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METHOD OF FORMING SELENIUM COATED BASE PLATES

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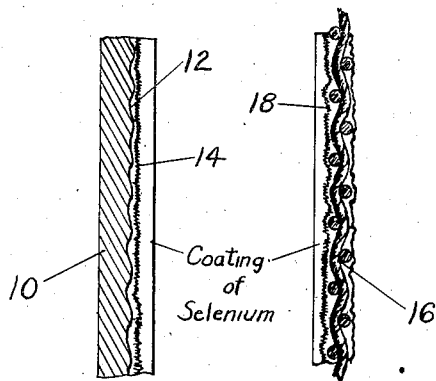


**Fig. 1**

**Fig. 2**

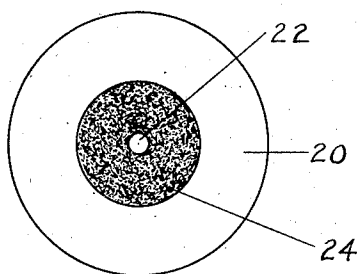


**Fig. 3**

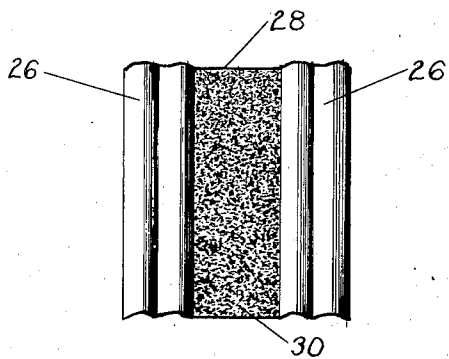


**Fig. 4**

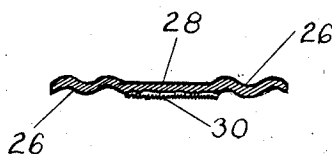


**Fig. 5**

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## UNITED STATES PATENT OFFICE

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METHOD OF FORMING SELENIUM COATED  
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This invention relates to improvements in base plates. More particularly, the invention relates to improvements in base plates that are used to support a coating of selenium.

It is, therefore, an object of the invention to provide an improved base plate that is used to support a coating of selenium.

Base plates that are intended as supports for a coating of selenium, are used wherever selenium is used. These base plates are used a great deal in making selenium rectifiers and in making light sensitive cells. The base plates used in making the rectifiers and light sensitive cells can be used in many fields, so, for the sake of brevity and convenience, the specification will describe the making of base plates used in the formation of selenium rectifiers. It is to be understood, however, that the base plates for rectifiers mentioned in the specification and claims are representative of all base plates used as supports for coatings of selenium.

In making selenium rectifiers, manufacturers take a piece of metal that is known in the trade as a base plate, roughen its surface, and apply a coating of selenium to it. The coated base plate may then be used as the base plate electrode of a rectifying couple. The manufacturers have discovered, however, that a coating of selenium does not adhere very well to most metals. If an ordinary base plate is coated with selenium, the engagement between the coating of selenium and the base plate will not be very intimate. In many cases, the engagement between the coating of selenium and the base plate is so poor that portions of the coating of selenium are physically separate from the corresponding portions of the base plate. In extreme cases, the engagement between the coating of selenium and the base plate has been insufficient to maintain the two together, and the coating of selenium has peeled off of the base plate. In other cases where the coating of selenium is not physically separate from the base plate, it is electrically separate from the base plate, and a contact surface forms between the coating of selenium and the base plate. Where this electrical separation occurs, the internal resistance of the rectifier is quite high and the current density will not be uniform over the area of the rectifying couple. In many cases, this resistance will be so high that the rectifier will be quite inefficient. It is, therefore, essential that an intimate physical and electrical engagement be effected between the base plate and the coating of selenium. To secure a better bond between the coating of sele-

