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CENTIMETER WAVE ABSORBER

2,293,839

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Fig. 1.

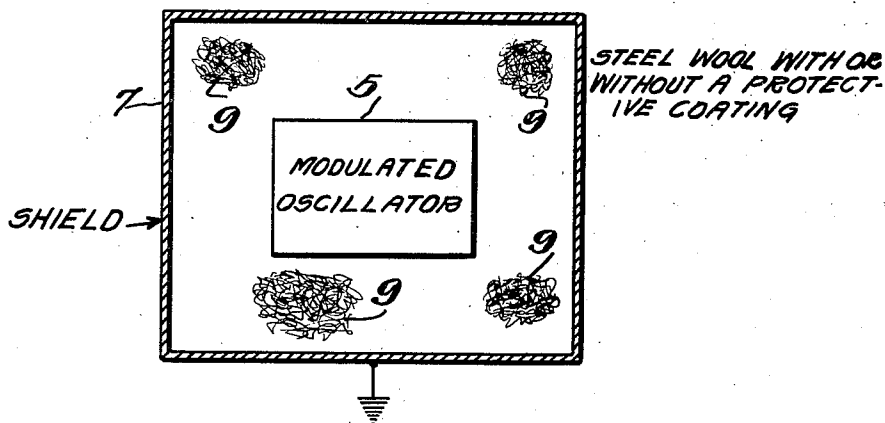
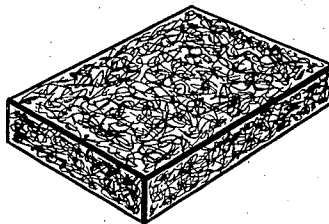


Fig. 2.



Fig. 3.



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CENTIMETER WAVE ABSORBER

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9 Claims. (Cl. 250-36)

This invention relates to the absorption of ultra high frequency radio energy, and has for its principal object the provision of means for preventing the reflection of radio frequency energy from objects, and for minimizing standing wave effects due to such reflections.

It is well known that ultra high frequency waves of radio energy, particularly those in the "quasi-optical" spectrum, are reflected from conducting and non-conducting surfaces in a manner similar to the reflection of light and sound energy. In a radio transmitter, for example, ultra high frequency energy is radiated from those parts which are at a high radio frequency potential. Some of this energy is reflected back to the transmitter and induces currents in the various circuits which may be in or out of phase with the currents normally flowing therein, or which may have some intermediate phase, depending on the distance traveled by the reflected wave.

Where the frequency is very high, the distances involved may be equal to many wavelengths. It will be appreciated, therefore, that the currents induced in the circuits by the reflected energy may modify the amplitude of the normal currents considerably. This effect is particularly serious where the signal source is frequency or amplitude modulated. In the former case a change of frequency changes the phase of the reflected energy, and thus changes the amplitude of the resultant current in the transmitter circuit. The resultant amplitude modulation is not desirable. In the latter case, the signal is seriously distorted since the effect of the reflected energy is different for each side band frequency.

One solution to this difficulty has been described in a copending application of Rene A. Braden, Serial No. 265,172, filed March 31, 1939, in which shields are placed very near all high frequency circuits so that there can be no substantial phase shift in the reflected energy. The present invention, however, proposes to accomplish the same result by covering reflecting surfaces with an absorbent material which produces a deadening effect similar to that produced by acoustical absorbing materials.

This invention will be better understood from the following description when considered in connection with the accompanying drawing, and its scope is indicated by the appended claims.

Referring to the drawing, Figure 1 illustrates a shielding compartment which includes a high frequency absorbing material to prevent resonant cavity effects; Figure 2 is a cross sectional

view of an absorbing panel; and Figure 3 is a view of a construction brick having high frequency absorbing properties.

Referring now to Fig. 1, an ultra high frequency modulated oscillator 5, or other source of high frequency energy is mounted in a grounded metallic shielding box 7, closed on all sides, or substantially so, in the conventional manner. When the dimensions of the box are of the order of the wavelength, or larger, of the radio frequency oscillator, waves radiated from the oscillator will cause standing waves to be produced within the box. At certain frequencies electrical resonance is established with the result that a very high field intensity is produced within the enclosed space. This is called a "resonant cavity" condition, and is well known. The phenomena may be put to many uses, but it is the purpose of the present invention to provide means for preventing such a condition from occurring when it is not desired, not merely by detuning the cavity, since this is only effective at a particular frequency, but by absorbing the energy.

