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VOLTAGE INDICATOR

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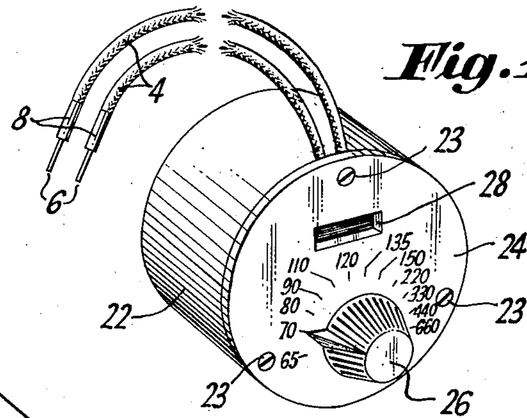


Fig.1

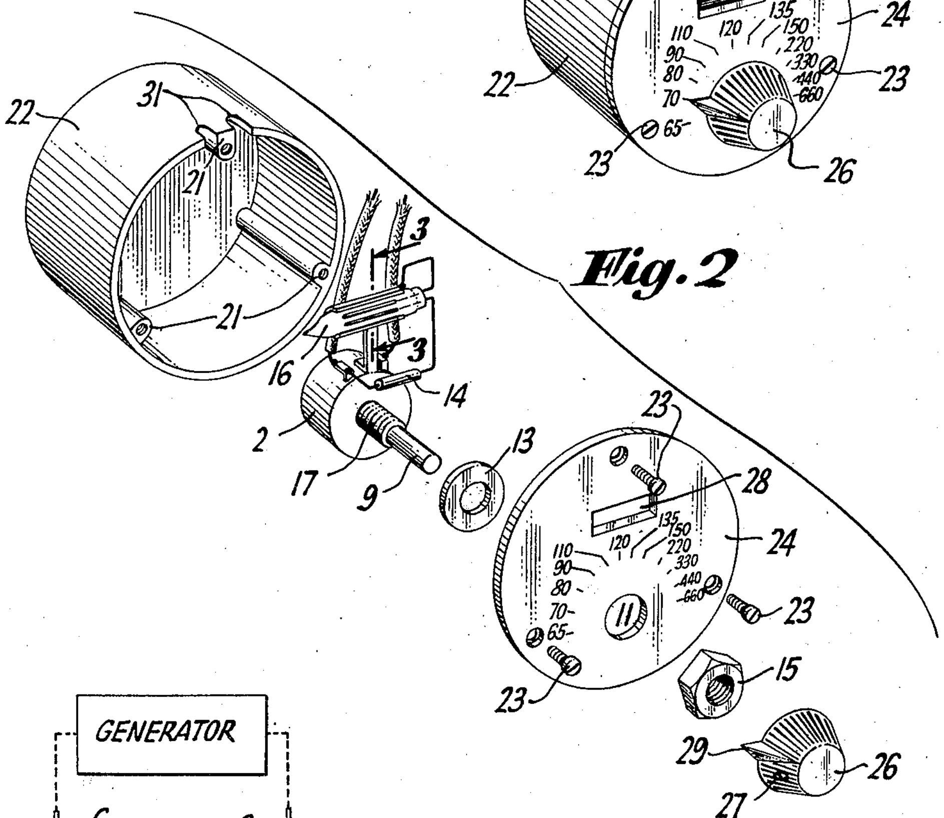


Fig.2

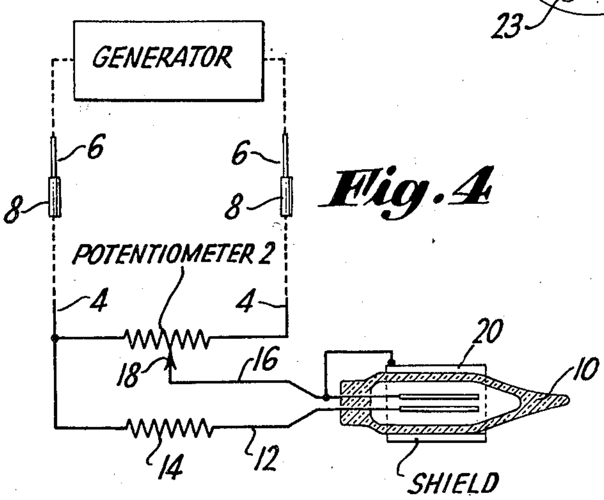
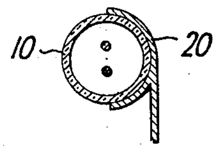


Fig.4

Fig.3



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VOLTAGE INDICATOR

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1 Claim. (Cl. 324—98)

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The present invention comprises a voltage indicator device which is characterized by the following highly desirable advantages: It is relatively inexpensive and simple to manufacture, rugged, compact, light-weight, capable of indicating an extremely wide range of commercial voltages (both alternating current and direct current) with a moderate degree of accuracy, and is a highly practical and versatile tool which can be inserted into the vest pocket of a user.

