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W. E. GRISWOLD

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PRINTING MEMBER AND METHOD OF PRODUCING SAME

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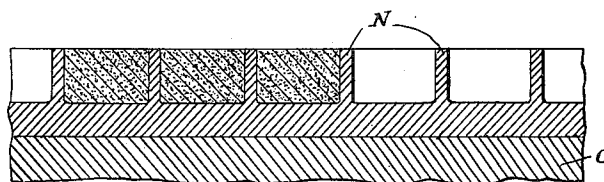


Fig: 1

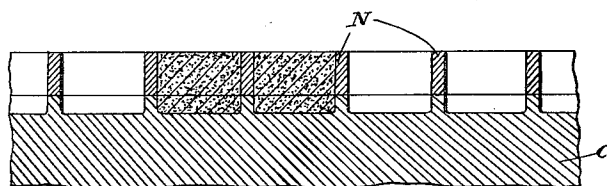


Fig: 2

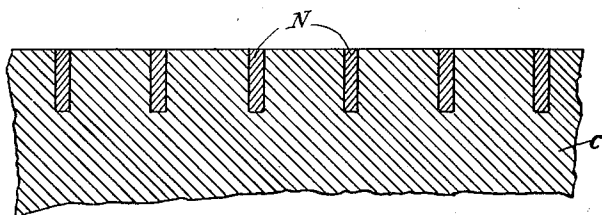


Fig: 3

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PRINTING MEMBER AND METHOD OF PRODUCING SAME

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8 Claims. (Cl. 41—43)

My invention relates to a new and improved method of producing an intaglio printing member, of the type which is generally used for what is designated as photogravure or "Rotogravure" printing, and to a new and improved printing member of this type, and to a member which may be converted into such printing member. The invention also relates to a new and improved method of making such a printing member, which may be a plate, or a cylinder, or which may have any other shape.

Another object of my invention is to provide a method of preparing such a printing member, which will not require the same high degree of skill which is now required for preparing copper plates, for use in photogravure printing.

One of the objects of my invention is to provide a printing member which shall have long life.

Another object of my invention is to provide a printing member having a surface which is harder than the copper which is now used for making such printing members.

Another object of my invention is to provide a printing member of this type, the printing surface of said printing member having a plurality of cells, either regular or irregular, the walls of said cells being narrower than according to present practice.

Another object of my invention is to provide a printing member of this type, having cell walls which are so narrow that a slight bleeding of the printing ink will cover the spaces on the paper which correspond to said cell walls, so as to substantially eliminate the white line effect which is now produced in ordinary photogravure printing.

Another object of my invention is to provide a plate for printing a print of pictorial matter or the like, whereby said white line effect is substantially eliminated, thus producing more adequate reproduction of tone or color, so that a print can be made which can be used as an original for further reproduction. It is to be understood that whenever I refer to printing, I include multicolor printing, as well as monochrome or monochrome printing.

Another object of my invention is to provide a printing member of this type, having cells of substantial depth, which can be made without substantial undercutting of the cell walls.

Another object of my invention is to provide a printing member of this type having a surface made of nickel or other material, said cells having a filling which is suitably made of material

which is different from the material of said cell walls. The surface of said printing member may be made of material which is substantially passive to the etching material, or to any other agency which is used for controlling the amount of copper or other material which is located in said cells.

Another object of my invention is to provide a printing member which can be reconditioned for further use.

Other objects of my invention will be set forth in the following description and drawing, which illustrate several preferred embodiments thereof, it being understood that the above statement of the objects of my invention is intended generally to illustrate the same, and without limiting the invention in any manner.

Fig. 1 is a diagrammatic sectional view showing one embodiment of the invention.

Fig. 2 is a similar sectional view showing a second embodiment of the invention.

Fig. 3 is a similar sectional view of a third embodiment.

While plates or cylinders for photogravure printing have been made by various methods, the ordinary commercial method may be summarized as follows:

Carbon tissue, which consists of a paper backing, which carries a surface layer which consists essentially of gelatin and pigment, is sensitized in the usual manner, by means of a solution of potassium dichromate, or other suitable dichromate.