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nium and the base plate, which is usually made of magnesium, aluminum, iron, brass, or copper, manufacturers have roughened the surface of the base plate by sandblasting, etching, or abrading, until the base plate has a mat finish. When a coating of selenium is applied to this type of surface, a better bond has been attained. Manufacturers have found that a really permanent physical and electrical bond between the coating of selenium and the base plate cannot be obtained in this way. To make a better bond between the base plate and the coating of selenium, some manufacturers have electroplated the base plate with nickel before they coated it with selenium. The coating of nickel helps considerably in making the coating of selenium adhere to the base plate. However, even this bond between the coating of selenium and the electroplated base plate is not strong enough to avoid a physical or electrical separation of the coating of selenium and the base plate. The present methods of making selenium rectifiers are objectionable because they do not provide a good physical and electrical bond between the coating of selenium and the base plate. The invention obviates this objection by providing a new method of applying nickel to a base plate that forms a surface to which a coating of selenium can adhere and with which it can form a permanent bond. It is, therefore, an object of the present invention to provide a new method of applying nickel to a base plate that forms a surface to which a coating of selenium can adhere.

Former methods of making selenium rectifiers that utilized nickel, consisted of electro-plating a base plate with the nickel and then applying the coating of selenium. This method is inefficient and has not been found to be very satisfactory. In this method, the base plate is treated to give it a roughened surface with a large number of minute projections thereon. These projections help to make the coating of selenium adhere to the base plate. When the base plate has been electro-plated with nickel, its ability to make the coating of selenium adhere to it has been increased. Its ability to make the coating of selenium adhere to it is not, however, as great as it should be. The electro-plating action covers the entire surface of the base plate with a uniform continuous uninterrupted coating, to which the coating of selenium cannot adhere well. In addition the electro-plating of the base plates covers the projections that were formed on the base plate in the roughening operation, with a coating of nickel that serves to eliminate the

sharp edges of the projections. This smoothing or elimination of the sharp edges of the projections, reduces the ability of the projections to cause the coating of selenium to adhere to them. The coating of nickel provided by electro-plating cannot, therefore, provide as intimate and as permanent a bond between the selenium and the base plate as is desired. This is objectionable. The invention obviates this objection by providing a method of applying nickel to a base plate that provides a thin discontinuous layer of nickel on the surface of the base plate. The thin discontinuous layer of nickel presents a large surface area to the coating of selenium and has a rough surface with sharp projections thereon to which the coating of selenium adheres well. This surface can then be coated with selenium and will form an intimate and permanent bond with the coating of selenium. It is, therefore, an object of the present invention to provide a thin discontinuous layer of nickel on a base plate for use in making rectifiers.

Rectifiers are sometimes used where weight is an important consideration. In such cases, every ounce of material that is not absolutely essential must be eliminated. In such cases the elements of the rectifiers must be made as light as possible. The invention provides a method of making lightweight rectifiers. This method consists of spraying molten metal onto a light material, such as a textile. The metal will solidify on the textile and form an effective but very light base plate. It is, therefore, an object of the present invention to provide a lightweight base plate for rectifiers by spraying molten metal onto lightweight material.

Where rectifiers are used to rectify relatively heavy currents, they get quite warm. When the rectifiers get warm, it is necessary that some cooling effect be provided to maintain the temperature below the level at which the efficiency of the rectifier decreases. One cooling means that has been used, is the insertion of fins between adjoining rectifying couples. These fins conduct the heat from the center of the couples to the outside where it is dissipated. These fins help a great deal but are not as efficient as they might be. There is a butt engagement between the couple and the fin, that is not as efficient in transmitting heat as a solid joint would be. This butt engagement is objectionable because it limits the transfer of heat from the couple to the fin. The invention obviates this butt engagement by forming the rectifying surface on a portion of the fin itself. It is, therefore, an object of the present invention to provide a rectifying surface on a portion of a radiating fin.

In the drawing and accompanying description, several preferred embodiments of the invention are shown and described, but it is to be understood that the drawing and accompanying description do not limit the invention and the invention will be defined by the appended claims.

