Dec. 2, 1941. W. H. WELLS ET AL. 2,264,685

INSULATING STRUCTURE

Filed June 28, 1940

Fig. 1.

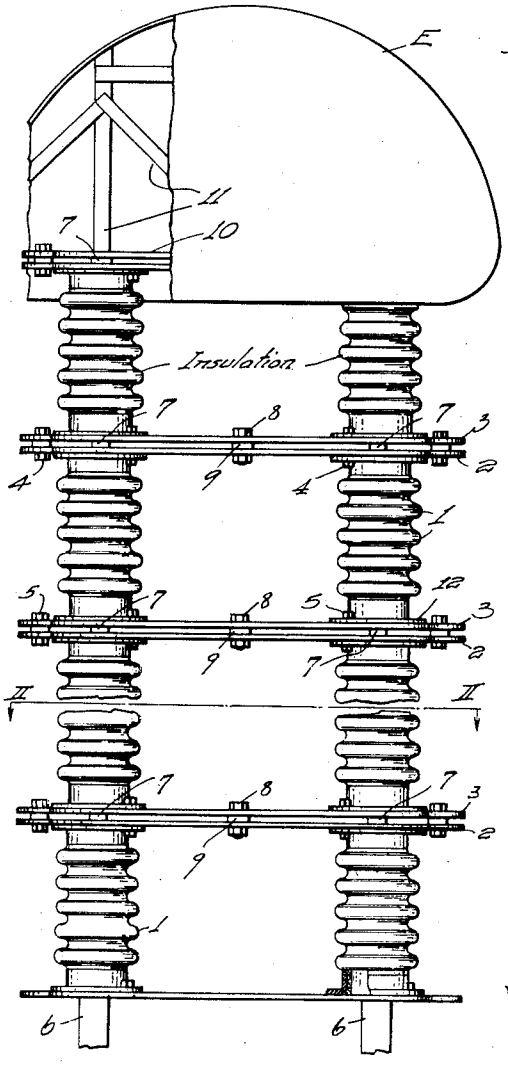


Fig. 2.

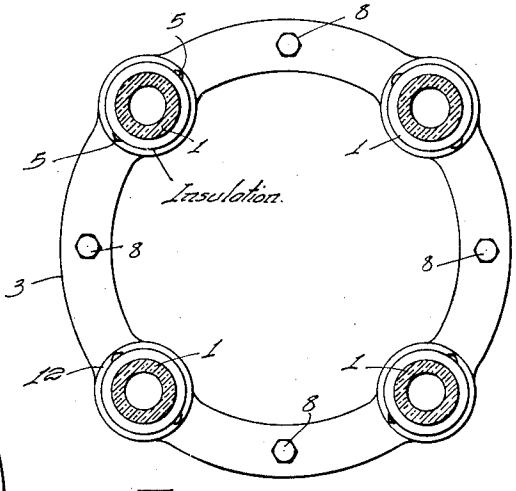
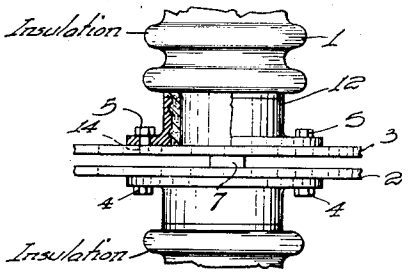


Fig. 3.



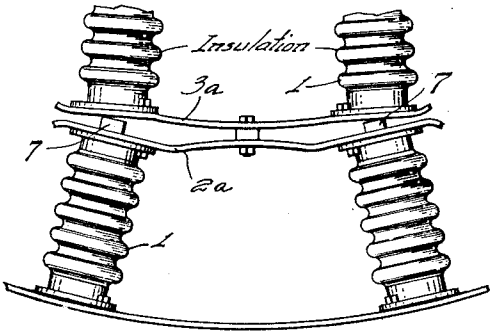


Fig. 4.

