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COATED RECTIFIERS AND PROCESS OF MAKING

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FIG. 3.

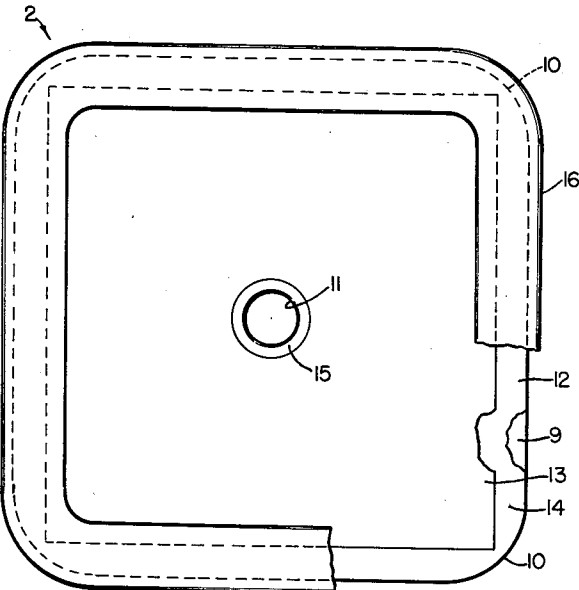


FIG. 4.

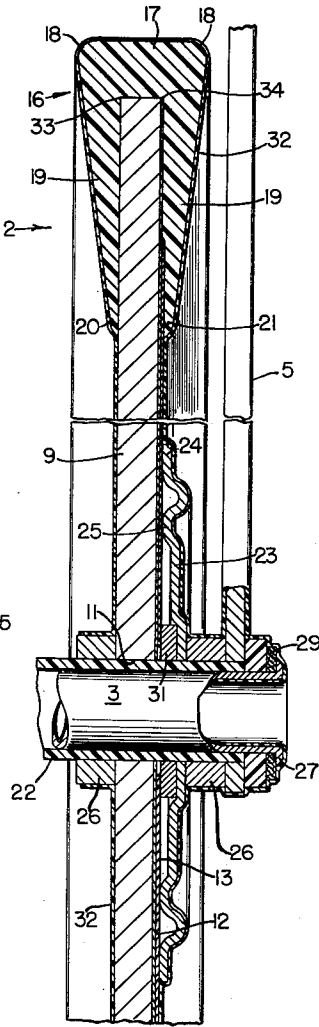


FIG. 1.

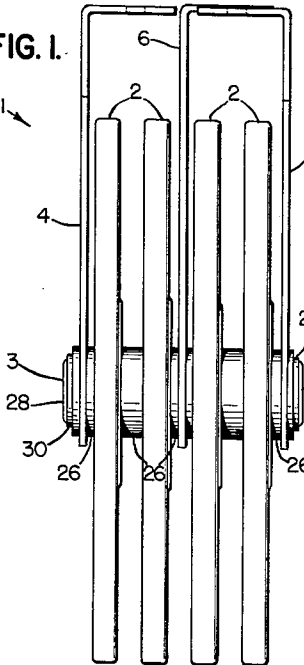


FIG. 2.

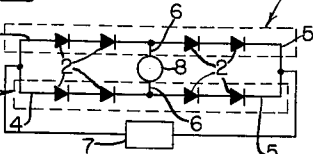
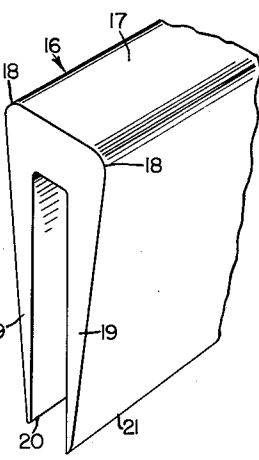


FIG. 5.



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1

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COATED RECTIFIERS AND PROCESS OF MAKING
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This invention relates to plastic coated dry-plate rectifiers and to the process of making the same.

A dry-plate rectifier unit normally includes a plurality of individual rectifier elements interconnected to increase the current carrying and voltage capacity of the unit. Each of the individual elements includes a stamped metal base plate carrying a rectifying coating of selenium, copper oxide or the like in intimate contact with one surface thereof. A counter-electrode is sprayed or otherwise applied to the rectifying coating and, by a conventional heat treatment of the element, a minute barrier layer is established between the rectifying coating and the counter-electrode. The barrier layer allows current to flow through an individual element in only one direction and thus establishes the rectifying action of the element.

