Feb. 28, 1939. H. A. EWEN 2,149,118

ELECTRIC INSULATOR

Filed Jan. 30, 1936

Fig. 1

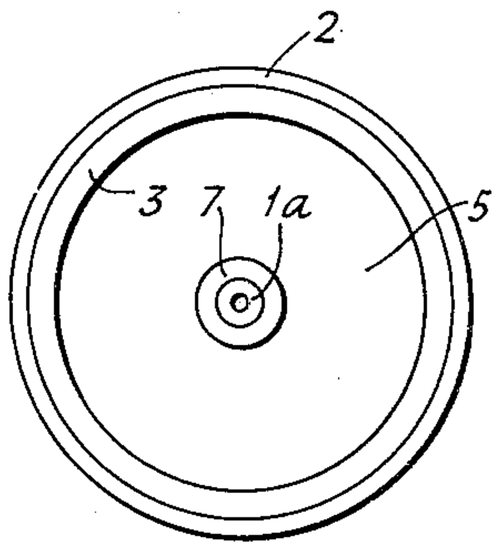


Fig. 2

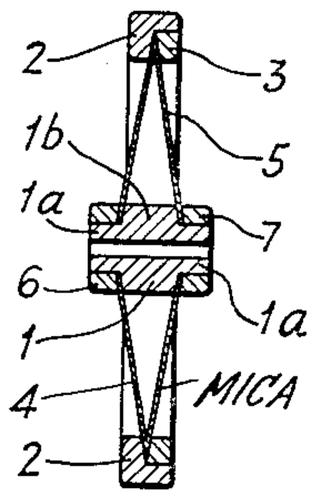


Fig. 3

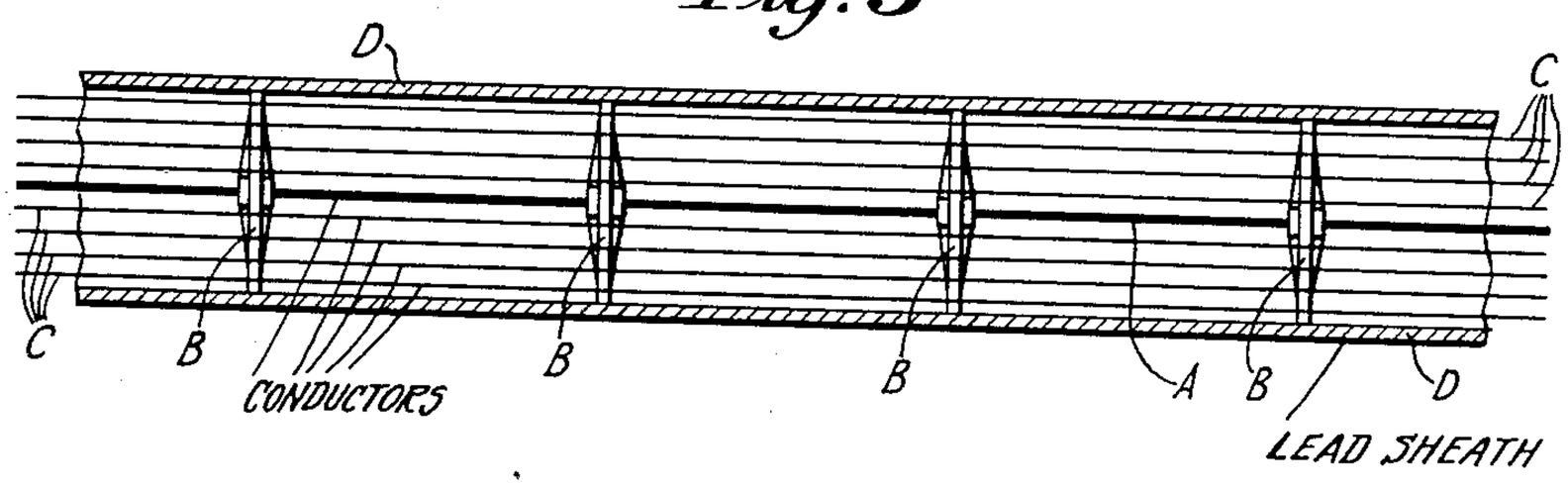


