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CAPACITATIVE VOLTAGE DIVIDER

Filed May 13, 1957

Fig. 1.

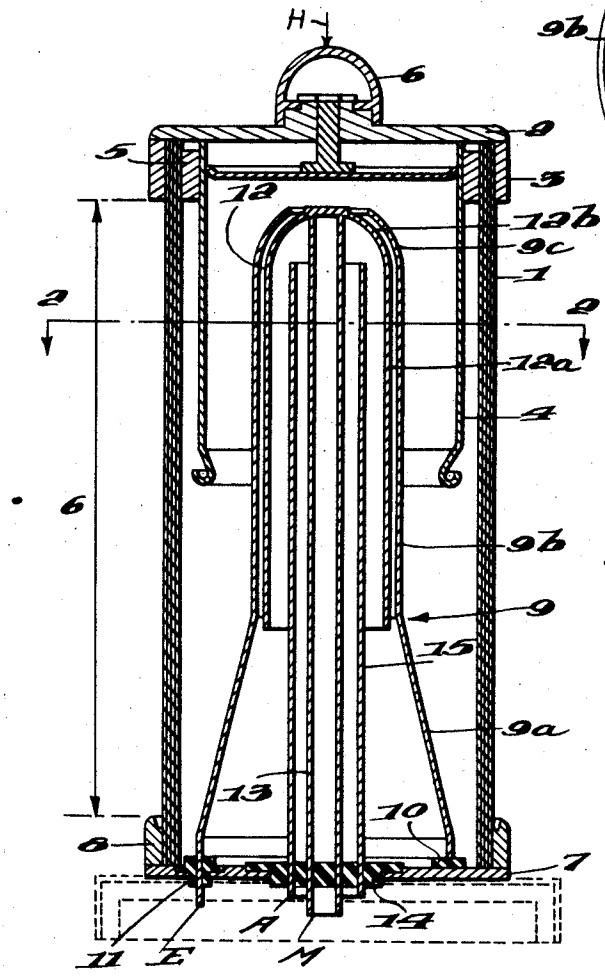
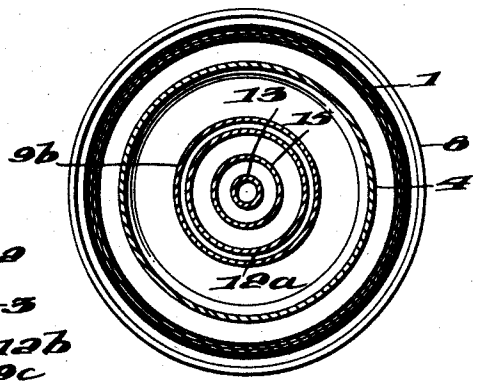


Fig. 2.



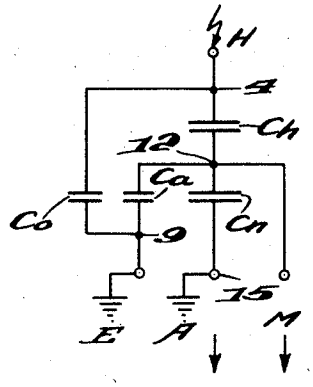


Fig. 3.

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CAPACITATIVE VOLTAGE DIVIDER

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5 Claims. (Cl. 317—242)

This invention relates to a capacitative voltage divider for high voltages.

The use of a purely capacitative voltage divider, which is generally composed of an arrangement of condensers connected in a series circuit, is only rarely adopted, despite its true-to-form and scale reproduction of the quantity to be recorded, even when the same proceeds very rapidly.

The usefulness of the capacitative voltage divider is, however, associated with various conditions which cannot be fulfilled any longer at high voltages. The cathode ray oscillograph needed for viewing the quantity must be set up in the immediate vicinity of the lower voltage part of the divider, in order to avoid long leads which falsify the actual curve form, and particularly so at high frequencies.

Also, objects set up in the vicinity of the capacitative voltage divider of conventional construction disturb the dividing ratio. The error in this dividing ratio depends primarily on the ratio of the resultant scattering capacity to the serial capacity of the divider. The smaller this ratio, the more accurate becomes the dividing ratio of the voltage divider.

The total capacity of a capacitative voltage divider must be as small as possible so that reactions on the quantity to be recorded are avoided. The prerequisities for the smallest error in the dividing ratio and for the freedom from reactions are reversed in the customary construction.