This carbon tissue is then photographically printed by means of a suitable light source, whose light is passed through a so-called replica or working screen. Said screen has transparent lines, which define opaque squares. Ordinarily there are one hundred and fifty lines to the inch, and the width of a line is about one-third the width of a square. The carbon tissue is then subjected to a second photographic printing by means of a suitable light source, through a positive transparency, which contains the gradations of light and shade which are to be reproduced.

The gelatin layer of the carbon tissue is caused to adhere to a copper plate or cylinder, and the paper backing of the print is stripped and the image is developed. After the carbon print is dry, the copper plate or cylinder is subjected to the action of a solution of ferric chloride, or other suitable mordant or etching medium. Since the carbon print was made from a positive, the thinnest portions of the carbon print

correspond to the shadows of the picture or other representation so that the copper is etched deeper in the shadows than in the half tones, and deeper in the half tones than in the high lights of the picture. Likewise, the parts of the print which correspond to the transparent lines of the screen have the maximum thickness of gelatin or other colloid.

The etching is so regulated that the lines on the face of the printing member which correspond to the screen lines, are practically unaffected by the etching. The varying thickness of the protective layer of colloid in the square areas results in variation of etching effect, and consequently of cell depth.

As is well known in the art, this method of producing a printing member or printing cylinder requires high skill, and several concentrations of etching solution are necessary, in order to secure the desired tone range. It is likewise necessary to regulate the application of the etching solutions, in order to limit the undercutting of the cell walls, so that the cell walls will have sufficient material to resist the action of the doctor blade.

According to the improvements specified herein, the material of the cell walls is a harder material than copper. However, the invention includes the use of copper for making the printing member, in certain aspects thereof, and the invention is not limited to the use of any material, or any combination of materials. As shown in the drawing herein, said cell walls may be made of nickel, as represented by the reference letter N. If desired, the bottom wall or inner wall of each cell or recess may be made of nickel, when the cell is of maximum depth, in the embodiment shown in Fig. 1, or else, as shown in Fig. 2, the nickel or equivalent substance need not extend to the bottom walls or inner walls of the respective recesses, and said inner walls may be made of copper C or other metal or material. However, it is highly preferable to make the cells of uniform depth, corresponding to the maximum cell depth, and to have the lateral wall of the cell, and also its inner end wall, made of nickel. The maximum cell depth is about 1/400 of an inch, according to established practice, and it corresponds to the deepest shadow. When the cells are filled with copper, and the copper is etched, as later stated herein, the maximum cell depth is automatically predetermined, because the copper can be etched by means of an etching force to which the nickel is inert. Likewise, undercutting of the cell walls is impossible. It is therefore possible to etch the copper fillings of the cells by using a single etching fluid for a predetermined period. When the copper has been completely removed from the cells which correspond to the deepest shadows, the copper has been etched in the other cells, in accordance with the varying tone of the picture to be printed.

By using a relatively hard material such as nickel, for making the cell wall, (and also for making the inner wall of the recess, if desired), I can secure printing at higher speed and for much longer press runs, since the doctor blade has much less abrasive action on the outer faces of the nickel cell walls, than if the relatively soft copper is used.

Another advantage of using a material which is harder than copper, is that it is possible to reduce the width of the cell wall, while still furnishing adequate support to the doctor blade. By using a narrow cell wall, the width of the

white lines on the printed paper is considerably lessened. By using a cell wall which is sufficiently thin, and by using a suitable grade of printing ink, it is possible to cause the ink to bleed lightly over or beyond the cell walls, so that the white lines on the printed paper are substantially or wholly eliminated. The substantial or total elimination of these white lines, makes it possible to reproduce gradation of tone more adequately, so that a print can be made which can be used as an original for further reproduction.

Likewise, and by using a material for the cell walls which is substantially inert to the etching solution, such as nickel, I can substantially eliminate undercutting of the cell walls and undesired etching of the top surfaces of the cell walls.

The material which is located within the cells and between the cell walls, can be copper or other material, which is suitably different from the material of the cell walls.

In making the improved printing member, I prefer to use a master or replica screen, of the type previously mentioned, or I can use any other type of screen. Likewise I can use the grain screen which is well known in photogravure, or a mosaic screen, or any other suitable means for securing the general result previously specified. Likewise, and if desired, I can cover the surface which is to be etched, by means of a fine dust of asphaltum powder, according to well known practice.

