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METHOD FOR MANUFACTURING A METAL STENCIL

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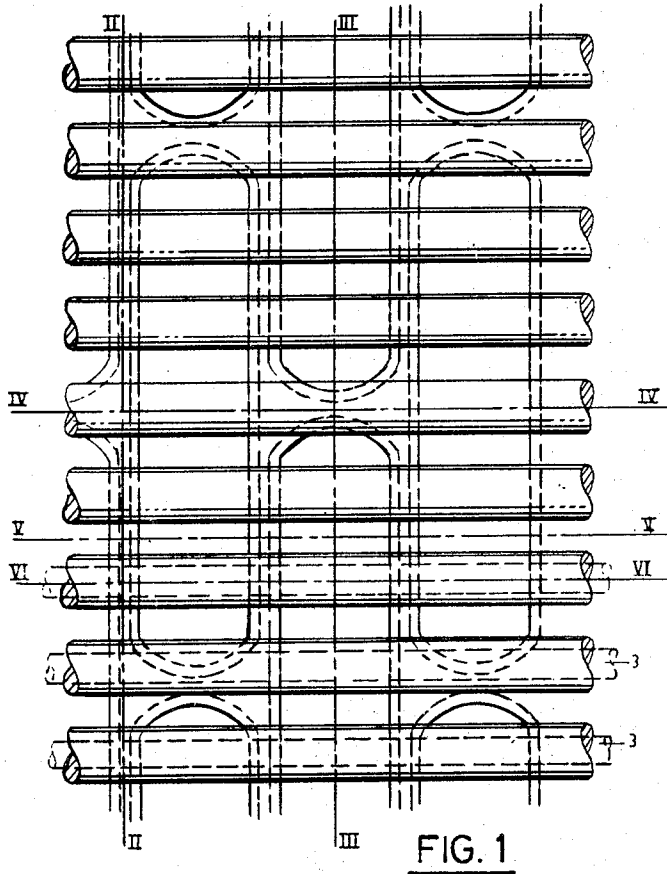


FIG. 1



FIG. 2

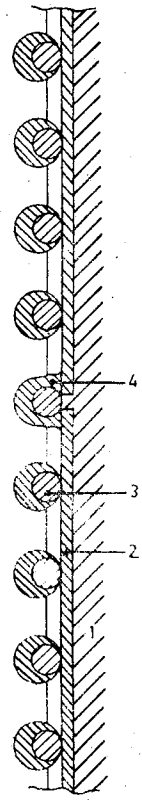


FIG. 3

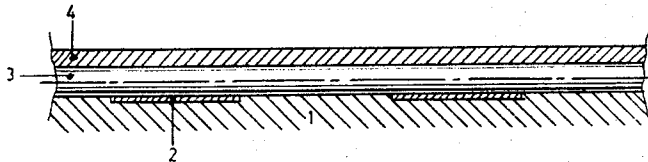


FIG. 4

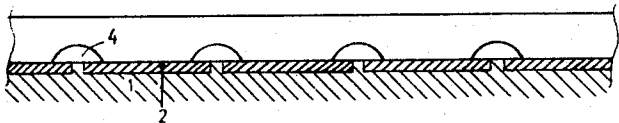


FIG. 5

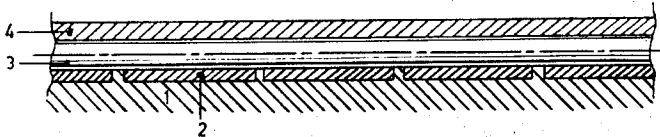


FIG. 6

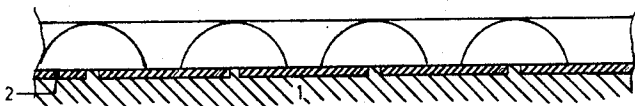


FIG. 7

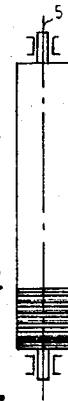


FIG. 8

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3,681,208 METHOD FOR MANUFACTURING A METAL STENCIL

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4 Claims

ABSTRACT OF THE DISCLOSURE

Method for manufacturing a metal stencil by starting from a cylindrical metal matrix having on its surface a pattern of insulating material; a thin metal wire is tightly wound upon said matrix, after which a layer of metal is deposited upon the matrix, whereupon this layer is removed from the matrix.

SURVEY OF THE PRIOR ART

The invention relates principally to a method for manufacturing a metal stencil comprising a perforated first layer and a second layer composed of wires. So far this method was performed by disposing two gauzes over each other which were at first cylindrically bent and subsequently secured. The inner cylinder obtained by soldering or welding, consists of a strong wire netting serving as a supporting cylinder. A finer gauze is tensioned around this latter cylinder. The finer gauze may consist of a flat fabric which is permanently held in a cylindrical form by means of a glued joint, or the gauze may already previously be embodied as a seamless knitted cylindrical hose.

