April 6, 1948. C. A. KOTTERMAN 2,438,923

METHOD AND MEANS FOR MAKING SELENIUM ELEMENTS

Filed Feb. 11, 1943

FIG. 1.

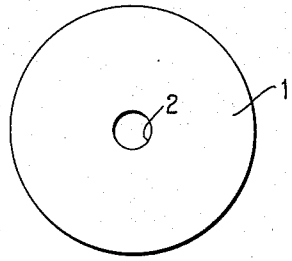


FIG. 2.

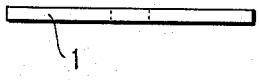


FIG. 3.

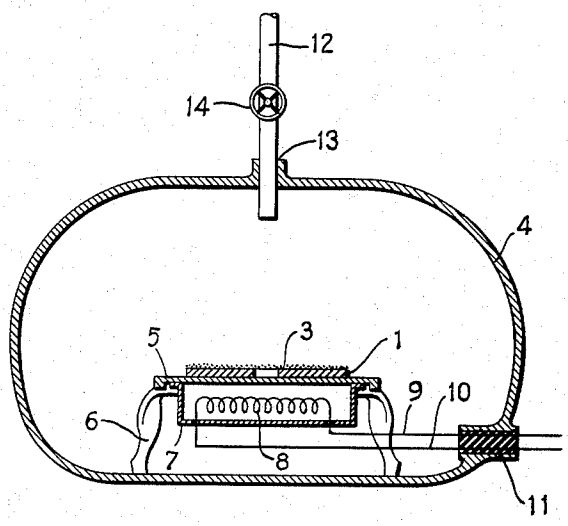
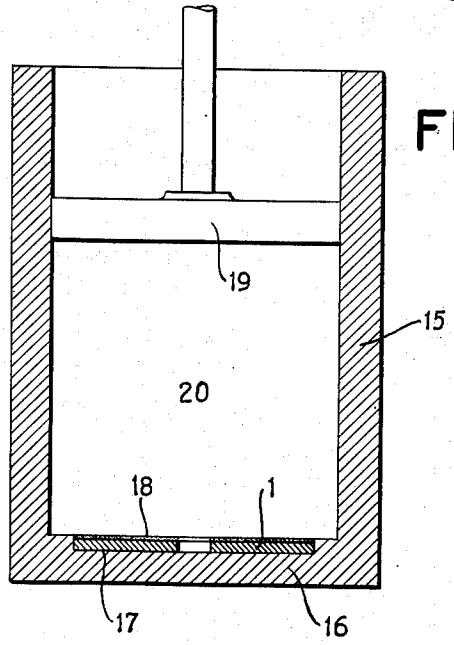


FIG. 4.



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METHOD AND MEANS FOR MAKING SELENIUM ELEMENTS

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5 Claims. (Cl. 175—366)

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This invention relates to selenium cells and particularly to a method useful in making them.

The object is to provide a method of compressing the selenium against its base plate which will not contaminate the selenium.

Selenium elements have heretofore been made by placing vitreous selenium on a base plate, melting it, and spreading the molten selenium over the plate, after which the selenium has been allowed to solidify by cooling. Then the selenium would be crystallized by heat-treating it under pressure. This requires some kind of a pressure plate pressed against the selenium surface. Difficulty was frequently encountered in this pressure treatment in applying the pressure, owing to the impurities imparted to the selenium by contact with the pressure plate.

In accordance with the present invention this difficulty is overcome by the use of pressure imparted from an inert or harmless gas. This is carried out by placing the selenium-coated element in a gas-filled chamber and applying pressure to the gas. In this way the pressure can be easily controlled and an inert gas can be selected. Or if desired, any other type of gas might be selected to impart desirable properties to the selenium.

The invention will be better understood from the following detailed description taken in conjunction with the accompanying drawing, of which:

Fig. 1 is a plan view of a base plate for the selenium element;

Fig. 2 is a side view of the plate shown in Fig. 1;

Fig. 3 is a cross sectional view of a pressure chamber in which the selenium element is being heat-pressure treated in accordance with this invention; and

Fig. 4 shows another form of pressure chamber according to the invention.

Fig. 1 shows a well-known form of base plate for a selenium element, although it will be understood that the invention is not limited to this particular form. The base plate 1 is ordinarily a disc which may be of iron or steel or other metal and may be nickel-plated and roughened as by sand-blasting. If desired, it may be provided with a center hole 2 for mounting the selenium element after it is made. A layer of selenium 3 is then spread on top of the disc and melted on the surface of the disc. This may conveniently be done in the chamber 4 shown in Fig. 3. For this purpose the selenium-coated base plate may be erected on a metallic table 5 held up by legs

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6 resting on the floor of the chamber. A heating element 7 is provided to heat the table and this may be of the electrical type comprising a heating coil 8 with power supply wires 9 and 10 leading through the side of the chamber through a seal 11. To melt the selenium powder 3 it is only necessary to raise the temperature due to the heating element above the melting point of the selenium which is about 220° C. When the selenium has completely melted and flows evenly over the surface of base element 1 the heating current may be turned off and the selenium allowed to cool and solidify over the surface of the plate 1.