For this purpose small masses of fibrous conducting material 9 are inserted more or less at random within the shield 7. It is not necessary to cover the entire inner surface of the shield with absorbing material, although this may be done, but a sufficient amount should be used to insure the desired result. The absorbers themselves are loosely packed fibres of steel, copper, or other conducting material. I have found that the product commercially available and known as "steel wool" is well suited to this purpose. Reflections and standing waves in a shielding container may be substantially reduced or eliminated with five or six pads of this commercial product. For example, absorbing material of this type may be used to great advantage inside signal generators and other ultra high radio frequency apparatus.

The effectiveness of this absorbing material may be readily measured. Ultra high frequency waves are introduced into a substantially closed container whose length may be varied. A voltmeter is mounted within the container to indicate the field intensity therein. The ratio of the square root of the maximum to the minimum field intensity is then determined as the container is adjusted through resonance and anti-resonance. Alternatively the frequency of the signal may be varied to determine this ratio. This process is repeated as the absorbing material is added until there is substantially no

difference between the maximum field and the minimum field, at which point it is known that all standing waves have been eliminated.

The absorbing material may be prepared for use in different forms. In Fig. 2 the absorbent 11 is fixed on the surface of a board 13, for example, with which shielded test cages and the like may be constructed. Test cages are used to shield radio receivers and the like from signals and electrical disturbance which would otherwise make measurements impossible. A cage constructed in the manner suggested would be free from reflections set up by the test apparatus itself, and the absorbent material will also act as an effective shield against outside disturbances.

Another form herein proposed is illustrated in Fig. 3. In this case the absorbing fibres are embedded uniformly throughout a brick of insulating material such as Bakelite, styrol, or any of the well known plastics. The advantages of this arrangement are that the fibres are prevented from packing, they are protected from the moisture, which is particularly important where steel or iron fibres are used, and that the brick is permanent and easy to handle. The insulating material should have a dielectric constant as near as possible to that of air in order to minimize reflections which may occur directly from the surface of the brick. An alternative arrangement would be to coat the individual fibres with a protective coating of styrol to prevent rusting.

I have thus described a new system for reducing the reflection of ultra high frequency energy and for reducing standing waves in a shielding container. Many further modifications of this invention will become apparent to those skilled in the art. This invention is not to be limited to the specific embodiments which have been herein described but only by the prior art and the spirit of the appended claims.

I claim as my invention:

1. In an ultra high frequency radio device, a container in which standing waves of ultra high radio frequency energy are formed and absorb-

ing means comprising a mass of loosely packed fibrous conductors positioned within said container for minimizing said standing waves.

2. In an ultra high frequency radio device, a container in which standing waves of energy are formed, and an absorbing material in said container for minimizing said standing waves, said material comprising a mass of conducting fibres.

3. In an ultra high frequency radio device, an oscillator, shielding means for said oscillator, and a fibrous conducting material between said oscillator and said shielding means for absorbing radiations from said oscillator.

4. In a radio device, a source of ultra high radio frequency oscillations, shielding means for said source, said means comprising a packed mass of fibrous conductors.

5. In a radio device, a source of ultra high radio frequency oscillations, shielding means for said source, and absorbing means between said oscillator and said shield comprised of a loosely packed mass of fibrous conducting material for minimizing reflections from said shield.

6. A non-reflecting shielding material for ultra high radio frequencies comprising a continuous mass of fibrous conductors enclosing the object to be shielded.

7. An absorbent shield for ultra high radio frequencies comprising a continuous mass of fibrous conductors covered with an insulating material enclosing the object to be shielded.

8. In an ultra high frequency radio device, a container in which standing waves of energy are formed, and an absorbing material in said container for minimizing said standing waves, said material comprising a mass of conducting fibres of electromagnetic material.

9. In a radio device, a source of ultra high radio frequency oscillations, shielding means for said source, said means comprising a packed mass of fibrous conductors of electromagnetic material.

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