

April 10, 1962

H. S. JONES, JR
ANTENNA TESTING SHIELD

3,029,430

Filed Aug. 26, 1960

2 Sheets-Sheet 1

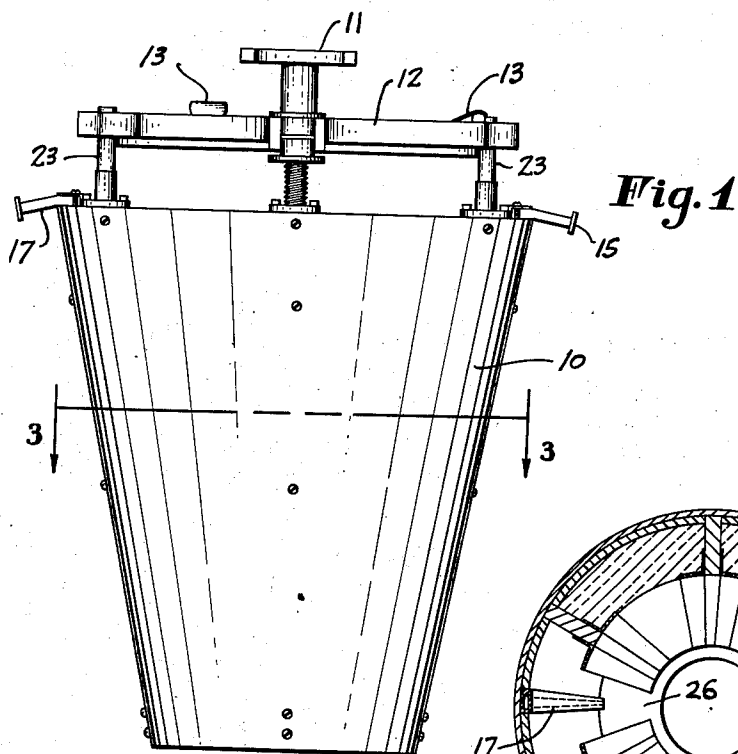


Fig. 1

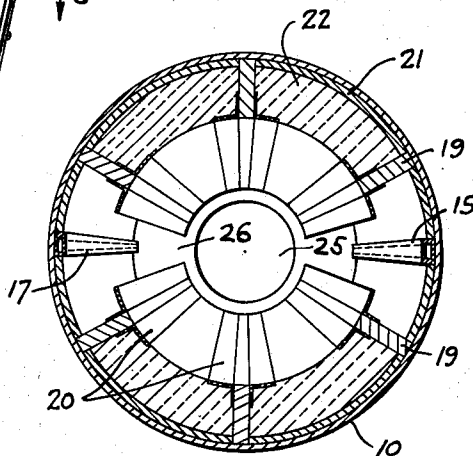


Fig. 3

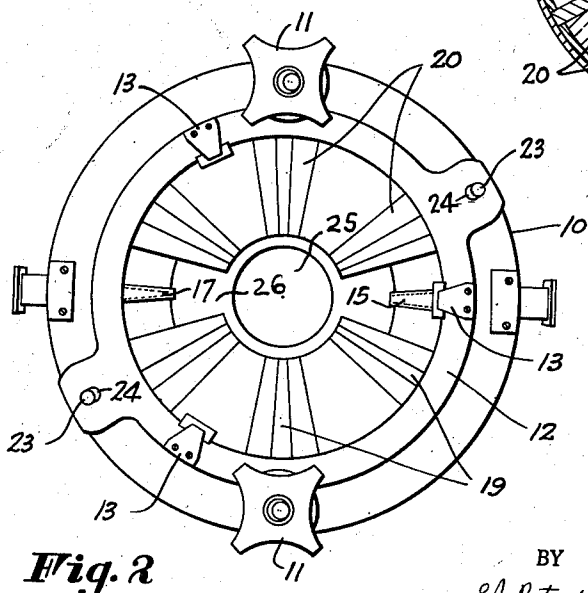


Fig. 2

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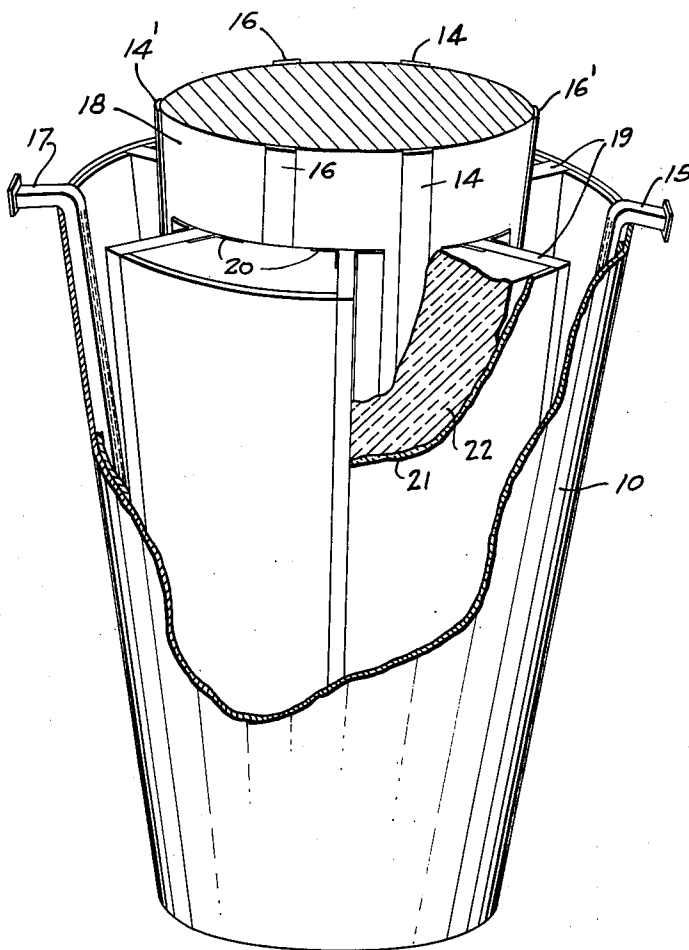


Fig. 4

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ANTENNA TESTING SHIELD

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2 Claims. (Cl. 343-703)

(Granted under Title 35, U.S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by or for the Government for governmental purposes without the payment to me of any royalty thereon.

This invention relates generally to the testing of guided missile fuzes, and more particularly relates to a device for coupling fuze antennas to test equipment under conditions approximating those of free space.

In the past, those engaged in the art of testing microwave fuzes utilizing antennas for sensing the proximity of a target have been unsuccessful in simulating free space conditions as the environment for the fuze under test. The reason for the failure of the prior art to come up with a workable solution to this testing problem has been a lack of appreciation of the extremely complex nature of conditions which a missile fuze encounters during its flight through space. Antenna leakage, skin currents, and far target signal return are among those conditions complexing the free space fuze environment.

This invention effects a practicable solution to the above-mentioned problem by providing a hood which surrounds the fuze under test and which contains therein antennas for coupling energy from the fuze to test equipment and thence back to the fuze. The hood is so constructed that antenna leakage, fuze skin currents and far target return can be effectively simulated and controlled.

Accordingly, it is an object of this invention to provide a device for simulating free space conditions in a fuze undergoing operational testing.

A further object of this invention is to provide for the coupling of energy from a microwave fuze to test equipment and back to the fuze for determining the fuze response under conditions of actual use.

Other objects, advantages and features of the invention will be apparent from the following description considered together with the drawings, in which:

FIG. 1 is a side view of a space hood in accordance with the invention.

FIG. 2 is a plan view of the space hood of FIG. 1.

FIG. 3 is a sectional view taken through section line 3-3 of FIG. 1; and

FIG. 4 is a three-dimensional view of the space hood of FIG. 1, broken away in parts and with the fuze partially positioned therein.

