March 11, 1941. J. J. TAYLOR 2,234,391

METHOD OF MANUFACTURING ELECTRIC INSULATORS

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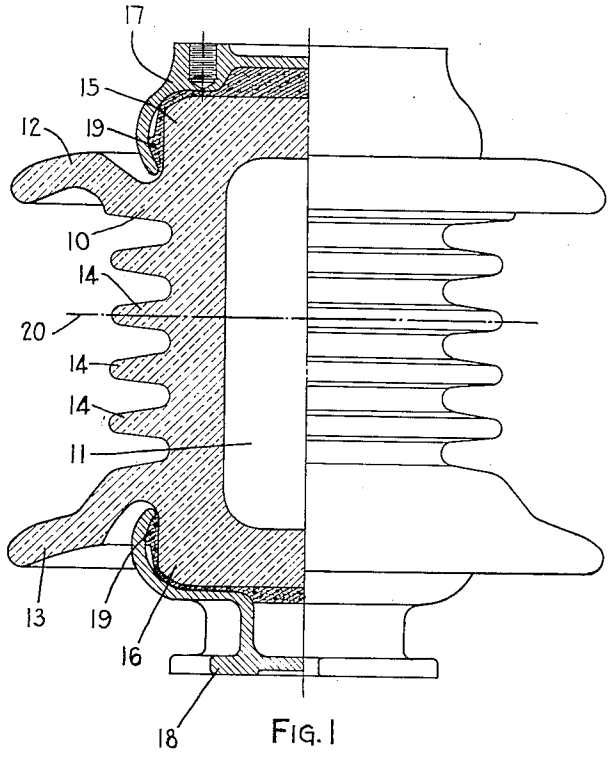


FIG. 1

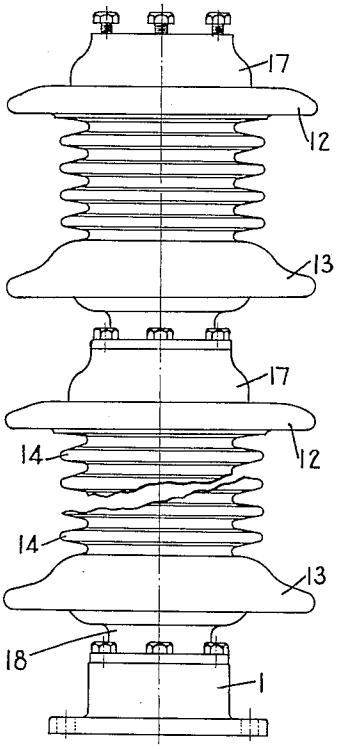


FIG. 2

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METHOD OF MANUFACTURING ELECTRIC INSULATORS

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7 Claims. (Cl. 25—156)

This invention relates to electric insulators and a method of manufacturing the same and has for one of its objects the provision of a method for manufacturing insulators of certain shapes which shall be more economical than the methods heretofore known and which shall produce insulators of more uniformly high quality.

A further object of the invention is to provide a method for manufacturing insulators having an internal recess completely surrounded by a continuous homogeneous imperforate shell.

A further object of the invention is to provide a novel method of manufacturing insulators having wide end flanges and intermediate flanges of less diameter by which method the amount of trimming heretofore required is reduced.

The invention is exemplified by the combination and arrangement of parts shown in the accompanying drawing and is described in the following specification and by the steps of the process set forth in said specification, and the invention is more particularly pointed out in the appended claims.

In the drawing:

Fig. 1 is a part elevation and part section showing one form of insulator made according to the present invention.

Fig. 2 is an elevation partly broken away of a stack of insulators like that shown in Fig. 1.

In the operation of electric insulators, particularly of the pedestal or post type, it has been found that hollow insulators have a number of advantages over those made of solid dielectric material. One of the obvious advantages, of course, is that for a given amount of material a hollow insulator is much stronger for resisting bending stresses than would be a solid insulator. Another advantage of the hollow insulator over one made of a solid piece of material is that a thick piece of dielectric material such as porcelain is more apt to have internal flaws than is a piece of thinner sections. Heretofore, however, difficulties have been experienced in the operation of hollow insulators because of the danger of electrical discharges through the internal recess. If the recess is vented to the atmosphere, moisture is apt to condense within the insulator thus reducing the internal resistance and giving rise to internal discharges. Where attempts have been made to seal the recess against communication with the outer atmosphere, difficulties have been experienced in providing permanent seals and in satisfactorily filling the insulator with gas having a permanent high resistance. Difficulties in manufacturing an insulator having an internal recess and providing reliable insulating properties adjacent the terminals of the insulator have also been encountered. The present invention provides a simple and economical method for overcoming these difficulties, and at the same time, provides an insulator which is so shaped and constructed that it is very efficient both mechanically and electrically for post or pillar work either when used individually or arranged in stacks.

