Sept. 21, 1937. R. C. SHERMUND 2,093,491

SEAL AND METHOD OF MAKING

Filed Oct. 21, 1935

Fig. 1.

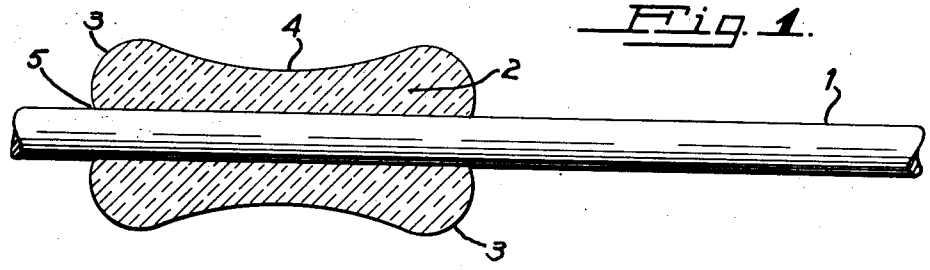


Fig. 2.

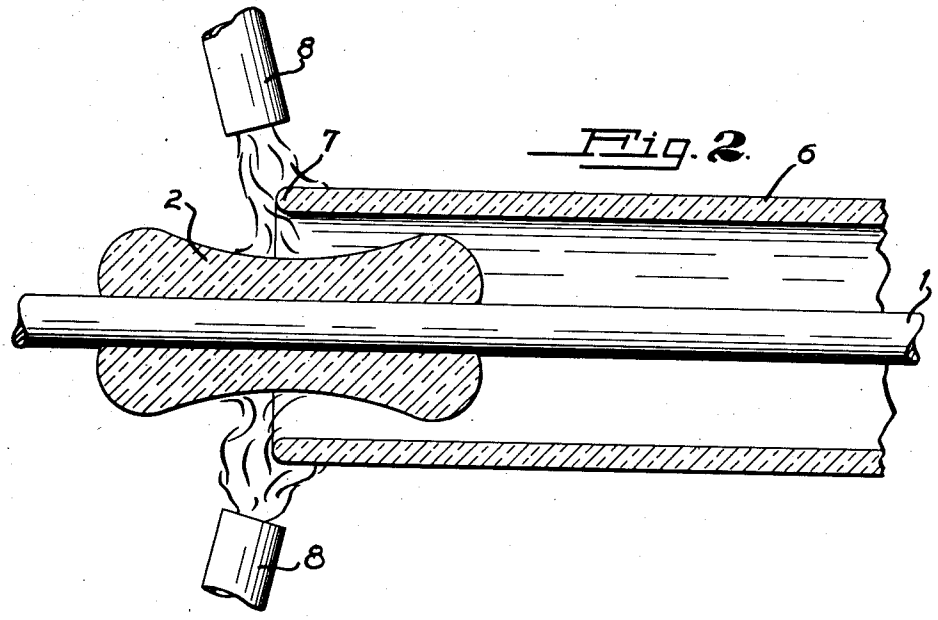
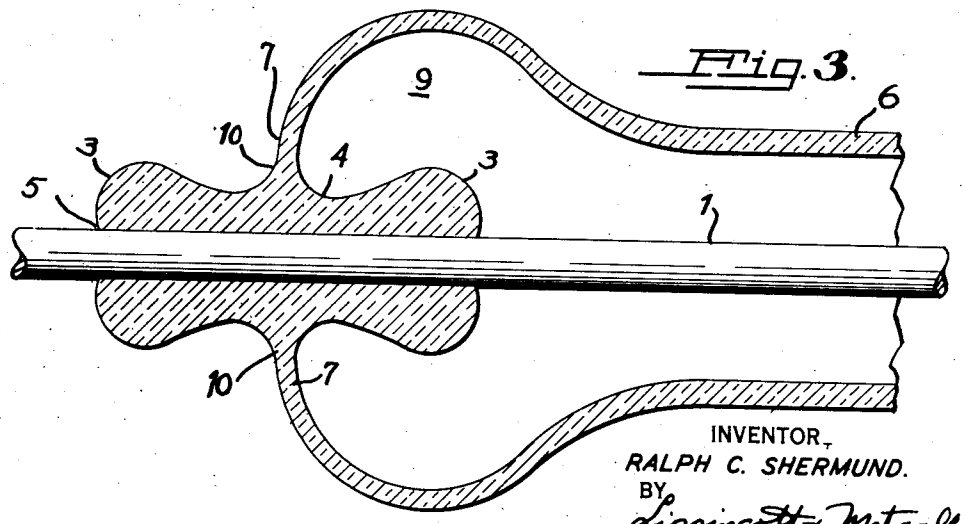


Fig. 3.



INVENTOR,
RALPH C. SHERMUND.
BY
Lippincott & Metcalf
ATTORNEYS.