In the drawing,

Fig. 1 is a greatly enlarged side elevational view of a rectifier made in accordance with the principles of the invention,

Fig. 2 is a greatly enlarged side elevational view of a textile onto which molten material has been sprayed,

Fig. 3 is a front elevational view of a radiating fin on which a rectifying surface has been formed,

Fig. 4 is a plan view of the fin shown in Fig. 5, and

Fig. 5 is a front elevational view of a modified

form of radiating fin on which a rectifying surface has been formed.

Referring to the drawing in detail, a base plate is denoted by the numeral 10. This base plate will ordinarily be made of magnesium, aluminum, iron, brass, or copper, but it may be made of any material. Iron is probably used more often than any other metal because of its availability and low price. This base plate is used as a foundation for the metal that is secured to it, and is also used as a convenient means of transmitting current to the rectifying surfaces. One of the surfaces of the base plate 10 is treated to give it a coarse and rough finish 12. This can be done by scratch-brushing, sandblasting, etching, abrading, roughening by a die, or any similar means. After one of the surfaces has been roughened, a fine spray of molten metal is applied to that surface to form a discontinuous layer 14. This is preferably done by a metal spray gun that melts and sprays metal in the molten state. The invention preferably uses nickel as the metal sprayed onto the base plate, but other metals can be used. Copper, silver, aluminum, and similar metals can be used, but nickel has been found to give a better bond with the coating of selenium. For the sake of convenience the application of nickel to a base plate will be described but it is to be understood that where the word nickel is used, it also represents the other metals that act similarly. The spraying of the nickel onto the base plate, forms a discontinuous layer of nickel. As the atomized nickel strikes the base plate it solidifies immediately. The nickel cannot, therefore, remain in the fluid state and flow together to form a continuous coating. The spraying and immediate cooling of the atomized particles of nickel, result in the formation of a coarse and rough layer of nickel. This layer consists of a great number of minute particles of nickel that have sharp edges. These sharp edges make the bond between the coating of selenium and the base plate permanent. By adjusting the spray gun, the operator can regulate the amount of metal sprayed onto the base plate, and can also determine the thickness of the sprayed layer. Ordinarily the thickness of the layer need not be more than one-thousandth of an inch. The spray gun does not atomize all of the metal and sometimes it sprays relatively large particles of the metal onto the base plate. In such a case, the base plate will have relatively large projections on its surface that are not desirable. These projections may be compressed to the size of the rest of the particles by subjecting them to pressure. This can be done in a press, between rollers, or in any other suitable way. The invention preferably applies the nickel to the base plate by spraying, but several other methods could be used. The base plate may be made of relatively soft metal such as lead, and small particles of nickel forced into the surface of the lead. This may be done in a press or in any similar device. These particles would cooperate with each other to form a discontinuous layer of nickel that would be similar to the surface secured by spraying the nickel onto the base plate. Another method consists of placing minute particles of nickel on a base plate that has a tinned surface. The base plate can be heated until the tin melts, and then cooled until the tin solidifies. The particles of nickel will then be held securely by the tin which will have solidified around the base of the particles of nickel. The layer of tin must be thin enough that it does not completely cover the particles of nickel. The

layer of tin must engage and hold the bottoms of the nickel particles only, and must leave the upper portions of the nickel particles free. A discontinuous layer of nickel may also be applied to the base plate by "sputtering." The base plate is placed in a rarefied atmosphere, as in an evacuated chamber, and in proximity to a container of nickel. This container of nickel is heated until the nickel melts and begins to boil. As the nickel boils, some of it will come into contact with the base plate and will condense on the surface of the base plate. The surface formed by "sputtering" will be similar to the surface formed by spraying the nickel onto the base plate. A discontinuous layer of nickel may be obtained in still another way. Particles of nickel may be placed on a heated base plate in a vacuum. The nickel may be heated until it just begins to fuse and then it should be cooled. In this way, the bottom portions of the nickel particles may be held together but upper portions will be free. As a matter of fact, there are other ways of forming a discontinuous layer of nickel on a base plate and these and other ways can be used. Regardless of how the discontinuous layer is formed, the invention resides in the provision of such an irregular and discontinuous layer applied to a base plate for use in making selenium rectifiers.

