

Jan. 8, 1946.

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2,392,744

METHOD OF MAKING SELENIUM ELEMENTS

Filed Nov. 18, 1942

2 Sheets-Sheet 1

FIG.1.

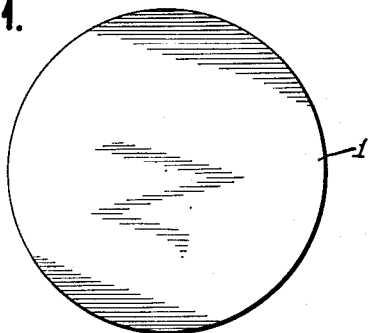


FIG.5.

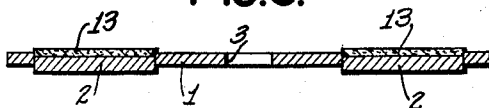


FIG.2.

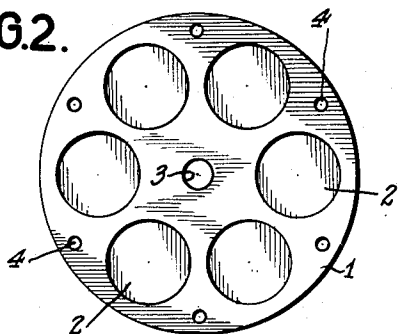


FIG.2a.



FIG.3.

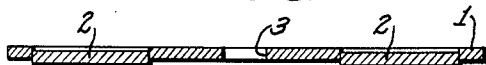


FIG.4.

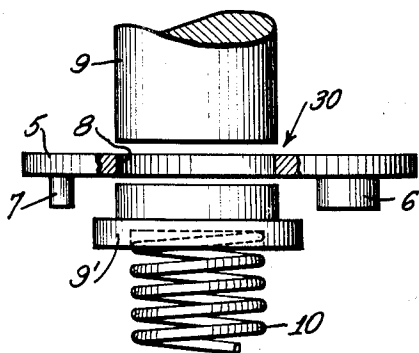
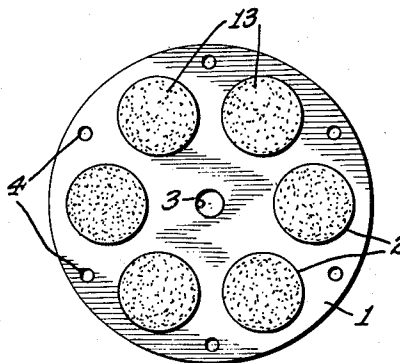


FIG.6.



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FIG. 7.

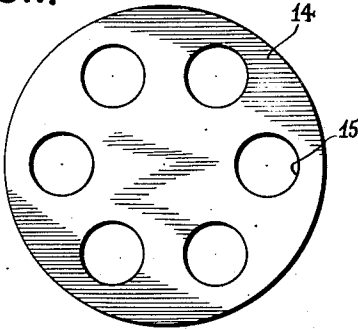


FIG. 9.

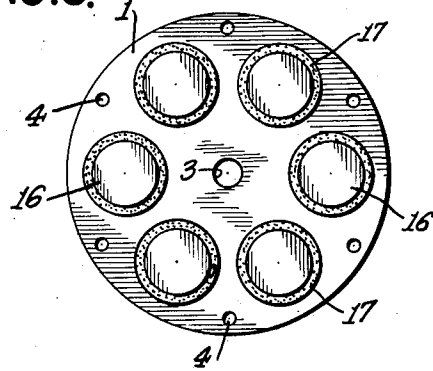


FIG. 8.

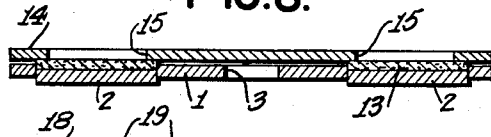


FIG. 10.

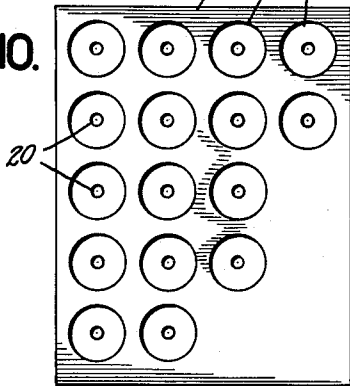


FIG. 11.

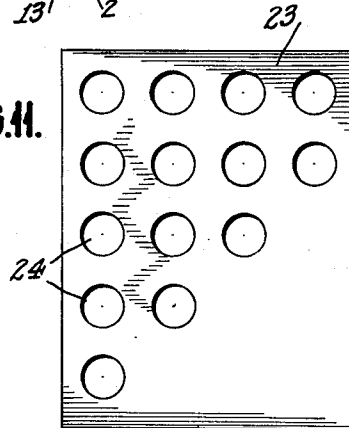


FIG. 13.

