M. VON RECKLINGHAUSEN.

SEAL FOR VAPOR ELECTRIC APPARATUS.

APPLICATION FILED JULY 12, 1913.

1,271,245.

Patented July 2, 1918.

2 SHEETS—SHEET 1.

Fig. 1

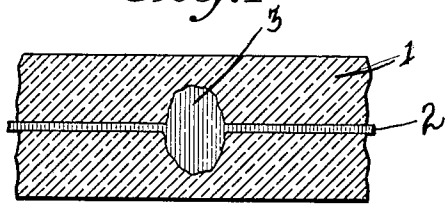


Fig. 2

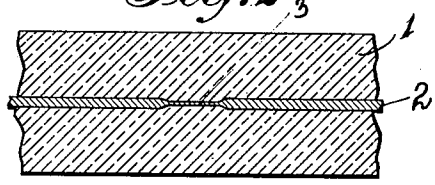


Fig. 3

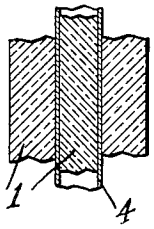


Fig. 4

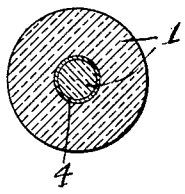


Fig. 5

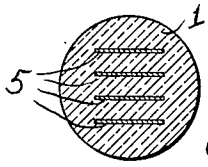


Fig. 6

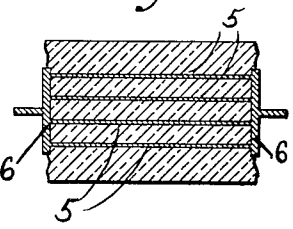


Fig. 8

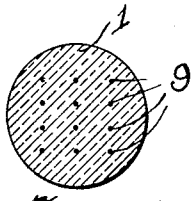


Fig. 9

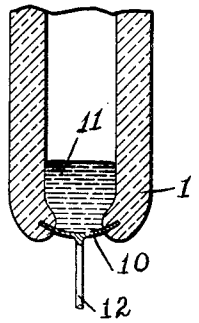
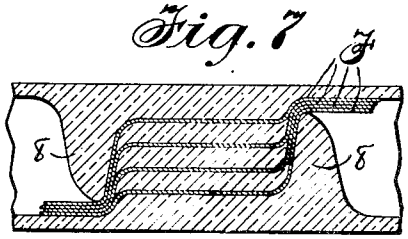


Fig. 7



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Fig. 10

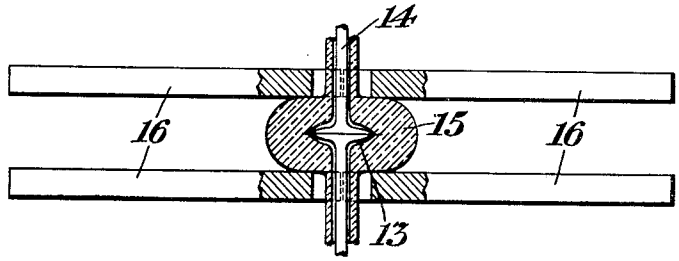


Fig. 11

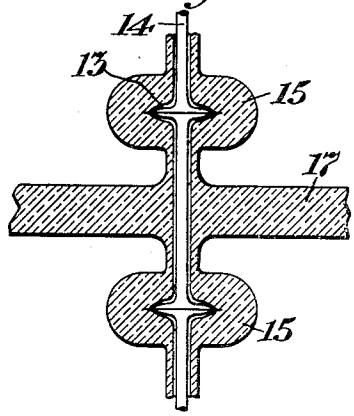
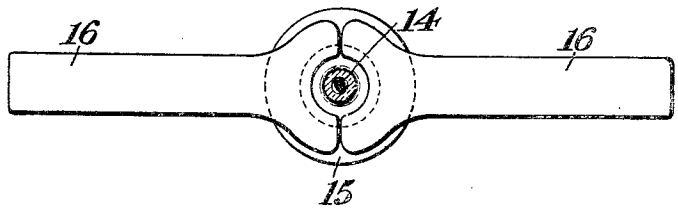


Fig. 12



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UNITED STATES PATENT OFFICE.