Fig. 4

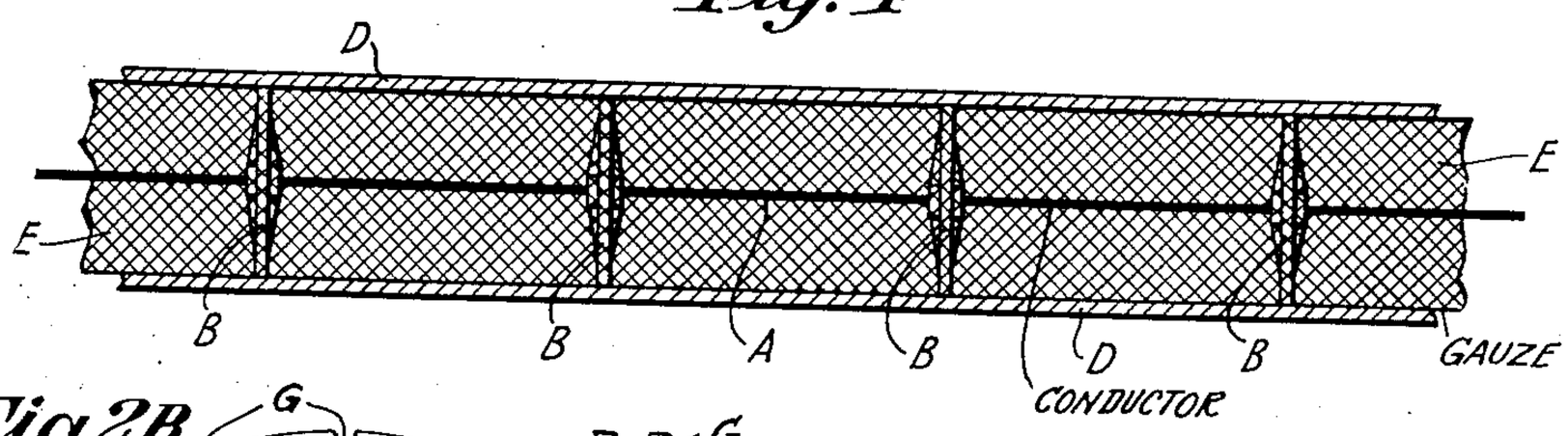


Fig. 2B.

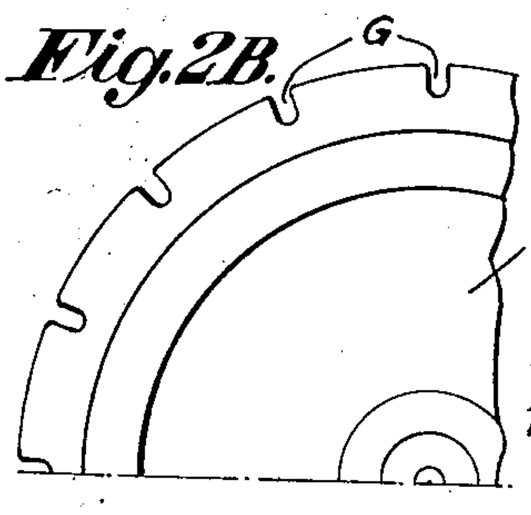
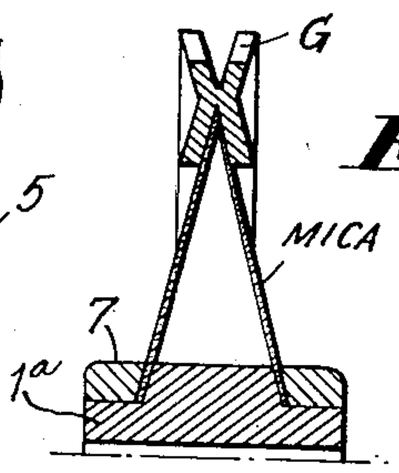


Fig. 2A.



INVENTOR.
HARRY ALEXANDER EWEN

BY H. B. Brower

ATTORNEY.

