Aug. 16, 1932. L. T. FREDERICK 1,872,269

COMPOSITE ARTICLE AND METHOD OF MAKING SAME

Filed April 17, 1926 2 Sheets-Sheet 1

Fig. 1.

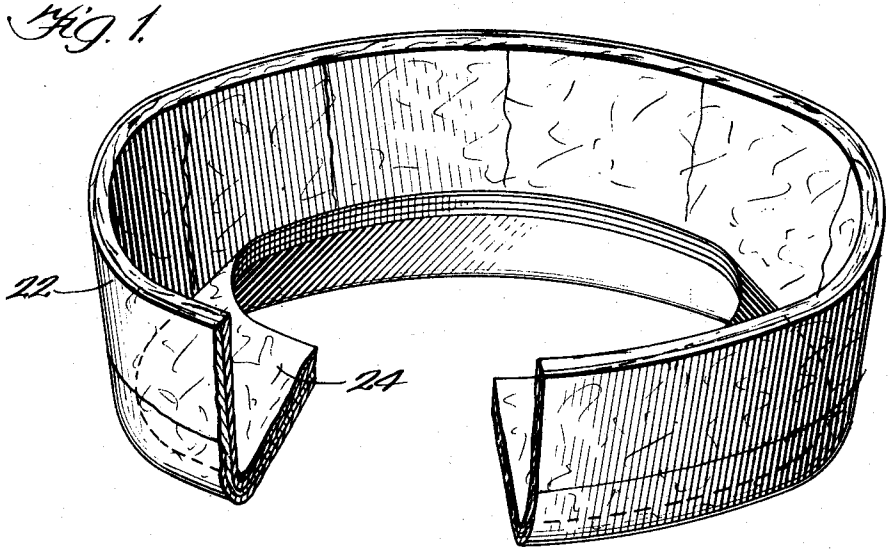


Fig. 2.

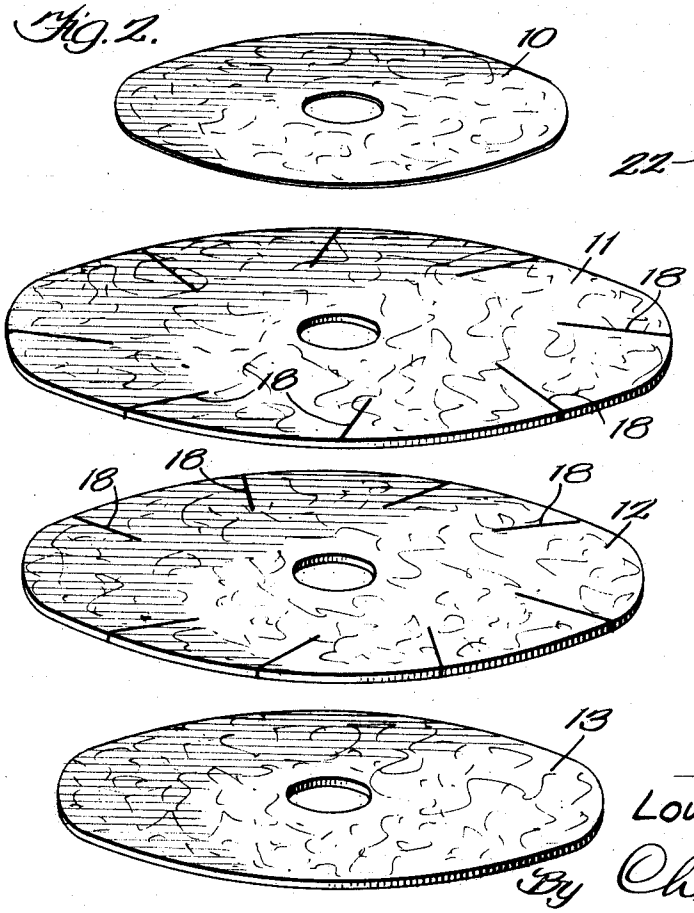
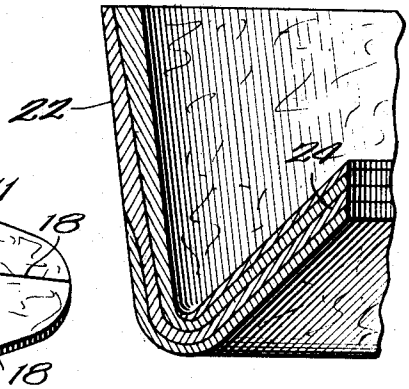


Fig. 3.