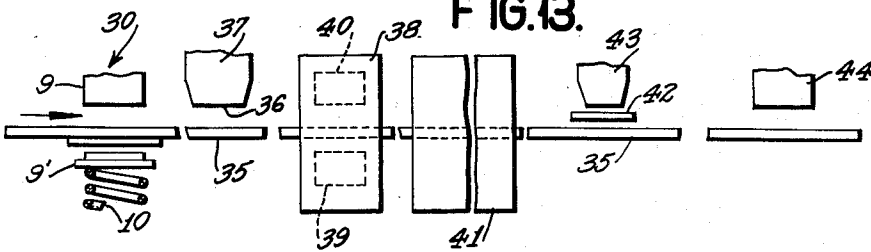


FIG. 12.

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METHOD OF MAKING SELENIUM ELEMENTS

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Application November 18, 1942, Serial No. 466,080

4 Claims. (Cl. 175—366)

This invention relates to selenium coated elements and to a method of making and treating them; and has for its object to provide apparatus and a method for rapidly making and processing such elements in large numbers

Selenium coated elements such as are ordinarily used for rectifier or photo cells ordinarily comprise a base or carrier disk or plate, such as iron, steel, or aluminum. A layer of selenium is spread over the surface of such a base plate, for example, by fusing selenium or condensing selenium vapor thereon or compressing thereon a layer of selenium powder at elevated temperatures. Such a coated base plate is then ordinarily treated further by heat to produce the proper crystal structure in the selenium, and is further processed or treated to adapt it as a rectifier or a photo cell. For example, a counterelectrode is applied over the surface of the selenium as by spraying with a conducting substance such as Wood's metal, and it may then be given an electro-forming treatment by the application of voltage between the base and counterelectrode.

It is desirable to be able to handle a large number of the elements at one time in carrying out these steps in the fabricating and treatment. This is done in accordance with the present invention by punching out the disks or base elements from a large plate, and wedging or holding the punched-out elements in a suitable holder or jig. Selenium is then placed on the punchings in the jig and the entire assembly given such treatments and processing as is required, while handling them as a unit in the large jig.

The invention will be more fully understood from the following detailed description taken in conjunction with the drawings of which:

Fig. 1 shows a plate from which the elements are to be made;

Fig. 2 shows a face view of the plate with punchings made therein, Fig. 2a shows a single selenium element which is punched out from a plate; Fig. 3 being a cross-sectional view of the plate;

Fig. 4 shows a punch adapted for punching out elements in Fig. 2;

Fig. 5 is a cross section view of the plate of Fig. 3 with selenium powder applied;

Fig. 6 is a face view of the arrangements shown in Fig. 5;

Fig. 7 shows a mask adapted to be placed over the arrangement of Fig. 6;

Fig. 8 is a cross sectional side view of the assembly of Fig. 6 with the mask of Fig. 7 laid thereon;

Fig. 9 is a face view of the arrangement in Fig. 8;

Fig. 10 shows a different form of plate containing punched elements;

Fig. 11 shows a mask adapted to register with the plate of Fig. 10;

Fig. 12 shows a long strip useful in a continuous process; and

Fig. 13 shows how a continuous process may be applied to the strip of Fig. 12.

Fig. 1 shows a large plate or disk 1 which should be of an electrical conducting substance such as iron or steel which may be coated with nickel, or of aluminum, from which a number of small base plates or disks are to be punched out for use as base plates for the selenium elements. Fig. 2 shows the smaller selenium elements 2 punched out from plate 1, one of these individual elements being shown in Fig. 2a. In Figs. 2 and 3 the individual elements 2 are shown wedged into the positions in the plate from which they were punched; although they might, if desired, be similarly held in another holding plate or jig. The punching and jiggling operations may conveniently be done as indicated in Fig. 2 by punching a hole 3 in the center and a number of registration holes 4 around the plate 1. The base elements 2 may then easily be punched out by means of a punch 30 shown in Fig. 4. This comprises a plate 5 having a pin 6 adapted to register with hole 3 and another pin 7 adapted to register successively with any of holes 4. The plate 5 is provided with a hole 8 with which a punch 9 registers. The arrangement is such that when pin 6 is placed in hole 3 and pin 7 in one of holes 4, the punch 9 may be operated to pass through hole 8 and punch out an element 2 from plate 1. The plate 1 itself can conveniently be made to act as the holding jig for the elements 2 by placing beneath the punch plate 5 a button 9' resiliently held toward plate 5 by a spring 10. When an element 2 is punched downwardly through plate 1 it presses against button 9' and compresses spring 10, so that when punch 9 is retracted the force of the spring acting on the button pushes the punched out element back into its position in plate 1, where it wedges against the walls from which it was cut. The elements 2 may be pushed back flush with the surface of plate 1, or they may be pushed back somewhat less than flush, as shown in Fig. 3.

Selenium powder is then sprinkled on the elements 2, as shown in Fig. 5. When the elements 2 are not flush with the upper surface of plate 1 the powder may all be caused to lie within the depression formed by the bounding walls of the holes in the plate; or the powder may be laid to a height above the surface of plate 1. A top view of this is shown in Fig. 6. The plate 1 with the powder coated disks 2 is then compressed in a suitable press and under an elevated temperature, preferably around 120° C. This pressure-heat treatment may last one or two minutes, which will serve to mold the selenium to the base

elements 2. During the processing the elements 2 may be pushed flush with plate 1 if they were not flush prior to the pressing.