WITNESSES:

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INSULATING STRUCTURE

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6 Claims. (Cl. 174—148)

Our invention relates to insulators and it has particular relation to insulating structures for supporting large electrical equipment which is maintained at a high electrical potential. Although not limited thereto, the invention is particularly applicable to structures for supporting large electrodes maintained at high voltages such as the high-voltage electrode in equipment for breaking up or "smashing" atoms.

Such structures are generally built up of a number of smaller insulators which are of porcelain or like material. Although these materials have been found to be the best available for such insualtors, they have a serious disadvantage in that they are relatively brittle and weak in tension. Since different portions of large supporting structures of the type in question are often subject to different temperatures, it has been found that the insulators, when maintained in a rigid structure, are often subjected to excessive tensional and torsional stresses. In order to avoid these stresses, the invention provides a relatively flexible supporting structure. The structure is made up of a plurality of superimposed units, each of which includes a number of porcelain insulators connected at the top and bottom to metallic connecting plates. These connecting plates are of a shape and size such that they are relatively flexible in bending perpendicular to their planes and in torsion. A number of spacing members are disposed between the adjacent units to provide a structure in which the stresses resulting from temperature differences will be taken up by the connecting plates rather than the insulators themselves.

It is accordingly an object of our invention to provide a novel and improved insulating structure.

It is another object of our invention to provide an insulating structure which will not be subjected to excessive stresses when temperature differences exist between various portions thereof.

A further object of the invention is to provide a large insulating supporting structure made up of ceramic insulators arranged to be free from excessive stresses despite various unfavorable conditions to which the structure may be exposed.

Other objects and advantages of our invention will appear from the following description taken in conjunction with the accompanying drawing in which:

Figure 1 is an elevational view, with parts broken away, of an insulating structure built in accordance with the invention;

Fig. 2 is a horizontal sectional view taken along the line II—II of Fig. 1;

Fig. 3 is an enlarged elevational view, partly in section, of a portion of the device; and

Fig. 4 is an elevational view of a portion of the structure showing the effects of temperature differences thereon.

Referring to Figures 1 and 2 of the drawing, there is shown an insulating structure built up of a plurality of units, each of which includes a number of ceramic insulators 1 disposed between a top connecting member 2 and a lower connecting member 3. These insulators are secured to the top and bottom plates by means of bolts 4 and 5, respectively, and although four insulators are shown in each unit, the number may be varied, as required by the size and weight of the equipment which is to be supported. The various units are preferably superimposed with the insulators 1 of different units in alignment. The lower unit is supported on standards 6 and spacing members 7 are disposed between the top connecting member of each unit and the bottom connecting plate of the unit immediately above. These spacing members 7 are shown as metallic discs or washers, but it will be evident that they may be made in other shapes or of other materials if desired. As shown in the drawing, the members 7 are preferably disposed in line with the insulators of the adjacent units. The top and bottom supporting members 2 and 3 of adjacent units are secured together by bolts 8 which are shown approximately mid-way between the insulators 1. If desired, additional spacing washers may be provided at 9 between the connecting members with the bolts 8 passing therethrough.

In Fig. 1, the structure is shown supporting a large high potential electrode E such as is provided in the equipment for breaking up or "smashing" atoms. It is preferable that some of the equipment for maintaining the high potential required for such a device be located within the electrode, although for the sake of simplicity, a showing of this has been omitted from the drawing. The electrode is preferably supported from an additional connecting member 10 by means of braces indicated at 11.

As is more clearly shown in Fig. 3, the insulators 1 are made up of ceramic material to the ends of which metallic flanges 12 are cemented or otherwise secured. These flanges are provided with apertures through which bolts 4 and 5 extend. The bolts are screwed to corresponding threaded apertures 14 in the connecting members

2 and 3. The connecting members 2, 3 and 10 are preferably of a relatively thin metal which is relatively flexible in torsion and in bending perpendicular to the plane of the member. While they are shown in Fig. 2 as being substantially ring-shaped, under certain conditions, it may be desirable to make them square, rectangular, elliptical, or of some other shape. To provide maximum flexibility, it is preferable that they be apertured in the center when one of these other shapes is employed.