This known method is advantageous in that for the outer layer a very fine gauze may be selected. A considerable drawback, however, consists in that owing to the supporting inner cylinder the squeegee within the stencil cannot come directly in touch with the stencil cylinder proper during the printing operation and consequently the quality of printing is impaired.

It should be observed that still two other methods for manufacturing cylindrical metal stencils are known. So by a galvanic process metal can be deposited on a cylindrical matrix bearing a pattern of non-conductive points which do not protrude from the surface of the matrix. At the location of these points no metal is deposited, but from the edges metal is gradually deposited in the area of the non-conductive screen points and as a consequence the diameter of the perforations aimed at decreases as the thickness of the deposited layer of metal increases.

According to this known process the finest stencil which can be manufactured thereby is provided with 1600 to 2000 perforations per cm.². The diameter of the perforations amounts then only to forty to fifty microns at a thickness of wall of about eighty microns.

If it is desired to make a still finer stencil then it is necessary to manufacture a still thinner screen cylinder. The life time of such a stencil is, however, very short owing to the weakness thereof. From the technical viewpoint it is therefore not justified in practice to go in this process beyond 2500 perforations per cm.².

There may yet be pointed to another method which bears a similarity to the process just described, but whereby the non-conductive screen points are provided on the surface of a smooth matrix via a photographic process. Owing to complications produced on sliding such a stencil from the matrix, this method is only applied to the manufacture of a designed stencil of which only one or some copies are wanted. Moreover on applying the screen

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points photographically a flat photographic film should be used which on winding around the cylindrical matrix produces a seam which considerably limits the applicability of the method.

SUMMARY OF THE INVENTION

It is an object of the invention to provide a method for the manufacture of a stencil with a very fine perforation and which has a sufficient strength, and with which stencil a particularly sharp product or printed matter can be obtained. The invention starts from the known method mentioned in the opening part of this specification.

The aforementioned objects are attained according to the invention:

- in that one starts from a matrix with a two-dimensional curve and electrically conductive surface bearing a pattern of insulating material;
- in that one tightly applies a single row of very fine wires, spaced from each other, upon this matrix;
- in that one deposits metal on the matrix by a galvanic process, so that the wire is anchored in the deposited metal layer;
- in that the deposited layer is removed from the matrix.

Due to these features an entirely new type of stencil is obtained which allows for much finer perforations, while the aforementioned disadvantages are avoided and the squeegee can come very close to the printing outer surface of the stencil.

The product obtained with the method according to the invention is distinguished in that the stencil as it were is constructed from two different materials united into a whole, the perforation on the inner side being mostly not identical to that on the outer side.

Due to this new method a screen cylinder or stencil is obtained, having on its inner side a screen corresponding to the matrix while the outer side exhibits a slotted screen consisting of parallelly extending slots (the space between the juxtaposed wires).

The invention is also based on the understanding that in order to absorb the forces transverse to the direction of the squeegee it suffices to use a wall thickness amounting to 25–33% of that required to absorb the frictional forces of the squeegee acting perpendicular thereto. The latter force to which is added the frictional force exerted by the material to be printed upon the stencil is entirely absorbed by the wires. As a result the usual thickness of 80 microns required for galvanic stencils can be reduced to only 25 to 30 microns, whilst maintaining a commensurate strength and life time of the stencil.

A preferred embodiment of the method according to the invention is obtained when one starts from a cylindrical matrix and when the row of wires is applied by winding helically at least one wire around the matrix. Hereby it is possible to obtain in a very simple way a tight winding of the wire around the matrix, whereby also a very exact mutual spacing of the consecutive windings can be maintained.

The wire or wires applied according to the invention may have a rather arbitrary compositions but preferably a wire of conductive material or with a conductive surface is applied. The embedment is thereby improved and the progress of the galvanic part of the process is facilitated. A non-conductive wire will preferably be used when the mechanical load of the stencil to be manufactured in the operative direction of the squeegee is small and when a very high value is attached to the greatest possible distance between the windings of the wire at a given number of windings per cm. of the length of the matrix.

The invention renders it possible on performing the

method to start from a matrix provided with a screen consisting of grooves which substantially extend perpendicularly to the curvature of the surface of the matrix. The width of these grooves determines then the one dimension of the perforations aimed at, while the mutual spacing of the wires lying in the close proximity of each other determines the other dimension.

The invention will be clarified with reference to the accompanying drawing in which to a considerably enlarged scale a plan view of a small part of the stencil is depicted (FIG. 1) and further a number of cross sections are represented (FIGS. 2 to 6) of the product according to the invention, and a section (FIG. 7) through a stencil manufactured according to a conventional process, while finally very diagrammatically to a strongly reduced scale a device for performing the method according to the invention is represented (FIG. 8).

