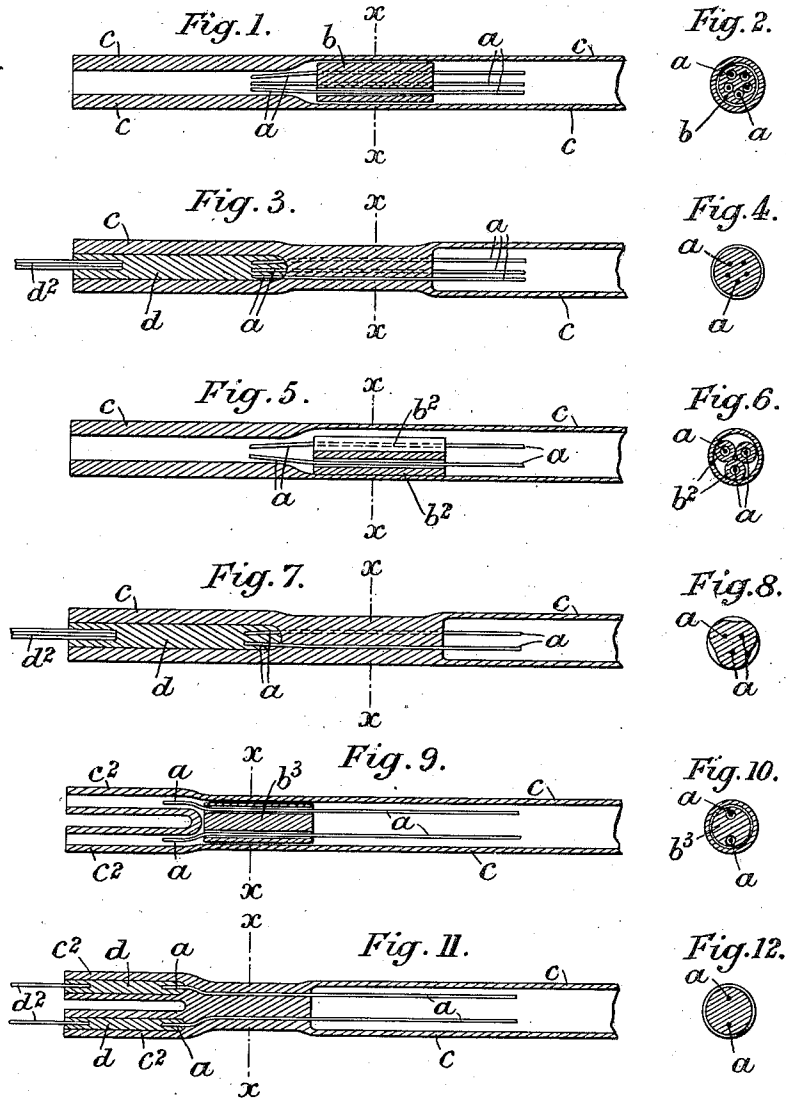


April 1, 1924.

1,489,099

F. REYNOLDS
MANUFACTURE AND PRODUCTION OF GAS TIGHT SEALS OR CLOSURES
BETWEEN METAL AND VITREOUS MATERIAL
Filed June 5, 1922



INVENTOR:-
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by his Attorneys
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UNITED STATES PATENT OFFICE.

FREDERICK REYNOLDS, OF WALKERVILLE-ON-TYNE, ENGLAND, ASSIGNOR OF ONE-HALF TO THE SILICA SYNDICATE LIMITED, OF WESTMINSTER, ENGLAND, A COMPANY OF GREAT BRITAIN.

MANUFACTURE AND PRODUCTION OF GAS-TIGHT SEALS OR CLOSURES BETWEEN METAL AND VITREOUS MATERIAL.

Application filed June 5, 1922. Serial No. 566,089.

To all whom it may concern:

Be it known that I, FREDERICK REYNOLDS, a subject of the King of Great Britain, residing at 14 Rosewood Crescent, Walkerville-on-Tyne, Northumberland, England, have invented new and useful Improvements in the Manufacture and Production of Gas-Tight Seals or Closures Between Metal and Vitreous Material, of which the following is a specification.

In the specification of Letters Patent No. 1,118,812, November 24, 1914, a method of making a seal, or closure, between a quartz vacuum vessel and the conductive wires which pass thereinto, is described, the said method employing a plug of lead, or other soft metal. The largest wire which can be sealed into a quartz tube in this way without causing the tube to crack is one of a diameter of about a millimeter and, therefore, the electric current which can be passed through such a seal is limited to that which such a wire will carry without overheating.

I have found that such a seal can be adapted to carry larger electric currents if, instead of a single wire, several wires be employed, but if several wires be twisted or bunched together and introduced into the tube of quartz or silica-glass, and then the softened tube be pressed onto the wires some of the lead used to make the seal, when in a molten condition, will pass along the channels between the wires and gain access to the quartz, or silica-glass, tube beyond the seal which passage of the lead, is, of course objectionable.