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ELECTRIC INSULATOR

Harry Alexander Ewen, London, England, assignor to Radio Corporation of America, a corporation of Delaware

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9 Claims. (Cl. 174—28)

This invention relates to electric insulators for use on very high radio frequencies.

Extended experiments with various insulators including porcelain and similar composition insulators of a ceramic nature have shown that where very high frequencies corresponding to very short wave radio wave lengths are in question the losses, and in particular the dielectric losses, are so high as to be seriously disadvantageous, and it has been found that mica is from this point of view a considerably better insulator for very high frequencies.

The object of the present invention is to provide an improved insulator construction capable of efficient use for very high frequencies and which is mechanically strong and at the same time relatively simple and economical to manufacture. In this connection it will be appreciated that mica is from the mechanical point of view a material which is not easy to employ in an insulator construction whilst still obtaining good mechanical strength.

According to this invention an insulator suitable for use upon very high frequencies comprises at least two mica discs or plates each having an aperture, there being positioned within said apertures a first metal member and the outer peripheries of said plates being positioned within a second or outer metal member, said metal members being designed to carry or to be attached to the devices which are to be insulated from one another, and being so formed that when the mica plates and the two members are assembled together the said mica plates are clamped edgewise or approximately edgewise between the inner and outer metal members.

Preferably the two mica plates are of annular form and are so arranged that they are close together at their outer peripheries and spaced apart at their inner peripheries the said outer peripheries being entered into a recess formed or otherwise provided in the outer metal member and the said inner peripheries surrounding the inner metal member so that the mica part of the insulator appears tapered in section and is made up of the two mica discs with an air space between them.

The invention is illustrated in the accompanying drawing, in which Fig. 1 is a front elevation of an insulator of this invention; Fig. 2 is a section of Fig. 1; Fig. 2A is an enlarged partial section showing an outer ring with an X-shaped section; Fig. 2B is an enlarged partial elevation of the type of insulator shown in Fig. 2A; Fig. 3 is a longitudinal section of a concentric conductor cable, having a series of conductors; Fig. 4 is a longitudinal section of a concentric conductor cable having an outer conductor composed of metallic gauze.

Referring to Figs. 1 and 2 which show respectively in face view and in transverse sectional view one form of insulator in accordance with the invention the said insulator comprises a short length of circular section metal tube 1 which is, as shown, formed of reduced thickness for short lengths at opposite ends 1*a* thereof so that there is a central portion 1*b* of relatively greater thickness, said central portion joining the portions of reduced thickness at steps. The portions of reduced thickness may be threaded. The outer metal member may consist of a ring of approximately X-shaped section as shown by Fig. 2A, or as illustrated by Fig. 2 it may be made up of a ring 2 of approximately L section with one sloping face and a ring 3 also having a sloping face and so formed that it can be screwed into the ring 2 into the position shown in Fig. 2 where the two sloping faces come adjacent one another and together constitute an inverted V sectioned recess. There are two thin mica discs 4, 5, employed, said discs having central holes adapted to fit over the reduced thickness threaded portions 1*a* of the inner tube 1 and being of such dimensions that when they are so fitted, one over each end of the tube 1 and pressed up against the steps upon the tube, the outer peripheries of the mica discs or annuli touch one another to form an apex which is positioned inside the inverted V sectioned recess illustrated, or, where the outer metal member is of X section, constituted by one half of the said X-section. With the illustrated construction the discs or annuli are preferably positioned before the member 3, which is a clamping device, is positioned in the member 2. If the inner tube has its reduced portions threaded, circular nuts 6, 7 are screwed over the said threaded portions outside the two mica discs or annuli thus pressing said mica discs or annuli up against the steps of the inner tube and also pressing the outer edges of the mica discs or annuli against one another and up into the inverted V. If the reduced portions of the inner tube are unthreaded the members 6 and 7 will be simply press-fit washers which are pressed on to the said reduced portions and serve a purpose similar to that of the nuts. Similarly the member 3, though described as screwed into the member 2 may be simply a press-fit washer. It will be appreciated that the steps in the inner tube should be cut at a suitable inclined angle

and that the mica discs should be chamfered or tapered at their inner or outer edges so as to give flat surfaces where mechanical contact occurs between the mica discs and the steps and between the mica discs and outer metal member and also where the two discs bear against one another. Similarly the circular nuts or press-fit washers 6, 7, which clamp the discs in position should have tapered or sloping faces where they engage the discs. It will be appreciated that there will be an air space between the discs, this air space being an annulus of triangular section, the base of each section being adjacent the inner tube.

