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SEALED INSULATOR BUSHING
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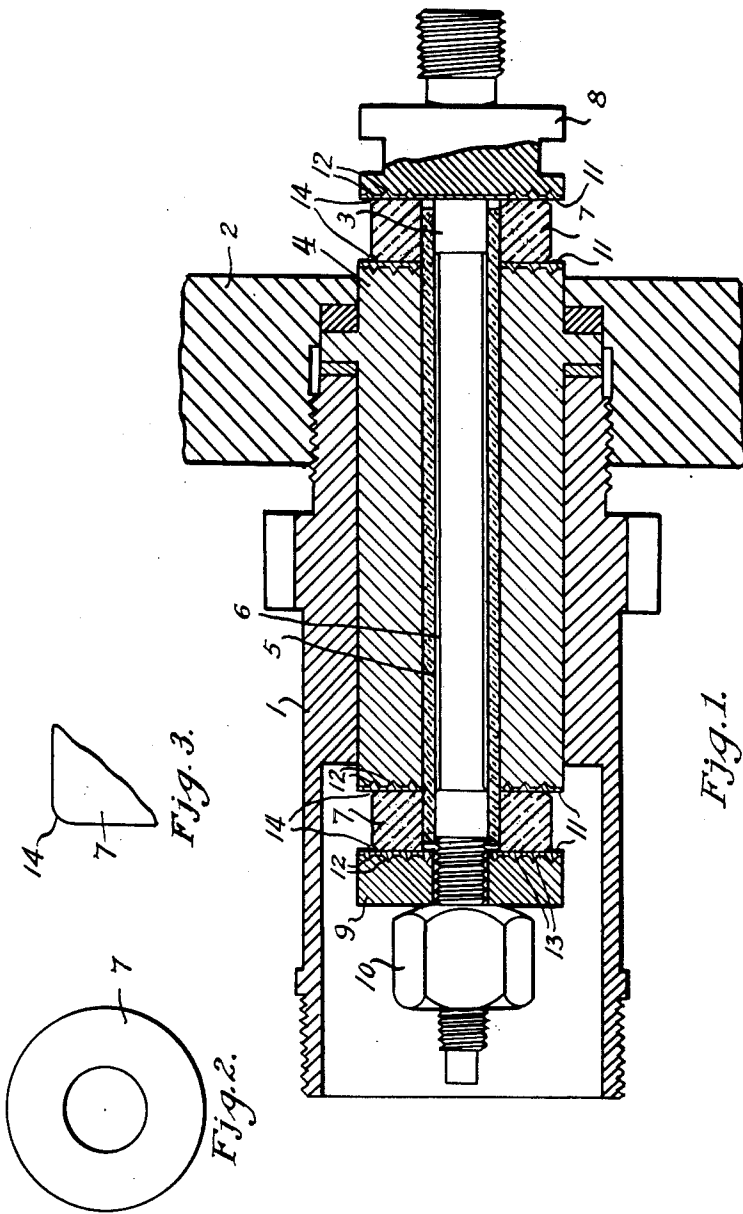


Fig. 1.

Fig. 3.

Fig. 2.

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SEALED INSULATOR BUSHING

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6 Claims. (Cl. 174—152)

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This invention relates to insulators particularly adapted for electrode leads in ionization chambers and the like.

For ionization chambers, it is desirable to provide an insulator which is mechanically strong, shock-proof, vacuum tight, capable of withstanding gas pressures of many atmospheres, and durable under intense neutron bombardment. It has been proposed to employ quartz as a material for making such insulators because this material has substantially perfect insulating properties and is comparatively very slowly deteriorated by neutron or other radiation. However, considerable pressures, of the order of 1000 pounds per square inch, must be imposed on the quartz parts of the insulator in order to obtain gas tight joints, and ordinary quartz parts do not possess sufficient inherent strength to withstand such heavy loads.

It is an object of this invention to provide an insulator having quartz insulating members therein so constructed as to possess sufficient inherent mechanical strength to withstand loads of the order of at least 1000 pounds per square inch.

The invention will be described with reference to the accompanying drawing, in which

Figure 1 is a longitudinal section through an insulator in accordance with the invention,

Figure 2 is a plan view of a quartz insulating member, and

Figure 3 is an elevation of a fragmentary portion of the quartz insulating member.

In the drawing, 1 is a substantially cylindrical insulator housing mounted in a wall 2 of an ionisation chamber or the like. The current conducting member comprises a high tensile steel bolt 3 extending through the housing. A bushing 4 supports the bolt within the housing, the bolt being insulated therefrom by means of a quartz tube 5. As shown, the bolt is reduced in diameter at 6 throughout the major portion of its length.