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SEAL FOR VAPOR ELECTRIC APPARATUS.

1,271,245. Specification of Letters Patent. Patented July 2, 1918.

Application filed July 12, 1913. Serial No. 778,686.

To all whom it may concern:

Be it known that I, MAX VON RECKLINGHAUSEN, a subject of the Emperor of Germany, and resident of Suresnes, France, have invented certain new and useful Improvements in Seals for Vapor Electric Apparatus, of which the following is a specification.

My invention relates to the making of hermetic seals for a leading-in conductor through the walls of vessels and more particularly relates to electric seals for vessels of quartz or similar material. It has been customary to make hermetic seals between glass and some suitable metal like platinum by selecting a glass of approximately the same coefficient of expansion with temperature as the metal. When, however, a metal which has the same coefficient of expansion as quartz is sought, no material appears to be available which will stand the temperature necessary to fuse the quartz without being itself melted. By my invention I, however, accomplish a hermetic seal through quartz by using an elastic conductor and making it of such thin section that the amount of expansion produced during the making of the seal is not sufficiently large to overcome the resistance of the quartz and thus start a leak. Under these conditions quartz is capable of withstanding heavy unit pressures which, however, may not aggregate many pounds in total. I have illustrated a considerable number of ways of applying this principle to conducting seals. I may use a number of metals which have a sufficiently high melting point for this quartz seal, for example platinum, molybdenum, and tungsten.

In the accompanying drawings Figures 1 and 2 are two views of a simple form of seal; Figs. 3 and 4 show a tubular seal; Figs. 5 and 6 show a multiple strip seal; Fig. 7 shows a different strip seal; Fig. 8 shows a multiple wire seal; Fig. 9 shows a disk seal; Fig. 10 shows a double disk seal; and Figs. 11 and 12 illustrate methods of manufacture.

In Fig. 1, the wall of the container is shown at 1, and the leading-in conductor through the wall at 2, which conductor may be of platinum. This conductor extends to the right and left furnishing connections to the interior and the exterior of the vessel. This container wall may be of quartz or similar material. Near the center of the platinum leading-in wire I have shown a flattened portion, 3, having one very thin dimension and a proportionally larger surface at right angles thereto. In view of the thinness of this flattened section the expansion transversely is not sufficient to overstrain the quartz and the expansion laterally is taken up in view of the thinness of the metal. The unflattened part of this wire, 2, cannot be relied upon to make a tight seal.

In making this seal the wire is first flattened, its surface cleaned by fire and the quartz melted and pressed tightly upon the metal till it sticks to the surface thereof. On cooling the quartz continues to adhere to the metal and no breaking away occurs sufficient to permit the leakage of air through the seal.

In the embodiment shown in Figs. 3 and 4, 4 is a thin tube of metal such as platinum and 1 is the wall of the container, a certain portion of 1 being shown within the tube 4. The tube 4 extends upward and downward as shown in Fig. 3 making connection with the electrode and the external circuit. In this seal the walls of the tube are made so thin that the expansion and resultant stress are insufficient to cause a leak, the platinum being overwhelmed, so to speak, by the greater mass of quartz.

This seal is constructed similarly to the seal of Fig. 1 by pressing the quartz in a soft state firmly against the metal inside and outside and permitting the seal to cool when complete.

In Figs. 5 and 6, I show a different embodiment in which a number of very thin strips, 5, 5, of metal such as platinum are buried in the quartz wall, 1. These strips, 5, are connected at the ends by plates, 6, which serve to collect and distribute current in the strips, 5. In this arrangement as in the others the strips are so thin as not to produce either expansion or stress enough to rupture the quartz or make a leaky seal.

Fig. 7 is a modification of Fig. 6. I may

extend the strips numbered 7 and constituting the seal in this case and connect them together at the ends, as shown, a certain portion of the quartz, 8, being formed up to press them into this position.

In Fig. 8 I have shown modifications somewhat similar to Fig. 5 by utilizing metal wires, 9, of very thin diameter, such as platinum wires, which wire should be connected in parallel both inside and outside the wall, 1, somewhat as in the case of Fig. 6. This seal of Fig. 8 is effective for the same reason as are the others.

