outer conductor 10 and an inner conductor 11 terminating in a dipole antenna 12 placed at the focal point of a reflector which, in the form illustrated, is a paraboloid of revolution. Aligned with the axis of the paraboloid 13 and with the direction of the radiated ultra high frequency energy is an absorbing device 14 which may be in the form of a pyramid of four sides having a base dimension equal to or larger than the over-all diameter of the paraboloid 13. The pyramidal absorbing device 14 has dimensions large compared to the wave length of the radiated energy.

It has been found convenient to utilize a pyramidal absorber of four sides since such device may be made collapsible to facilitate portability. For example, in one instance it has been found satisfactory with a wave length of one and one-fourth inches to utilize a hollow metallic pyramid of approximately square cross section with a base dimension of about twenty-four inches and an altitude of about thirty-six inches. In the example referred to, the inner surface of the absorbing device was smooth and coated with a highly conductive layer of metal, such as silver, and yet 98½ per cent of the incident energy was absorbed. With an unpolished surface or one coated with a resistive material, an even greater absorption may be obtained.

In Figure 2 there is shown another transmission line comprising an outer conductor 15 and an inner conductor 16 connected to a dipole radiating device 17 located at the focal point of a cylindrical paraboloid 18. If desired, the paraboloid 18 may have closed top and bottom sides. The parabolic reflector, therefore, has a predetermined flare so as to transmit a rather flat beam. In order to absorb such beam, an absorbing device 19 is provided which is flared in the same plane as that of the radiator or reflector 18. Therefore, the absorbing device 19 may have two triangular sides and an open base or mouth so that the dimensions are large compared to the wave length of the radiated energy. The absorbing device 19 is arranged to have its axis in substantial alignment with the direction of the radiated energy beam, and the mouth of the device preferably is of equal or greater dimensions than the mouth or opening of the reflector 18 of the radiating assembly.

From the example shown in Figure 2, it will be appreciated that the absorbing device such as 14 might also be a conical pyramid having dimensions of the order previously expressed and be-

ing arranged so that its axis is in substantial alignment with the direction of the radiant energy beam.

The arrangement shown in Figure 3 illustrates the use of a parabolic reflector **21** energized with ultra high frequency energy by means of a coaxial line having an outer conductor **22** and an inner conductor **23** connected to a dipole antenna **24**. A horn **25** which has been shown conical is connected to a circular wave guide or coaxial transmission line **26**. Mounted within the line **26** is an absorption member **27** having a tapered portion **28** looking toward the apex end of the horn **25**. The absorption device **27** preferably comprises a ceramic member containing finely divided resistive material such as graphite, carbon black or silicon carbide. Energy collected by the horn **25** is fed to the guide or transmission line **26** so that the incident energy impinges upon the member **27**. The taper portion **28** of the member **27** is so arranged as to prevent any substantial reflection of energy back along the line or guide **26**. The energy entering the member **27** is absorbed and converted into another form such as heat. It, therefore, will be appreciated that the arrangements shown in Figures 1 and 2 might be provided with similar absorption devices to insure complete absorption and dissipation of incident energy in the horn.

While for the purpose of illustrating and describing the present invention, certain specific embodiments and representations have been shown, it is to be understood that the invention is not to be limited thereby, since obviously, such variations may be made therein as are commensurate with the spirit and scope of the invention as defined in the appended claims.

The present invention is hereby claimed as follows:

1. Apparatus for simulating the transmission of ultra high frequency energy into free space, comprising a radiation device to which said energy may be supplied, and a horn having an open mouth arranged to receive energy radiated from said device and adapted to absorb substantially all of said energy, said horn tapering from a dimension considerably greater than cut-off to a dimension less then cut-off for the frequency range of said energy.

2. Apparatus for simulating the transmission of ultra high frequency energy into free space, comprising a directional radiation device to which said energy may be supplied, said device having a flare in a direction transversely of the direction of radiation, and means for absorbing substantially all of the energy radiated by said device, said means consisting of a horn composed of electrical conducting material and having an open mouth positioned to receive said radiated energy, said horn being flared in the same plane as said radiation device, said horn tapering from a dimension considerably greater than cut-off to a dimension less then cut-off for the frequency range of said energy.

3. Apparatus for simulating the transmission of ultra-high frequency energy into free space, comprising a radiation device to which said energy may be supplied, and a horn having an open mouth arranged to receive energy radiated from said device and adapted to absorb substantially all of said energy, said horn tapering from a dimension considerably greater than one-half the wave length of the radiated energy to a dimension less than one-half said wave length, said dimensions being measured in a transverse direction to the electric lines of force of the field of said radiated energy.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,923,916	Darbord	Aug. 22, 1933
2,054,896	Dallenbach	Sept. 22, 1936
2,094,602	Kassner	Oct. 5, 1937
2,151,118	King et al.	Mar. 21, 1939
2,210,415	Kellogg	Aug. 6, 1940
2,245,669	Hollmann	June 17, 1941
2,273,547	Von Radinger	Feb. 17, 1942
2,293,181	Terman	Aug. 18 1942
2,293,839	Linder	Aug. 25, 1942
2,307,012	Barrow	Jan. 5, 1943
2,398,606	Wang	Apr. 16, 1946