In Fig. 4, the effect of different temperatures in different portions of the supporting structure is exaggerated to show better the operation of the invention. In this case, the lower portion of the apparatus is at a higher temperature than the upper portion. Because of the resilient arrangement, this temperature difference permits the connecting members 2*a* and 3*a* to bend and twist without placing any material stress on the porcelain members 1. The spacing members 7 may be slightly rounded on their upper surfaces to provide better seating for the members 2*a* and 3*a* when the structure is subjected to such unequal temperatures. Ordinarily, however, the deformation of the members is so small that this is unnecessary. It will be noted here that if the connecting bolts 8 were located relatively close to the connections of the insulators to the plates, there would result, in effect, a rigid column of porcelain. Under such circumstances, the temperature differences would result in destructive tensional strain on the porcelain instead of being taken up by the connecting members.

From the above description, it will be evident that a number of advantages will be found in an insulating structure built in accordance with the invention. Because of the connecting members being relatively stiff in their planes, lateral loads will be transmitted more or less equally to all columns and will not set up excessive torsional stress due to local deformations. In this structure stresses resulting from inaccuracies and errors in the fit of various parts or resulting from improper assembly will be minimized. Devices constructed as taught by the invention will be found superior to structures built up to form a lattice work of porcelain rods and columns since such built-up arrangements are subject to tensional stress due to lateral loads and unknown secondary bending moments.

A further advantage of the construction is that each unit of the procelain column may be moved vertically by small amounts with respect to the others without setting up excessive stresses. This permits ready adjustment of the position of the electrode 9, a feature which is particularly desirable in such equipment.

Although we have shown and described a particular embodiment of the invention, it will be understood that various modifications may be made therein without departing from the spirit and scope of the invention as set forth in the appended claims.

We claim as our invention:

1. An insulating structure comprising a plurality of superimposed insulating units each of which includes a plurality of spaced insulators secured to top and bottom connecting members which are flexible in torsion, spacing means disposed between the top and bottom connecting members of adjacent units for supporting each unit on the unit therebelow, and means for securing said top and bottom connecting members of adjacent units against relative lateral displacement.

2. An insulating structure comprising a plurality of superimposed insulating units each of which includes a plurality of spaced insulators secured to top and bottom connecting plates flexible in torsion, spacing means disposed between the top and bottom connecting plates of adjacent units for supporting each unit on the unit therebelow, and means at points displaced from the points of attachment of said connecting members to said insulators for connecting said top and bottom connecting plates of adjacent units together to prevent relative displacement therebetween.

3. An insulating structure comprising a plurality of superimposed insulating units each of which includes a plurality of spaced insulators secured to top and bottom connecting members, said connecting members having central apertures and being flexible in torsion, means disposed between adjacent top and bottom connecting members, of adjoining units for supporting said units in vertically spaced relationship, and means at points displaced from the points of attachment of said connecting members to said insulators for connecting said adjacent top and bottom connecting members together.

4. An insulating structure comprising a plurality of superimposed insulating units each of which includes a plurality of insulators substantially equally spaced from each other and secured to top and bottom connecting rings, said rings being flexible in torsion, spacing members disposed between adjacent top and bottom rings of adjoining units at points substantially beneath the insulators of the upper of said adjoining units, and means at points intermediate said spacing members for connecting said adjacent top and bottom rings together.

5. In an insulating structure for supporting an electrical device, a plurality of superimposed insulating units each of which includes a plurality of insulators substantially equally spaced from each other and secured to top and bottom supporting rings, said rings being flexible in torsion, means disposed between adjacent top and bottom rings of adjoining units at points substantially in line with said insulators for supporting said units in vertically spaced relationship, and means intermediate said spacing means for connecting said adjacent top and bottom connecting rings together.

6. In an insulating structure, a plurality of superimposed insulating units each of which comprises a plurality of insulators secured at their ends to top and bottom supporting rings in horizontally spaced relationship, said supporting rings being of normally flat relatively thin metal flexible in torsion in vertical planes including radii thereof, a plurality of members disposed between adjacent top and bottom rings of adjacent units in horizontally spaced relationship to support each unit upon the one therebelow in vertically spaced relationship, and means displaced from said spaced members for interconnecting said top and bottom rings.

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