

Jan. 29, 1946.

M. F. SKINKER

2,393,938

METHOD OF MAKING SELENIUM ELEMENTS

Filed Jan. 7, 1943

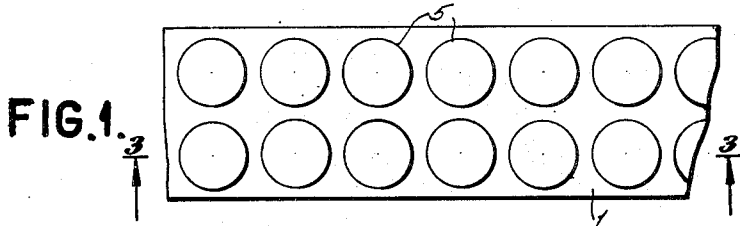


FIG. 1a



FIG. 1b.

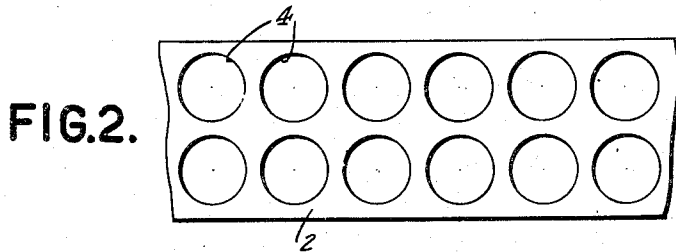
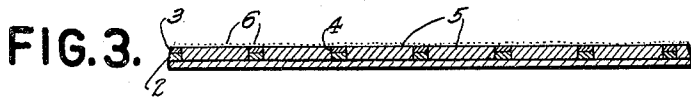


FIG. 5.

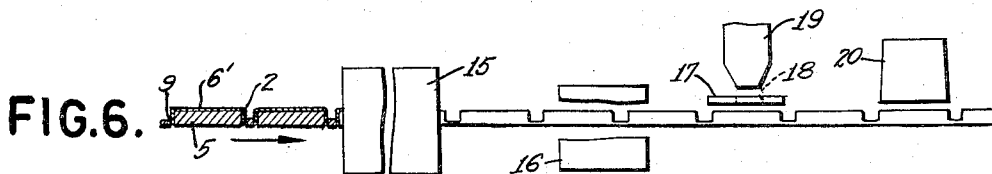
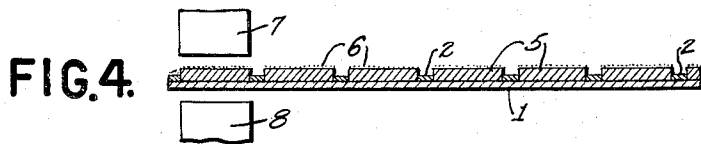
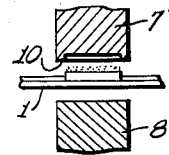


FIG. 7.

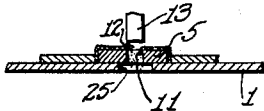
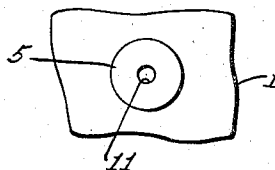


FIG. 8.



INVENTOR.

MURRAY FONTAINE SKINKER

BY

D. H. Angus
ATTORNEY

UNITED STATES PATENT OFFICE

2,393,938

METHOD OF MAKING SELENIUM ELEMENTS

Murray Fontaine Skinner, Montclair, N. J., assignor to Federal Telephone & Radio Corporation, New York, N. Y., a corporation of Delaware

Application January 7, 1943, Serial No. 471,617

11 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 rectifiers or photocells ordinarily comprise a base carrier or plate, which may be of iron, steel, aluminum, nickel or the like. 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 photocell. For example, a counter electrode is applied over the surface of the selenium which may be done by spraying with a suitable conducting substance such as a metal spray, and it may then be given an electro-forming treatment by the application of voltage between the base and the counter electrode.

It is desirable to be able to handle a large number of the elements at one time in carrying out the steps in the fabrication and treatment. This is done in accordance with the present invention by the use of jigs in which the base elements are fitted. One of the jigs is used as a supporting element to which the several base elements adhere and another of the jigs is used to confine the selenium to the surfaces of the base elements. The selenium coated base elements thus held in the first mentioned jig are then given such treatment and processing as is required, the jig enabling them to be handled as a unit. This method is well adapted to the use of a continuous process.

