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STORAGE TUBE TARGETS

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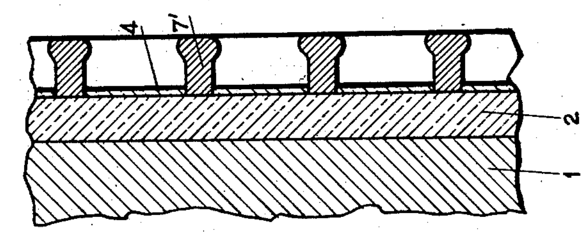

Fig. 5

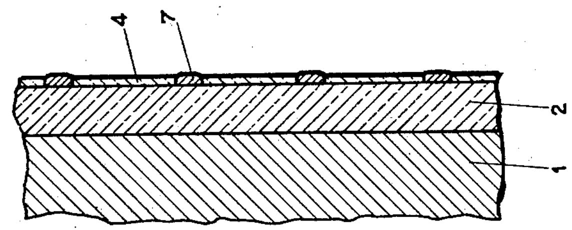

Fig. 4

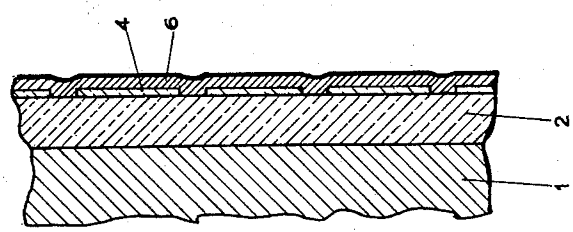

Fig. 3

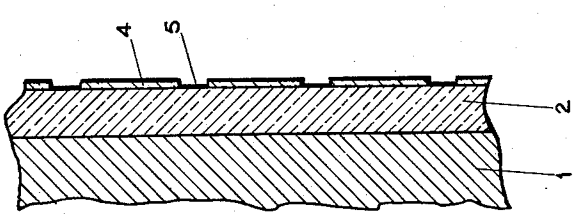

Fig. 2

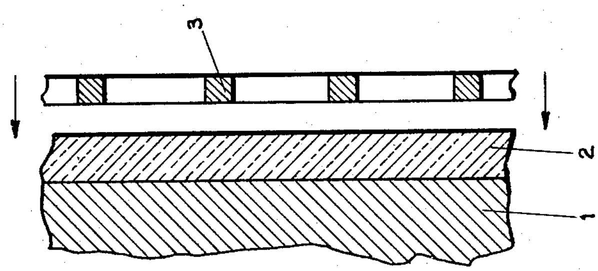

Fig. 1

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STORAGE TUBE TARGETS

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The present invention relates to a method of making a target for storage tubes and to the particular storage tube target made in accordance with the present invention.

In certain storage tubes, targets are used which include an insulating layer, contiguous on one side thereof to a metallic layer and on the other side thereof to a grid also made of metallic matrial which is very fine, for example, of which the pitch of mesh work is of the order of fifty microns.

In the known prior art proceses and methods for the manufacture of such targets, the grid ordinarily made separately of the assembly consisting of the metallic layer and of the insulating layer, was applied against the surface of the layer and fixed thereto by any suitable means.

However, for proper operation of these storage tubes of the type under consideration, it is essential that the distance between the grid and the metallic layer remains constant along the entire surface of the target, the precision which is required therefor being of the order of one micron.

This precision, however, could not be obtained with the known methods of the prior art so that the targets obtained thereby exhibited a defect as to uniformity thereof.

Accordingly, it is an object of the present invention to obviate the inadequacies of the prior art and to provide a storage-tube target in which the distance between the grid and the metallic layer is constant throughout with a precision corresponding to the very high desirable accuracy indicated hereinabove.

Another object of the present invention is a method of manufacture in which the grid is directly formed on the surface of the insulating layer to improve the manufacturing techniques thereof and reduce the steps and therewith the cost connected therewith.

The process according to the present invention includes the following steps:

(1) At first, a metallic plate is taken of which one face is oxidized;

(2) A matrix-grid is thereupon applied on the oxidized surface of this metallic plate and an insulating material different from that which constitutes the metallic oxide of the plate utilized is thereupon applied by evaporation onto the surface covered by the matrix-grid. This insulating material applied onto the surface covered by the matrix-grid must have the following properties:

(*a*) It must be capable of forming well defined shadows, that is, well defined outlines or contours at the limits or borders of the surface covered thereby, and

(*b*) It must have a poor adherence with respect to the metal which will be utilized to constitute the ultimate or final grid.

After removal of the matrix-grid, there remains on the oxidized surface small isles of this second insulating material which correspond to the apertures or holes of the mesh of the grid to be formed;

(3) Thereafter a layer of a metal of which the grid is to be constituted is applied by any suitable method, such as, for example, by pulverization in vacuum, onto the insulating surface. This layer will cover the isles of the second insulating material as well as the channels or grooves therebetween which were left by removal of the matrix-grid and which correspond to the network of the wires of the desired grid.

The metal under consideration must have the property of good adherence to the metallic oxide forming the insulating layer of the target but of poor adherence to the insulating material of which the isles are formed.

