March 26, 1940. H. E. HOLMAN 2,194,551

MEANS AND METHOD OF PRODUCING FLAT SURFACES

Filed June 11, 1937

Fig. 1

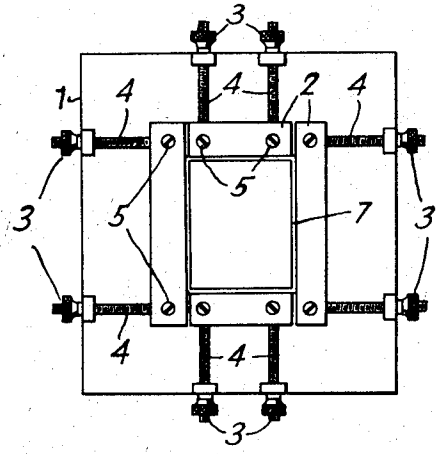


Fig. 2

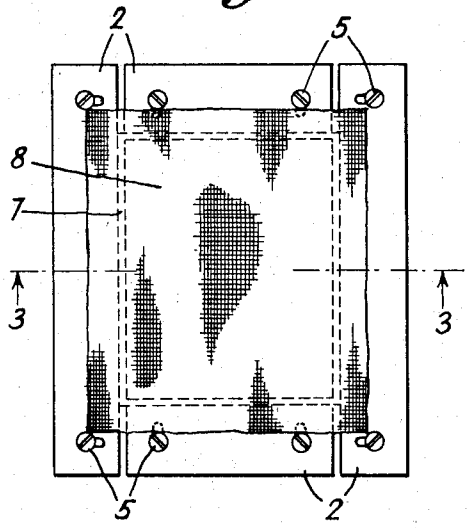


Fig. 5

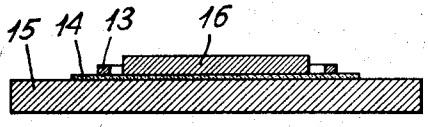


Fig. 3

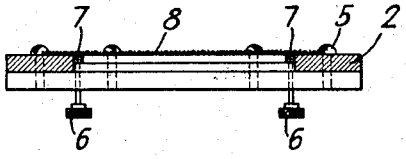


Fig. 6

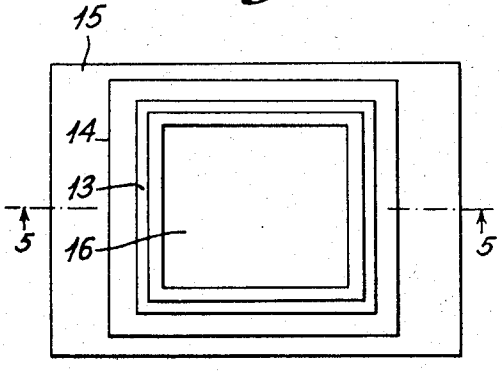
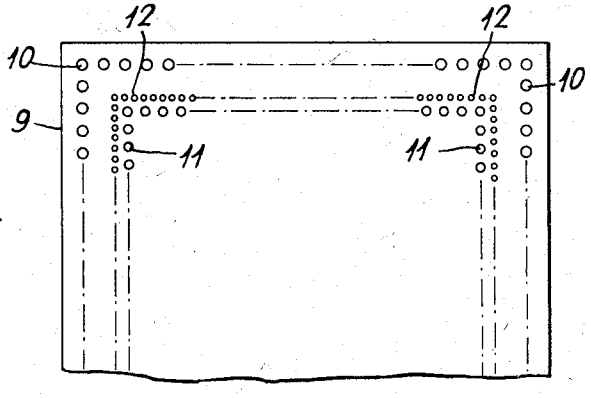


Fig. 4



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MEANS AND METHOD OF PRODUCING FLAT SURFACES

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4 Claims. (Cl. 140—109)

This invention relates to methods of producing flat surfaces and while capable of general application it has particular reference to the production of flat electrodes or electrode base supporting, or separating, members such as are used in cathode ray oscillograph tubes, thermionic valves, light sensitive cells and similar devices.