The main insulating members comprise two quartz rings 7 of similar size and shape, fitting over the extending end portions of the bolt 3 and tube 5. One ring is inserted between the head 8 of the bolt and the adjacent end of the bushing, and the other ring is inserted between the other end of the bushing and a washer 9. A nut 10 is screwed onto the outer end of bolt 3 to secure the parts in assembled relation. Soft metal, preferably lead or gold, gaskets 11 are inserted between the opposing surfaces of the rings 7 with the washer 9, bushing 4, and bolt

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head 8. The metal surfaces of the latter members in contact with the gaskets are preferably provided with a plurality of concentric V-shaped grooves 12. Thus on compression of the parts by means of the nut 10, the grooves 12 divide the gasket 11 into a plurality of substantially independent ring seals 13 which effectively render the insulator vacuum and pressure tight.

It will be observed that the tube 5 terminates in slightly spaced relation to washer 9 and head 8 and thus is not subjected to pressure stresses.

In order to obtain the necessary sealing contact between the parts, it is essential to screw up the bolt to a tension of the order of 1000 lbs. per square inch or greater. Thus, the quartz rings 7 must be capable of withstanding such pressure. Ordinary quartz rings are incapable of withstanding pressures of this order and an important feature of the invention resides in the treatment of the rings to render them pressure resistant.

The rings are first washed in chromic acid to remove traces of abrasive and then in several changes of distilled water. An oxy-hydrogen flame is then directed onto the edges and surface of the ring to round the edges to a radius of, for instance, $\frac{1}{2}$ inch, as indicated at 14, and to fire-polish the surface, thus producing a smooth glazed finish thereon. The microscopic and larger cracks normally present in a quartz surface are thus sealed up. During the firing operation, the surface portion of the quartz ring becomes melted, which, on solidification, forms a dense coherent surface.

Following the initial fire-polishing step, the flat surfaces of the rings are finely ground or lapped to true up the same whereby such surfaces are plane and parallel to an accuracy of, say, 0.0001 inch. The finely ground surfaces are then regulated with an oxy-hydrogen flame, great care being taken not to impair their flatness appreciably.

It has been found that quartz rings having their edges rounded and their flat surfaces fire-polished and glazed are capable of withstanding loads of 1000 lbs. per square inch and greater.

In order to prevent the setting up of strains on the quartz rings in the assembly by irregularities in the lead gaskets, it is advisable to subject the assembled insulator to a heat treatment at a temperature near the melting point of lead whereby the lead flows into intimate contact with the quartz and metal and irregularities are eliminated. Such heat treatment when carried out in vacuo also serves to free the quartz from any

absorbed moisture and therefore increases the insulation resistance thereof.

It is desirable to employ, in the assembly, a bolt of such length, diameter, and elasticity that, when loaded to apply a pressure of about 1000 lbs. per square inch on the insulating members, it is elongation as a result of the load is sufficient to be at least about 25% in excess of the original combined thickness of the gaskets 11. In other words, the sum of the thickness of the two gaskets is less than the amount of elongation of the bolt. This ensures that the gaskets always remain tight.

I claim:

1. An insulating member comprising a bolt 15 having a head, a bushing and a washer on the bolt, a quartz ring interposed between the head of the bolt and the bushing and between the washer and the bushing, and a nut on the bolt compressing said washer, bushing, and quartz rings under a pressure of at least 1000 lbs. per square inch, each said quartz ring having flat, parallel, opposite surfaces receiving said compressive force, each said surface having that degree of smoothness, denseness and mergence with contiguous surfaces which is attainable by fire polishing.

2. In a gas tight insulating joint, a quartz insulating member having flat parallel opposite surfaces, and metallic clamping means engaging said surfaces to make gas-tight joints therewith, said surfaces having that degree of smoothness, denseness and mergence with contiguous surfaces of the member which is attainable by fire polishing, whereby said insulating member is adapted to withstand clamping pressures of the order of 1000 lbs. per square inch.

3. In a gas tight insulating joint, a quartz insulating ring having flat parallel opposite annular surfaces and co-axial cylindrical surfaces, and metallic clamping means engaging said annular surfaces to make gas-tight joints therewith, said clamping means including a rod passing axially through said ring, said annular surfaces having that degree of smoothness, denseness and mergence with said cylindrical surfaces which is attainable by fire polishing, whereby said insulating ring is adapted to withstand clamping pressures of the order of 1000 lbs. per square inch.

4. A gas tight insulating joint, comprising a

quartz body having a resistance to fracture and a high degree of external smoothness of the order obtained by fire polishing, at least one member having a surface in contact with the surface of said body over a substantial area, and means for pressing said body and said member together under a pressure up to 1000 lbs. per square inch.

5. A joint as set forth in claim 4, in which said quartz body has opposing parallel surfaces, and said members are two in number and are in contact one with each of said parallel surfaces.

6. A method of preparing a smooth, quartz insulating element having at least two parallel surfaces and having a resistance to pressure of the order of 1000 lbs. per square inch, comprising the steps of washing a body of quartz having at least two substantially parallel surfaces in a strong acid, washing said body in distilled water, subjecting said body to intense fire-polishing heat, grinding said surfaces to an accuracy of .0001 inch in flatness and parallelism, and fire polishing said ground surfaces, whereby the surfaces of said body are rendered extremely smooth and the resistance of the body to fracture is greatly increased.

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