An important aspect of the voltage indicator of the invention is the mechanical configuration and engineering design which makes the device extremely simple to manufacture and assemble, and enables the device to withstand hard usage, both physical and electrical, without any effect on its ability to perform satisfactorily.

A detailed description of the invention follows, in conjunction with a drawing, wherein:

Fig. 1 illustrates a perspective view of the voltage indicator device of the invention, as seen from the front;

Fig. 2 is an exploded view of the device of Fig. 1 showing the component parts which go to make up the voltage indicator, in their order of assemblage;

Fig. 3 is a cross-section of the glow tube and shield taken along the line 3—3 of Fig. 1; and

Fig. 4 shows the circuit diagram of the voltage indicator device of the invention.

The same parts in the drawing are represented by the same reference numerals throughout the figures.

An understanding of the electrical principles employed in the voltage indicator device of the invention may be had by first referring to the schematic circuit diagram of Fig. 4, in which a potentiometer 2 is shown with its terminals connected to insulation covered test leads 4 adapted to be connected to a source of voltage to be measured. Such a source may be alternating current or direct current and is represented by the box labeled "generator." To simplify connections to the generator, the leads 4 are provided at the ends with metal prongs 6 extending into fibre or rigid plastic sleeves 8. A glow lamp 10 comprising a pair of parallel electrodes positioned in a glass envelope has one electrode connected by way of lead 12 to one terminal of the potentiometer through a current limiting resistor 14, and its other electrode connected by way of lead 16 to a tap 18 on the potentiometer. The glow lamp may contain any suitable inert gas, such as neon or argon, and is adapted to light up whenever the leads 4 are connected across a source of potential difference of suitable value to cause a breakdown of the gas in the tube. A feature of the invention

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is the U-shaped metallic shield 20 which surrounds the rear half of the glow lamp 10 and is connected to lead 16 and one terminal of the lamp, and serves to minimize the effect of electrostatic fields caused by the presence of other bodies in the general vicinity of the lamp.

In the operation of the system of Fig. 4, the tap 18 is moved along the potentiometer 2 until the lamp glows. This indicates that the potential difference between leads 16 and 12 exceeds the firing or breakdown voltage of the glow lamp. As described hereinafter, the tap 18, at the start of operation, is at a point of maximum potential difference between test leads 4, in which case the glow lamp 10 lights up immediately upon connecting the leads 4 to the voltage source. By adjusting the tap 18 to a critical point at which the lamp 10 extinguishes, there is found the voltage which is just below the firing voltage of the glow lamp, and this is a function of the voltage of the generator. A calibrated scale on the potentiometer enables the voltage of the generator to be read directly from the instrument at a critical point corresponding to the location at which the glow lamp extinguishes.

Fig. 1 shows the meter of the invention ready for use. The potentiometer and glow lamp are encased within a circular housing 22 of insulating material, such as Bakelite, having a cover plate 24 also of insulating material, such as Bakelite. Cover plate 24 is provided with a window 28 through which the glow lamp is seen, and with a calibrated scale having line markings from 65 to 660 representing voltges. The cover plate 24 is secured to spaced shoulders 21 on the housing 22, underneath the plate 24, by means of screws 23. A pair of spaced slots 31 at the top of the insulating housing on opposite sides of one shoulder 21 enables egress of the insulated covered test leads 4. This shoulder 21 gives strength to that portion of the housing between the slots 31, and prevents any tendency of the housing to break under pressure or strain placed on the leads 4. Moreover, the leads 4 extend downward at right angles to the main portion of the leads at the points of entry into the housing, thus preventing movement of that portion of the leads within the housing. This is an important feature of the invention. A rotatable knob 26 is secured to the rotatable metallic shaft 9 of the potentiometer by a recessed screw 27 (note Fig. 2). Shaft 9 of the potentiometer 10 is adapted to pass through a hole 11 in the insulating cover plate. The knob 26 is made of insulating material and has a pointer 29 for indicating the precise marking on the scale at which the glow lamp extinguishes. From a practical standpoint, it is preferred that the cover plate 24 and knob 26 have contrasting colors to enable easy reading of the scale. As an example, the cover plate 22 may be black, the line markings and scale readings 65–600 white, and the knob 26 with its pointer 29 also white. For ease in reading both A.-C. and D.-C. voltages, it is preferred that the insulation covering on the two test leads 4 have different colors, let us say for example, red and black for different leads.

