July 30, 1957 H. C. BOOTH 2,801,392

MICROWAVE SWITCHING AND ATTENUATOR DEVICE

Filed Sept. 4, 1956

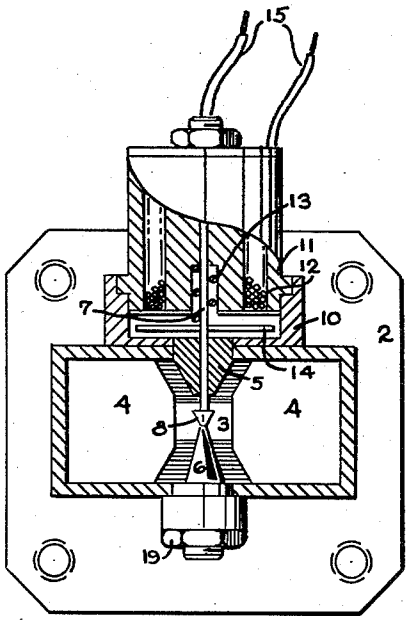


FIG. 1

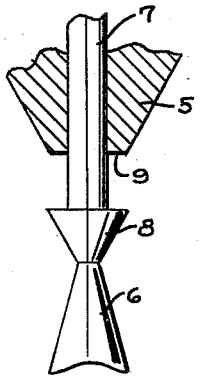


FIG. 2

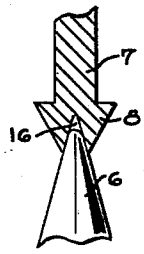


FIG. 3

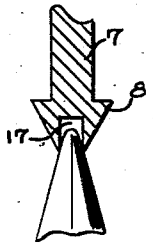


FIG. 4

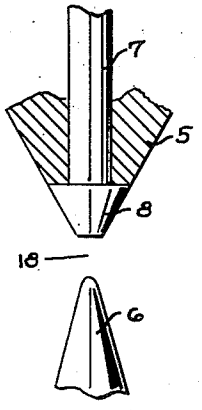


FIG. 5

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MICROWAVE SWITCHING AND ATTENUATOR DEVICE

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1 Claim. (Cl. 333—13)

The present invention relates to microwave switching and attenuator devices and more particularly to an improved attenuating element for such devices.

Devices of the character employing the improvement of my invention are commonly employed in microwave radar systems to serve in a dual protective role. First, when the system is operative, transmitting high power pulses to a common antenna, a high frequency electrical discharge disrupts the continuity of the waveguide circuit and presents a high impedance to prevent passage of electromagnetic energy to the receiver. Low power received energy will be permitted to pass to the receiving apparatus without interruption due to the resonant condition then prevailing. Second, under non-operative conditions when the normal protection first mentioned above is not available, spurious or stray radiation from adjacent systems may be blocked from the receiver by an electromechanically controlled attenuator mechanism mounted within the device. Examples of several illustrative embodiments are shown in U. S. Patent 2,734,171, issued February 7, 1956, to Harold Heins and assigned to the assignee of the present invention.

My invention has for its principal object the provision of an improved attenuating element for such devices.

A further object is to provide an attenuating element for such devices which incorporates a component of the resonant discharge gap electrode system in a unitary structure to facilitate ease of assembly and enhance performance characteristics.

The objects, features, and advantages of the invention will be readily understood after consideration of the following detailed specification and reference to the accompanying drawings in which:

Fig. 1 is a detailed cross-sectional view of the illustrative embodiment;

Fig. 2 is an enlarged fragmentary view of the attenuator-electrode structure of the embodiment in the closed position;

Figs. 3 and 4 are enlarged fragmentary views illustrating the internal structure of the improved attenuator-electrode member; and

Fig. 5 is a view of the illustrative embodiment shown in Fig. 2 in the open position.

Referring now to the drawings, Fig. 1 shows the illustrative embodiment which comprises a section of waveguide 1 of rectangular cross-section with a mounting flange 2 disposed at the ends thereof. A centrally disposed window member 3 permits passage through the device of the electromagnetic energy and completes the overall tube envelope structure which is filled with an ionizable gaseous atmosphere under reduced pressure. Spaced at quarter wavelength intervals in the manner well known in the art are a plurality of spaced metallic vane members 4 defining therebetween a resonant iris.

In conventional gaseous discharge switching tube construction, an opposed pair of spaced resonant discharge gap electrodes of a conical configuration are disposed

within each iris to complete the resonant circuit. According to the teachings of my invention, I provide a conical electrode 6 which is axially adjustable by means of nut 19. Opposed to this electrode is a cone base member 5 secured to the top wall of waveguide 1. This member is provided with tapered side walls and a substantially blunt end defining a flat surface 9 shown in enlarged detail in Fig. 2.

The attenuator-electrode member of my invention comprises a conductive rod or plunger 7 disposed within an axial passageway in base member 5 with an enlarged conical tip portion 8 which engages the opposed electrode 6 in the closed position. It will be noted that the configuration of tip 8 is such that when the attenuating rod 7 is withdrawn, a substantially conical electrode is now formed together with base member 5. The diameter of tip portion 8 will be larger than the diameter of the passageway. Prior art attenuating elements for the illustrative embodiment generally comprise only a rod element extending axially within a conical electrode while my improvement incorporates the movement of the entire cone tip portion along with the attenuating element. Hence in the open position as shown in Fig. 5 a discharge gap 18 is now defined between tip 8 and cone 6 to restore the resonant circuit condition.

The removing electromechanical mechanism follows the teachings of the aforementioned patent and will only be briefly described in the present invention. Metal collar 10 hermetically sealed to the top wall of waveguide section 1 supports the electromagnet or solenoid 11 having a plurality of turns of wire 12 surrounding a metallic core. Spring 13 rests against armature 14 secured to rod 7 and the tension of this spring will be overcome when the electromagnet is energized by connection of leads 15 to an appropriate circuit.

To assure proper seating of the cone tip 8 in contacting electrode 6, it may be desirable to provide a substantially V-shaped bore 16 as shown in Fig. 3. In some instances wherein electrode 6 is provided with a blunt tip portion, a substantially U-shaped bore 17 will suffice as shown in Fig. 4.

The complete embodiment will incomporate such components as a keep-alive or ignitor electrode and an exhaust tubulation which have been omitted to point out only the principal features of the invention. Further, the improved attenuator-electrode structure may be incorporated in the many variations of microwave switching and attenuating devices.

According to the teachings of the invention frequent problems in assembly, such as binding of the rod element within the prior art cone electrode structure are eliminated. Furthermore, the introduction of a large metallic mass presented by tip 8 will enhance performance by increasing the amount of attenuation in the gap when the mechanism is in closed position.

What is claimed is:

In a microwave switching and attenuator device comprising a hermetically sealed waveguide envelope filled with an ionizable atmosphere, composite resonant circuit and discharge gap structure disposed within said envelope, attenuating means associated with said discharge gap and electromechanical means mounted on said envelope to control said attenuating means, a combined attenuating element and discharge gap electrode member comprising a cone base member secured to the top wall of said envelope, said base member having a substantially blunt end defining a flat surface, tapered side walls and an axial passageway extending therethrough, a conductive member slidably disposed within said passageway terminating at its inner end in a conical tip portion having an upper wall of

larger diameter than the diameter of said passageway, said conical tip portion mating with the flat surface of said base member to define a substantially conical electrode when said conductive member is moved upwardly by said electromechanical means, an oppositely disposed conical

electrode positioned in the lower wall of said envelope to define a resonant discharge gap when conical tip portion is in contact with said base member.

No references cited.