Whenever I refer to nickel, it is to be understood that I include metals and other materials which are suitable, and which are preferably harder than copper, and this may include alloys of various types, even including alloys of nickel or copper, or copper which has been hardened by any suitable method. The nickel or equivalent material is preferably substantially inert to the material or agent which is used in etching the image or controlling the depths of the cells.

Likewise whenever I refer to the use of carbon tissue, it is to be understood that this is merely one form of etching resist and that I can use any other suitable form of resist, and I can use any suitable insulating resist.

As the improved printing member can be made in several ways, the various embodiments may be summarized as follows:—

Example No. 1

The printing plate may be made wholly of nickel, or it may be made of copper or other material, having a surface layer of nickel. The depth of this surface layer of nickel may be regulated as desired. If the inner walls of the recesses are to be made of nickel, said nickel surface layer is made of suitable thickness. If the cell walls are to be made of nickel, and the inner walls of the recesses are to be made of copper or other non-nickel material, the surface layer of nickel may have less depth than in the first instance. I prefer to have the inner walls of the recesses made of nickel or other suitable non-copper material. I first apply a suitable resist to the outer surface of the nickel, and I prefer that this resist should correspond to the lines of the screen, so that the squares or other areas between said lines consist of bare metal. This resist can be secured by coating the outer surface of the nickel by means of a suitable dichromated coating of engraver's glue or other suitable colloid, printing on said layer by means of a replica screen or working screen, having

transparent lines and opaque squares, and then developing and baking the colloid coating, so as to produce the so-called enamel resist, which is well known in half-tone work. However I can use
5 so-called cold top enamel, or a lithographic transfer which is fortified with resinous material, or any one of the numerous resists which are made of synthetic resins, or any other suitable resist. I then etch the nickel with a suitable
10 etching material, such as sulphuric and nitric acids and an aqueous solution of sodium chloride of suitable concentrations, until the desired cell depth has been secured. All the cells are thus etched, so that they have substantially the same
15 depth. The width of the lines of resist material can be selected, so as to secure the desired thickness of cell wall. Said cell wall may have a thickness, if nickel is used, as low as 0.002 inch. Said cell walls are preferably of substantially uniform thickness and with substantially straight
20 edges. I have discovered that this result may be secured for the particular purposes specified herein, by the electrolytic etching later specified. The thickness of the cell wall depends on the desired press life of the printing member and the desired reduction of white line width.

Instead of using an etching material, I prefer to use electrolytic etching. In this process of electrolytic etching, as is well known, the printing surface is made the anode while said printing surface is immersed in a suitable electrolyte, and current is passed through the printing surface, and said electrolyte, to a suitable cathode. I prefer to use electrolytic etching because this
30 substantially eliminates undercutting, amongst other advantages. After the cells have been etched to the desired depth, the cells are then filled with a suitable material, such as copper. I do not wish to be limited to the use of copper, since the filling material may be any suitable material which is different from the material which forms the cell walls. The filling material is preferably of the type which can be attacked by mordants or by a force to which the cell walls are
40 substantially inert. Said force may be the electrolytic force. The filling material is not necessarily a metal. For example, it may be rubber or other material which can be deposited from a suitable suspension, by electrical endosmose. Likewise, said filling material is preferably of the type which can be softened by heat or melted at a suitable temperature. Suitable resins and waxes may be used. These filling materials, which are equivalent to a metal filler, such as
50 copper, do not require photographic printing or photographic development, in order to regulate the depths of the fillings in the respective cells. The depths of said fillings can be directly regulated by etching. Such equivalent materials are included within the invention, whenever reference is made to a metal filling.

I can fill the cells with copper or with other suitable material or metal, by making the printing surface the cathode in a suitable bath of electrolyte, which can deposit copper. The anode
65 may be copper. The copper is thus electrodeposited in the cells, until the copper is at the same level as the outer faces of the cell walls, or slightly above said level. The outer surfaces of the cell walls are protected by the resist, so that no copper or the like is deposited upon the outer surfaces of the cell walls, since the resist is an insulator.