In Fig. 1 the numeral 10 designates an insulator body of porcelain or other dielectric material having an internal recess 11 completely enclosed on all sides by a continuous homogeneous imperforate wall of porcelain. The method of producing this structure comprises a very important part of the invention. At the opposite ends of the body 10 are radial flanges 12 and 13 and between the flanges 12 and 13 is a series of lesser flanges 14. Projecting longitudinally of the insulator beyond the flanges 12 and 13 are bosses 15 and 16 to which the cap 17 and the base 18, respectively, are secured by cement 19. The purpose and operation of the various parts mentioned will be more fully explained after the method of manufacturing the insulator has been described.

The insulator body 10 is first formed from plastic clay in two parts, the part above the line 20 being formed separately from the part below this line. If the two parts of the insulator on opposite sides of the line 20 are considered separately it will be readily apparent that the two parts, except for the grooves between the flanges 14, may be readily formed by jiggering or plunging in the manner commonly employed for manufacturing pintype or suspension insulators, the flanges 12 and 13 and the central openings being formed substantially complete at one operation of the plunging machine. After the upper and lower sections of the insulator have been thus formed the surfaces at the line 20 are smoothed off to provide substantially plane surfaces. This may be easily done since the sections are supported in rotatable molds in the plunging machine with the surfaces uppermost in the molds. After the surfaces have been formed into true planes they are moistened with a slip composed of the same material as the insulator body except, of course, that the material is suspended in sufficient water to permit it to flow. The two surfaces thus moistened are then placed face to face and pressed together with sufficient force to squeeze all excess slip from between the surfaces. The excess moisture in the slip will be absorbed

by the material of the adjacent surfaces so that the material of the two parts is united as one continuous homogeneous mass. This method of joining parts is well known in the art and is used for such purposes as connecting handles or spouts to chinaware and for connecting sections of various forms of porcelain ware that cannot be made in a single piece.

After the two sections of the insulator have thus been joined, the completed piece is placed in a suitable lathe and the openings between the flanges 14 are turned out. By this method of manufacture, it is necessary to cut away only the material between the flanges 14, there being no material between the portions of the flanges 12 and 13 which extend beyond the periphery of the flanges 14. If the insulator were made in one piece, it would be necessary to trim out the material from the entire space between the flanges 12 and 13 so that the method of forming the insulator in two parts eliminates a great deal of trimming which otherwise would be necessary. The insulator may be trimmed green or may be permitted to dry before trimming.

In the drawing it will be noted that the line 20 bisects one of the flanges 14. It is desirable to trim the insulator in this way so that a maximum area is provided at the surface of union and so that the outermost edge of this surface will be as far from the axis of the insulator as possible, thus reducing to a minimum the stress at this edge due to bending movements of the insulator. It has been found in practice, however, that there is very little if any danger of weakness either mechanically or electrically at this point and that the porcelain material is in fact continuous and homogeneous across this surface. After the dielectric body has been thus formed, it is placed in the kiln and fired in the usual way. During the early stages of firing, before the clay was vitrified, the expansion of the air in the recess 11 will force a considerable quantity of the air through the porous clay to the exterior of the insulator. When the porcelain finally vitrifies, the recess is completely hermetically sealed at a relatively high temperature so that when the insulator subsequently cools, a partial vacuum will exist within the insulator. This reduction of pressure within the insulator reduces the resistance to electrical discharge of the air within the recess to about one-third of that of air at atmospheric pressure. This resistance, however, is ample to prevent internal discharges if concentration of electrostatic stress within the recess can be avoided, thus providing an approximately uniform distribution of voltage within the insulator.

A number of means for controlling the electrostatic flux to prevent concentration within the internal recess might be employed. The arrangement of the insulator fittings shown in the drawing very effectively accomplishes this result, and at the same time, provides metal fittings for the insulator well adapted for the purpose for which the insulator is designed. It will be noted that the cap 17 and the base 18 have a wide lateral extent so that the electrostatic lines of force will emanate from a large area and will not be concentrated at any particular point as would be the case if a restricted pin were used as the insulator fitting. Furthermore, the most extensively projecting portions of the fittings are disposed at their outer peripheries so that they not only provide a large circle from which the electrostatic flux emanates, but produce the greatest concentration of electrostatic stress at the periphery of this circle which is entirely outside of the outer periphery of the recess 11. Also, the edges of the fittings approach sufficiently near each other and project inwardly beyond the ends of the recess 16 so that the lines of force connecting these edges do not pass directly through the ends of the recess 11 but only a relatively small amount of the stress between these edges will affect the interior of the recess. Where the electrostatic field is thus controlled, the recess within the dielectric member may be sealed at kiln temperature and yet provide sufficient resistance within the recess that there will be no danger of internal discharges due to overstressing of the rarified gas within the recess. It will be noted that there is a complete layer of continuous imperforate dielectric material overlying the inner face of each fitting so that danger of puncture is reduced to a minimum. The end flanges 12 and 13 provide an over-all arcing distance between the fittings substantially equal to the total length of the insulator including the fittings. The arcing distance, of course, includes the diagonal distance from each fitting to the outer periphery of the end flange adjacent thereto plus the distance between the peripheries of the two flanges.