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Fig. 4.

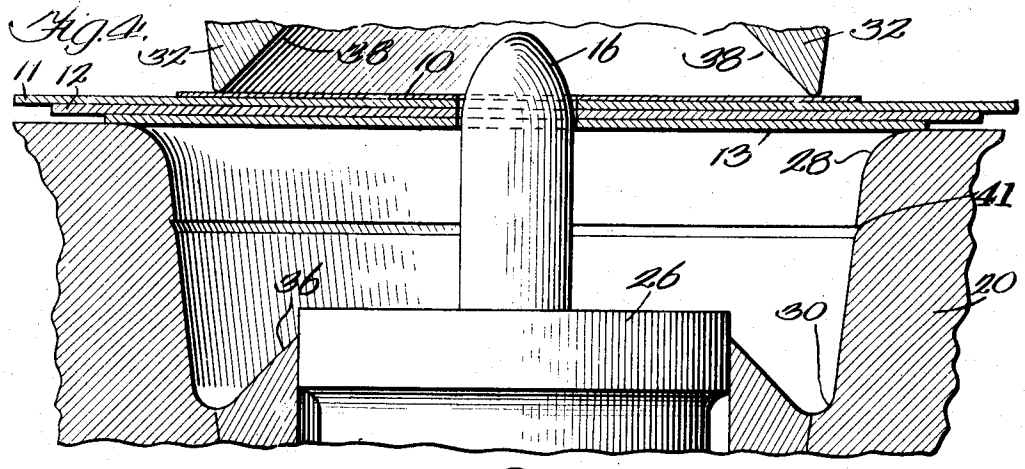


Fig. 5

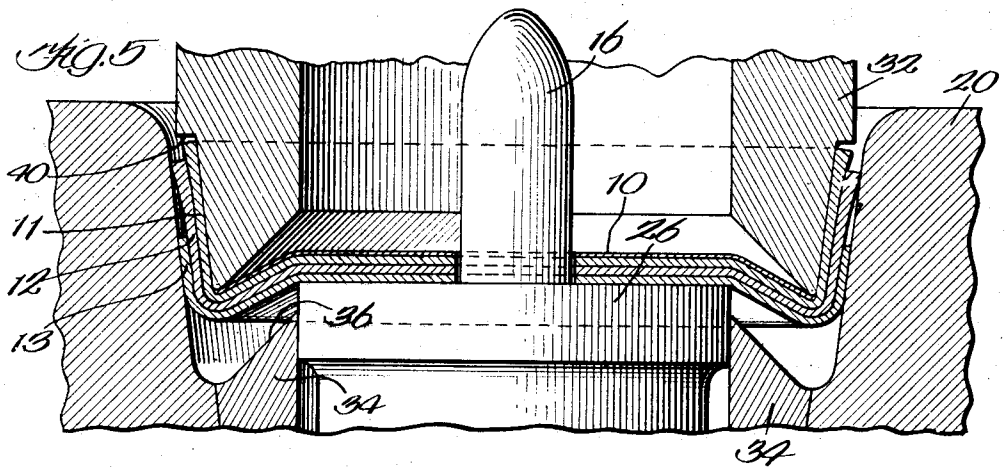
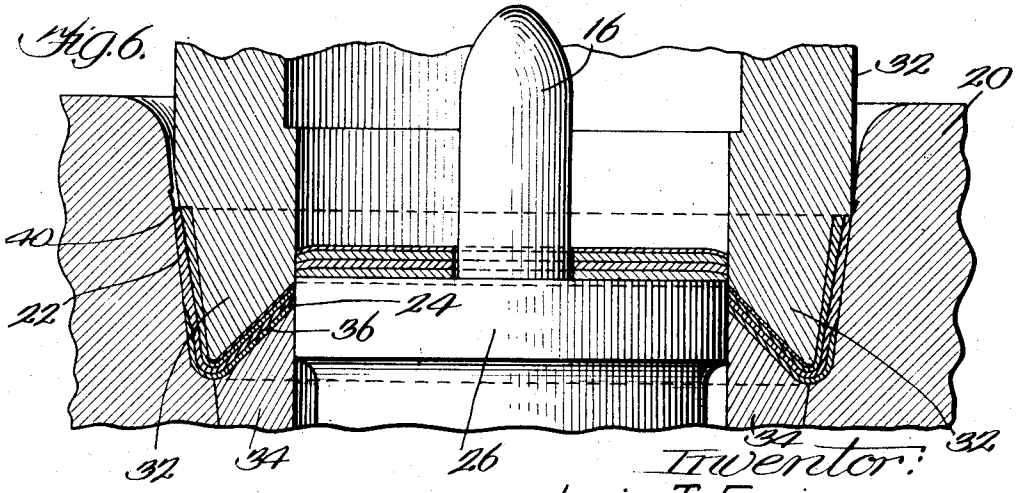


