June 28, 1949. J. M. VAN BEUREN 2,474,795

ATTENUATOR FOR HIGH-FREQUENCY PICKUP DEVICES

Original Filed Jan. 17, 1944

Fig. 1.

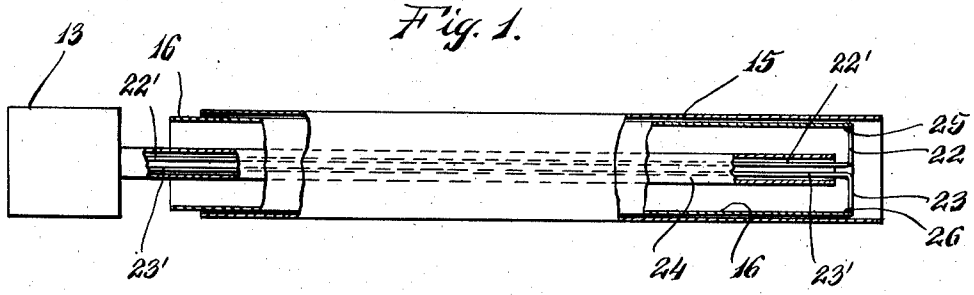


Fig. 2.

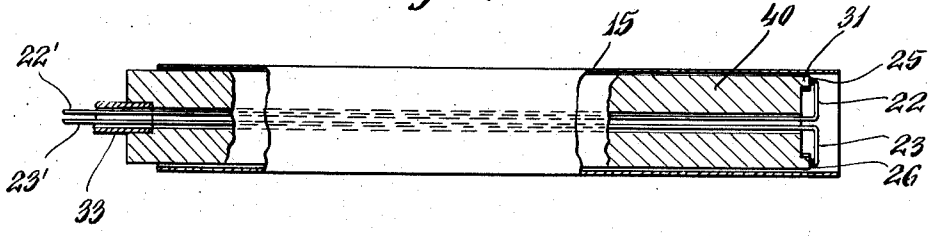


Fig. 3.

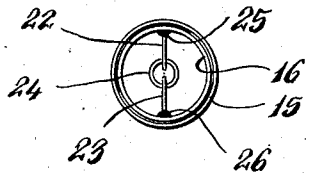


Fig. 4.

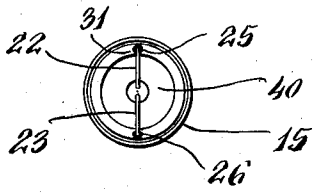
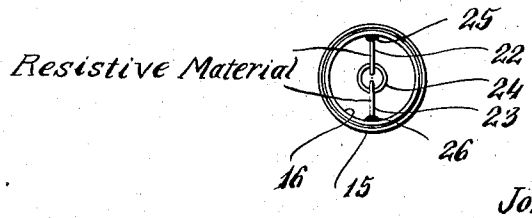


Fig. 5.



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ATTENUATOR FOR HIGH-FREQUENCY PICKUP DEVICES

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6 Claims. (Cl. 178—44)

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This invention relates to an attenuator, especially a type of attenuator employed in picking up radio frequency energy from a field.

This application is a division of my co-pending application, Serial No. 518,645, filed January 17, 1944.

One purpose of this invention is to provide an attenuator which can readily be used in making measurements, for example in connection with signal generators, noise meters and the like. However, this invention is equally applicable to devices for attenuation control in many other types of radio and audio frequency measurement.

Another purpose of this invention is to provide an attenuator in which the pickup circuit and transmission line connecting this pickup circuit with the indicating device are of relatively low impedance and consequently display relatively high efficiency. Actual measurements with this device have shown an increase in efficiency of from 100 to 200 per cent, over devices of types hitherto employed in the art.

Reference is now made to the accompanying drawing, where:

Fig. 1 represents partly in longitudinal section, one embodiment of an attenuator constructed in accordance with the present invention.

Fig. 2 represents, likewise partly in longitudinal section, an alternative form of attenuator according to this invention.

Fig. 3 is an end elevation, taken at the pickup end of the attenuator shown in Fig. 1.

Fig. 4 is an end elevation, taken at the pickup end of the attenuator shown in Fig. 2.

Fig. 5 is an end elevation of a modified form of the attenuator shown in Fig. 1.

Referring now to Fig. 1, there is here shown an outer shielding tube 15. Within tube 15 there is arranged a second metallic tube 16, which is of such diameter, compared with tube 15, as easily to slide therewithin. While tube 16 is illustrated as being in contact with tube 15, such contact is not essential and any suitable mechanical device may be employed to facilitate the sliding of one tube within the other.

Referring now to both Figs. 1 and 3, there are here shown two conductors 22 and 23 extending, at the active end of tube 16, from points 25 and 26, diametrically opposite upon the periphery of the tube. These conductors are turned longitudinally inward when they approach sufficiently close to one another at a point along the axis of tube 16 and constitute a transmission line 22', 23' of the parallel conductor type. Of course such transmission line may likewise be supplied

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with any suitable shielding, such as indicated by the tube 24. Any suitable indicating device 13 is connected to the rear ends of the conductors 22' and 23'.

In using the above described form of attenuator, it is preferred that it be so placed that the pickup conductors, 22 and 23, in Fig. 1, shall be transverse to the electro-magnetic field in which the attenuator is placed. However, it may be found possible under some conditions to employ attenuators according to this invention with fields which are not transverse to the pickup conductors.