One of the marked advantages of my invention is that the etching quality of the deposited cop-

per can be varied between wide limits by varying the factors which are involved in the electrodeposition. This is because the copper filling of the cells need not resist the mechanical strains which are imposed by the doctor blade, and by the printing operation. The type of copper filling which I prefer to use may be generally defined as a medium soft copper of homogeneous structure which
5 can be etched evenly and fairly quickly by the etching mordant. For example, with uniform cell depth adjusted to deepest desired shadow, the copper will be removed from the deepest shadow cell in no more than twenty minutes, in an aqueous solution of ferric chloride of 38 Bé. at ordinary room temperature of about 75° F.

After the cells have been filled with the copper, the resist is removed from the outer faces of the cell walls, by any suitable means, such as treatment with a caustic soda solution in water or mechanical means or the like. The printing surface is then ground, and this operation is much more simple than the same operation on an ordinary copper printing surface. Prior to forming the resist upon the nickel surface layer, said layer can be ground so as to produce the desired surface. Therefore the copper filling of the cells can be ground or buffed down to the level of the outer surfaces of the nickel cell walls, so that the outer surfaces of said nickel cell walls serve as a guide for locating the final smooth and continuous printing surface, which may be cylindrical or planar or have any desired shape.

After the printing surface has been thus prepared, a carbon print of the picture or the like, which has been exposed through a positive transparency which contains the gradations of light and shade which are to be reproduced, and without exposure through a screen, is transferred to the printing surface in the customary manner. Said print is processed as previously described, and after the gelatin layer is dry, the printing member is subjected to a suitable mordant, such as a solution of ferric chloride, in the usual manner. The ferric chloride solution does not attack the nickel cell walls, but it does etch the copper
45 fillings of the cells so that said copper filling is etched most deeply in the shadows, less deeply in the half-tones of the picture, and least of all in the high lights. The gelatin of the carbon print acts as a resist in the usual manner, but the gelatin layers over the screen lines serve no function in the etching, save as the support to maintain the continuity of the resist. The copper fillings or printing surface can be suitably cleaned to remove grease or the like, prior to applying the carbon print, and I can use any other details which are well known in the process of preparing copper photogravure plates or cylinders.

I do not wish to be limited to the use of etching for forming the cells, since the cells can be made by any suitable mechanical or other means.

Another advantage of the invention, is that it permits re-etching, with considerable freedom. According to present practice, it has been attempted to protect the outer surfaces of cell walls and partially protect the sides thereof by means of a suitable topping ink, but this, upon re-etching, either permitted further undercutting of the cell walls, or else the sides of the cell walls were protected too much. This invention permits re-etching to any desired extent. For example, an etching mordant may be applied locally to the copper fillings of selected cells, so as to increase the depth of the selected cells and deepen the tones, without affecting the cell walls, since cop-

per can be etched by numerous mordants such as a solution ferric chloride, and which do not affect nickel. Likewise, I can top the copper fillings of selected cells by means of wax or other suitable insulating resist and then deposit additional copper in the unprotected cells, by electrodeposition. I can use a portable electrolytic deposition unit, the unprotected cells serving as a cathode, the electrolyte being held by capillary attraction between the printing member and a suitably shaped anode. This makes it possible to lighten the tones of the picture, at selected points. This operation does not affect the cell walls, which may be protected by a resist during the electrolytic deposition or by using an electrolyte and voltage and other factors which will prevent copper from being deposited on the cell walls.

After the printing cylinder or the like has been used in a press run, it can be reconditioned for further etching and printing, by removing the copper fillings of the cells by means of a suitable etching solution which does not attack the nickel. The outer or top surfaces of the nickel cell walls can then be ground or buffed or reconditioned, in any suitable manner. A suitable topping resist may then be applied to the outer surfaces of the cell walls. If necessary, the depths of the cells can be increased, by suitable etching, electrolytic etching, or mechanical means. The cells can then be filled with copper or other suitable material, the resist can be removed and the printing surface can be ground or burnished, all as previously described.

If desired, a carbon print, (having or not having pigment in its layer of colloidal material), can be prepared by printing the lines of the screen thereon. Said carbon print could then be transferred to the surface of the cylinder or other printing member, and said print can be developed, in the ordinary manner, in order to form the resist upon the outer surface of the printing member, in order to protect the cell walls during etching.

