E. THOMSON.

METHOD OF MAKING A VITREOUS BODY OF VARIABLE COMPOSITION.

APPLICATION FILED SEPT. 1, 1915.

1,173,688. Patented Feb. 29, 1916.

Fig. 1.

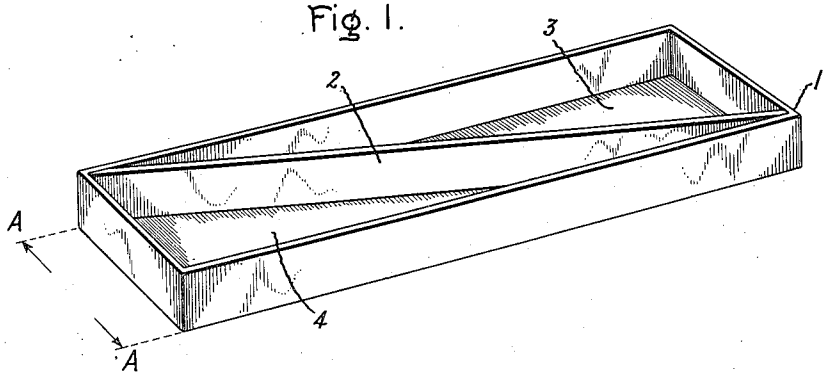


Fig. 2.

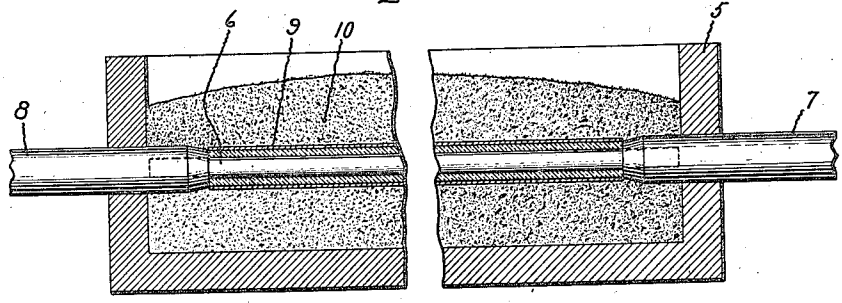


Fig. 3.

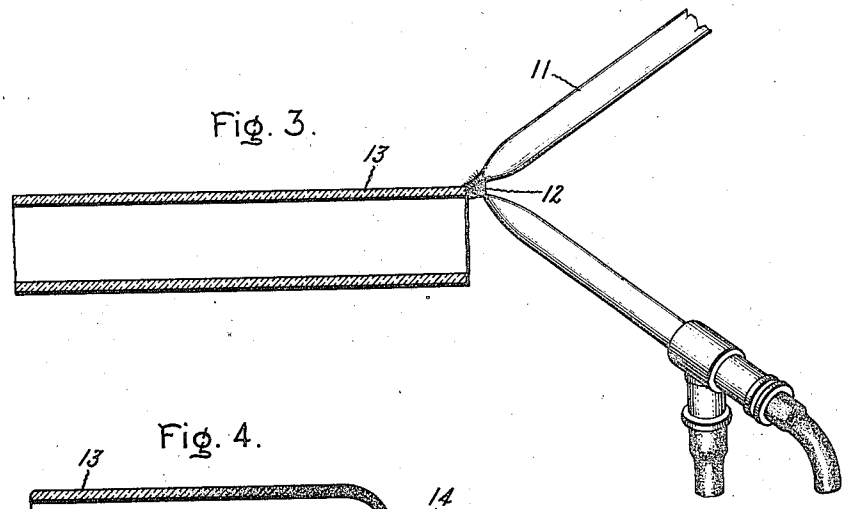
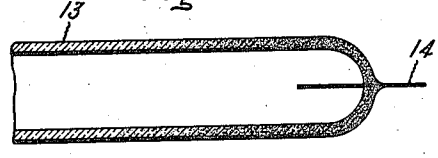


Fig. 4.



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UNITED STATES PATENT OFFICE.

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METHOD OF MAKING A VITREOUS BODY OF VARIABLE COMPOSITION.

1,173,688. Specification of Letters Patent. Patented Feb. 29, 1916.

Application filed September 1, 1915. Serial No. 48,474.

To all whom it may concern:

Be it known that I, ELIHU THOMSON, a citizen of the United States, residing at Swampscott, county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Methods of Making a Vitreous Body of Variable Composition, of which the following is a specification.

The present invention relates to the production of a vitreous body having a rod-like tubular or other extended shape and varying progressively in composition along a longitudinal axis.

My invention is particularly applicable to the production of a joint or union between two materials differing materially in coefficient of expansion, for example, silica and glass. This structure is especially useful for seals in silica containers, blending in composition at one end with the silica and at the other end with glass into which a metallic conductor may be embedded, thus making a unitary structure.