The action of the pickup conductors 22 and 23 is to form a single low impedance loop by their connection with tube 16. Since tube 16 may be formed of a material having low resistance, and since the effective cross-section of tube 16 may be made comparatively great, it will be seen that the loop thus formed will present low impedance, compared with the conventional type of loop.

As will be apparent to one skilled in the art, the form of attenuator shown in Figs. 1 and 3 is suited especially for connection to a balanced type of indicating or measuring instrument, where both input terminals are balanced with respect to the ground.

For certain applications, the efficiency of the above-described form of attenuator may be increased by using a resistance element as a line termination at the pickup end, such as two resistors in lieu of the end portions, conductors 22 and 23 in Figs. 1 and 3. Such resistors will usually be chosen so as to present a total resistance suitable as a terminating resistance for the surge impedance of the transmission line connected to such resistors.

Fig. 5 shows pickup conductors 22 and 23 made of high resistance material, so as to afford the total desired terminating resistance. In this form, such resistors act simultaneously as terminating resistances and as pickup elements.

While I have described sliding element 16 as a tube, it can be seen that the interior space thereof not occupied by the various conductors and shields performs no useful functions and therefore this space may be filled with the material of which the tube is composed. Under these conditions, there will no longer be any need for the additional shielding tubes enclosing the transmission lines, such as tube 24 in Fig. 1, since element 16 will then act as sufficient shield.

In practice, a solid rod may have a longitudinal hole extending therethrough and corresponding in position and extent to the interior bore of tube 24, for example. In the case of the

form of Figs. 1 and 3, the hole would be located along the central axis of such solid rod.

In Figs. 2 and 4 is shown an alternative form of my attenuator, using a solid rod, acting in the manner just described. The peripheral portion 31 of rod 40 corresponds to the inner tube 16 of the form of Figure 1. Pickup conductors 22 and 23 are connected thereto at opposite points 25 and 26 by any suitable means, such as solder. As just explained, only that portion of the space between the peripheral portion and the central portion which is not occupied by conductors may be filled in by metal. Therefore the portion of the rod between the periphery and the center must allow room for conductors 22 and 23.

At the rear end, rod 40 may be provided with a tubular extension 33, shielding the transmission lines, until they enter indicator 13, or a separate shielding member may be employed in lieu of this extension.

While I have illustrated my invention by the description of certain examples thereof and certain applications, such illustrations are not exclusive, and the scope of my invention is only limited by the hereunto appended claims, since many modifications and adaptations will be apparent to those skilled in the art.

I claim:

1. Electrical attenuator including a plurality of concentric conducting tubes, one sliding closely within the other, two pickup conductors extending substantially wholly radially at least partly across one end of the inner one of said tubes, each of said conductors having the peripherally located extremity thereof electrically connected to a predetermined point upon the periphery of said inner tube, the two points thus established being substantially 180° apart, and having the other extremity thereof bent substantially through 90 degrees and extending as a transmission line longitudinally of said inner tube, emerging from the other end of said tube and connected to a measuring device, whereby the active portions of said pickup conductors do not materially exceed in length the minimum distance between said transmission line and said inner tube, and do not project a substantial distance beyond the end of said inner tube.

2. Electrical attenuator including two conducting tubes, one sliding within the other, a shielded parallel 2-wire transmission line extending along the common axis of both said tubes, for connection to a measuring device at the end of said transmission line extending beyond the ends of said tubes, and two pickup conductors, respectively extending substantially radially, one from the other end of each conductor of said transmission line to a point upon the periphery of the inner one of said tubes, the points of connection of said respective pickup conductors to said inner tube being located substantially 180 degrees apart.

3. Electrical attenuator including an outer conducting tube and a conducting rod slidable therewithin, said rod having a longitudinal hole extending therethrough, substantially along the axis thereof, two transmission conductors extending through said longitudinal hole and bent substantially 90° so as to extend radially at the active end of each conductor and being connected to said rod at points substantially 180° apart, the other ends of both conductors extending beyond the rear of the attenuator so as to be connected to a measuring device, whereby said rod functions as the outer shielding conductor of a shielded transmission line, and whereby such bent over portions of said two conductors function as pickup elements.

4. Attenuator according to claim 1, in which the radially extending portion of each pickup conductor includes a terminating resistor proportioned to one half the surge impedance of the transmission line constituted by the longitudinally extending portions of both said conductors, whereby transmission efficiency is increased, and whereby said resistor functions simultaneously as at least a portion of the pickup conductor.

5. Electrical attenuator including an outer metallic tube, a cylindrical metallic body slidable therewithin and having a centrally located axial bore therealong, a twin conductor transmission line extending through said bore, means for connecting the rear end of said line to an indicating device, and two pickup elements, located substantially at the front end of said body, connected respectively to points 180° apart upon said front end of said body and respectively to the front end of each conductor of said line, and projecting beyond said front end of said body only sufficiently to be insulated from intermediate portions thereof.

6. Electrical attenuator according to claim 5, in which said pickup elements are each formed of resistive material, so as to function simultaneously as pickup elements and as line terminating resistors.

JOHN M. VAN BEUREN.

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The following references are of record in the file of this patent:

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