C. KRÄMER.

GAS TIGHT MECHANICAL SEAL.

APPLICATION FILED AUG. 28, 1913.

1,097,552. Patented May 19, 1914.

Fig. 1.

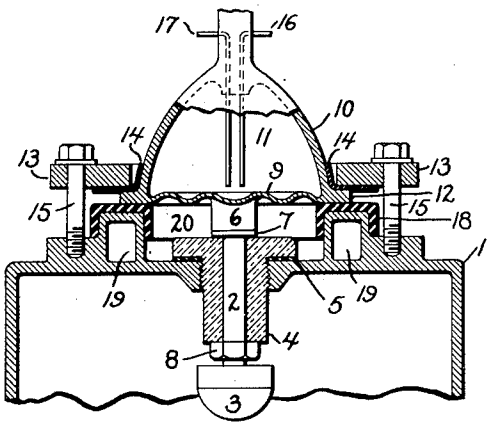


Fig. 2.

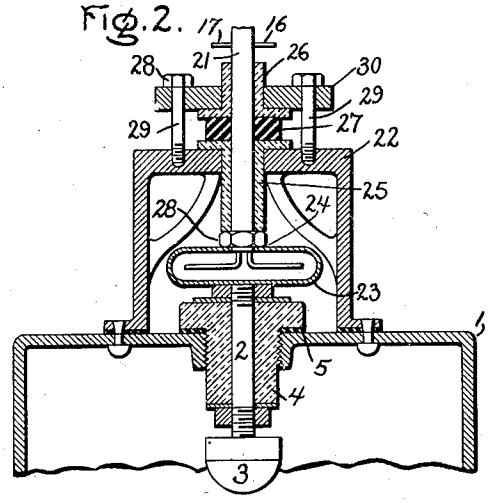
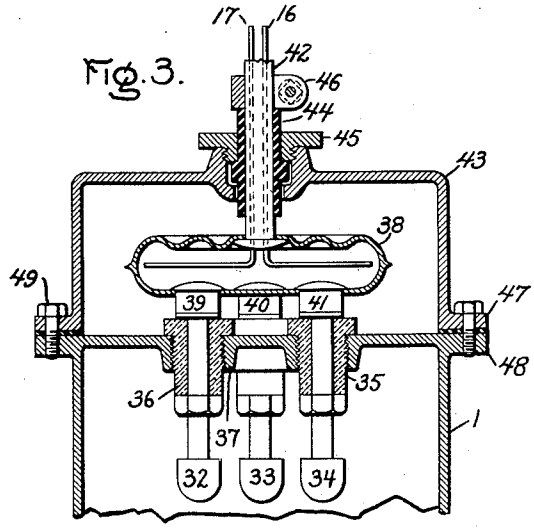


Fig. 3.



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UNITED STATES PATENT OFFICE.

CHRISTIAN KRÄMER, OF BERLIN, GERMANY, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

GAS-TIGHT MECHANICAL SEAL.

1,097,552. Specification of Letters Patent. Patented May 19, 1914.

Application filed August 28, 1913. Serial No. 787,098.

To all whom it may concern:

Be it known that I, CHRISTIAN KRÄMER, a subject of the Emperor of Germany, residing at Berlin, Germany, have invented certain new and useful Improvements in Gas-Tight Mechanical Seals, of which the following is a specification.

The present invention relates to the construction of electrical vacuum apparatus, as, for example, mercury vapor devices, in which it is necessary to use mechanical seals. For example, in the construction of high-powered mercury arc rectifiers, metal containers are provided and difficulty is experienced with the electrode insulating seals, as it is necessary not only that they should be gas-tight but should also be able to withstand high temperatures and the expansions and contractions due to temperature changes. Substances, such as rubber, ordinarily used for making tight seals, obviously will not withstand high temperatures.

In accordance with my present invention a refractory insulating seal is provided for the electrodes and this is surrounded by gas-tight external housing which may be artificially cooled. To compensate for expansions and contractions of the leading-in conductor and to prevent strains being communicated to a harmful extent to the housing itself, the electrical connection to the leading-in conductor is made yieldable, as by the use of an intermediate resilient diaphragm.

In the accompanying drawings, Figures 1 and 2 are longitudinal sections of two forms of construction for a single electrode, and Fig. 3 is a sectional view of a seal for a plurality of electrodes.

The evacuated receptacle 1, Fig. 1, indicated as broken away, may consist of a metal, such as iron, or of some suitable refractory gas-tight material such as lava. Assuming the receptacle to be metal-walled, the leading-in conductor 2 for electrode 3 is surrounded by a refractory insulating bushing 4 consisting, for example, of porcelain. The joint between the porcelain bushing and the walls of the receptacle may be made substantially gas-tight by an aluminum, lead or other suitable metal gasket 5, the porcelain bushing being screw-threaded as indicated. The leading-in conductor 2 may be provided at its upper end with a shoulder 6, which is drawn against a metal gasket 7 by tightening the nut 8 at its opposite end. Surrounding the exposed end of this seal is a housing formed in part by a resilient diaphragm 9 bearing upon the shoulder 6. The upper wall 10 of the water-cooled chamber 11 is provided with a flange 12, upon which bears a ring 13 which may be drawn against an insulating washer 14 resting on the flange 12 by tightening the bolts 15. As the chamber 11 is provided with pipes 16 and 17 for introducing water, or any other cooling fluid, an organic insulation 18, such as rubber, resin-impregnated fiber, or the like, may be used between the flange 12 and the wall of the receptacle itself which may be also provided with a duct 19 for introducing a cooling fluid. As the space between the refractory seal and the housing surrounding it may be evacuated to a high degree, it being provided with a seal easily made vacuum-tight, there will be little or no tendency for gas to leak past the joint between the refractory bushing 4 and the adjacent metal parts. Any slight amount of mercury vapor, which may penetrate into the antechamber 20, will be condensed there and will itself serve to make the seal between the antechamber and the main evacuated receptacle all the more secure. The electrode and its leading-in conductor are subject to changes of temperature and therefore will tend to expand and contract but these expansions and contractions are largely taken up by the resilient diaphragm 9 and therefore will not injure the seal between the antechamber and the atmosphere.