Humidity and other foreign matter in the air contaminates selenium and other rectifying material and also tends to corrode the base electrode and the counterelectrodes. Selenium and the like is a relatively brittle material and the coating particularly adjacent the edges of a plate element is readily damaged during the manufacturing and assembling of rectifier units.

It has been suggested that the complete rectifier assembly be covered with a thin film of vinyl plastic to prevent contact of the element proper with the surrounding atmosphere.

The coating of the assembled rectifier does not however prevent damaging of the rectifying coating during the manufacturing process.

The base plate of the element is normally stamped from suitable sheet material with a relatively square periphery. During the coating process the molten or fluid plastic tends to flow away from the corners and edges of the plate elements because of conventional fluid tension phenomena. As a result, only a relatively thin plastic coating covers the corners and edges of the elements.

When the rectifier is carrying current, heat is generated in the elements and the elements expand and contract accordingly. The sharp edges of a plate element tend to cut through the adjacent covering and because of the thinness of this portion of the covering actual breakthrough often occurs.

Further, there is an unequal rate of expansion between the base plate and the counterelectrode. The thin plastic covering immediately adjacent this joint separates and creates a void adjacent the formed barrier layer, not shown, at which the covering is easily destroyed.

In accordance with the present invention, a plastic coating in the form of a sleeve or the like is built up over the peripheral edges of the individual rectifier elements prior to assembling the elements into the complete rectifier.

After the individual elements are assembled, uncured plastic is applied to the rectifier to substantially cover the rectifier with a thin film of uncured plastic which is allowed to cure to establish a tough, long-lived protective coating on the elements and other components of the rectifier. The sleeve protects the edges of the elements from mechanical destruction during the assembling process and establishes a relatively large radius to which the protective coating uniformly and readily adheres.

In accordance with another aspect of the invention, the same plastic is employed for both the protective coating and the sleeve which may blend during the curing of the

2

final protective coating to form a single continuous coating. This establishes a very stable, durable covering which tightly adheres to the element and which allows the generated heat to be dissipated from the element.

In accordance with still another aspect of the invention the four corners of the base plate are rounded to eliminate the sharp corner in the plate. Consequently, the danger of break-through at that point is substantially reduced.

The present invention provides an extremely strong and tightly adhering coating at the edges of a rectifier element and at the joint between the base plate and the counterelectrode to protect the element against chemical and mechanical damage and destruction.

The drawings furnished herewith illustrate the best mode presently contemplated for carrying out the invention.

In the drawing:

FIGURE 1 is an elevational view of a basic rectifier unit for building bridge type rectifiers;

FIG. 2 is a schematic diagram of a rectifier circuit employing the rectifier unit of FIG. 1;

FIG. 3 is a front elevational view of a rectifier element shown in the rectifier unit of FIG. 1 with parts broken away to more clearly show the construction of the element;

FIG. 4 is an enlarged fragmentary view of the rectifier unit of FIG. 1; and

FIG. 5 is a fragmentary perspective view of an edge encircling sleeve for an illustrated rectifying element.

Referring to the drawing and particularly to FIG. 1, a basic rectifier unit 1 from which bridge type rectifying circuits are formed is shown consisting of four individual rectifying elements 2 which are supported in superposed relation as a stack upon a metal mounting shaft 3. The individual elements 2 are polarized to conduct current in a single direction and are mounted electrically in the same direction. The elements 2 are serially connected with outer direct current terminals 4 and 5 at the ends of the stack and an intermediate alternating current terminal 6 in the middle of the stack. The rectifier unit 1 forms a basic unit from which a single phase or three phase full wave bridge type rectifier is formed. To form a single phase full wave circuit, for example, a pair of the units 1 are employed and connected as schematically shown in FIG. 2. The corresponding outer terminals 4 and 5 are connected to establish a pair of output terminals adapted to be connected to a D.C. load 7 and the pair of intermediate terminals 6 establish an alternating current input adapted to be connected to a suitable source of alternating current 8.