Generally speaking, the invention covers any embodiment in which the printing member is made of two or more kinds of material having suitably different properties, and more particularly, the invention covers a plate or cylinder or the like, in which the effective portion of the printing member is made of two or more kinds of material, one of which is harder or more mechanically resistant than the other material or materials, both materials being of the types previously described. It is one of the advantages of the invention that the same can be utilized with the ordinary rigid cylinder for making the photogravure printing cylinder. The invention also covers a printing member made of two materials, one of which is substantially inert to an etching material or force which affects the other material.

It will be noted that the lateral surfaces of the cell walls, as well as their top surfaces are made of nickel or other suitable metal, and that in the preferred embodiment, the inner end-walls of the cells are also made of nickel or other suitable metal. The nickel or an equivalent metal or alloy may be designated as the first metal. Adjacent cells preferably, (but not necessarily) have common nickel cell walls, so that the cell walls are laterally continuous. Hence the cell walls can be formed with the desired thickness.

Example No. 2

In the second example, the printing member or

its surface may be made of copper, or other suitable metal. A resist is applied to the surface of this copper member, and said resist corresponds to the squares of the screen which have been previously mentioned, so that the protected areas of the resist, of square or other shape, are separated by lines of bare copper or other metal. The bared lines on the copper surface are then attacked by means of an etching mordant, such as nitric acid, ferric chloride or the like. This etching can be continued until a depth corresponding to the desired depth of cell wall has been obtained. The width of the screen line is properly selected, to produce the desired thickness of cell wall, making allowance for the increase in the width of cell wall which is produced by undercutting.

However, in this second embodiment, I also prefer to use electrolytic etching, for the reasons previously specified.

After the printing member has been etched to a suitable depth, the printing member can then be made the cathode in a suitable electrolytic bath from which nickel or other suitable metal can be deposited, until the nickel which has been deposited in the cell wall spaces, is at the same level or slightly above or below the level of the copper or other base metal or material. As in the previous example, the insulating resist prevents electrodeposition of the nickel, on the portions of the material which are covered by said resist.

After the electrodeposition has been completed, the resist is removed by any suitable method, and the printing surface is then ground to produce a smooth continuous surface. In this embodiment, I prefer to have the nickel extend slightly above or beyond the copper, and to grind the nickel down to the level of the copper, and the grinding or buffing is then continued so as to produce the desired smooth and continuous printing surface. This is a simpler operation than the grinding of the all-copper printing surface in current practice, because the grinding of the relatively hard nickel is limited to the surfaces of the separated lines. The result of this method is shown in Fig. 3.

Example No. 3

The printing member of copper or other suitable material is prepared so as to form recesses or cells, preferably of uniform depth and size, by using lines of resist as previously described, and etching by means of a suitable mordant, or electrolytically. The resist on the outer surfaces of the cell walls is then removed in any suitable manner. Nickel or other suitable material is then deposited to suitable depth by means of electrolysis, upon the entire inner surfaces of the walls of the cells, including the end walls of the cells, and also upon the top surfaces or outer surfaces of the walls of the cells. The outer surfaces of the cell walls are then topped with a suitable topping ink, which may contain some suitable resinous material, or with other suitable insulating resist. The cells are then filled with the material which is to be etched, such as copper, preferably to the level of or slightly above the level of the final printing surface, and this can be done by means of electrodeposition. The resist can then be removed, and the printing surface can then be ground or buffed, so as to produce the desired continuous and smooth printing surface.

I have described preferred embodiments of the invention, but it is clear that numerous changes

and omissions can be made without departing from its spirit. For example, instead of using nickel, I can use chromium, etc. Following established practice, that part of the picture which corresponds to a cell, may be designated as an elemental area of said picture. The bleeding of the ink over the spaces between said elemental areas, produces an ink deposit of substantially uniform depth between said elemental areas. Said elemental areas have ink deposits of varying depth, corresponding to the different color tones of said areas.

