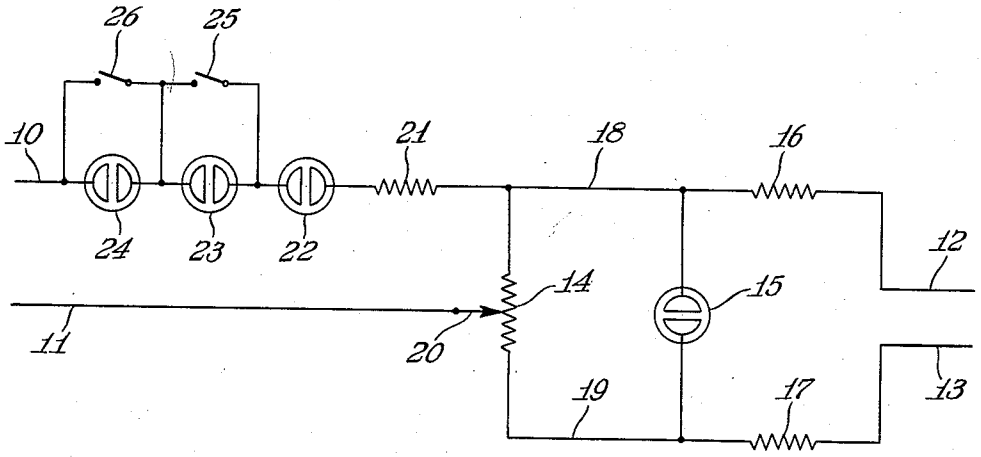
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WIDE RANGE HIGH IMPEDANCE VOLTMETER

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WIDE RANGE HIGH IMPEDANCE VOLTMETER

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2 Claims. (Cl. 324—122)

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This invention relates to an improved wide range, high impedance voltmeter, and more particularly, to such an instrument employing one or more glow lamps.

There is a particular need on the market at the present time for a wide range voltmeter, and particularly, one which will cover a range from some 8 or 10 volts up to some 500 or 600 volts. There is a further need at the present time for such a voltmeter of relatively high impedance, such, for example, as an impedance of the magnitude of hundreds of megohms.

One of the principal features and objects of the present invention is to provide such a voltmeter which is economical to manufacture and rugged and reliable in use.

It is, of course, well known that glow lamps, such, for example, as neon glow lamps, have a characteristic ignition voltage as well as a characteristic extinguishing voltage. In the past, advantage has been taken of the characteristic of the glow lamp to provide a voltmeter which utilizes a calibrated potentiometer and which is capable of measuring voltages of an unknown source, provided the voltages of the unknown source are above the ignition voltage of the glow lamp. In other words, by tapping off a portion of the unknown voltage by means of a potentiometer, it has been possible to reduce the voltage drop across the glow lamp until it extinguishes. If such a potentiometer is calibrated against a known standard, it is possible to provide a reading for the instrument which will indicate the value of the unknown voltage. A great disadvantage of such an arrangement lies in the fact that it is not capable of measuring voltages below the ignition voltage of the glow lamp, which voltage, in the case of a neon glow lamp, lies in the vicinity of 80 volts D. C. or 65 volts A. C. This, of course, very materially limits the usefulness of an instrument such as that referred to above which has been available in the past.

One of the principal features and objects of the present invention is predicated on the concept of combining a second calibrated voltage source with the unknown voltage source so that a source of potential across the indicating glow lamp is the combination of the voltages of these two separate sources. By such an arrangement, it is possible to measure voltages far below the ignition voltage of the glow lamp, and thus the usefulness of the voltmeter is enormously increased.

A further object of the present invention is to provide a novel high impedance, A. C.-D. C. voltmeter.

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Another object of the present invention is to provide a novel A. C.-D. C. voltmeter employing a glow lamp which will measure either A. C. or D. C. voltages, both below and above the ignition voltage of the glow lamp.

This application is a division of my copending application entitled "Wide Range A. C.-D. C. Voltmeter," Serial No. 108,829, filed August 5, 1949, Patent No. 2,682,636, June 29, 1954.

The novel features which I believe to be characteristic of my invention are set forth with particularity in the appended claims. My invention itself, however, both as to its organization, manner of construction, and method of operation, together with further objects and advantages thereof, may best be understood by reference to the following description taken in connection with the accompanying drawings, in which the single figure thereof is a diagrammatic representation of a high impedance, neon voltmeter embodying the novel teachings and principles of the present invention.