Each of the individual elements 2 includes a metallic base plate 9 generally of a rectangular configuration having rounded corners 10 and a central aperture 11 for mounting the element upon the tubular support 3. Referring particularly to FIGS. 3 and 4, a semi-conducting coating of selenium or other similar material 12 is disposed over the entire one face of the base plate 9. A counterelectrode 13 of a low melting temperature alloy is sprayed or otherwise applied in intimate overlying contact with a central annular portion of the semi-conducting coating 12 to establish marginal portions 14 and 15 adjacent the edges of base plate 9. The marginal portions 14 and 15 prevent shorting of the base plate 9 to the counterelectrode 13. The rectifier element 2 is then treated in any conventional manner to form a minute barrier layer, not shown, between the selenium coating 12 and the counterelectrode 13. The minute barrier layer not shown, functions to allow current flow in only one direction through the rectifying element, that is from the base plate 9 to the counterelectrode 13.

In accordance with the illustrated embodiment of the present invention, a relatively thick vinyl plastic sleeve

16 having a generally channel-shaped cross-section, as shown most clearly in FIGS. 4 and 5, is arranged in encircling relation about the perimeter of the individual rectifier elements 2 preferably immediately after formation of the barrier layer, not shown. The sleeve 14 includes a relatively thick web or base portion 17 integrally joined by rounded junctures 18 with tapering side legs 19 which terminate in the respective featherlike edges 20 and 21. The side legs 19 extend radially inwardly on the one surface over the outer marginal portion 14 of the coating 12 and the outer peripheral portion of the counterelectrode 13 and a corresponding distance on the opposite or back face of the base plate 9.

The sleeve 16 serves to protect the outer edges of the respective layers of the element 2 against mechanical destruction during subsequent processing and the rounded junctures 18 of sleeve 16 provide a relatively large radius adjacent the outer edges of the element 2 for subsequent coating.

Referring particularly to FIGS. 1 and 3, the individual elements 2 and terminals 4, 5 and 6 are mounted on the tubular support 3 and insulated therefrom by an insulating tubular liner 22 covering the outer periphery of the support. Dish-shaped current collectors 23 are mounted on the shaft immediately adjacent each of the counterelectrodes 13. The outer periphery of each collector is deformed to establish a pair of radially-spaced faces 24 and 25 adapted to intimately engage the counterelectrode and collect the current therefrom. The current collectors 23 are clamped in position as hereinafter described to firmly hold the current collecting faces 24 and 25 in position.

Metallic spacing washers 26 are interposed between the successive individual elements 2 and terminals 4, 5 and 6 to space the components and allow efficient air cooling of the rectifier unit 1 by a fan or other suitable means, not shown. The washers 26 are metallic to maintain current flow through the unit.

The terminals 4, 5 and 6, the elements 2 and washers 26 are clamped together by flaring the opposite ends of the support 3 outwardly to form clamping flanges 27 and 28. The flanges 27 and 28 of tubular support 3 are insulated from the adjacent terminals 4 and 5 by washers 29 and 30 of fiber or other suitable insulating material.

Referring to FIG. 4, metallic spacing and supporting washers 31 are disposed between the rectifying elements 2 and the adjacent current collector 23 to prevent collapsing of the collector under the clamping forces. The washers 31 are, however, slightly thinner than the normal unstressed spacing between the elements 2 and the current collectors 23 to establish a slight compression and spring action within each collector 23. The spring action maintains the collecting faces 24 and 25 in firm electrical contact with the adjacent counterelectrode 13.

To prevent contamination of the selenium coating 12 and corrosion of rectifier components, particularly the base plate 9 and the counterelectrode 13 by matter in the surrounding atmosphere within which the element is to be used, a coating 32 is applied to the rectifier unit 1. The coating 32 is any suitable impervious material which can be applied in close contact with the exposed surfaces of the rectifier.

Vinyl plastic is especially suitable for coating 32 because it is economically available and establishes a tough, durable coating which can be tenaciously and readily bonded to the element surfaces.

Further, other plastics, including thermosetting plastics which may blend with the sleeve to form a continuous covering may also be used.