Where a lightweight rectifier is desired, the invention may be used to advantage. In making a lightweight rectifier, a non-conductor base plate of very light weight material is used. One such material is a textile. By use of the invention, it is possible to spray molten nickel onto the textile and permit it to solidify. Such a base plate would be very useful in making selenium rectifiers because it would have a very coarse surface. The selenium could adhere rather easily to this sort of surface. In addition, this base plate would be cooled quite readily. It would have a large surface area and a small mass that would keep it cool at all times. Where desired, the textile could be made with large interstices that would increase the surface area of the rectifier. In the drawing, Fig. 2 shows an enlarged section of a base plate that consists of a textile 16 into which molten nickel has been sprayed. This figure shows the coarse surface 18, thus obtained, that is so desirable. This coarse surface 18 combines with the heat dissipating ability and the light weight of the base plate to make it a very advantageous one.

The problem of cooling in large capacity rectifiers can be quite important. Some manufacturers have inserted cooling fins between rectifying couples to conduct away the heat. These fins have helped in dissipating the heat, but have not been completely satisfactory. The butt engagement between the rectifying couple and the fin does not give as good a transfer of heat as might be desired. The invention provides a novel method of cooling a rectifier that comprises the forming of the rectifier on a portion of the surface of the fin. This can be done by any of the methods described above. In the spraying or "sputtering" method, the portion of the fin that is to operate as a radiator is masked, and the rest of the fin is treated. In Fig. 3 a fin of highly conducting metal is denoted by the numeral 20. On the center of the fin is a discontinuous layer of nickel 24 that is adapted to re-

ceive the coating of selenium. The hole 22 receives a bolt that secures this fin to similarly treated fins.

Where desired, the fins may be made in other shapes. In Figs. 4 and 5, a different fin is denoted by the numeral 28. This fin is rectangular in shape and has corrugations 26 on both of its ends. These corrugations give the necessary surface area for heat dissipation without increasing the overall size of the rectifier. In addition, these corrugations give a flue-like effect that fosters the movement of air past the fin. This movement of air aids in the dissipation of the heat generated by the rectifier. The center of the fin has a discontinuous layer of nickel 30 on it that will receive the coating of selenium. By using the invention, it is possible to form a base plate to which a coating of selenium will adhere, and from which it cannot separate physically or electrically.

The drawing and specification have shown and described preferred embodiments of the invention but it is obvious to those skilled in the art that various changes or modifications may be made in the form of the invention without altering the scope of the invention.

What I claim is:

1. The method of making an improved base plate for selenium rectifiers that comprises the roughening of the surface of a piece of metal, spraying molten nickel onto the roughened surface of the piece of metal to form a plurality of upstanding projections that constitute a thin discontinuous layer of nickel to which a coating of selenium can adhere well, subjecting said sprayed piece of metal to pressure to compress some of the larger projections, heating said discontinuous layer of nickel until it can melt selenium brought into engagement with it, and bringing selenium into engagement with said layer of nickel.

2. The method of making an improved base plate for selenium rectifiers that comprises roughening the surface of a piece of metal, bringing a plurality of minute particles of nickel into engagement with said piece of metal to form a thin discontinuous layer of nickel on the roughened surface of the piece of metal, subjecting said layer to pressure to compress some of the larger particles, placing selenium in engagement with said discontinuous layer of nickel and heating and subsequently cooling said selenium while it is in engagement with said layer of discontinuous nickel to make the said selenium adhere to said layer.

3. The method of making an improved base plate for selenium rectifiers that comprises roughening the surface of a piece of metal, bringing a plurality of minute particles of nickel into engagement with said piece of metal to form a thin discontinuous layer of nickel on the roughened surface of the piece of metal, subjecting said layer to pressure to compress some of the larger particles, heating said discontinuous layer, simultaneously pressing and rubbing selenium against said discontinuous layer while said layer is heated, and cooling said discontinuous layer and the selenium rubbed thereagainst to make the said selenium adhere to said layer.

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