Cathode ray tubes used for television transmission purposes may contain in addition to a cathode, accelerating and focusing electrodes, a flat electrode in the form of a mesh screen which acts as a stabilizing or a screening electrode, or again a flat activated mica sheet may act as a signal producing electrode as in the case of the type of tube known as an "iconoscope". Again, such a tube may have a flat signal plate for collecting electrons emitted from an activated mica or other sheet. Such electrodes are frequently mounted extremely close to each other and it is desirable therefore that they should be as flat as it is practically possible to make them, and accordingly it is the chief object of the present invention to provide a method of producing a flat electrode or electrode base.

According to the present invention a method of flattening a piece of material and maintaining said material substantially flat, comprises subjecting said piece of material to a stretching treatment, securing it to a supporting framework while in the stretched condition and subsequently severing the portion mounted upon the supporting framework from the body of the material.

The stretching treatment may consist in applying said material to an adjustable stretching device, securing it to a supporting framework while in the stretched condition and subsequently severing the portion mounted upon the supporting framework from the body of the material.

Again the stretching treatment may consist in applying said piece of material to a heated surface and while in the heated condition applying a temporary supporting framework to said piece of material with a cementing medium interposed between said material and framework, allowing the assembly to cool and thereafter mounting said piece of material upon a final supporting framework and severing the portion mounted on this final supporting framework from the portion cemented to said temporary framework.

In a particular application of the invention, a flat electrode or electrode supporting or base member for use in a device of the type referred to is produced by applying it to the adjustable stretching device, securing it to a supporting framework while in the stretched condition and subsequently severing the portion mounted upon the supporting framework from the portion applied to the adjustable stretching device. The adjustable stretching device may comprise relatively movable elements to the surfaces of which an adhesive material is applied which serves to maintain the electrode or other member in position during the stretching operation while permitting relative movement between parts of the electrode or other member and the engaged surface of the adjustable stretching device, and the supporting framework may be secured to the electrode or other member by an electroplating operation. A metal mesh electrode or a sheet of mica may be mounted upon a metal supporting framework having a lower coefficient of expansion than the metal mesh and in a particular application of the invention, the metal framework is of the low expansion steel known under the registered trade-mark Invar.

In order that the invention may be more clearly understood and readily carried into effect, the production of a flat mesh electrode and of a flat mica base for an activated screen will now be described by way of example with reference to the drawing in which:

Figure 1 is a plan of stretching device employed in carrying out the invention,

Figure 2 is an enlarged view of the movable elements of the stretching device and shows a piece of mesh in position,

Figure 3 is an end elevation of Figure 2,

Figure 4 is a fragmentary view of a piece of mica sheet prepared prior to application to the stretching device.

Figure 5 is a side view of a modified form of stretching apparatus and,

Figure 6 is a planned view of Figure 5.

Referring to Figure 1 of the drawing, the stretching device consists of a fairly thick base member 1 of a substance which is unaffected by acids or alkalies and may be of the material known under the register trade-mark Paxolin. Four bars or elements 2 of this material are arranged to be relatively movable over the surface of the base 1 by means of nuts 3 and screw rods 4 the ends of which are secured to the bars 2. Adjustment of the nuts 3 causes the bars or elements to be drawn towards or away from each other. Set screws 5 serve to clamp the bars 2 in any desired position. Further screws 6 shown in Fig. 3 serve to raise the level of sup-

porting framework 7 which is placed within the space bounded by the elements or bars 2 as a preliminary step in the operation of the device.

