Nov. 1, 1960 D. G. TAYLOR 2,958,120

METHOD OF FLUSH CIRCUIT MANUFACTURE

Filed May 1, 1956

FIG. 1

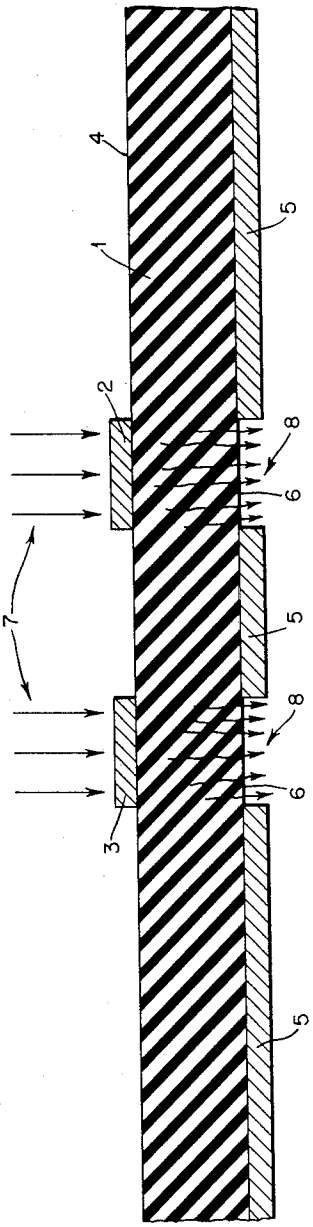
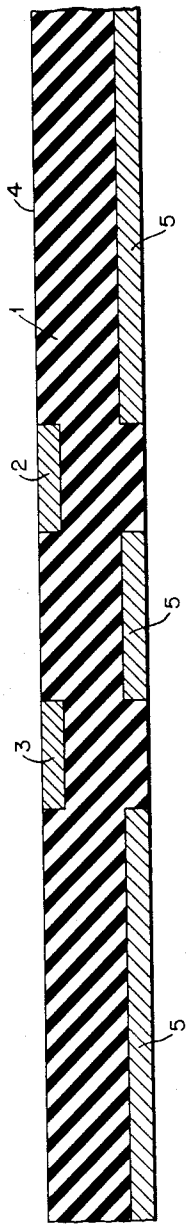


FIG. 2



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United States Patent Office 2,958,120 Patented Nov. 1, 1960

2,958,120

METHOD OF FLUSH CIRCUIT MANUFACTURE

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Filed May 1, 1956, Ser. No. 582,004

2 Claims. (Cl. 29—155.5)

This application relates to the manufacture of conductive patterns on an insulating backing and in particular to a technique of forming such patterns in flush relationship with the insulating backing.

In the manufacture of flush circuit patterns, the processes used are variations of two basic techniques. These techniques are known as the direct and the indirect process. The direct process involves the steps of providing a conductive pattern on the surface of the insulating backing and then pressing the pattern and backing into flush relationship. The indirect process involves the steps of providing a conductive pattern on a temporary support, pressing an insulating backing material over the conductive pattern and removing the backing and pattern assembly from the temporary support. As the speed of the machines in which these flush circuits are to be used has been increasing, it has become increasingly difficult to maintain an inter-conductor spatial relationship in the finished flush circuit to a desired accuracy because the conductors of the pattern tend to move laterally with relation to each other during the flushing step of the process.

This invention is directed to a simple technique of controlling the flow of the insulating backing to maintain inter-conductor spatial relationship of the individual parts of a conductor pattern during the flushing operation.

Accordingly, it is a primary object of this invention to provide a method of maintaining accurate inter-conductor spatial relationship in a flush circuit.

A related object is to provide a method of controlling the flow of a backing material while pressing a pattern flush with the backing so that horizontal distances between parts of the pattern are maintained.

Other objects of the invention will be pointed out in the following description and claims and illustrated in the accompanying drawings, which disclose, by way of example, the principle of the invention and the best mode, which has been contemplated, of applying that principle.

In the drawings:

Figure 1 is a cross sectional view of a quantity of backing material showing a flow controlling negative of the desired pattern applied to the reverse side of the material.

Figure 2 is a view as in Figure 1 after the desired pattern has been pressed flush with the backing material.