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

Fig. 1 illustrates a face view of a large number of base elements resting on a large carrier plate;

Fig. 1a is a face view of a base element;

Fig. 1b is an elevational view of the base element shown in Fig. 1a;

Fig. 2 illustrates a face view of a jig which can be placed on the carrier plate;

Fig. 3 is a sectional side view taken at line 3—3 of Fig. 1, showing a pair of jigs of Figs. 2 around the base elements of Fig. 1 and a covering of selenium powder;

Fig. 4 illustrates in section the arrangement of

Fig. 3 with the upper jig removed and shows a press adapted to compress the selenium against the base elements;

Fig. 5 shows another form of press which can be used in place of that shown in Fig. 4;

Fig. 6 shows partially in section the arrangement of Fig. 4 with the carrier plate removed and shows the elements in a continuous fabricating process;

Fig. 7 shows a punch which may be used to punch out center holes in the selenium coated elements; and

Fig. 8 is a face view of the arrangement shown in Fig. 7.

Referring to the drawing there are laid on plate 1 a pair of jigs 2 and 3. One of these jigs is shown in Fig. 2. The two jigs are identical and are provided with round holes 4 which are slightly larger than the diameter of the base element shown in Figs. 1a and 1b. Jig 3 is superimposed on jig 2 with the holes in registration, as shown in Fig. 3. Then base elements 5 are placed within the holes of the jig as shown in Fig. 3, the upper surface of the base element being approximately flush with the upper surface of the jig 3. Selenium 6 is then spread over the entire upper surface including that of the upper jig and of the base elements 5. The selenium is preferably applied in the form of a powder which may be easily sprinkled on to a desired thickness.

The upper jig 3 is then lifted off, which will leave the arrangement in the form shown in Fig. 4, with the selenium powder only on the base elements 5. The selenium powder 6 is then pressed and molded to the base elements 5 at an elevated temperature. This may be done preferably at a temperature of around 120° C., although the temperature may vary considerably from this. The pressing is done between press platens such as 7 and 8. This pressing at the elevated temperature will cause the selenium to flatten down on the base elements 5 and to push out and down on the jig 2 and between the jig and the base elements; and at this temperature and pressure the selenium will harden and cause the base elements and the jig to lock together.

If desired, the upper press platen may be given the shape shown in Fig. 5 wherein the upper platen 7' has an annular rib 10 adapted to come down around the periphery of the base element and to push the selenium powder firmly against both the periphery and the jig itself. This is shown in Fig. 6 wherein the pressed selenium 6' is shown around the peripheries of the base elements and wedged between the jig at 9 and the

peripheries of the base elements. If the selenium coated base elements are of the type having center holes (not shown in Fig. 6 but represented in Figs. 7 and 8), such holes are apt to be filled or clogged with the pressed selenium as indicated at the hole 11 in Fig. 7 wherein the selenium powder 12 is shown pushed down into the hole. If this is the case, a small punch 13 having a diameter registering with the hole 11 may be applied to clean out the hole after the pressing operation. To permit this operation the plate 1 should be provided with holes 25 registering with holes 11 so that the punch can pass through.

After the heat-pressure treatment, the jig 2 bearing the selenium coated elements may be removed from the carrier plate 1 and treated as a unit as indicated in Fig. 6.

The elements in the jig may now be given any of the desired treatments. It would ordinarily be desired to give the elements a second heat treatment at a higher temperature of around 200° C. or 215° C. for example for several minutes or a half hour or so. It may also be desired to give the selenium surface a treatment of some sort after the oven treatment and it would ordinarily be desired to spray a counter electrode over the surface and then it will be desired to punch out the selenium elements from the supporting jig 2.

The invention is well adapted to the performance of each step by a continuous process as is indicated by Fig. 6. This shows the jig 2 bearing the selenium coated elements moving toward the right as indicated by the arrow, where it will pass through an oven 15 of suitable dimensions to cause the elements to remain therein for the desired time at the elevated temperature of, for example, 200 to 215° C.

If it be desired to treat the selenium surface with a treating material, the strip 2 may be passed through a compartment 16 containing such material, for example, in vapor form. The strip may then pass on underneath a mask 17 having a hole 18 of slightly smaller diameter than the diameter of the element 5. The hole 18 should be concentric with reference to the element 5. A suitable mechanism may bring the mask down flat against the selenium surface of each element as it passes by and when the mask is brought down, a spray may be directed against the selenium surface through the mask from a sprayer 19. This spray would ordinarily be a suitable metallic counter electrode substance. The elements may then be punched out from the jig by means of a punch 20, and this will serve to clean off the caked peripheral portions of selenium 9 by which the elements had been adhering to the jig.