It is convenient to consider the production of a nickel mesh electrode. The metal framework 7 is first placed in position and the bars 2 are then closed around this framework. A thin coating of cementing varnish such as commercial gold size is then applied to the upper surface of the elements or bars 2 and a piece of flat nickel mesh 8 is then placed upon the bars so that the margin of the mesh is held by the varnish. The device is then left in order to allow the varnish partially to harden. When the varnish is sufficiently hard the bars or elements 2 are moved slowly away from each other to tension the mesh in bi-lateral directions by adjustment of the nuts 3, the mesh being stretched to an extent dependent upon the viscosity or molecular friction of the semi-hard varnish. The uniform viscosity of the varnish allows it to yield at points where further tension would rupure the mesh while permitting stretching of the mesh where further extension is possible. Further, any cross stresses which may be introduced due to the pulling of the mesh in only two directions, i. e. bi-laterally will be eliminated by movement of the mesh along its adhering edges, the degree of tension being thus equalized from point to point. It is desirable to perform the stretching operating in stages allowing a period of time between each tensioning in order still further to harden the cementing varnish as naturally the greatest tension will be required when the mesh is almost flat, in order to remove dents or buckles. When the maximum flatness of the mesh has been obtained, the framework 7 is raised into contact with the mesh by operating the screws 6.

The complete device is now placed in an electro-plating bath and metal is plated on the framework 7 through the spaces in the mesh 8, the framework 7 being connected to the negative terminal of the plating apparatus. After the plating process has continued for a sufficient time the spaces in the mesh become filled with deposited metal which forms rivets firmly securing the mesh to the framework 7. It is important that the mesh within the framework should not become filled with deposited metal and accordingly this area of the mesh is treated with a varnish which prevents the plating solution from affecting the mesh where the varnish is applied to it.

Finally the mesh is cut around the outside edge of the framework which is then removed from the stretching device and the surplus mesh remaining on the elements or bars 2 is removed.

The framework 7 may be of various metals but in all cases where the mesh is likely to be heated when mounted in a discharge tube, it is preferred to use the low expansion steel known as "Invar." While at first sight it might appear desirable that the metal supporting framework should have the same co-efficient of expansion as the mesh, this would only be the case if the mounted mesh could be heated and cooled slowly. Assuming that the framework and mesh have the same co-efficient of expansion, because the mesh cools much more quickly than the supporting framework there would be a resultant straining of the mesh. When the framework itself cools down the mesh would then become slack.

If "Invar" steel is used for the framework, the mesh will become slack on heating because it will expand more rapidly than the framework, but on cooling, the straining will cease, the frame work retaining substantially its original size. The elasticity of the mesh will usually be quite sufficient to absorb the slight difference in the size of the framework.

Referring to Fig. 4 of the drawing a fragment of a mica plate 9 intended to form a base for a mosaic electrode is shown. The method of mounting such a mica plate upon a supporting framework is similar to that already described, but as the mica has a continuous surface, three rows of holes 10, 11 and 12 are provided. The first row of holes 10 is provided to facilitate rapid hardening of the gold size which would not otherwise be exposed to the air. The holes 10 cause the formation of plugs of gold size in the mica plate and oxidation of the size is expedited in consequence of the increased exposed area. The row of holes 11 permit deposition of metal upon the supporting framework and the formation of rivets as previously described. The row of holes 12 is provided to facilitate final cutting of the surplus mica away from that mounted upon the framework.

A modified method of mounting a mica sheet is illustrated in Figures 5 and 6 of the drawing. Referring to these figures, a rectangular metal framework 13 of square section and about 1 centimeter larger than the framework to which the mica sheet is finally secured is used to provide a temporary supporting framework for the mica between a stretching operation and the final riveting by electro-plating. A sheet of mica 14 perforated as described with reference to Figure 4 is placed upon an accurately planned steel plate 15 which has been carefully cleaned and the plate with the mica is heated to a temperature of about 150 degs. C. The framework 13 is ground flat on one side and has a coating of a wax composition, the melting point of which is approximately 150 degs. C. applied to the ground side which is then placed upon the heated mica sheet on the steel plate and pressed firmly into contact with the mica sheet. The assembly is now allowed to cool, and in order to keep the mica sheet flat a block of metal 16 is placed on the mica within the framework 13 during the cooling process.