Fig. 6.



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Patented Aug. 16, 1932 1,872,269

UNITED STATES PATENT OFFICE

LOUIS T. FREDERICK, OF VALPARAISO, INDIANA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO CONTINENTAL DIAMOND FIBRE COMPANY, OF NEWARK, DELAWARE, A CORPORATION OF DELAWARE

COMPOSITE ARTICLE AND METHOD OF MAKING SAME

Application filed April 17, 1926. Serial No. 102,820.

In general my invention relates to a process for forming a practically homogeneous and substantially rigid article from superposed sheets or laminations of semi-plastic material. In one of its aspects my process includes the drawing or pressing of the sheets into a finished article having a circumferential skirt or flange which may or may not be disposed at an angle to another portion of the body of the article, in accordance with the cross sectional shape desired. In another aspect, my improved process contemplates the use of laminations or sheets, and particularly discs of different areas or diameters for permitting the sheets when drawn or pressed by the dies to flow or stretch into a finished article of substantially uniform cross section and requisite strength. The invention also includes the article made by my process. In particular I have illustrated my invention as applied to mica insulating rings and to the method of making them. These rings are intended primarily for the commutators of dynamo electric machines, and the general object of the invention is to produce a ring which shall have high and uniform insulating properties, possess high mechanical strength, and be economical to manufacture.

I obtain this object in the manner illustrated in the accompanying drawings, in which

Figure 1 illustrates the finished article, a section being broken away to show the internal construction.

Figure 2 represents a set of discs from which the ring is produced, these being shown spaced apart for the purpose of illustrating their individual construction and their relationship to each other in assembly.

Figure 3 is a fragmentary sectional view taken through the flanges of one of the rings to show on an enlarged scale the final relationship of the parts.

Figures 4, 5 and 6 show the progressive steps of manufacture in a forming machine or press.

Like numerals denote like parts throughout the several views.

I will describe a typical instance of the process and product in order that the principle of the invention may be understood. In a typical case the work material is "mica plate", a known article consisting of flakes of mica laid in overlapping relation and bound together by shellac or other suitable binder. This mica plate has high insulating property, electrically, and it is my purpose to produce from it a ring which is strong mechanically and whose dielectric properties are uniform throughout its surface. This mica plate is produced in sheets and is semi-plastic when hot.

To described the process in its developed form; I first prepare a plurality of discs or complete sheets 10, 11, 12, 13 of mica plate as illustrated in Figure 2. By complete sheets I mean a sheet which is coextensive with the entire surface of the ring in distinction to sectors of the ring. These discs may be varied in number, size and character, but I am describing a typical example. The discs are all perforated at the center so that they may fit over a centering pin 16 shown in Figures 4 to 6 and hereinafter again referred to. In the form shown the lowermost disc 13 is unslitted. Above this I place a disc 12 of larger diameter and having a number of slits 18 running in from the periphery. These slits are in the form of line-like incisions as distinguished from sectors, notches or slots, which later form relatively extensive cut-out portions, the difference in function between my line-like incisions and the slots or notches being that when my slitted discs are drawn as herein disclosed the adjacent edges of the slits of each disc or sheet are caused to overlap, thereby permitting sufficient contraction of the peripheral or outer portions of the sheet. In the case of the sheets having sectors or notches or substantial cutouts the adjacent edges of the cutouts merely abut upon pressing or drawing, in the contracting operation. They do not overlap. By preference these do not run radially but at an oblique angle to a radius. Above this I place a disc 11 of somewhat larger diameter and having slits 18 similar to the slits of disc 12. Above disc 11 is placed a disc 10 which is

of smaller diameter than disc 13 and is unslitted.