This difficulty is overcome according to this present invention by passing two, or more, wires or the like, through separate holes in a cylindrical piece, or plug, of quartz, or silica-glass, or other vitreous material, or through separate tubes of quartz, or silica-glass, or other vitreous material, and then placing the said cylindrical piece, or plug, or the said tubes, and the contained wires, or the like, in the enveloping tube of quartz, or silica-glass, or other vitreous material, within which the seal is to be made; and fusing the whole together.

I will describe, with reference to the accompanying drawing, ways in which this invention can be performed, presuming for the purposes of description, that wires which

are conductors of electricity are to be enclosed in quartz or silica-glass. Figure 1 is a longitudinal section and Figure 2 is a transverse section on the line *x, x* shewing the wires passed through holes in a quartz, or silica-glass cylindrical piece, or plug, which, and the wires, are placed in the enveloping tube of quartz, or silica-glass, within which the seal is to be made. Figures 3 and 4 are like sections shewing the device after the quartz, or silica-glass has been fused and pressed together and the lead seal has been made.

Figures 5, 6, 7 and 8 are like views of a modification wherein the wires are passed each through a small quartz, or silica-glass, tube.

Figures 9, 10, 11 and 12 are like views of another modification in which each wire has its own lead seal.

Referring first to Figures 1, 2, 3 and 4, the wires *a* to be used in the seal are passed one through each of a corresponding number of holes running lengthwise in the quartz, or silica-glass, cylindrical or filling, piece *b* so that the wires *a* are separated from each other by the quartz, or silica-glass, and, when this cylindrical, or filling, piece, *b* with the wires *a* running through it, is placed as shewn in Figures 1 and 2, inside the quartz, or silica-glass, tube *c*, within which the seal is to be made, and the whole is fused together, each wire *a* becomes embedded in quartz, or silica-glass, as shewn in Figures 3 and 4, and the wires do not touch each other at the place where the seal is made between the said wires and the quartz, or silica-glass.

Or the said seal may be made, as illustrated in Figures 5, 6, 7 and 8, by passing each wire *a* through a fine-bore small tube *b*¹ of quartz, or silica-glass, and then placing these tubes *b*² together as shewn in Figures 5 and 6 inside the tube *c* in which the seal is to be made and fusing the whole together as shewn in Figures 7 and 8.

Figures 9, 10, 11 and 12 illustrate a case in which it is required to have two, or more, wires *a* sealed into the same end of a small diameter quartz, or silica-glass, tube, each wire having a lead seal of its own and being insulated from the other wire, or wires. I can use either of the hereinbefore described methods of fusing the wires into the main

seal-tube but, each wire *a* is provided with a separate tube *c*² which receives the lead-seal these tubes *c*² having been formed with, or fused on, the end of the main seal-tube *c* before the wires *a* are placed in position in holes in the cylindrical piece *b*³ of quartz, or silica-glass as shewn in Figures 9 and 10, the said cylindrical pieces being afterwards fused with the tube *c* and around the wires *a*, as shewn in Figures 11 and 12.

In either of the foregoing cases the lead-seal (shewn at *d* in Figures 3, 7 and 11) can be introduced as described in the aforesaid specification of Letters Patent No. 1,118,812, November 24, 1914 to make the whole seal, or closure, gas-tight the ends of all the wires *a* extending to a sufficient distance into the lead to make proper electrical contact with it. *d*² shews the external conductor inserted in the lead seal.

Although I have referred to quartz, or silica-glass, as being the material in which the seal is to be made, it will be understood that this invention is not limited in its application to the use of that particular vitreous material, and although I have mentioned lead as the metal employed according to the aforesaid Patent No. 1,118,812, November 24, 1914, other suitable metal, or alloy, may be similarly used if preferred.

In the claims where I speak of passing metallic elements through separate holes in

vitreous material, it should be understood that it is immaterial whether that vitreous material is composed of separate tubes or is one body.

What I claim is:—

1. The manufacture of gas-tight seals between metal and vitreous material by passing a plurality of metallic elements through separate holes in vitreous material, placing said vitreous material and the contained metallic elements in an enveloping tube of vitreous material within which the seal is to be made, and fusing the whole together, substantially as described.

2. The manufacture of gas-tight seals between metal and vitreous material by passing a plurality of metallic elements through separate holes in vitreous material, placing said vitreous material and the contained metallic elements in an enveloping tube of vitreous material within which the seal is to be made, fusing the whole together and completing the sealing with metal, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

FREDERICK REYNOLDS.

Witnesses:

WILLIAM CRAIG,
JOSEPH REED RUECROFT.