As the mica sheet is in an extended condition when the metal framework is placed in position, it is clear that when the mica cools it will be in a state of tension, the framework, as previously mentioned, being of the metal known under the registered trade-mark Invar, and having a lower co-efficient of expansion than the mica. The degree of tension is controlled by the solidifying temperature of the wax used to cement the framework to the mica and the temperature to which the mica is raised prior to the framework being placed upon it.

The stretched mica sheet attached to the framework is now placed on the final supporting framework and the assembly is placed in an electro-plating bath in which the mica becomes riveted to the final supporting framework as described above.

Modifications may of course be made within the scope of the invention. Thus, for example, instead of perforating the margin of a mica sheet as described, strips of metal mesh may be placed over the plain margin of the mica. The gold size then hardens normally through the spaces of the mesh and the tensioning takes place through the adhering strip of metal mesh.

While gold size has been referred to as a suitable varnish, it will be understood that other materials may be employed. Thus cellulose acetate, the preparation sold under the trade name Durofix, bitumen compounds, marine glue, various aquarium cements, and so forth, may all be used, but in these cases the process of tensioning needs to be carefully and progressively performed during the whole period of the drying of the cement in order that the edge of the mesh may move endwise as is necessary in order to ensure flatness. Progressive tensioning is, of course, necessary with any cementing medium employed, but owing to the fact that gold size is somewhat elastic when dry, the need for exactness is not so great as when other and less elastic cements are used. It is desirable that the cementing material should be one in which the hardening is brought about by the oxidation of the vehicle in which the gums or resins are dissolved. It is easier to control the degree of hardening produced in a given time in the case of varnishes of the type referred to than in the case of varnishes hardened by heating or evaporation which will not allow satisfactory manipulation.

The use of water soluble cements or glues is not possible when the process of securing the mesh to the mounting ring by electro-deposition is required, but if other means of securing are employed, such as soldering by fusible metals, such adhesives would be suitable providing the tensioning is carefully attended.

Again, any material may be used which permits relative movement between the material to be stretched and the surface of the stretching framework while maintaining a substantial gripping action. Thus, as a further example, a viscous non-drying material such as rubber grease under pressure from a clamping device may be used, the grease serving as a medium transmitting the pulling action by its molecular friction in its normal unhardened state.

While this specification is directed to rectangular stretching device, it will be understood that a device constructed for stretching and mounting circular or other shaped surfaces may be constructed and used in accordance with the invention.

It is to be understood that various modifications may be made within the purview of this invention and that such modifications shall be considered to be within the spirit and scope of the appended claims.

I claim as my invention:

1. The method of flattening a piece of material and securing the same to a frame which comprises the steps of elastically attaching the material to a stretching device, bilaterally tensioning the material by movement of the stretching device, permanently securing the frame to the material while the latter is under tension, and subsequently severing the portion mounted upon the frame from the portion attached to the stretching device.

2. The method of flattening a piece of material and securing the same to a frame for subsequent use in an electronic discharge device which comprises the steps of elastically attaching the material to a stretching device, uniformly tensioning the material in bilateral direction by movement of the stretching device, permanently securing a frame having a low coefficient of expansion to the material while the latter is under tension, and subsequently severing that portion of the material which extends beyond the periphery of the frame from the part secured to the frame.

3. A device for flattening a piece of material comprising a base member, a plurality of slidable elements positioned on said base, means for elastically securing the material to said slidable elements, and means for sliding said elements whereby the material may be uniformly tensioned due to such sliding and the elasticity of the securing means.

4. A device for flattening a piece of material prior to its being secured to a frame comprising a base member, a plurality of angularly positioned adjustable elements positioned on said base, means for elastically securing the material to said adjustable elements, a frame member, means for moving the adjustable elements whereby the material may be uniformly tensioned due to such movement and the elasticity of the securing means, and means for maintaining said frame member in contact with the tensioned material whereby the material may be permanently secured thereto.

HERBERT EDWARD HOLMAN.