It will be seen from Fig. 2 that a plurality of insulators shown in Fig. 1 may be readily connected in a stack to form a pillar or post of any desired height and the total over-all arcing distance will be substantially equal to the total height of the stack, notwithstanding the presence of the metal fittings between the units of the stack.

Although in most cases the insulator will operate satisfactorily with reduced pressure in the internal recess, the form of insulator and process of manufacture readily lends itself to the method of filling described and claimed in my prior Patent No. 2,142,422 granted January 3, 1939, which method may be used for filling the recess to produce increased pressure therein.

I claim:

1. The method of forming an insulator having end flanges comprising the steps of separately forming by plunging two insulator parts from plastic material each part being formed with a main body portion having a flange at one end thereof, the entire body portion as initially formed being of materially less diameter than said flange to facilitate axial movement of the plunging tool over the end of said body opposite said flange and thereafter uniting the ends of said body portions opposite said flanges to form an insulator having a continuous intermediate body portion with flanges at opposite ends thereof and with the entire portion between said flanges of materially less diameter than said flange.

2. The method of manufacturing an insulator comprising the steps of forming two insulator parts from plastic material each part having a body portion with a projecting flange at one end thereof the entire body portion of each part, aside from its flange, being of materially less diameter than its flange, uniting the ends of said body portions opposite said flanges while the material thereof is still plastic thus forming a spool shaped body with flanges at each end thereof and with the entire intermediate portion of materially less diameter than said flanges and thereafter trimming the periphery of the united

body portions to form flanges thereon of less extent than said end flanges.

3. The method of manufacturing an insulator having a recess therein comprising the steps of forming by plunging two insulator parts each having a body portion with a flange thereon at one end thereof and with a recess therein open at the end thereof opposite said flange, the entire body portion of each part aside from its flange being as initially formed of materially less diameter than its flange and of maximum diameter adjacent said flange to facilitate axial movement of a plunging tool over the end of said body portion opposite said flange, uniting the ends of said body portions while still plastic with the recesses therein in registration with each other and thereafter firing the united body portions to form a unitary insulator having a recess therein and having flanges at the opposite ends thereof of greater diameter than any portion of the intermediate body.

4. The method of manufacturing an insulator comprising the steps of forming two body portions each having a radial flange adjacent one end thereof and each having a recess therein open at the end thereof opposite said flange, slip joining the ends of said body portions with the open ends of said recesses in registration with each other, trimming the periphery of said body portion to form flanges thereon of less radial extent than said end flanges and thereafter firing the joined body portions to form a unitary insulator.

5. The method of manufacturing an insulator comprising the steps of forming two body portions, slip joining the ends of said body portions and thereafter trimming the periphery of the joined body portions to form radially projecting flanges thereon, the joined surfaces of said body portions registering with a plane that divides one of said flanges.

6. The method of manufacturing an insulator comprising the steps of forming from plastic material two body portions each having a radially extending flange at one end thereof and each having a recess therein opening at the end of said body portion opposite said flange, slip joining the ends of said body portions with the ends of said recesses in registration with each other, trimming the periphery of said joined body portions to form flanges thereon of less radial extent than said end flanges and firing the joined body portions to vitrify the material thereof and seal the recess therein, one of the flanges formed by trimming said body portion having the joined surfaces of said body portions between the upper and lower surfaces thereof.

7. The method of manufacturing an insulator having a recess therein comprising the steps of forming from plastic porcelain material an elongated insulator part having a recess therein open at one face of said part, forming a closure from like material, placing the closure over the said recess and in contact with said face, then slip-jointing the engaging faces of said closure and said part while in a plastic condition to cause the material of said closure and said part to unite and form a unitary body, trimming the periphery of said body to form a plurality of spaced flanges thereon with the joined faces of said closure and said part lying between the upper and lower faces of one of said flanges and extending to the outer periphery of said flange and thereafter firing the body to form a vitrified porcelain insulator.

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