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WAVE-GUIDE VALVE

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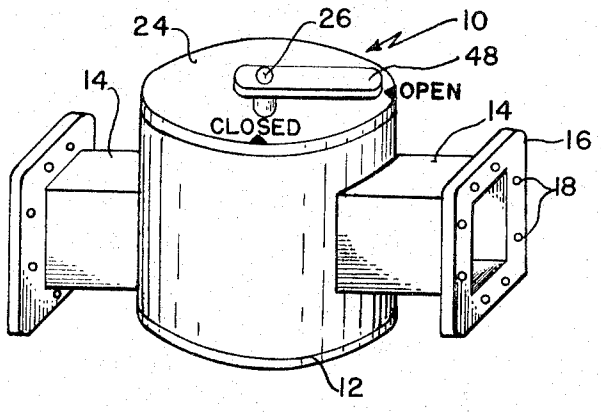


FIG. 1

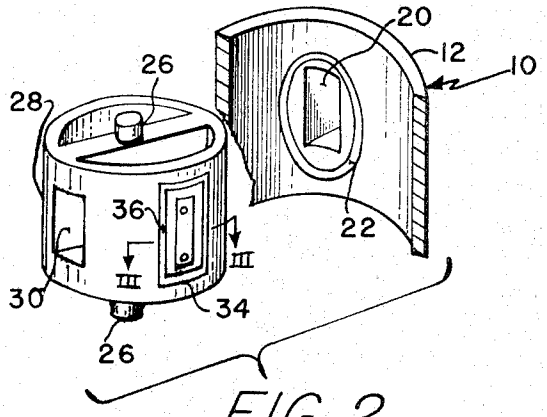


FIG. 2

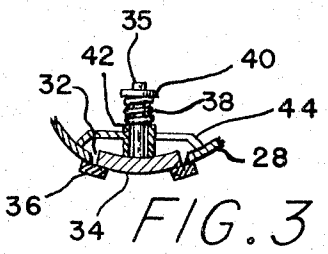


FIG. 3

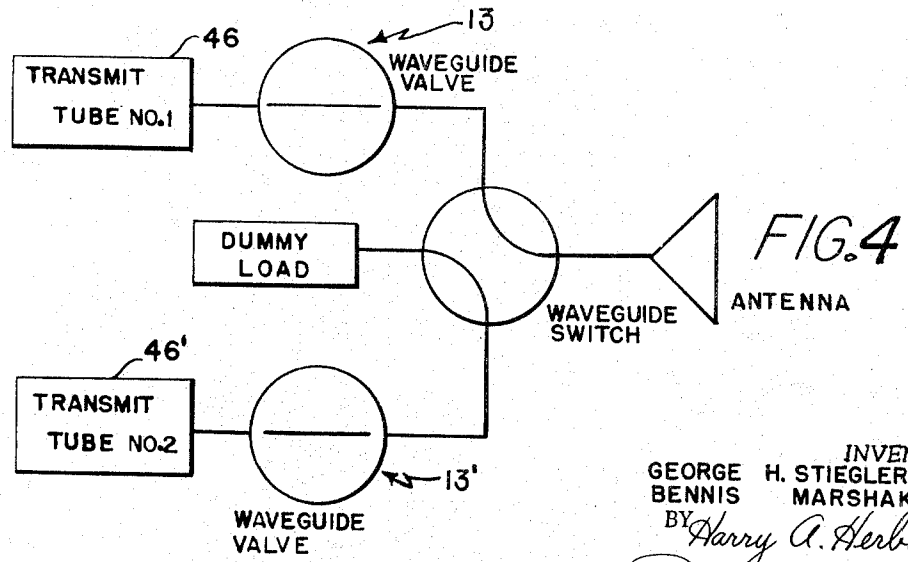


FIG. 4

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WAVEGUIDE VALVE

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ABSTRACT OF THE DISCLOSURE

A waveguide tube is isolated, pressurewise, from a system to make possible its removal without depressurization of the system and loss of pressurizing gas and further without interruption of the high power energy of the transmission line.

The invention relates to a waveguide valve and more particularly to an automatically actuated cut off valve, responsive to pressure drop, useful in making replacements in pressurized waveguides.

Microwave tubes have advanced to the point where they can generate more power than transmission lines can handle. One way of getting around this deficiency is to use pressurized dry air inside the waveguide. As a rule of thumb, the power handling capabilities of the line increase roughly with the 1.8 power of the pressure ratio. Substantial power increases thus call for substantial pressure increases and lead to many mechanical problems. Also experimental data indicates after certain pressure increases, we reach a saturation level with no appreciable power handling capability with increased pressure. A better method appears to be the use of a gaseous dielectric that could stand the electric stress applied at lower pressures. Several such gases are known and have been applied. Sulfur hexafluoride (SF_6) is the most widely used. It has excellent characteristics for a transmission line dielectric: high dielectric strength, stable properties, inertness, ability to extinguish arcs in a fraction of time required by air, etc. Its major drawback is its expense. In the course of operating a radar equipment or any other high power R.F. device, it is required that the waveguide be broken to replace the transmit tube with the subsequent loss of all the gas. This, as explained previously, is expensive and in practice several times the initial volume is lost for the waveguide must be purged several times to assure that all the air is removed from the line. The problem is to place a device in the line which will seal off the gas but also be compatible in the transmission of high power R.F. energy.

The object of the present invention is the provision of such a device.