Patented Sept. 21, 1937 2,093,491

UNITED STATES PATENT OFFICE

2,093,491

SEAL AND METHOD OF MAKING

Ralph C. Shermund, San Francisco, Calif., assignor to Heintz and Kaufman, Ltd., South San Francisco, Calif., a corporation of Nevada

Application October 21, 1935, Serial No. 45,861

3 Claims. (Cl. 49—81)

My invention relates to a seal, and more particularly to a metal-to-glass seal and method of forming it so that breakage due to strain around the seal is greatly reduced. My invention is particularly applicable in the sealing of tungsten rods of relatively large diameter through glass envelopes to produce a seal which will maintain a vacuum therein.

Among the objects of my invention are: To provide a metal-to-glass seal wherein strains are balanced; to provide a metal-to-glass seal having a low breakage factor; to provide a method of sealing tungsten rods of relatively large diameter through a glass envelope; and to provide a simple and efficient tungsten-to-glass seal.

My invention possesses numerous other objects and features of advantage, some of which, together with the foregoing, will be set forth in the following description of specific apparatus embodying and utilizing my novel method. It is therefore to be understood that my method is applicable to other apparatus, and that I do not limit myself, in any way, to the apparatus of the present application, as I may adopt various other apparatus embodiments, utilizing the method, within the scope of the appended claims.

Referring to the drawing:

Figure 1 is a longitudinal view partly in section and partly in elevation, showing a preferred form of bead.

Figure 2 is a longitudinal view partly in section and partly in elevation, with diagrammatic representation of heating flames, of an intermediate step in forming the seal of my invention.

Figure 3 is a longitudinal view partly in section and partly in elevation of the finished seal of my invention.

In modern high power transmitting tubes utilized as oscillation generators for radio purposes or in allied arts, the necessity arises of conducting large amounts of current, particularly for the purpose of heating a thermionic cathode, into the interior of an evacuated envelope and large cross sections are needed in the conductors. Up to a certain diameter, tungsten wire, for example, seals readily to glass of certain characteristics such as that known in the trade as G702P or allied glasses, and the resultant seal is air-tight. The glasses available, however, are not exactly of the same expansion characteristics as tungsten and as a consequence, the larger the lead that is to be sealed through the envelope becomes, the greater the danger of crackage of the seal in use. Consequently, when leads are to be sealed through the envelopes of high power transmitting tubes and where the diameter of the leads is greater, for example, than $\frac{1}{16}$ of an inch, special precautions must be taken in order that seal breakage be eliminated.

I have chosen as an example for illustrating my seal, a one-eighth inch tungsten rod 1 and as a first step in the method of making my preferred type of seal, I fuse upon the tungsten rod a specially formed bead 2. This bead is fused onto the rod in the usual manner, and is of special shape, having ball-shaped ends 3 with an extensive depressed portion 4 therebetween. I also prefer that the ends of the bead contacting the tungsten rod 1 be somewhat in-curved at the point 5 of contact.

I prefer to make the bead somewhat elongated and in case of an eighth-inch rod, I prefer to make the bead approximately one inch long and the diameter of the ball-shaped ends approximately three times the diameter of the rod.

The next step in forming my seal is illustrated in Figure 2, where a glass tube 6 is positioned with one end 7 directly over the depressed portion 4 of the bead, and heating flames 8—8 are applied so as to heat both the central portion of the bead and the end of the glass tube. The pressure of the flames will cause the end of the tube 7 to turn in and contact the central portion 4 of the bead, and after fusion has taken place at this point, air pressure is applied to the opposite end of the glass tube 6 so that an enlarged head 9 is formed adjacent the bead. This air pressure is preferably applied before any great length of the tube 6 fuses to the beads so that the junction 10 between the bead and the tube has approximately the same curve on each opposite surface of the tube 6 where it joins the bead at end 7 of the tube 6, and thus, leaves the bead at approximately right angles thereto.

Extra glass at point of fusion is drawn into the head 9, thus preventing heavy sections at the bead center. There is thus formed a symmetrical seal and all the glass surfaces leave the tungsten rod at approximately right angles thereto and the glass of the tube 6 leaves the bead at approximately right angles thereto. There is a balanced amount of glass on both sides of the junction 10 and thus there can be no unequal heating of the glass at this point in tube operation.

The seal has proved itself in practice to withstand large amounts of heat without any danger of cracking whatsoever and I have been able to seal tungsten rods as large as one-quarter inch in diameter through a glass envelope in this man-

ner without air leakage through the seal and without cracking of the seal in operation.

It is obvious that the open end of the tube 6 may be sealed to the main envelope of the device in which the seal is to be used in any convenient manner, as is well known in the art.

I claim:

1. A seal comprising a tungsten rod, a glass wall sealed to said rod, and glass extensions extending in opposite directions and an equal distance from said seal along said rod, and sealed thereto, said extensions having enlarged terminals.

2. A seal comprising a tungsten rod, a glass wall sealed to said rod, and glass extensions extending in opposite directions and an equal distance from said seal along said rod, and sealed thereto, the terminals of said extensions being ball-shaped and larger in diameter than intermediate portions of said extensions.

3. The method of sealing a glass wall to a tungsten rod which comprises sealing a bead on said rod longer than the thickness of said wall, enlarging the ends of said bead, and sealing the wall to said bead midway the enlarged ends.

RALPH C. SHERMUND.