Dec. 28, 1943. E. G. LINDER 2,337,612

INDICATOR

Original Filed June 25, 1940

FIG. 1.

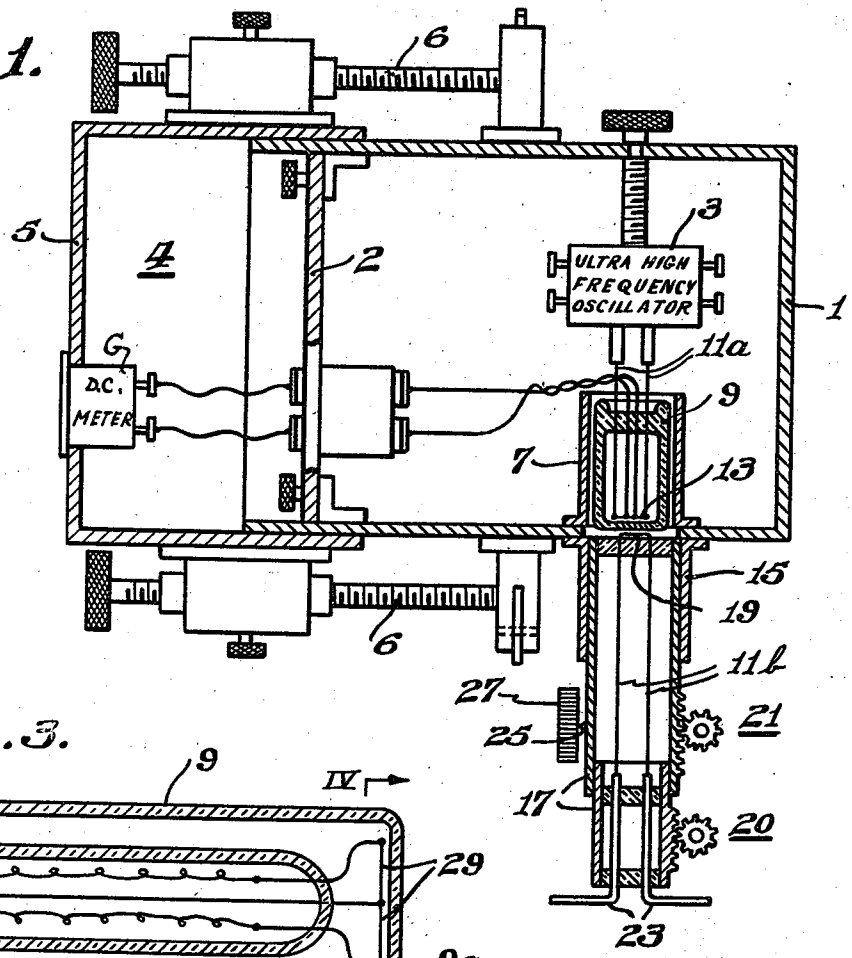


FIG. 3.

FIG. 4.

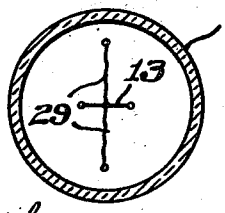
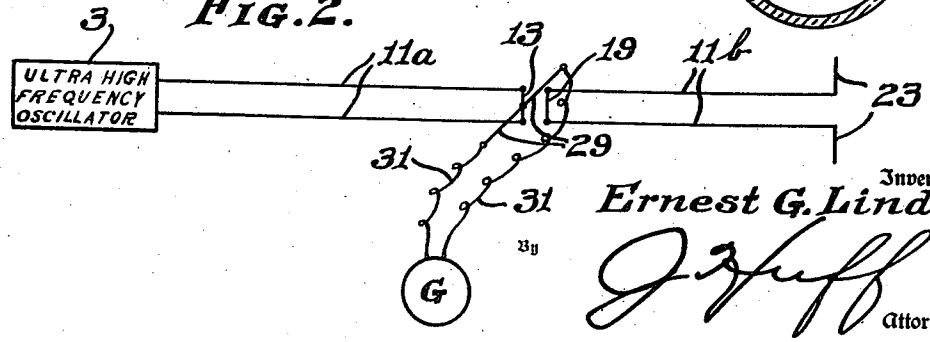


FIG. 2.



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Patented Dec. 28, 1943 2,337,612

UNITED STATES PATENT OFFICE

2,337,612

INDICATOR

Ernest G. Linder, Philadelphia, Pa., assignor to Radio Corporation of America, a corporation of Delaware

Original application June 25, 1940, Serial No. 342,236, now Patent No. 2,296,678, dated September 22, 1942. Divided and this application June 30, 1941, Serial No. 400,488

5 Claims. (Cl. 250—36)

This invention relates to indicators, and more particularly to electric indicators especially useful in connection with short wave circuits, the present application being a division of my copending application, Serial No. 342,236, filed June 25, 1940, now Patent No. 2,296,678, granted September 22, 1942.

In my aforesaid copending application, I have disclosed an improved microwave signal generator to which is coupled a tunable transmission line, and the primary object of my present invention is to provide an improved measuring device especially suited for use with short wave circuits of this type to indicate power, current, etc.

Another object of my present invention is to provide an improved measuring device as aforesaid which is simple in construction and highly efficient in use.