In a system where there are two transmitters feeding an antenna through a waveguide switch with one transmitter in standby, as is shown in the diagram in FIGURE 4 of the drawing, a device of this type is also necessary whether the pressurization is air or SF_6. The waveguide switch only electrically isolates the transmitters. The invention provides means for isolating, pressure wise, a tube during the process of its replacement, so that costly materials and pressure are not dissipated in the replacement process. Hence, without such a device, when it becomes necessary to replace a tube in either transmitter, both transmitters must be shut down, substantially negating the advantage of the standby transmitter. In a system such as the FPS–27, for which the device was developed, both conditions warranting this device exist; pressurization with an expensive gas such as (SF_6) and a standby transmitter. It might be argued that such a device already exists in the form of pressure windows, such as at the

output of the transmit tube. The disadvantages with pressure windows in high power systems are: they are expensive, have relatively high VSWR, large insertion loss, as much as 10% of the transmit power or more, and the need for water cooling.

Other advantages, features and objects of the invention will become more apparent from the following description taken in connection with the illustrative embodiments in the accompanying drawings, wherein:

FIGURE 1 is a perspective view of an assembled waveguide valve;

FIGURE 2 is an exploded fragmentary perspective view showing the drum and a portion of the waveguide housing;

FIGURE 3 is a sectional view of the seal plate, taken substantially on the line 3—3 of FIGURE 2; and

FIGURE 4 is a diagrammatic view showing a pair of waveguide valves for alternate use in case of damage to either of the transmitter tubes shown.

Referring in detail to the drawing, the wave guide valve is indicated generally by the numeral **10**. A housing **12** is rigidly mounted on a pair of waveguide conduits **14** which are secured into the waveguide circuit by any suitable means. The means shown are flanges **16** and bolts **18**. The housing is a hollow drum-like structure provided with a pair of diametrically opposed inlet and outlet ports **20** for communicating with the waveguide conduits **14**. Choke elements **22** are provided at inlet and outlet ports **20**. The housing **12** is also provided with top and bottom heads **24** having centrally located journal openings for receiving the axle studs **26** of a rotor member **28**, capable of 90° rotation.

A passage **30** through the rotor **26** is of waveguide size, which, in open position aligns with the choke grooves **22** in the housing and completes an RF transmission line with a low VSWR and low insertion loss. See FIGURE 2.

As can also be seen from FIGURE 2, the rotor **28** has a recess **32** cut in its periphery 90° away from the axis of the waveguide passage **30**.

A seal plate **34**, which functions as a valve head is mounted on a pin **35** and fits into the recess **32**. The dimensions of the seal plate **34** are slightly larger than the opening **20** in the housing **12**. The plate **34** is provided with a sealing means, such as a soft rubber gasket **36** which is capable of seating on the opening **20** when the pressure inside the drum **28** pushes it outward, as will be the case while replacements are being made in the line. Normally, however, the plate or valve head **34** is maintained in the position shown in FIGURE 3 by the bias of the spring **38** which is seated between a collar **40** on the pin **35**, and the top of a sleeve **42**. A spider **44** holds the sleeve **42** immovable with respect to the rotor **28** while allowing the pin **35**, functioning as a valve stem, to slide within the sleeve **42**.

In its biased position the plate **34** clears the inner surface of the wall of the housing **10** by a clearance sufficient to allow the rotor to be rotated to place the seal plate **34** at the opening **20**.

In the normal operation when the entire system is pressurized, the drum or rotor is turned to the position marked "open," FIGURE 1, the valve is biased to open position, and the wave guide transmission line is intact. For the manual means for turning the rotor to "closed" position so that the valve may close the waveguide conduit, automatic means may also be employed.

In FIGURE 4, a pair of transmission tubes **13** and **13'** are incorporated in a working waveguide transmission line. Each waveguide is connected in series relationship to transmit tubes **46** and **46'**. In the event that a tube, say tube **46**, needs to be replaced, the rotor is turned 90° by expedient means such as the manual handle **48**, to closed position. The seal plate **34** is now adjacent the

waveguide opening **20**. When the transmit tube **46** is removed, a differential in pressure is created by the escaping gas, the lower pressure being on the housing side of the seal plate. The seal plate is sucked into the opening **20** and all of the waveguide line connection to tube **46** is sealed off. When the tube is replaced that portion of the line between the tube and the valve is repressurized and the valve is ready to be opened. Naturally, the appropriate interlocks are incorporated to prevent firing the tube when the valve is closed.

Although the invention has been described with reference to a particular embodiment, it will be understood to those skilled in the art that the invention is capable of a variety of alternative embodiments within the spirit and scope of the appended claims.

We claim:

1. A waveguide valve comprising a cylindrical housing insertable in a waveguide conduit, said housing having openings therein for permitting uninterrupted wave transmission, one of said openings functioning as a valve seat, means located within said housing for closing one of said openings to close said conduit, said means comprising a drum concentric with said housing and axially rotatable therein, said drum being provided with openings placed an angular distance from each other in said drum and capable of communicating with the openings in said housing to provide an uninterrupted conduit, a recess in said drum located an angular distance from said openings, means for rotating said drum to place said recess in a position adjacent said valve seat, a plate operating as a valve head resiliently secured to said drum and adapted under diminution of pressure in said conduit to seat upon said valve seat and close said conduit.

2. A waveguide valve comprising a cylindrical housing, having a pair of diametrically opposed openings, said openings being capable of communication with a waveguide conduit, a drum mounted inside said cylindrical housing concentric therewith, and rotatable with respect thereto about an axis perpendicular to the flow of the gas in the conduit, diametrically opposed openings in said drum capable of communicating with said first named openings in said housing to provide a continuous flow conduit, said drum being provided with an additional opening, a recess in said drum, a valve head plate located in said recess and movable radially with respect thereto to close one of the openings in said cylindrical housing to close said waveguide conduit, means for biasing said valve head away from said conduit guide opening.

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