The simplicity of the meter device of the invention, as exemplified by the few components employed and the ease of assemblage, will be apparent from an inspection of the exploded view of Fig. 2. The glow lamp 16 is mounted above on the periphery of the potentiometer, and secured thereto solely by virtue of the soldered connections from its electrodes to the potentiometer. A physically small limiting resistor 14 is positioned below the glow lamp, as shown. A suitable washer 13, metallic or insulating, serves to properly space the cover plate 24 from the potentiometer and glow lamp. A threaded locknut 15 which engages the threads of a bushing 17 surrounding the shaft 9, firmly holds the potentiometer to the underside of cover plate 24.

To obtain a moderate degree of accuracy in the meter of the invention, let us say, a reproducibility of the extinguishing voltage to about ±1 volt, the glow lamps are carefully selected and aged. I have found that there is a residual variation due to changes in the potential distribution over the surface of the glass envelope of the lamp and to the presence of electrostatic fields due to potential differences between the electrodes of the lamp and other bodies in the general vicinity of the lamp. Because the potential distribution on the glass lamp envelope and the stray electrostatic fields depend upon the surface leakage on the glass and adjacent insulation, the ordinarly glow lamp assembly is quite susceptible to change in ignition and extinguishing voltages with change in humidity and the position of the hands in holding the device. To overcome this difficulty and improve the accuracy of the device, I employ a U-shaped brass shield 20 around the center of the lamp, and in the rear thereof so as not to obstruct visibility of the lamp from the front of the instrument.

The scale shown on the cover plate of Figs. 1 and 2 is adapted to give direct readings for alternating current voltages from 65 to 660 volts. The arrangement is such that the lamp glows immediately upon connecting the test leads 4 to a source of voltage. Merely rotating the knob 26 until a point is reached where the lamp extinguishes will give a voltage reading of the source to be measured. For use with a direct current voltage supply, the reading should be multiplied by 1.15. In order to determine whether the circuit voltage is A. C. or D. C., the indicator on knob 26 should be set at a point on the scale where the glow lamp glows very brightly. If the circuit voltage is A. C., both electrodes of the lamp will glow. If the circuit voltage is D. C., only one electrode will glow with the red lead connected to the positive side; viz. the electrode furthest from knob 26 as seen through the window on the cover plate 24 will glow; assuming that the red lead is connected to the limiting resistor.

The device of the invention is highly versatile and virtually burn-off proof. It can be used to check whether lines are 110, 220 volts etc. whether A. C. or D. C., whether delta and wye connected polyphase circuits by checking the voltage between lines and from lines to ground, to pick out blown fuses by setting the indicator knob just below the line voltage on the scale and testing across the line on the load side of the fuse. Because the internal resistance of the device is high (approximately ½ megohm) it draws negligible current and can be used to measure plate voltages, etc. in high impedance circuits, to check leakage between the line and metal frames of flat irons, soldering irons, etc. and provide dependable voltage readings even on voltage operated circuits such as those using radio-electronic tubes.

The rugged construction of the device of the invention enables it to survive a large amount of physical abuse. Its construction, shape, and lightness permits it to be carried in the vest pocket of a user or thrown into a kit without injury to the meter.

In the embodiment illustrated in the drawing and successfully tried out in practice, the following values were used: potentiometer 500,000 ohms across the terminals, and limiting resistor 200,000 ohms. The glow lamp contained neon as the inert gas, and was approximately 1″ long and ¼″ wide. The housing and cover plate had a diameter of 1¾″, and the depth of the housing was ⅞″. The thickness of the cover plate was 1/16″. The window in the cover plate was approximately ½″ by 3/16″. The weight of the voltage indicator device was approximately 4 oz.

What I claim is:

A voltage indicator comprising a housing of insulation material open at one end, a cover plate having scale markings thereon and a window opening therethrough, a potentiometer mounted on said cover plate in the rear thereof, a bracket secured to said potentiometer, a U-shaped metallic shield supported by said bracket, a two-electrode glow lamp positioned within said shield in such position that said shield surrounds solely the rear center half of the glow lamp and said lamp is visible through said window of said cover plate, said potentiometer having a variable tap terminal directly connected to one electrode of said glow lamp and a pair of line terminals coupled across the ends of the potentiometer, one of said line terminals being connected to the other electrode of said glow lamp through a current limiting resistor, a connection from said one electrode to said U-shaped shield, and test leads connected to said terminals and extending out of said housing through apertures therein.

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