These discs are superposed in the order described in the forming machine, whose chief portions are illustrated in Figures 4 to 6. Referring to the machine itself, there is a stationary recessed die 20, the walls of which converge slightly in a downward direction to produce the final product shown in Figure 1, viz. the completed ring having an external flange 22 and the internal flange 24. The discs are centered over the pin 16 previously mentioned, which pin rises from a stationary cylindrical core 26. The upper rim 28 of the recessed die 20 is rounded and there is also a rounded shoulder 30 at the bottom of the recess.

Cooperating with the recessed die is a projecting die 32 which in general form is a hollow cylinder and has a lower periphery in the form approximately of a rounded V. This projecting die diverges upward from the lower periphery at a pitch corresponding to the pitch of the walls of the recessed die 20. Its inner diameter is substantially equal to the external diameter of the center core 26, thus making a sliding fit upon it and serving as a cut-off in cooperation with the upper peripheral shoulder of said core. It is reciprocated vertically by any suitable means.

The press or former also has an ejector die 34, which is annular in form and is also reciprocated vertically with the proper timing which will be hereinafter described. The mechanism for operating it need not be here described, as the press forms no part of my present invention but is shown and described in a copending application filed by me on the 11th day of November, 1926, Serial No. 147,710.

The ejector die surrounds and is guided by the center core 26 and when in lowermost position as shown in Figures 4, 5 and 6 it constitutes the bottom of the chamber in which the ring is formed. It has a conical upper surface 36 which cooperates with the correspondingly beveled surface 38 at the lower rim of the projecting die 32.

By preference the projecting die 32 has an annular shoulder 40 at the top of the acting portion, viz. at the point corresponding to the top of the finished ring. This shoulder serves to finish the ring and also to cut off any surplus material in case the discs of work material are too large for the work in hand.

In practicing the process, after the discs are formed as previously explained, they are placed one upon another in the machine in the manner shown in Figure 4. They rest upon the top of the recessed die 20 and are held centered by the pin 16. After the discs are thus positioned the projecting die 32 commences to descend, and as it does so it bends the work sheets in the manner shown in Figure 5. The lower rim of the die forces the engaged portions of the discs downward faster than the adjacent portion, and as the die approaches its lowermost position it cooperates with the upper annular shoulder of the core 26 to sever the central portion of the disc from the remainder which is to form the ring. This action is illustrated in Figure 6 which shows the projecting die in lowermost position and the ring in its final form.

The sheets are hot when they are put into the press, and hence are plastic to a considerable degree. In the illustrated case where four sheets are employed the uppermost sheet is of a diameter but slightly larger than the diameter of the lower rim of the projecting die 32. The other discs are larger than the diameter of the recess in the die 20 and are arranged with a disc of larger diameter above one of smaller diameter. Of course it will be apparent that I am not limited to the use of any particular number of discs, and that it may be desirable, especially where rings of small size are to be made, to use only two superposed discs, i. e., the upper discs 10 and 11, or three discs in which case discs 10 and 11 may be used with either a slotted disc similar to disc 12 or an unslotted disc similar to disc 13. I have also discovered that rings of small size and dimension may be successfully made of two superposed discs without slotting the periphery of the larger disc since the peripheral portions of the disc do not tear or rupture during the folding process. The diameter of the slotted disc 11 is such that as the die descends the outer periphery will come somewhat beneath the shoulder 40. The periphery of the slotted disc 12 next below will, in the beginning come somewhat lower down and the periphery of disc 13 next below will come still further down as shown in Figure 5. As the projecting die descends the outer annular portion of the slotted discs 11, 12 will not only be pressed toward each other radially but will be also contracted circularly and simultaneously caused to slip upon each other until finally the parts assume the relation shown in Figure 6 in which the upper, outer rim of the discs will come flush with each other and into contact with the shoulder 40. Thus there is a consolidating, contracting and slipping action and the slitted portions of the discs 11, 12 are caused to overlap each other, thus permitting the parts to become co-adjusted and to assume the final form shown. It will be noted that the unslotted disc 13 does not slip entirely up to the top of the mold as does the slotted disc 12, but is squeezed out partially as shown clearly in the enlarged sectional view in Fig. 3. It should be understood that the pressing operation flows the discs into a homogeneous article in which there are no plans of cleavage and the showing of such plans in the drawings of the final object being merely

to indicate the final relative arrangement of the material of the discs. The shoulder 40 finishes the upper edge of the ring and will cut off any surplus material which may be present by squeezing it out into a groove 41 formed in the walls of the die 20. It is also evident that by my method of centering the sheets by gauging them from the margins of their central apertures in distinction from their peripheral margins, these outer edges of the sheets are free during the drawing and pressing operation so that they are free to register or form a finished edge of the flange, the edge being formed of the conterminous edges of the various sheets which originally were of different diameters.