The inner and outer metal members may be formed in any convenient way for attachment to the devices which are to be insulated from one another by the insulator. For example, the outer metal member of X-section may be slotted or grooved at a point G to take wires running parallel to the axis of the inner metal member or tube. As a rule one of the members to be insulated from one another by the insulator will be inserted into the inner tube, and the said inner tube may be provided with a suitably positioned grub screw, or the like, to assist in positioning the said member to be insulated within the inner tube.

Though not limited to its application thereto, the invention is particularly applicable to concentric feeders for carrying very high frequency or short wave length energy to and from wireless transmitters, transmitting and receiving aerials, and so forth. Thus a concentric feeder in accordance with this invention and embodying insulators in accordance with this invention, might, as shown in Fig. 3, consist of a central conductor A which is passed through the inner tubes of a series of insulators B each as above described, the insulators being spaced from one another along the conductor. The cable also comprises a series of outer conductors C which are carried by the outer rings of the insulators, the outer conductors lying in a surface which is concentric with respect to the inner conductor. The said outer conductors run parallel to one another and they may be straight or twisted so that they constitute parallel helices. Each conductor may, if desired, be individually twisted. All the conductors may be relatively flexible and a lead sheath D, or the like, may be drawn over the outer conductors so that a relatively flexible concentric feeder construction is obtained, the spacing between inner and outer conductors being largely air spacing and the said inner and outer conductors being separated from one another and held in the desired relative positions by the series of insulators by which said conductors are carried.

In the modified cable shown in Fig. 4 the conductors C are dispensed with and instead there is employed an outer conductor member E in the form of a tube of metal gauze or mesh.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed I declare that what I claim is:

1. An insulator suitable for use upon very high frequencies comprising at least two mica plates each having an aperture, there being positioned within said apertures a first metal member and the outer peripheries of said plates being positioned within a second metal member, each one of said metal members having abutments for the mica plates, retaining means securing the plates to said abutments, said first and second metal members being assembled together, and said mica plates being clamped approximately edgewise between the first and second metal members.

2. An insulator as claimed in claim 1 and wherein the two mica plates are of annular form and are so arranged that they are close together at their outer peripheries and spaced apart at their inner peripheries.

3. An insulator as claimed in claim 1 and wherein the first metal member is a tube formed with ends of reduced thickness, said reduced ends being encircled by the mica plates which are of annular form, and means being provided for clamping the inner portions of said plates, said means comprising ring members placed at said reduced ends.

4. An insulator as claimed in claim 1 and wherein the second metal member is of approximately X section.

5. A disc wheel-like insulator comprising two perforated insulating discs, a metallic hub supporting and spacing said discs apart from each other, and a metallic rim binding said discs together at their outer periphery.

6. An insulator for concentric conductors comprising two perforated thin discs of insulating material spaced apart at the center by a metallic hub-like supporting member and two washers located at the ends of said hub-like supporting member, and said discs being bound together at their outer periphery by two metallic rim binding members.

7. An insulator for concentric conductors comprising two thin discs of insulating material each having a central aperture, a metallic tube passing through said apertures for spacing said discs apart, and a metallic rim binding member having an X cross-section located at the outer periphery of said discs.

8. An insulator for concentric conductors comprising two thin discs of insulating material each having a central aperture, a metallic tube passing through said apertures for spacing the discs apart, a metallic rim binding member having an X cross-section located at the outer periphery of said discs, and a plurality of slots located at the outer periphery of said rim binding member to receive a plurality of wires running parallel to the axis of said metallic tube.

9. An insulator as claimed in claim 1 and wherein the first metal member is apertured.

HARRY ALEXANDER EWEN.