In accordance with this invention, I provide a multi-section, ultra high frequency transmission line one section of which is terminated by a heater to which the junction of a thermocouple is connected. This heater not only acts as a heater for the thermocouple, but also as a coupling element to a second section of the transmission line, the latter terminating in a suitable antenna or other load. Preferably, the thermocouple is positioned at right angles to the heater to minimize induced currents and it may be connected to a galvanometer or other suitable indicating instrument. The heater and thermocouple are arranged in an evacuated glass container or envelope having a plane end, the heater being placed parallel to and as close to this end of the envelope as possible in order to permit close coupling between the sections of the line or to any other suitable external circuit.

The novel features that I consider characteristic of my invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and method of operation, as well as additional objects and advantages thereof, will best be understood from the following description of one embodiment thereof, when read in connection with the accompanying drawing in which

Figure 1 is a view, partly in section, showing an ultra high frequency system embodying my present invention,

Figure 2 is a circuit diagram showing, in detail, the relation between the heater and the thermocouple, on the one hand, and the sections of the transmission line on the other hand.

Figure 3 is a longitudinal section of a vacuum tube constructed according to my present invention, and

Figure 4 is a sectional view taken on the line IV—IV of Figure 3.

Referring more particularly to the drawing, wherein similar reference characters designate corresponding parts throughout, there is shown, in Figure 1, a shielding container 1, such as a metallic box, within which is mounted a source 3 of high frequency energy, such as a magnetron oscillator, the box or container having a removable end portion or wall 2 beyond which is a shielding compartment 4 in which the wall 2 is enclosed. A telescoping closure 5 is adjustable on the box 1 by means of the screws 6 to adjust the shielding compartment 4 to minimize standing waves therein, all as more fully set forth in my above identified copending application.

Mounted within the shielding box is a shielding cylinder 7 within which is located an evacuated glass envelope 9, the envelope 9 containing a pair of conductors 11*a* constituting one section of a transmission line connected to the oscillator 3 and terminating in a heater element 13 which constitutes a terminating impedance therefor (see Figure 2). On the outside of the box 1 is a shielding can or the like 15 which carries telescoping shielding cylinders 17 within which the conductors 11*b* constituting a second section of the transmission line are carried, the inner end of the line section 11*b* being terminated by a short conductor 19. The line sections 11*a* and 11*b* constitute a tunable transmission line which may be tuned to resonance by means of a rack and gear arrangement 20, and the entire line may be moved by a rack and gear 21 to vary the output delivered to a dipole antenna 23 or other suitable load. The attenuation ratio is indicated by a pointer 25 and a scale 27. The conductor 19 is disposed parallel to the heater 13, and the heater 13 is arranged in parallel relation with and as close to the flat or plane end 9*a* of the envelope 9 as possible so that close coupling may be obtained between the line sections 11*a* and 11*b*.

A thermocouple 29 is mounted in the envelope 9 preferably at right angles to the heater 13 to minimize induced currents, the thermocouple 29 being secured to the mid-point of the heater 13 in any suitable manner. A pair of conductors 31 connect the free ends of the thermocouple 29 to a suitable D. C. meter, such as a galvanometer G, which may be mounted on the closure 5 and which indicates the current set up in the thermocouple by the heater 13. Thus, the heater 13

acts not only as a heater for the thermocouple 29, but also to couple the line section 11*a* to the line section 11*b* in cooperation with the conductor 19.

From the foregoing description, it will be apparent to those skilled in the art that I have provided an improved indicator which is especially suited for use in connection with short wave circuits. Although I have shown and described but one embodiment of my invention, it will be apparent to those skilled in the art that many variations therein, as well as other modifications, are possible. I therefore desire that my invention shall not be limited except insofar as is made necessary by the prior art and by the spirit of the appended claims.

I claim as my invention:

1. A vacuum thermocouple mounted in an evacuated container having a substantially plane end, said thermocouple having a heater element parallel to and so closely adjacent to said plane end that said element may be disposed in sufficiently close proximity to another conductive element outside of said container for close coupling thereto.

2. In combination, an evacuated envelope having a substantially plane end, a heater element within said envelope parallel to said plane end and in such close proximity thereto that said element may be disposed in sufficiently close proximity to another conductive element outside of said envelope for close coupling thereto, and a thermocouple within said envelope also parallel with said plane end, said thermocouple extending at right angles to said heater element and being secured to said heater element.

3. In a radio device, a thermocouple having a heater element and a thermal junction element, a source of radio frequency energy, a transmission line terminated at one end by said heater element and coupled to said source at the other end, a second transmission line coupled to said heater element, and indicating means connected to said thermal junction element for indicating the radio frequency current at the coupling point of said lines.

4. In an ultra high frequency generator, a source of radio frequency energy, a transmission line coupled to said source, a thermocouple having a heater element, said element constituting a terminating impedance for said line, a second transmission line coupled to said heater element, and means for adjusting the relative positions of said element and said second line to vary the coupling therebetween.

5. In an ultra high frequency signal generator, a source of oscillations, a shielding container for said source, said container having a removable end portion, a shielding compartment enclosing said end portion, means for adjusting said shielding compartment to minimize standing waves therein, a transmission line coupled to said source, a thermocouple having a heater element and a thermal junction element, said heater element being connected to the end of said line and constituting the terminating impedance thereof, a second transmission line coupled to said heater element for deriving output currents from said source, and indicating means mounted in said shielding compartment and connected to said thermal junction element.

ERNEST G. LINDER.