As to the inner flange 24 of the finished ring, a stretching action seems to take place, with the result that in spite of the presence of the additional disc 10 the finished inner flange of the ring will be no thicker than the outer one. The inner flange 24 will be four ply in distinction to the three plies of the outer flange, and as the upper disc 10 projects beyond the rim of die 32 it reinforces the ring at the lower bend where strength is of advantage.

From the foregoing it will be evident that by operating upon the sheets when hot and plastic and selecting the sizes and construction of work sheets shown and pressing them in a mold of this character with outer walls which diverge outward and inner walls which converge inward the work sheets adjust themselves and become consolidated in a ring which is two ply at the top and three ply at the base of the outer flange and four ply at the inner flange and yet of approximately the same thickness at all points of both flanges. It will be understood that when the discs are placed in the machine care is taken not to have the slits of one disc overlying the slits of the adjacent one. The result is that the slits do not register in the finished article and in fact the edges apparently overlap at these points and hence the slits do not weaken the ring although they permit the mutual adjustment and flowing, so to speak, of the material of which the work sheets are formed. This has been found to produce a ring of great mechanical strength and one in which the di-electric properties are quite uniform over the surface, thus preventing electrical penetration any more easily at one point than at another. By forming the slits 18 in the discs 11 and 12 non-radially, if disc 11 when superposed on disc 12 be reversed in its arrangement so that the incisions 18 extend in a direction opposite to those in the disc 12, or in other words, if one of these discs be turned over from the position shown in Figure 2 and then superposed on the other, when the pressing operation takes place the incisions will lie criss-cross and therefore cannot possibly come into registration. If radial incisions be used this function will not be present; hence the advantage of non-radial incisions.

It will be understood that the number of discs may be varied, and that other modifications may be made in the process without exceeding the scope of the invention, which is set out in the appended claims.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:

1. The method of making laminated rings consisting in taking sheets of semi-plastic mica material, stacking a plurality of such sheets one above another, and forcing them into a receptacle having converging sides for consolidating the sheets and simultaneously compacting their peripheral portions by means of pressure exerted edgewise on said peripheral portions.

2. The method of making laminated rings from semi-plastic mica sheets consisting in taking sheets of unequal size, aligning the sheets coaxially one above the other, and forcing said sheets into a receptacle having converging sides for consolidating the sheets and simultaneously compacting their peripheral portions by means of pressure exerted edgewise on said peripheral portions.

3. The method of making laminated rings consisting in preparing a plurality of discs of different diameter, slitting their peripheral portions, placing them coaxially one above the other with a sheet of smaller diameter below a sheet of larger diameter, bending the peripheral portions of the sheets upwardly from their original plane, and simultaneously exerting pressure, thereby consolidating the sheets and compacting the peripheral portion by means of pressure exerted edgewise on said peripheral portions more closely.

4. The method of making laminated rings consisting in preparing circular sheets of mica plate of different diameters, making slits in the peripheral portion of the sheets extending non-radially, heating the sheets to render them semi-plastic, superposing the sheets concentrically, bending the sheets along a circle concentric with but spaced from the circumference of the sheets to form an outer flange extending obliquely to the plane of the ring, and pressing the sheets together to consolidate them.

5. The method of making laminated insulating rings consisting in preparing circular sheets of mica plate of different diameters, heating them to render them semi-plastic, superposing the sheets concentrically, bending the sheets along a circle concentric with but spaced from the circumference of the sheets to form an outer flange extending obliquely to the plane of the ring, pressing the sheets together to consolidate them, and also compacting the upper outer rim of the ring

by means of edgewise pressure to consolidate and finish the same.

6. An insulating ring approximately V shaped in cross section and composed of a plurality of layers consolidated together, some of the layers having slits extending to the outer periphery and arranged in a non-radial direction, the slits of one layer being out of register with the slits of the adjacent layer.