Referring now to Figure 1, the quantity of backing material 1 is provided with a desired pattern shown as segments 2 and 3 which ultimately are desired to be brought into flush relationship with the upper surface 4 of the backing. During the flushing operation horizontal dimensions such as the distance from one segment to the other or from the segments to a reference position such as the edge of the material 1 must be maintained. In order to accommodate the segments 2 and 3 of the pattern, it is necessary that the backing material 1 be displaced and in such displacement, the flow of the material 1 may carry the segments 2 and 3 out of position. The flow of the material 1 can be controlled by supporting the material 1 in a configuration that is a negative of the

desired pattern during the flushing operation. One way in which this can be done is to provide a sheet of material having a negative configuration of the desired pattern in it. This material is shown as element 5. It being noted that vacant spaces in the material 5 coincide with the under surface 6 of the backing 1 directly beneath the segments 2 and 3 of the desired pattern to be pressed into the backing 1.

In the flushing operation, pressure or a combination of heat and pressure, is applied to the segments 2 and 3 in the direction of the arrows 7. The flushing operation results in the segments 2 and 3 being forced into flush relationship with the upper surface 4 of the backing and as a result of the openings in the material 5, the direction of flow of the backing, as it is deformed, to accommodate the segments 2 and 3 is shown by the arrows 8 drawn in the material 1. This flow confines movement of the segments 2 and 3 to a vertical path. There is no tendency toward horizontal movement because all horizontal forces applied to the segments of the desired pattern are opposed by equal and opposite horizontal forces as a result of the direction of flow of the backing material 1.

Referring now to Figure 2, the finished flush pattern is shown in which the desired pattern represented by segments 2 and 3 is now accommodated into flush relationship with the surface 4 of the backing 1 and the displaced backing material resulting from the presence of these segments now occupies the open spaces in the material 5. The support with the negative pattern need only have sufficient strength to support the backing material 1 during the flushing cycle, and it may be part of a supporting plate, a separate sheet of material or part of the backing material itself.

Taking for a specific example a flush circuit, the insulating backing may be a sheet of phenolic resin, commonly known in the art as XXXP, used in printed wiring applications. This material is generally provided with a bonded layer of copper foil on each side. Using the photo-etch process also well known in the art, it is possible, referring to Figure 1 to provide a positive conductor pattern such as elements 2 and 3 on the side 4 of the insulating backing 1 and a negative of the conductor pattern on the side 8 of the insulating backing 1 wherein, in this example, the copper foil on the opposite side of the insulating backing 1 serves the purpose of the material 5. Once the flushing cycle has taken place and the conductive segments 2 and 3 have been accommodated into flush relationship with the surface 4 of the insulating backing 1 and portions of the insulating backing 1 have filled the openings in the material 5 on the opposite of the sheet of the insulating backing 1, these portions and the foil 5 may now be removed by, for example, such operations as abrading. In many applications employing flush circuits the material 5 does not interfere with the circuit operation and may be left on.

As may be seen from the above description what has been provided is a negative configuration of material supporting the reverse side of a sheet of backing material into which a positive configuration of segments of a desired pattern is to be pressed flush, so that the negative configuration of material serves to control the flow of the backing material in the flushing operation thereby permitting dimensional stability to be maintained between individual segments of the pattern, as the segments travel vertically during the flushing operation.

Thus, while the technique of this invention has been described in detail with respect to the manufacturing of flush wiring patterns, it will be obvious to one skilled in the art that the basic principle of this invention, namely, supporting the material in a configuration that is the negative of the desired pattern on the opposite side of a sheet of backing material in order to control

the flow of the backing material during the vertical flushing operation may readily be applied in any situation wherein a design of a material is brought into flush relationship with a backing material.

While there have been shown and described and pointed out the fundamental novel features of the invention as applied to a preferred embodiment, it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention. It is the intention therefore, to be limited only as indicated by the following claims.

What is claimed is:

1. A method of manufacturing a flush wiring pattern comprising in combination the steps of printing with an etching resistant material a positive configuration of a conductive pattern on a first side of a sheet of insulating material having metal foil covering both sides thereof, printing with an etching resistant material a negative configuration of said conductive pattern in registering alignment with said conductive pattern on the opposite side of said sheet of insulating material, etching away said metal foil not covered by said etching resistant material forming thereby a conductive foil pattern on one side of said sheet of insulating material and a female die of said conductive foil pattern of foil on the opposite side of said sheet of insulating material, removing said etching resist, placing said sheet of insulating material on a plane surface of a support with said foil female die of said conductive foil pattern in contact with said support and applying vertical pressure to said conductive foil pattern sufficient to press said conductive foil pattern flush with the surface of said sheet of insulating material and simultaneously to press said insulating backing into the space defined by said foil female die and the plane surface of said support and into contact with the plane surface of said support.

2. The method of claim 1 including the step of removing said foil female die and the displaced insulating material therein from the opposite side of said sheet of insulating material.

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