(4) By subsequently rubbing the layer of the deposited metal or by acting thereon in an analogous, suitable manner, the parts of the metal deposited on the isles of the second insulating material are caused to be loosened or detached therefrom by reason of the poor adherence thereof with the second insulating material whereas the metal filling the channels or grooves between the isles and deposited directly onto the oxide of metal of the base resist to the rubbing action, thanks to the relatively good adherence thereof.

As a result thereof, a structure of metallic grid encrusted or emplaced between the isles of the second insulating material are obtained.

(5) Finally, by submerging the target assembly into an electrolytic bath of a metal which may be that of which the grid is made or of a different metal, a supplementary deposit of the metal is caused on the metallic encrusted structure which thereby causes the grid to grow.

Accordingly, it is a primary object to provide a method for manufacturing, in a simple manner, a target for storage tubes which has the required and desired very high degree of accuracy.

Another object of the present invention is to provide a target for storage tubes which excels by the great uniformity throughout the target.

These and other objects, features and advantages of the present invention will become more obvious from the following description when taken in connection with the accompanying drawing which shows, for purposes of illustration only, the various steps of one embodiment of the method in accordance with the present invention, and wherein:

FIGURES 1 through 5 are cross-sectional views through a target of a storage tube in accordance with the present invention and illustrating the successive stages in the manufacture of the target according to the steps 1 to 5 listed hereinabove.

Referring now to the drawing, wherein like reference numerals are used throughout the various views to designate like parts, reference numeral **1** designates the metallic plate, for example, of aluminum which has been oxidized in such a manner that it is covered with a layer **2** of alumina (aluminum oxide Al_2O_3). A matrix-grid **3** is then placed over the surface **2**, and a very thin layer of insulating material having the properties (*a*) and (*b*) indicated hereinabove is deposited into the holes of the mesh of this grid in any suitable manner, for example, by evaporation under vacuum. As an example, silicon monoxide (SiO) is suitable for the application under consideration if the insulating layer of the target is constituted by alumina, and if the metal of the grid is copper.

FIGURE 2 shows the isles **4** of silicon monoxide on the surface **2** which subsist after removal of the matrix-grid **3**. The channels or grooves **5** form the matrix for the grid to be formed.

In FIGURE 3, the channels or grooves **5** and the isles **4** are covered by or are submerged in a layer **6** of metal, for example, projected by cathodic pulverization under vacuum. The metal of layer **6** may be, for example, copper which adheres poorly to silicon monoxide (SiO) but which adheres well to aluminum oxide (Al_2O_3).

As shown in FIGURE 4, after rubbing or any other suitable equivalent action only the metallic structure of the grid **7** remains which adheres to the surface **2** whereas the metallic portions facing the isles **4** have been removed or become detached.

FIGURE 5 shows the grid designated therein by reference numeral 7' which has been caused to grow as the result of passage of the target assembly through an electrolytic bath, for example, of cooper.

Thus, FIGURE 5 presents the finished product of the target made in conformity with the present invention according to which the structure of the grid is formed directly on the surface of the insulating layer.

Laboratory tests and practical experience both have demonstrated that with the thicknesses of the elements **2** and **7'** of the order of a few microns to several tens of microns and with a grid having twenty meshes per millimeter, with a transparency of 60% to 70%, a constancy in the distance between the grid **7'** and the surface of the plate **1** is realized with a tolerance of about one micron over the entire surface of the target.

It should be noted that with the possible exception of the formation of the first insulating layer by oxidation of the metal plate and of the subsequent optional electrolytic treatment of the grid structure, all steps used in the manufacture of the storage-tube target in accordance with the present invention are mechanical in nature and do not require chemical treatments, dissolution, or washing out of parts of the assembly thereby facilitating manufacture and quality control thereof.

While we have shown and described one embodiment of the method and finished product obtained in accordance with the present invention, it is understood that the same is not limited thereto but is susceptible of many changes and modifications within the scope and spirit of the present invention.

For example, the present invention is not limited to the plane structure shown in the drawing. Quite to the contrary, the method described hereinabove is equally applicable if the surface of the metallic grid **1** is curved or non-planar, and thereby readily enables also the realiza-

tion of a convex target structure having the same advantages as mentioned hereinabove. Consequently, we intend to cover all such changes and modifications as are encompassed by the scope of the appended claim.

We claim:

A method of manufacturing a metal grid fixed with a surface thereof to a surface of a first insulating layer, comprising the steps of applying against said insulating surface a matrix grid; projecting onto said matrix grid a second layer of an insulating material different from said insulating material; removing said matrix grid thereby establishing a network of grooves in said second insulating layer; projecting onto said grooved layer a coating of metal having the characteristics of being strongly adherent to said first insulating layer material while being loosely adherent to said second insulating layer material; and removing the particles of said metal coating adherent to said second layer surface while leaving a grid structure by the portions thereof filling said grooves and adherent to said first layer surface, said first insulating layer being of alumina, said grid being of copper, and said second insulating layer being of silicon monoxide.

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