Fig. 9 is another form of seal, in which the quartz wall, 1, has an opening in it closed by a disk, 10, having very thin edges which edges are buried in the rim of the window in the quartz wall. This disk, which may be of platinum, should be connected with the electrode on the inside by mercury or by a suitable wire and may be connected to the outside circuit either through an extension of the platinum disk or through a conductor, 12, connected to the said disk. In this case the thin portion, which alone should be relied upon for the seal, should not be of sufficient mass to break away from the quartz.

In the manufacture of these seals it is often desirable to protect the surface of the metal from the effects of the air by doing the heating in an inert gas or in a vacuum. For example the seals shown in Fig. 7 may be made in the following manner: Pieces of quartz approximately the same width are inserted between four thin strips of metal which are to form the seals. Around this packet of metal and quartz may be placed additional quartz which is to form the wall of the container or a portion thereof and the whole placed in a larger quartz tube through which an inert gas is made to pass, the whole may then be melted from the outside by a suitable flame.

Fig. 11 shows a method of adapting a platinum disk having extremely thin edges to form a seal for a quartz mercury tube. A quartz mercury tube which is to constitute the seal chamber is softened up and the disk placed in the tube and the heavy walls of the quartz tube forced in upon the edges of the disk. If desired the quartz may be reinforced at this point for the purpose of securing extreme mechanical strength in the quartz and giving sufficient pressure to hold the joint between the quartz and the edge of the disk very tight. This disk is inserted in a conducting rod acting as a lead in through the wall and one or more additional seals of the same sort may be placed in the same lead in conductor and sealed in the wall as shown in Fig. 11 wherein 13 are the disks, 15 the reinforced walls, and 14 the tube supporting the seal.

In Fig. 10 I show the details of clamps which may be used for pressing the quartz on to the edge of the disk in forming the seal. These tools may be power operated or automatic if desired. The clamps are shown at 16.

In Fig. 12 I show in plan view the formation of such a seal, there being two upper clamps and two lower clamps. It will be understood that my invention is not limited to this particular form of clamping device nor to this particular shape of terminal, for the idea is capable of many applications and I wish to claim all that is new in the arrangement shown.

In connection with the action of these seals, so far as described, it will be understood that any piece of quartz of good strength can stand a certain pressure or certain strain without breaking, and further the numerical amount of the expansion of metal used for lead-in wires with temperature depends upon the thickness of the metal expanded. Consequently there will be a certain thickness of metal in which the amount of expansion numerically will be below what is necessary to cause actual rupture in the quartz just referred to and my seal lies within this range. The above, however, is put forth merely as a tentative explanation of what goes on during the construction and use of my seal and I do not wish to limit myself to this particular theory of operation for the result speaks for itself.

I claim as my invention—

1. In a seal for an evacuated container, a metallic conductor embedded air-tight in an insulator of quartz with an expansion coefficient practically equal to zero characterized by putting into the quartz a conductor made of a metal of higher or the same melting point as quartz, the conductor being of such cross section that the thickness of the metal in one of the axes perpendicular to the length axis of the conductor is very small in comparison with the thickness in the other axis perpendicular to the length axis of the conductor.

2. In a seal for an evacuated container, a plurality of metallic conductors embedded gas tight in a body of quartz or similar material having an expansion coefficient relatively small, said metallic conductors being made of material of higher melting point than said quartz or equivalent and being of such cross section that the thickness of the material in the direction of one axis perpendicular to the length axis of the conductor is very small in comparison with the thickness of the metal along the other axis perpendicular to the length axis of the conductor, and means for joining the several conductors on both sides of the seal.

3. A seal for an evacuated container com-

prising a wall of quartz, a conductor leading through said quartz, said conductor having a flattened portion, said quartz being sealed to and including the natural irregular edge of said flattened portion.

4. A seal for a quartz container comprising a wall of quartz and a gridiron having extremely thin strips of metal for its transverse members whereby the expansion of the metal is maintained below the safe maximum, said gridiron being embedded airtight in said quartz wall.

Signed at New York, in the county of New York and State of New York, this 10th day of July, A. D. 1913.

MAX VON RECKLINGHAUSEN.

Witnesses:
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THOS. H. BROWN.