It will be recognized that by my process there is provided a simple expedient for handling as a unit a large number of selenium elements and means is provided for cleaning off the selenium around the edges of the elements and for applying the proper counter electrode. The invention is not limited to the particular arrangement shown but other arrangements will readily suggest themselves upon an understanding of my above description. For example, it may be desired in the case of a continuous process to have only one row of elements 5 on the carrier plate 1 and in the jig 2, instead of the two rows shown in the drawing. Furthermore, when a continuous process is used as indicated in Fig. 6, it may be desirable to move the jig 2 by intermittent

motion and to perform the various operations on successive selenium elements during each pause in the motion. For example, the mask 17 may be brought down and the sprayer 19 operated during a pause and the punch 20 also operated during a pause. In this way, each element in the jig will be given each of the desired operations.

What is claimed is:

1. The method of making a plurality of selenium elements as a unit which comprises placing a number of base elements in a pair of holding jigs with the upper jig located between the elements, then covering the elements with a selenium layer, then removing the upper jig, and then causing the selenium to adhere to the elements and the lower jig.

2. The method of making a plurality of selenium elements as a unit which comprises placing a number of base elements in a pair of holding jigs laid one over the other, then covering the elements with a layer of selenium powder, then removing the upper jig, and then pressing the selenium powder against the elements at an elevated temperature, causing some selenium to lock the lower jig to the base elements.

3. The method of making a plurality of selenium elements as a unit which comprises placing a pair of identical jigs one over the other on a carrier plate, placing base elements within holes in said jigs, then covering the base elements with a selenium powder, then removing the upper jig, then compressing the powder against the base elements and causing the powder to compress and lock the lower jig to the elements.

4. The method of making a plurality of selenium elements as a unit which comprises placing a pair of identical jigs one over the other on a carrier plate, placing base elements within holes in said jigs, then covering the base elements with selenium powder, then removing the upper jig, then compressing the powder against the base elements causing the powder to adhere to the elements and lock the elements to the lower jig, then removing the lower jig with the elements from the carrier plate as a unit and further processing said elements in said lower jig.

5. The method of making a plurality of selenium elements as a unit which comprises placing a pair of identical jigs one over the other on a carrier plate, placing base elements within holes in said jigs, then covering the base elements with selenium powder, then removing the upper jig, then compressing the powder against the base elements at an elevated temperature and pushing the powder down around the peripheries of the elements and between the lower jig and said peripheries, then removing the lower jig with the elements from the carrier plate as a unit and further processing said elements in said lower jig.

6. The method of making a plurality of selenium elements which comprises placing a number of base elements in a jig structure with retaining portions of the jig structure located adjacent the margins of the base elements, applying to exposed surfaces of the base elements and to said retaining portions of the jig structure a coherent layer of selenium adhering to said surfaces and retaining portions and binding the base elements and the jig structure together as a unit, subjecting the base elements to further treatment while in said unit and thereafter separating the base elements from the jig.

7. The method set forth in claim 6 in which

the base elements are fitted into apertures in the jig structure and the selenium layer adheres to marginal portions of the jig structure adjacent said apertures.

8. The method set forth in claim 6 in which the unit is passed continuously through a treating stage in which the elements are treated successively in series.

9. The method of making a plurality of selenium elements which comprises placing a number of base elements within registering apertures in superposed lower and upper jigs, applying selenium to the upper surfaces of the base elements in substantial alignment with the upper jig, removing the upper jig and any selenium carried thereby, subjecting the selenium to heat treatment and causing it to adhere to the base elements and to spread across the margins of said elements into adhering engagement with the lower jig, forming a unit, subjecting the base elements to further treatment while in said unit and thereafter separating the base elements from the jig.

10. The method set forth in claim 9 in which the jigs and base elements are located on a support during the application and heating of the selenium, the support being removed after the lower jig and base elements are interconnected as a unit.

11. The method of making a plurality of selenium elements which comprises placing a number of base elements in close fitting apertures in a jig of sheet material, applying selenium to the upper surfaces of the base elements, heating the selenium to fuse it into a coherent coating adhering to the base elements, extending the coating across the joint between the base elements and the jig and into adherent engagement with the jig, forming a unit, subjecting the base elements to further treatment while in said unit, and thereafter separating the base elements from the jig.

MURRAY F. SKINKER.