In FIGS. 1, 2 and 3, a conically-shaped metallic spacehood 10 is shown. As shown in FIGS. 2 and 3, the interior of spacehood 10 is divided into a plurality of compartments by conductive partitions 19. Mounted along the edge of each of the partitions 19 is a metallic strip 20 for making electrical contact with the surface of the fuze. The strips 20 are preferably of beryllium-copper—a springy alloy well suited for pressing snugly against the fuze surface.

In FIG. 3 it can be seen that each compartment is lined with standard R.F. current absorbing material 21 and all but two of the compartments are filled with a standard microwave absorbing material 22. In one of the two compartments not containing material 22 there is secured a transmitting antenna 15 and in the other diametrically opposite the first there is mounted a receiving antenna 17.

The bottom of the spacehood, upon which the nose of

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a fuze seats when it is in position, is formed of a metallic ring 26 having an orifice 25. Positioning ring 12 slidably mounted upon pins 23 extending through apertures 24 serves to retain the fuze as it is lowered into the spacehood by means of screw carriages 11. Indexing members 13 are equally spaced about the circumference of ring 12 to designate the proper position of the fuze receiving antennas when the fuze is seated in ring 12.

In FIG. 4 a conically-shaped fuze 18 having transmitting antennas 14 and receiving antennas 16 along the surface thereof is shown partially lowered into spacehood 10. The positioning apparatus illustrated in FIGS. 1 and 2 has been omitted here for clarity. Fuze transmitting antenna 14' is centrally disposed in the compartment containing hood receiving antenna 17, while fuze receiving antenna 16' is similarly disposed in the compartment containing hood transmitting antenna 15. The other fuze antennas 14 and 16 are centrally located in the compartments filled with microwave absorbing material 22. The hood antennas 15 and 17 are in parallel relationship with their associated fuze antennas 16' and 14' and are inverted with respect thereto to impart the proper phase relationship to the coupled microwave energy.

In the testing of the fuze, energy is usually fed into a matched three-way junction and distributed equally to the transmitting antennas 14 and 14'. The radiated energy picked up by the hood antenna 17 is fed into test equipment including delay means and is then fed back to the transmitting antenna 15. Fuze antenna 16' will pick up the returned energy and feed it to the fuze detonator whose functioning is to be tested by additional equipment. It is to be understood that since the fuze and its associated testing equipment are purely conventional and form no part of the present invention no showing thereof in the drawings is made.

The spacehood of the present invention thus effectively decouples the fuze antennas from each other by restricting the energy radiated therefrom to the hood compartments. Up to 60 db decoupling between adjacent fuze transmitting and receiving antennas has been achieved while the noise level of the fuze receiver detector has been reduced about eight-fold over that of the prior art devices. The highly efficient coupling between the fuze antennas and their associated hood antennas has been found to be optimized at a spacing therebetween of about 1.75 inches for a typical fuze operating at microwave frequencies. However, despite their close relative proximity, no increase in the voltage standing wave ratio of either the fuze or hood antennas is observable.

Although one specific embodiment of the invention has been described, it should be realized that various modifications could be made. For example, the number of antennas could be varied and the shape of the spacehood changed to meet the requirements of the particular fuze to be tested.

I claim as my invention:

1. A device for use in conjunction with means for testing the operating characteristics of a fuze having sending and receiving antennas mounted thereon, said device comprising: a hood having a conical shape, means for securing said fuze within said hood, two antennas integral with the hood and mounted in the interior thereof such that one of said hood antennas is in coupled relationship with one of said fuze sending antennas and the other of said hood antennas is in coupled relationship to one of said fuze receiving antennas, the interior of said hood being divided into a plurality of compartments equal in number to the number of fuze antennas, each compartment surrounding one of the fuze antennas,

the hood antennas being mounted within two of said compartments.

2. The device set forth in claim 1 wherein those compartments not having hood antennas mounted therein are lined with microwave absorbing material, and the edges of said plurality of compartments are provided with conductive strips which are adapted to be flush with the

surface of said fuze when the fuze is secured in place by said securing means.

References Cited in the file of this patent

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