Fig. 2 shows somewhat modified mechanical construction of a seal made according to the same principle in which the yieldable connection between the leading-in conductor and the outer terminal forms no part of the housing itself. In this case a conductor 21 passes through the wall 22 of the antechamber, and makes mechanical and electrical contact with a resilient diaphragm 23 bearing upon the leading-in conductor 2, a union 24 being provided to make a tight joint. The conductor 21 is insulated from the housing 22 by sleeves 25 and 26 which may consist of fiber, rubber or even mineral insulating material. A section 27 of compressible organic insulation, such as rubber, is provided which is squeezed against the adjoining parts by tightening the nuts 28 of the bolts 29 which pass through a ring 30 and partly penetrate

the wall of the housing 22. Pipes 16 and 17 are provided to introduce a cooling fluid into the interior of the diaphragm 23.

In some cases it is desirable to provide a plurality of electrodes in order to distribute the heating effect of the arc upon the seal. In this case, as shown in Fig. 3, a single evacuated housing may be provided for a group of electrodes. The seal between the receptacle 1 and the electrodes 32, 33 and 34 is similar to that already described in connection with Figs. 1 and 2. Refractory mineral insulating sleeves 35 and 36 being provided in each case, as shown in section for electrodes 32 and 34, these being connected by a metal ring 37 surrounding the bushing for the leading-in conductor of electrodes 33. The resilient diaphragm 38 makes contact with the leading-in conductors 39, 40 and 41, and is provided with water-cooling pipes 16 and 17, as indicated. These pipes pass through a conductor 42 insulated from a housing 43 by a sleeve 44 of rubber or the like urged against adjacent parts by tightening the screw-threaded ring 45. A clamp 46 for making electrical contact is shown bearing against the conductor 42. The walls 43 of the sealed housing and the wall of the receptacle 1 are made vacuum-tight by suitable gaskets located between the flanges 47 and 48, which may be in intimate contact by tightening the bolts 49. Of course in each of the constructions described a greater number of inclosing housings may be provided, the second surrounding the joint between the first housing and the receptacle, this in turn being surrounded by a third if necessary, and so on.

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

1. The combination of an evacuated receptacle, an electrode therein, an electrical leading-in conductor for said electrode passing through a wall of said receptacle, and an evacuated housing including a yieldable member inclosing the external part of said conductor and making electrical contact therewith.

2. A vapor device comprising a metal-walled envelop, an electrode, a leading-in conductor therefor, a refractory insulating seal therefor, an external gas-tight vessel surrounding said seal, and an electrical connection, including a yieldable member, to said leading-in conductor.

3. A vapor electric device comprising a metal-walled envelop, an electrode, a leading-in conductor extending through said envelop to said electrode, a refractory insulation surrounding said conductor, an evacuated housing constituting an antechamber interposed between the atmosphere and said seal, and a conductor including a resilient section extending through said housing from said leading-in conductor to an accessible exterior point of electrical connection.

4. A high-powered mercury vapor device comprising the combination of a gas-tight metal receptacle, an electrode therein, an electrical leading-in conductor passing through the wall of said receptacle to said electrode, an insulating mineral bushing surrounding said conductor and mechanically fitted in the wall of the receptacle to make a substantially gas-tight seal, a housing inclosing the external parts of said seal, a packing for rendering said housing gas-tight, and an electrical conductor including a resilient diaphragm extending through said housing to the leading-in conductor.

5. The combination of a gas-tight metal container, an electrode therefor, a leading-in conductor therefor passing through the wall of said container, a refractory insulation surrounding said conductor, an external gas-tight housing inclosing the joint at said conductor from the atmosphere, means for cooling said housing, and means for compensating thermal expansions and contractions of said conductor for making electrical connection thereto.

6. The combination of a gas-tight receptacle, an electrode therein, an electrical leading-in conductor for said electrode passing through the wall of said receptacle, a refractory insulating seal surrounding said conductor, a gas-tight housing inclosing said seal, a conductor including a resilient section and extending through said housing from the leading-in conductor to an exterior accessible point of the electrical connection and compressible insulating packings located respectively between said housing and said envelop and conductor.

In witness whereof, I have hereunto set my hand this 9 day of August, 1913.

CHRISTIAN KRÄMER.

Witnesses:

WALTER REINHARSH,

ERICH LEVY.

It is hereby certified that in Letters Patent No. 1,097,552, granted May 19, 1914, upon the application of Christian Krämer, of Berlin, Germany, for an improvement in "Gas-Tight Mechanical Seals," an error appears in the printed specification requiring correction as follows: Page 2, line 50, after the word "vapor" insert the word *electric;* and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 16th day of June, A. D., 1914.

[SEAL.]

J. T. NEWTON,

Acting Commissioner of Patents.