DESCRIPTION OF A PREFERRED EMBODIMENT

Upon a cylindrical metal matrix 1 a screen of shallow pits or grooves 2 is manufactured by etching or by a mechanical process, e.g. by means of a milling roller. These pits or grooves are filled up by an insulating material e.g. enamel or synthetic resin. FIG. 1 shows a particular embodiment in which these grooves 2 have a width of 250 microns and a length of 1000 microns. These grooves are interspaced by dams with a width of 30 microns. The longitudinal axis of the grooves extends parallel to the longitudinal axis 5 of the matrix (see FIG. 7). Thereupon the metal surface of the cylinder 1 is passivated according to a known galvanotechnical method in such a way that a metal subsequently deposited thereon by a galvanic process does not adhere thereto.

Thereupon a single row of very thin mutually spaced wires 3 are provided tight on the matrix 1 by means of a winding device 6 which is diagrammatically represented in FIG. 7. In the situation depicted in FIG. 1 the wire has a diameter of fifty microns and the spacing amounts to hundred microns. Consequently there are odd sixty six windings per cm. length of the matrix. When the beginning and the end of the wire 3 have been fastened to the matrix 1, the matrix is introduced into a galvanic bath e.g. a nickel bath. By a galvanic process a layer 4 of nickel of 30 microns in thickness is formed on the matrix, this layer enclosing the windings of the wire entirely. This enclosure is promoted by the deposition upon the wire itself of a layer of nickel of about thirty microns.

The final shape of the stencil is represented in FIG. 1 and in longitudinal sections according to the lines II—II and III—III (see FIGS. 2 and 3) and in a cross section according to the line IV—IV (see FIG. 4). The total wall thickness of the screen cylinder obtained is now eighty microns. The permeability compares favourably with that which would be obtained when by the conventional galvanic method a screen cylinder with a wall thickness of eighty microns would be manufactured. In the production of stencils according to the invention the inevitable accretion of nickel in the lateral direction over the non conductive locations will only give rise to a decrease of the permeability of the base screen from 250 microns to a value of 250 minus $(2 \times 30) = 190$ microns.

When starting from FIG. 1 the wire windings are not provided (see FIG. 7) and in the nickel bath a screen cylinder is produced of eighty microns in thickness in order to obtain the required rigidity then the capacity of the perforations would be decreased to 250 minus $(2 \times 80) = 90$ microns.

This is evident when FIG. 7 is compared with FIG. 5. Due to the direction of the grooves 2 parallel to the longitudinal axis of the matrix, the invention renders it possible that the screen cylinder manufactured thereon obtains at a maximal capacity also a maximal strength

in the direction of the centre line 5, whereby the thickness of wall can be kept as small as possible.

It should be noted that the application of a cylindrical matrix is favourable but not essential for the invention. It suffices to use a matrix with a two dimensional curved surface on which a number of parallel wires are stretched. In that case a flat stencil and no cylindrical stencil is obtained.

It is also favourable but not strictly necessary for the invention to provide grooves 2 in the surface of the matrix. It is also possible to provide pits in the surface or grooves along the entire length of the matrix. In the last case the screen cylinder obtained is constituted by slightly flattened wires in the longitudinal direction of the matrix of the same form as the cross section according to the line V—V (see FIG. 5) and consisting of the galvanically deposited metal on which and in which the cylindrical wire windings are anchored.

Finally it should be noted that in the production of flat stencils the starting point may also be cylindrical matrix, whereby after the manufacture of the stencils the cylinders obtained are severed in the longitudinal direction.

Summarizing, the advantages of the stencil manufactured whilst performing the method according to the invention can be indicated as follows:

in spite of the very small thickness of the metal layer deposited by a galvanic process the stencil exhibits a considerable strength especially in the direction of the movement of the squeegee;

the stencil is particularly resistant to changes in dimensions since no relative shifting of the crossings of the wires from a woven gauze can take place;

the consumption of material is considerably limited with respect to the conventional galvanic method.

What I claim is:

1. A method of manufacturing a metal stencil having a perforated first layer and a second layer composed of wires, comprising the steps of:

(a) providing a matrix with a two-dimensional curved and electrically conductive surface bearing a pattern of insulating material;

(b) applying a single row of wires to the matrix over said conductive surface and said pattern of insulating material, said wires being spaced from each other upon the matrix;

(c) depositing metal on the matrix by a galvanic process so that the wires are anchored in the deposited metal layer; and

(d) removing the layer from the matrix.

2. A method as defined in claim 1 wherein the matrix is cylindrical, and the row of wires is applied by helical winding at least one wire around the matrix.

3. A method as defined in claim 1 wherein the wire applied includes a conductive surface.

4. A method as defined in claim 1 wherein the matrix includes a screen having grooves which extend perpendicularly with respect to the curvature of the surface of the matrix.

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101—128.4; 204—16