It should be understood that the particular method, above described, of heating and melting the selenium in the chamber need not necessarily be followed, but is only given here as a convenient method of doing it when the chamber is to be used. Instead of melting the selenium in the chamber, it could for example be melted outside the chamber, cooled down, and then placed within the chamber in its cooled and hardened condition.

Following the application of the selenium to the disc, pressure is applied within the chamber by means of gas pumped through pipe 12 into the chamber, and the gas pressure may be made as high as desired. A pressure of for example 5,000 to 10,000 pounds per square inch or even up to 100,000 pounds per square inch might be a satisfactory degree of pressure. The gas supplied should be one which preferably does not react with the selenium. An inert gas such as argon, helium or the like might be used for this purpose. During the pressure treatment the temperature of the selenium should ordinarily be raised somewhat above the atmospheric temperature, for example about 125° C. which while not melting the selenium on the disc softens it and serves to accelerate the crystal growth. The length of the heat-pressure treatment will depend on the manner in which the selenium is to be crystallized. It might be that under some conditions only a few minutes of pressure need be applied, after which the heat-treatment might be continued without pressure, if desired, to increase the crystallization.

Fig. 4 shows a modification of the chamber in which the base plate and the selenium layer are constrained against sidewise motion. This chamber comprises a cylinder 15 closed at the bottom by the bottom portion 16; and in portion 16 there is provided a recess 17 of the proper size to receive the disc 1. The selenium layer 18 cov-

ering the disc 1 is made to fit within the side walls of the recess with a snug fit. For this purpose it may be preferable, although not necessarily essential, to melt the selenium on the disc in its position in the chamber by some means for supplying heat. The gas pressure may be supplied by a plunger 19 which may be pushed down in a well-known manner to compress the gas in chamber 20 or if desired the gas may be introduced under pressure from a pipe as shown in Fig. 3. The heat which will ordinarily be desired during the pressure treatment may be supplied from an external heating source placed under the portion 16 of the chamber.

The arrangement of Fig. 4 has an advantage over that of Fig. 3 in that protection is afforded the selenium layer against allowing the gas to get between the base plate and the selenium or between portions of the selenium layer itself. It will be important in both the embodiments of Figs. 3 and 4 to prevent the gas getting between the base plate and the selenium, otherwise there is apt to be a lack of adherence of the selenium to the plate. Consequently, all precautions should be taken that the selinum layer is closely adherent to the base before the pressure is applied. Another advantage is that the base plate is nested in the recess in the bottom of the cylinder, the wall or shoulder of the recess preventing the plastic selenium from oozing out over the edge of the supporting plate.

The use of the chamber to produce the pressure treatment has many advantages over the former process of applying pressure by a pressure plate, because by the use of the chamber the atmosphere within it can be maintained clean and free from impurities and there is no danger of impurities reaching the selenium surface through handling. Furthermore, there is no danger of impurities being imparted through the pressure plates. Another advantage is that the degree of pressure on the selenium can be controlled very accurately by means of a gas pressure gauge and valve.

If desired, other gases than inert gases may be applied in the treatment of the selenium. It is known that some gases have a beneficial effect and any of these known gases may be used for whatever length of time is required. If desired, the pressure may first be applied by an inert gas which may be followed by a treatment with a gas which it is desired to combine with the selenium.

What is claimed is:

1. The method of making a selenium element which comprises applying a layer of vitreous selenium to a carrier plate, heating to cause melting of the selenium layer on the carrier plate, cooling the molten selenium to cause solidification and then subjecting the plate to an elevated gas pressure while heating it to a temperature not exceeding the melting point of selenium.

2. The method of treating a selenium element comprising a carrier plate with an adherent vitreous selenium layer which comprises applying a gas pressure of about 5,000 to 10,000 pounds per square inch against said selenium layer.

3. The method according to claim 2 in which the selenium is heated to a temperature in the general order of around 125° C. while the pressure is being applied.

4. The method of treating a selenium element comprising a carrier plate with an adherent vitreous selenium layer which comprises applying a gas pressure of about 5,000 to 100,000 pounds per square inch against said selenium layer.

5. The method of making a selenium element which comprises forming a vitreous selenium layer on a carrier plate, placing said element in a closed chamber, applying gas pressure within said chamber and subjecting the plate and selenium layer in the chamber while the gas pressure is being applied to a temperature not exceeding the melting point of selenium until the selenium is converted to the crystalline form.

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