The coating 32 of vinyl plastic is applied by dipping the rectifier unit 1 in a suitable molten bath, not shown, of uncured vinyl plastic. The unit 1 is withdrawn and a thin film of uncured fluid plastic which adheres to all of the exposed surfaces of the unit 1 is cured to provide an intimately adhering vinyl plastic coating 32.

In the fabrication of rectifier elements, the base plate

1 is stamped or otherwise formed from a sheet of suitable material. Referring particularly to FIG. 4, the encircling opposite corner edges 33 and 34 of the periphery of the plate 9 are relatively sharp and tend to rapidly wear through the adjacent plastic sleeve 16. However, the sleeve 16 is sufficiently thick to prevent any possible break-through and positively prevents subjecting the plate 1 and selenium coating 4 to the surrounding atmosphere in this manner.

Further, the edges 33 and 34 of the conducting base plate 9 are relatively difficult to coat directly because the surface tension of the fluid plastic, as initially applied, causes the fluid plastic to flow therefrom and establish a relatively thin coating. The rounded edges 18 of sleeve 16 provide relatively easily covered surfaces and consequently the thickness of coating 32 is essentially continuous over all the exposed rectifier surfaces.

The sleeve 16 also provides a thicker protective layer adjacent the edge of the interface of the counterelectrode 13 and selenium coating 12 and gives improved protection against contamination or destruction of the barrier layer, not shown.

If suitable temperature and time is provided during the dipping and the curing operation, the surfaces of a vinyl plastic sleeve 16 become molten because of its thermosetting properties and blends with the uncured molten plastic coating 32 to form an integral vinyl coating 32 over the rectifying unit. The fluid plastic may also enter between the interface of the rectifier surfaces and the sleeve 16 to bond the sleeve 16 to the adjacent surfaces.

The sleeve 16 may have any desired cross-sectional configuration in order to provide the built-up portions over the edges 33 and 34. For example, the central portion of the sleeve 17 can be removed to provide a relatively shallow or thin portion immediately over the central portion of the periphery of the plate.

Further, if desired, separate angle shaped sleeves or coatings can be employed to separately encircle each of the edges 33 and 34 rather than a single integrally formed U-shaped sleeve, as shown.

Although vinyl plastic is described as the preferred protective coating for the rectifier element, any other suitable coating may be employed. Different plastics may also be employed for the sleeve portion and the outer covering and they may or may not blend to form a single, integral protective unit.

Although a selenium, dry-plate rectifier element is specifically described, any other similarly acting materials, such as copper and copper oxide elements can be employed.

The present invention provides a tough, durable covering for a rectifier element which hermetically seals and positively protects the element for exceptionally long periods of operation.

Various modes of carrying out the invention are contemplated as being within the scope of the following claims particularly pointing out and distinctly claiming the subject matter which is regarded as the invention.

I claim:

1. The method of fabricating rectifiers having a protective covering, which comprises forming the individual rectifier plates, covering the outer peripheral edges of the rectifier plates with a thick layer of protective material, assembling the rectifier plates into a rectifier, and covering the rectifier with a second protective material as a substantially continuous covering.

2. The method of plastic coating a rectifier having a plurality of plate-like elements arranged in spaced stacked relation, which comprises covering the periphery of each plate-like element with a relatively thick plastic layer prior to assembly of the rectifier, coating the assembled rectifier with an uncured plastic, and curing said plastic to cover the rectifier with a protective envelope.

3. The method of fabricating dry-plate rectifiers, which comprises forming a plurality of individual rectifier plates,

5

covering the outer peripheral edges of the individual rectifier plates with a thermosetting plastic sleeve, said sleeve being generally U-shaped with a smooth unbroken outer contour adjacent the edges of the plate, assembling the rectifier, applying an uncured thermosetting plastic coating to said assembled rectifier, and curing said thermosetting plastic coating.

4. The method of fabricating dry-plate rectifiers, which comprises forming a plurality of individual rectifier plates, covering the outer peripheral edges of the individual rectifier plates with a vinyl plastic sleeve, assembling the rectifier, immersing the rectifier in a bath of fluidized vinyl plastic, and removing and curing said plastic to

5

10

6

coat the rectifier with a continuous coating tightly adhering to the exposed surfaces of the rectifier.

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