By means of the present invention there is created a purely capacitative voltage divider for high voltages at industrial frequencies and also up to high frequencies such as those encountered in impulse modulation of transmitting techniques. Moreover, the voltage divider according to the present invention is particularly suited for high surge voltages.

All the requirements for usefulness of a purely capacitative voltage divider are completely fulfilled in the voltage divider according to the present invention.

In particular, the capacitative voltage divider comprises two cylindrical condensers which are arranged coaxially within a supporting cylindrical casing made of insulating material. The high voltage electrode in the form of a cylindrical sleeve surrounds the low voltage electrode and the measuring grounded electrode, both of which are also composed of cylindrical sleeves. The voltage divider according to the invention is characterized in that a screening electrode, also in the form of a cylindrical sleeve, is interposed between the high voltage electrode and the low voltage and measuring grounded electrodes so as to protect the latter two electrodes against the penetration of interference fields.

The cylindrical casing of insulating material is provided at both ends with metallic reinforcing and cover plates thereby to form a closed pressure casing in which a high grade dielectric can be used. The use of insulating gas under increased pressure permits a space-saving construction for the voltage divider. The construction can also be facilitated by using an electro-negative gas with high voltage resistance at low pressure.

The independence and invariability of the transmission ratio of the voltage divider is assured in the construction according to the invention with regard to the location and external influences.

By using an insulating gas within the container and with a suitable electrode configuration, the dividing ratio is also independent of frequency, polarity and temperature; thus the voltage divider can be calibrated at a low frequency with the greatest attainable accuracy. Through the arrangement of the active part, the voltage divider is practically free of inductivity, and freedom from losses is also assured.

A further advantage of the invention is that the voltage divider can be set up directly at the height of the spot at which a quantity is to be measured and viewed, in any arbitrary position. The cathode ray oscillograph can stand below the grounded lower mounting for the divider container. In practice, the divider can be mounted above a movable Faraday cage, in which the cathode ray oscillograph could also be accommodated, which is especially favorable for surge voltage testing. A voltage divider according to the invention can, therefore, be built up to the highest practically needed voltage.

The foregoing advantages for the improved construction will become apparent from the following detailed description of a typical embodiment and from the related drawings, in which:

Fig. 1 is a vertical view of the improved voltage divider drawn in diametral section;

Fig. 2 is a horizontal sectional view taken on line 2—2 of Fig. 1; and

Fig. 3 is an electrical schematic wiring diagram showing the circuit arrangements and capacities between the various electrodes.

With reference now to the drawings, it will be seen that the voltage divider comprises a casing 1 of cylindrical configuration and made of insulating material which is gastight, such as hard paper. Assuming that the casing 1 stands upright, the upper end of the casing is closed by a round metallic cover plate 2 and a metallic reinforcing band 3 is applied to the exterior surface of the casing 1 just below the cover plate 2. The high voltage electrode 4 in the form of a cylindrical metallic conductive sleeve is secured at its upper end to the cover plate 2 and extends downwardly into the upper portion of the interior of the casing 1 and concentric with the latter. Electrode 4 is of less diameter than casing 1 and is spaced radially inward from the latter by means of a ring shaped spacing element 5. The cover plate also supports an arrangement 6 for regulating the high voltage capacity. A continuous capacity change can be remote-controlled by means of an oil pressure control system under voltages.

The other electrode members of the voltage divider are carried by a lower plate 7 which closes the lower end of the casing 1, and the lower end of the casing is likewise reinforced by a band 8 which is applied around the casing adjacent the plate 7.

The screening electrode 9 is seen to be metallic, is conductive, and is a figure of revolution, arranged coaxially with the casing 1. The lower portion 9*a* of the screening electrode sleeve 9 tapers progressively radially outwardly and is supported upon a ring 10 of insulating material which in turn rests upon the inner face of the lower plate 7, and a bushing 11 through the plate 7 serves to bring out a grounded connection E for the screening electrode 9. The tapered portion 9*a* of the screening electrode merges at its upper end into a cylindrical sleeve portion 9*b* which extends upwardly into the

interior of the high voltage electrode 4 and this cylindrical portion 9*b* merges into an open center domed portion 9*c*.

The low voltage electrode 12 is also seen to be metallic, is conductive and likewise is a figure of revolution arranged coaxially with the casing 1 and hence also coaxially with electrodes 4 and 9 and lying radially inward from the screening electrode 9. The low voltage electrode 12 comprises a cylindrical portion 12*a* and a domed portion 12*b* generally coextensive in length with and confronting the cylindrical and domed portions 9*b*, 9*c* of the screening electrode 9 and parallel therewith. For supporting the low voltage electrode 12 it will be seen that a tubular, metallic, conductive member 13 coaxial with the casing 1 has its lower end secured within a bushing 14 of insulating material mounted centrally in the lower closure plate 7 and extends upwardly through the interior of electrode sleeve 12 and is connected to the central portion of the domed section 12*b*.