In the accompanying drawing Figure 1 illustrates somewhat diagrammatically an apparatus for mixing the two ingredients; Fig. 2 illustrates a device for sintering the mixture preparatory to subsequent working; Fig. 3 shows how the article may be used to build up a seal in a quartz tube, and Fig. 4 shows a completed seal for an electrical leading-in wire.

My invention will be described with particular reference to a joint between silica or quartz and a low-expansion boro-silicate glass, but I wish it to be understood that these particular materials are chosen for illustrative purposes and that others may be similarly used.

The mixing of the two ingredients is carried out in a trough-shaped container 1, having a diagonal wall 2 dividing the trough into two compartments relatively wide at one end and narrow at the other. Into one of these compartments, for example, compartment 3, is placed a quantity of finely divided quartz and in compartment 4 is placed finely divided glass, preferably a low expansion glass, such as a potassium (or sodium) magnesium boro-silicate. The dividing wall 2 is then removed and the two vitreous materials are carefully mixed for example by means of a rod, with a reciprocating motion in a direction at right angles to their linear extension, that is, in the direction A—A.

When a mixture has been obtained which is homogeneous on a transverse section while preserving the gradual longitudinal variation, it is subjected to a sintering temperature. For example, if a tubular article is desired, the mixture is poured around a core by tilting the container 1 on its long axis without disturbing the longitudinal distribution of the mixture. Rod or cane-like bodies may be sintered by either placing the material in a hollow heater and passing the current therethrough to sinter it, or by placing said material in a mixing box made to the required shape and sintering by means of an oxygen flame.

Fig. 2 illustrates one form of apparatus suitable for producing tubes by electrical heating. It comprises a container 5 of suitable refractory material, such for example, as firebrick, through the ends of which projects a refractory heater 6 having enlarged terminals 7 and 8. The heater proper has a smaller cross-section than the terminal and preferably is surrounded by a cylinder 9 of carbonizable material such, for example, as paper spaced away from the heater a distance slightly greater than the thickness desired in the wall of the cylinder to be made. Between the heater 6 and the cylinder 9 is placed the mixture to be sintered. A packing of silica 10 may surround the heater but this may be omitted if desired.

The resistor is heated by passage of current to a temperature of about 1300–1400° C. on the hottest zone for about 1½ minutes, thereby causing the finely divided vitreous material to cohere or sinter. The center of the heater gets naturally hotter than the ends where the electrodes have a cooling effect. Advantage may be taken of this fact to produce the desired temperature gradation whereby the glass end (or lowest melting material) is not overheated, while the quartz end is sufficiently sintered. With this result in view two mixtures are so located around one heater that the quartz end of each is at the center of the heater. The sintered tube blanks are removed by

cutting in the center and slipping each tube off the core, and finished in an electric arc or oxygen-gas flame to produce fusion.

In order to produce a seal for a gas-tight quartz container, the tube thus made may be sealed at the end consisting of silica into the wall of the container. The end of the tube may be finally closed with glass and as shown in Fig. 4 a metallic conductor such as tungsten embedded by fusion in the low expansion glass in the usual well understood manner. Similarly a blended seal may be built up gradually by fusion using a rod of silica and glassy material varying longitudinally in composition as above described. That is the end of a rod 11 consisting largely of silica, is melted in a flame 12 or arc and applied as indicated in Fig. 3 to the mouth of a silica container 13 to be provided with a seal. The melting is continued using methods well-understood by glass-blowers and quartz-workers until finally the end of the rod consisting of glass is reached which may be used to close the end of the tube in which a metallic conductor 14 may be embedded, as indicated in Fig. 4. The advantage of such a seal lies in the entire elimination of zones with a consequent simplification and cheapening of structure and avoidance of undue strains due to differences of co-efficients of expansion between contiguous zones.

What I claim as new and desire to secure by Letters Patent of the United States, is:—

1. The process of making an extended body consisting of a mixture of two ingredients varying gradually in relative proportion from one end of the body to the other which consists in placing said ingredients side by side in a finely divided state, the cross-sectional proportion of said ingredients varying in desired manner, stirring said ingredients transversely to mix the same, and finally consolidating the particles to form a coherent mass.

2. The process of making an extended body consisting of a mixture of quartz and glass varying gradually in relative proportion from one end of the body to the other which consists in placing said ingredients side by side in a finely divided state, the cross-sectional proportion of said ingredients varying in desired manner, stirring said ingredients transversely until a homogeneous mixture is secured while preserving the predetermined longitudinal variation intact and finally heating said mixture to consolidate the particles into a coherent mass.

In witness whereof, I have hereunto set my hand this 30th day of August, 1915.

ELIHU THOMSON.