

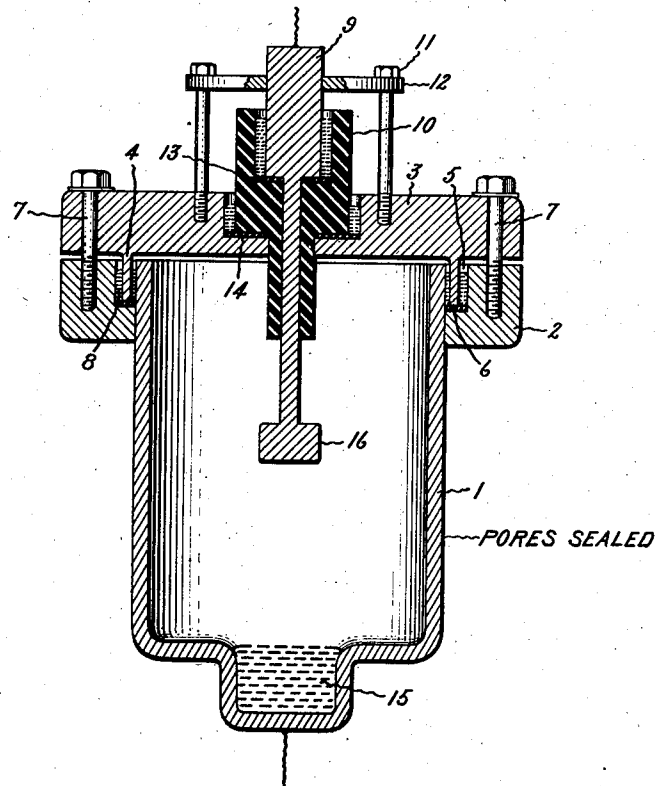
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1,591,432

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GAS IMPERVIOUS CONTAINER

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UNITED STATES PATENT OFFICE.

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GAS-IMPERVIOUS CONTAINER.

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In accordance with my present invention I have provided a metal container, the walls of which are so impervious to gas that a high vacuum may be maintained therein indefinitely.

Heretofore, evacuated containers of metal have required during the operation intermittent or continuous pumping to prevent undue deterioration of the vacuum. Even when leakage through the seals was precluded, the vacuum deteriorated apparently by slow leakage of gas through extremely minute crevices in the metal walls. The pores, or crevices in the metal are so minute that various ordinary coatings of enamel or the like applied on the surface had no material effect on the porosity. Apparently the viscosity of ordinary coating materials is too great to permit their penetration into crevices as minute as those present in a metal such as steel.

In accordance with my invention, I have provided a container rendered so impervious to gas by a metal sealing or filling the pores that a high vacuum may be maintained therein without substantial deterioration.

The new gas-tight devices embodying my invention are the result of my discovery, that in a reducing atmosphere the penetrability or fluidity of certain metals, particularly copper and silver, is so extraordinary that these metals will enter openings of microscopic dimensions in metal wetted thereby and effectually seal the same. Containers embodying my invention are suited to various industrial applications, for example, for evacuated high powered mercury arc rectifiers.

The accompanying drawing shows one embodiment of my invention, namely, a metal tank mercury arc rectifier.

The rectifier here shown comprises a tank 1 consisting preferably of steel. To the upper rim is joined a channeled flange 2; conveniently by electric welding. The cover 3 has projecting a circular rib 4 extending into the channel 5 and bearing against a gasket 6 consisting of asbestos or other suitable material. By tightening the bolts 7 the cover 3 is drawn down upon the gasket and by the use of a sealing liquid 8, such as mercury, a gas-tight seal is made. The anode stem 9 is similarly sealed against an insulator 10. When the bolts 11 are drawn down against the plate 12, the mercury sealed

gaskets 13, 14 are made gas-tight. The container 1 contains a mercury cathode 15 from which an arc is produced to an anode 16 in any well known manner.

In carrying out my invention the tank 1, cover 3 and other parts to be assembled as a container are coated either externally or internally, or both, with copper in any suitable manner, conveniently by electroplating or by spraying with finely divided metal. The thickness of the metal to be rendered gas-tight may vary considerably, but the coating ordinarily need be only a few mils in thickness. Although various cupreous metals, such as alloys of copper can be used or even silver, I prefer to use copper and I prefer to apply the same on the external surface of the container. The coated parts are heated to the melting point of the copper or other sealing metal in hydrogen, carbon monoxide or other suitable reducing gas, thereby causing the pores to be filled by the fluid metal. The process of joining metals to each other by the use of copper, or the like, fused in a hydrogen or other reducing atmosphere, is described in Coolidge Patent 1,181,741. The adaptability of the fluid metals under these conditions for penetrating microscopic pores leading into the body of steel or similar metal in the reducing atmosphere heretofore has not been utilized.

Machining of sheet metal thus treated shows that in some cases the fluid copper penetrates a considerable depth in the body of the iron or steel. Test pieces have shown a penetration through minute pores for distances as great as $\frac{7}{8}$ inch. Containers prepared from copper-sealed steel in accordance with my invention have held a high vacuum for protracted periods without appreciable leakage.

Although I have described my invention with particular reference to evacuated mercury arc devices, I wish it to be understood that the advantages of my invention are not limited to evacuated containers but that any containers which are to be used in a gas-tight condition can to advantage embody my invention.

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

1. In combination, an electrical device comprising a ferrous metal container, the outer surface of said container being impreg-

nated with a metal adapted to seal the pores of the container and render it gas-tight, and means whereby a metal vapor arc may be operated in said device.

- 5 2. An electrical discharge device comprising a container of ferrous metal, one of the surfaces of the container being impregnated with cupreous metal to thereby seal the pores of the container, and means for operating a metal vapor arc therein.

- 10 3. In combination, an electrical device comprising an evacuated ferrous metal container, means for sealing the pores of said container to render the container gas-tight

said means comprising a cupreous metal, 15 and means whereby a metal vapor arc may be operated in said device.

4. In combination, a mercury arc rectifier comprising a tank consisting in part at least of a ferrous metal, means for impregnating 20 the exterior surface of the tank with a cupreous metal to thereby seal the pores of the tank and render it gas-tight, and means whereby a mercury arc may be operated in said device.

25 In witness whereof, I have hereunto set my hand this 4th day of May, 1922.

PAUL O. NOBLE.