The high impedance, neon A. C.-D. C. voltmeter illustrated in the drawing is calibrated when the neon glow lamp ignites as distinct from a voltmeter which is calibrated when the neon glow lamp extinguishes. The circuit of the voltmeter is arranged to be connected to two sources of potential through conductors 10 and 11 on the one hand, and conductors 12 and 13 on the other hand. The conductors 10 and 11 are more specifically arranged to be connected to the source of voltage whose value and characteristic is to be determined. The conductors 12 and 13 are arranged to be connected to a 110-volt or a 220-volt source of alternating or direct current, or a dry battery greater than 90 volts.

In the illustrated form of the invention, a portion of the unknown voltage is combined with a portion of a known voltage obtained from a potentiometer 14. The voltage applied across the ends of this potentiometer 14 is obtained from a voltage regulator arrangement which includes a neon glow lamp 15 and a pair of resistances 16 and 17, these resistances being connected in the lines 12 and 13, respectively.

As is well known to those skilled in the art, this will supply a clipped sine wave of substantially constant peak-to-peak voltage at conductors 18 and 19, regardless of voltage variations in the A. C. or D. C. source connected to conductors 12 and 13. By way of illustration, and not by way of limitation, the resistances 16 and 17 may be approximately 150,000 ohms apiece, while the potentiometer 14 may have a resistance of 500,000 ohms.

As shown in the drawing, the output conductors 18 and 19 of the voltage regulator are connected to opposite ends of the potentiometer 14. This potentiometer 14 is provided with a movable contact 20 which is connected to conductor 11 leading to one side of the unknown voltage source. The top end of the potentiometer 14 is connected through a resistor 21 and a plurality of neon glow lamps 22, 23 and 24 to conductor 10 leading to the other side of the unknown voltage source. Resistor 21, by way of example, and not by way of limitation, may have a value of 100,000 ohms. In the illustrated embodiment of the invention, it will be apparent that when the lower conductor 11 of the unknown voltage input is of the same polarity at a given time as the upper conductor 18 of the known voltage source, the circuit is adding the proportional amount of voltage from the known voltage source represented by the upper portion of the potentiometer 14.

The number of neon glow lamps connected in series in the circuit between conductor 10 and resistor 21 will depend upon the voltage range desired. Thus, when a voltage range of approximately 10 to 80 volts D. C. or 10 to 65 volts A. C. is to be determined, only one glow lamp, namely, glow lamp 22, will be used. To this end, the glow lamp 23 is shorted out of the circuit by closing a switch 25, and similarly, glow lamp 24 is shorted out of the circuit by closing a switch 26. When a higher range is required, switch 25 is opened, but switch 26 is closed. When a still higher range is desired, both switches 25 and 26 will be opened. Additional glow lamps and shorting switches may be inserted in series in the circuit without departing from the teachings of the present invention.

In considering this illustrated embodiment of the present invention, it will be noted that there is substantially no load on the circuit to be measured, and for that reason, the glow lamp 22 must ignite to give a reading. It is to be noted, however, that when glow lamp 22 ignites, you already have had your reading, and for that reason, it no longer makes any difference if you are drawing current. Since the glow lamp 22, before it ignites, has a very high impedance, it will be apparent that the instrument illustrated in the drawing is a high impedance voltmeter.

It will furthermore be observed that the potentiometer 14 may be calibrated to read voltage directly when the neon glow lamp ignites. From the above description, it will also be apparent that this voltmeter may be used for either measuring A. C. voltages or D. C. voltages. When A. C. voltages are being measured, the neon glow lamps

22, 23 and 24 will have both plates glowing, while only one of the plates of each tube will glow when D. C. voltage is being measured. The polarity may, of course, be determined by noting which of the two plates of the respective indicating glow lamps are glowing.

From the above description, it will be apparent that I have provided an extremely simple, low cost electrical instrument and apparatus. It will furthermore be apparent that this invention has a wide range of application and usefulness.

It will be understood that modifications and variations may be effected without departing from the scope of the novel concepts of the present invention.

I claim as my invention:

1. A voltmeter comprising a plurality of glow lamps connected in series, means for connecting said glow lamps to an unknown voltage source whose value is unknown, means for selectively shorting out individual ones of said glow lamps, means for adding additional voltage in series with said unknown voltage to cause said glow lamps not shorted out to ignite, the difference between the aggregative ignition values of the non-shorted out glow lamps and the amount of additional voltage added being the voltage value of the unknown voltage source.

2. A voltmeter comprising a plurality of glow lamps connected in series, means for connecting said glow lamps to an unknown voltage source, means for selectively shorting out at least all but one of said glow lamps, a voltage regulator, means for connecting said voltage regulator to a known voltage source, a variable voltage divider network connected to said voltage regulator and in series with said unknown voltage source, said variable voltage divider network being adjustable to insert additional sufficient voltage into the energization circuit of said glow lamps to cause ignition of the latter.

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