Ordinarily the selenium will be made to undergo a further heat treatment at a somewhat higher temperature of around 200 or 214° C. This may be done by putting the plate 1 containing the selenium coated elements in an oven at this temperature for a time in the order of a half hour or more.

A mask 14 (Fig. 7) having holes 15 which are of somewhat small diameter than elements 2 is then placed over the assembly of Fig. 6, so that holes 15 register with the selenium coated base elements 2, as shown in Fig. 8. A counterelectrode may then be spread on the selenium through holes 15, a suitable counterelectrode being a conducting alloy such as Wood's metal or an alloy of bismuth, cadmium or tin. When the mask 15 is removed, the assembly on plate 1 appears as in Fig. 9, each selenium-coated element 2, having its coating of selenium covered by a centrally located area 16 of the counterelectrode, and a margin 17 of selenium around the counterelectrode.

Other treatments may be performed on the elements as desired while still holding them in the plate as a unit. For example, the selenium surface can be lacquered with a lacquer or fumed with selenium dioxide prior to the application of the counterelectrode. Furthermore, after the application of the counterelectrodes the elements may all be electro-formed by the application of voltage between the plate 1, as one contact and the individual counterelectrodes as the opposite contact.

The invention is well adapted for use in a continuous process as shown in Figs. 12 and 13. Fig. 12 shows a long narrow strip of metal 35 from which the base elements 2 are extracted. The base elements may be punched out by the same sort of a punch shown in Fig. 4. Fig. 13 shows how the strip 35 may be subjected to the various treatments by a continuous process. The unpunched strip is first led through the punch 30 in the direction of the arrow in intermittent steps. After every forward intermittent motion and while the strip is stationary, the punch 9 is brought down punching out an element 2 which is thus pushed back into place by the button 9' as described previously.

In its intermittent forward motion the strip 35 intermittently stops with each successive element 2 beneath a powder dispenser 36 fed with a selenium powder from a hopper 37 which sprinkles powder upon the elements 2. The strip bearing the powder-covered elements then passes on into a heated press 38 having the pair of press members 39 and 40 and these press members are intermittently brought together to press each individual selenium covered element as it stops for a short time between the press members. The strip 35 then passes on through an oven 41 sufficiently elongated to provide a desired time of heat treatment for compressed selenium elements. After leaving the oven 41 the strip passes under the mask 42 provided with the masking opening of somewhat smaller diameter than the diameter of element 2. Suitable means may be provided for bringing the mask down on each individual element as it stops momentarily under the mask and the counterelectrode metal is sprayed from a suitable spray 43 on the selenium surface through the mask. Then the elements may be punched out of stop 35 by a punch 44 which may be similar to punch 9. Suitable mechanism (not

shown) may be provided for moving strip 35 forward and for operating the punches, powder dispenser, press, mask and spray during the momentary pauses in the motion of the strip.

The selenium elements may then be removed from their positions in the holding plate 1, for example, by the use of a punch such as punch 9, but without the cooperation of the bottom button 9'.

Other forms of plates may be used than that shown in Figs. 1 to 10. For example, a large rectangular plate such as 18 in Fig. 11 might be used and the small base elements 19 punched from it. The small elements may also have central holes 20 punched through them if desired, as shown. Fig. 12 illustrates a powder mask 21 having the holes 22 of substantially the same size as the elements 19, and Fig. 13 illustrates a spray mask 23 having holes 24 of somewhat smaller area than elements 19 for the application of the counterelectrodes.

Other shapes and adaptations will suggest themselves from the specific embodiments shown.

There is provided in accordance with this invention a method and apparatus for making and treating as a unit a large number of selenium elements. This greatly facilitates the manufacture and increases the output by reason of the fact that so many can be made and treated at once.

What is claimed is:

1. The method of making a plurality of selenium elements, which comprises completely separating a number of base elements from a plate and holding the separated elements in the positions in the plate from which they were separated, then covering the elements with selenium, then applying counterelectrodes to the elements while held in the plate.

2. The method of making a plurality of selenium elements as a unit which comprises completely separating a plurality of base elements from a plate and holding the separated elements in the positions in the plate from which they were separated, then covering the plate with a mask to cover the plate but leave the elements uncovered, then sprinkling selenium powder over the elements, then compressing the powder against the base elements at an elevated temperature to mold the selenium to the elements, then applying another mask to the plate leaving uncovered part of the selenium while leaving covered a margin of selenium around the uncovered portion and then spraying the uncovered selenium portions with a counterelectrode.

3. The method of making a plurality of selenium elements by a continuous process which comprises moving an elongated metal strip along a path of travel, completely separating base elements from said strip and pushing them back into the locations of the metal strip from which they were separated, at one position on said path, sprinkling selenium powder on said elements at another position of said path, compressing the powder against the elements at an elevated temperature at a subsequent position on said path, passing said strip through an oven at a subsequent position on said path, applying a mask over the compressed selenium and spraying a metal through the mask on the selenium at a subsequent position on said path and then removing the elements from the strip.

4. The method according to claim 3 in which the strip is moved by intermittent motions.

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