The measuring grounded electrode is seen to consist of a cylindrical sleeve 15 arranged coaxially with the other electrodes. Electrode 15 has its lower end mounted in and extending through the bushing 14 so as to surround the supporting tubular member 13 for the low voltage electrode 12 and extends upwardly to the domed electrode portion 12*b* radially inward from the cylindrical electrode portion 12*a*.

The various condensers established by the Fig. 1 construction are shown schematically in Fig. 3. With reference now to Fig. 3, it will be seen that a high voltage capacity C_h is established between electrodes 4 and 12, and a low voltage capacity C_n is established between electrodes 12 and 15. As scattering or stray capacities are present, a capacity C_o is established between high voltage electrode 4 and screening electrode 9, as well as a capacity C_a between low voltage electrode 12 and screening electrode 9. As indicated in Fig. 3, the terminal E connected to screening electrode 9 and terminal A connected to the measuring electrode 15 are at ground potential.

I claim:

1. A voltage divider of the capacitative type comprising a hollow cylindrical insulating casing, a high voltage electrode in the form of a conductive cylindrical sleeve arranged coaxially within said casing, said high voltage electrode having a lead-in terminal at one end of said cylindrical casing, a low voltage electrode in the form of a conductive cylindrical sleeve arranged coaxially within said casing and spaced radially inward from said high voltage electrode, a measuring grounded electrode in the form of a conductive cylindrical sleeve arranged coaxially within said casing and spaced radially inward from said low voltage electrode thereby to establish a high voltage capacity between said high voltage and low voltage electrodes series connected with a low voltage capacity between said low voltage and measuring grounded electrodes, said measuring electrode having lead-in terminal means extending through said casing, a conductive member coaxially arranged within and spaced from said measuring grounded electrode, said conductive member being connected at one end to said low voltage electrode and extending at its other end from the other end of said casing, and a grounded cylindrical screening electrode sleeve arranged coaxially within said casing and

located intermediate and spaced from said high and low voltage electrodes to protect said low voltage and measuring electrodes against penetration of interference fields, said screening electrode sleeve having grounded lead-in terminal means extending from said casing.

2. A capacitative voltage divider as defined in claim 1 wherein the surface of said low voltage electrode influenced by the field of said high voltage electrode is kept so small because of the surrounding screening electrode that said high voltage capacity exhibits a value of a few microfarads.

3. A capacitative voltage divider as defined in claim 2 characterized in that the same dielectric is provided for said high and low voltage capacities.

4. A voltage divider as defined in claim 1 wherein said high voltage electrode is mounted within said casing by mounting means at said one end thereof and said low voltage, measuring and screen electrodes are mounted within said casing by mounting means at said other end thereof, and further wherein said screen electrode has a length at least as great as the lengths of said low voltage and measuring electrodes.

5. A voltage divider of the capacitative type comprising a cylindrical casing of insulating material, a high voltage electrode in the form of a conductive cylindrical sleeve arranged coaxially within said casing, said high voltage electrode being connected at one end to a first end of said casing and having a lead-in terminal extending through said casing first end, a low voltage electrode in the form of a conductive cylindrical sleeve arranged coaxially within said casing and spaced radially inward from said high voltage electrode, a conductive member coaxially arranged within and spaced from said low voltage electrode, one end of said conductive member being secured by insulating means to the second end of said casing and the other end of said conductive member being secured to said low voltage member at its end adjacent said first casing end to support said low voltage electrode from the second casing end, a measuring grounded electrode in the form of a conductive cylindrical sleeve arranged coaxially within said casing intermediate and spaced from said low voltage electrode and said conductive member, one end of said measuring electrode being secured by insulating means to said second casing end, and being provided with lead-in terminal means extending therethrough, and a grounded cylindrical screening electrode sleeve arranged coaxially within said casing and located intermediate and spaced from said high and low voltage electrodes, one end of said screen electrode being secured by insulating means to said second casing end, and being provided with lead-in terminal means extending therethrough, said screen electrode having a length at least as great as the lengths of said measuring and low voltage electrodes thereby to protectively enclose the same against penetration of interference fields.

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