7. An insulating ring for commutators consisting of a plurality of laminations of mica plate approximately V shaped in cross section, the laminations being pressed together and consolidated and the inner flange having a greater number of layers than the outer flange and being of approximately the same thickness.

8. An insulating ring for commutators consisting of a plurality of laminations of mica plate approximately V shaped in cross section, the V being rounded at the bottom, the laminations being consolidated and the inner flange having a greater number of layers than the outer flange, the excess layer of the inner flange rounding the point of the V for reinforcing it there.

9. The method of making insulating bodies which includes concentrically superposing a plurality of layers of circular mica sheets, some of which are of different diameters and subjecting them while hot to the action of a drawing die and punching out the central portion of the sheets during the die drawing operation.

10. The method of making insulating bodies which includes concentrically superposing a plurality of circular mica sheets, one of which is of larger diameter than another, and subjecting the sheets while hot to the action of a drawing die and punching out the central portion of the sheets during the die drawing operation.

11. The herein described method which comprises superposing a plurality of mica discs of different diameters disposed in co-axial registration, holding the central portions of the discs while subjecting intermediate portions thereof to a die pressing action to draw the same and cause the registration of the peripheral portions of said discs whereby to form an article of substantially uniform cross section and punching out the held central portion at the conclusion of the drawing operation.

12. A mica insulation ring substantially V-shaped in cross section and having flanges composed of a plurality of superposed layers of mica pressed into a substantial homogeneous mass, one of the flanges of the ring having a greater number of layers than the other.

13. A mica insulating member composed of a plurality of superposed sheets of mica die pressed and drawn into desired cross section, a certain part of said cross section being composed of more layers than another part.

14. The method of making mica insulating rings having intersecting flanges, consisting in preparing washers of mica plate, centering them by holding them at the center hole of the washers, heating the washers, die pressing them to form the two flanges, and die trimming the inner and outer flanges while remaining in the pressing die.

15. An annular insulating ring comprising concentrically stacked mica discs of unequal diameter formed and compacted into a solid unitary object.

16. The method of making laminated rings which comprises stacking a plurality of preformed mica discs of different diameters, heating the discs to render them semiplastic, bending the discs along a line spaced from the circumference thereof to form an outer flange extending obliquely, and finally pressing the sheets to consolidate them while simultaneously removing a central portion.

17. The method of making mica insulating rings which consists in bending a heated stack of preformed mica discs of different size arranged in concentric relationship along a line spaced from the circumference of the stack to form an outer flange extending obliquely and finally compacting the sheets to consolidate them whereby to cause a flow of mica within the product in order to effect a uniform distribution of mica in any zone of the product.

18. An annular insulating ring having two converging integral flanges, said ring being formed from a stack of mica discs including a larger and a smaller disc in such a manner that the larger disc extends in both flanges forming a retaining shell, while the smaller disc extends in the inner portion of the ring to strengthen and reenforce one of the flanges.

19. The method of making laminated insulating rings, which consists in stacking a plurality of pre-formed mica discs of different diameters and bending the discs along a line spaced from the circumference of the largest to form converging flanges, wherein a larger disc extends in both flanges and forms a retaining shell, while a smaller disc extends principally in one flange only, whereby to strengthen the flange.

20. The method of making laminated mica rings, which consists in forming a plurality of discs of different diameter, placing the discs co-axially one above the other and bending the peripheral portions of the stack upwardly from the original plane and simultaneously exerting pressure whereby to consolidate the sheets and compact the peripheral portions by means of pressure exerted edgewise on the peripheral portions.

21. An annular insulating ring comprising concentrically stacked mica discs of unequal size, the discs being formed and compacted

into a solid unitary object and having the central portions of the compacted discs punched out to trim the inner edges of the annular ring to size.

22. An annular insulating ring having two converging integral flanges, said ring being formed from a stack of mica discs including a larger and a smaller disc in such a manner that the larger disc extends in both flanges forming a frame work, while the smaller disc extends in the intersection of the flanges to strengthen and re-enforce the ring at this point.

23. The method of making laminated insulating rings which consists in stacking a plurality of pre-formed mica discs of different diameters and bending the discs along a line spaced from the circumference of the largest to form converging flanges, wherein a larger disc extends in both flanges and forms a retaining shell, while a smaller disc extends in one flange and partially in the other flange at its base to strengthen the ring at the intersection of the flanges.

In witness whereof, I have hereunto subscribed my name.

LOUIS T. FREDERICK.