The copper or other filling material can be located within the cells while the copper or the like is molten, or by spraying the copper or the like by means of a current of air or a current of an inert gas, so that the solid copper particles are sprayed in relative cool condition. The resist prevents the filling material from adhering to the outer surfaces of the cell walls, and said resist may be capable of resisting high temperatures. Surplus material and the resist can then be removed from the printing surface. Whenever I refer to filling material in the description or claims, the filling material may fill the cells either wholly or partially.

Whenever I use a layer of gelatin or other colloid for controlling the depth of the filling material in the cells, said layer may be free from pigment or material other than said colloid, or said layer may contain pigment or other additional material.

The filling material may be of the type which can be located in the cells in the form of particles or in the form of a continuous mass, and said material can be shaped into final form by heat, or heat and pressure.

In the various embodiments described, the intaglio printing member has intaglio or depressed cells in the outer surface thereof. The second metal (copper or equivalent material) is located continuously intermediate the lateral walls of the cells at the bases of said cells, instead of forming a separated point or points so that the depth of the second metal in each cell determines the depth of the ink which is taken up by said cell.

Whenever I refer generally to "etching" in the claims, I include etching by means of a chemical or by electrolysis or other method, so as to reduce the amount of filling material in a cell or cells.

I claim:

1. A photogravure printing member having a surface having a series of depressed cells therein, said cells having inner end walls and also having lateral walls made wholly of a first metal, at least some of said cells having masses of metal filling material at their inner ends, said masses extending continuously between the lateral walls of said cells and being of different depths in the respective cells and in accordance with the varying tone of the picture to be printed, said filling material being made of metal other than said first metal, said cells having substantially equal depths, said first metal being inert to a force which can etch the filling material.

2. A photogravure printing member having a surface having a series of depressed cells therein, said cells having inner end walls and also having lateral walls made wholly of metal which is harder than copper and which is inert to an etching medium which can etch copper, at least some of said cells having masses of copper at their inner ends, said copper masses extending continuously between the lateral walls of said cells and

being of different depths in the respective cells, and in accordance with the varying tone of the picture to be printed.

3. A photogravure printing member having a surface having a series of depressed cells therein, said cells having inner end walls and also having lateral walls made wholly of metal which is harder than copper and which is inert to an etching medium which can etch copper, at least some of said cells having masses of copper at their inner ends, said copper masses extending continuously between the lateral walls of said cells and being of different depths in the respective cells, and in accordance with the varying tone of the picture to be printed, said cells being of substantially equal depth, the depth of a cell being substantially equal to the depth required for printing the deepest shadow of the picture.

4. A method of making a photogravure printing plate from a metal member having a surface layer of a first metal, which consists in applying a resist to the outer surface of said surface layer and in accordance with the shape of the walls of cells which are to be etched in said surface layer, then etching the exposed portion of said surface layer so as to form etched cells therein having laterally continuous walls made of said first metal, then filling the etched cells with a second metal while preventing any deposit of the second metal on the outer surfaces of said lateral cell walls, then removing the resist, then applying a print resist to said outer surface, and then etching only the second metal in accordance with the varying tone of said print resist.

5. A photogravure printing member having an outer surface, said surface having a series of depressed cells therein, said cells having laterally continuous metal walls which extend up to said outer surface, said walls being of substantially equal depth, at least some of said cells having etchable filling metal at their base portions and located intermediate the metal lateral walls of the respective cells and completely filling at least parts of said respective cells, said filling metal forming fillings whose heights vary in said respective cells in accordance with the varying tone of the picture, in order to determine the depths of the bodies of inks which are taken up in said respective cells, said lateral walls being made of a metal which is inert to a force which can etch said filling metal, said inert metal extending at least up to the tops of said fillings.

6. A photogravure printing member having an outer surface, said surface having a series of depressed cells therein, said cells having laterally continuous metal walls which extend up to said outer surface, said walls being of substantially equal depth, at least some of said cells having etchable filling metal at their base portions and located intermediate the metal lateral walls of the respective cells and completely filling at least parts of said respective cells, said filling metal forming fillings whose heights vary in said respective cells in accordance with the varying tone of the picture, in order to determine the depths of the bodies of inks which are taken up in said respective cells, said lateral walls being made of a metal which is inert to a force which can etch said filling metal, said inert metal extending at least up to the tops of said fillings, said filling metal being copper, said inert metal being harder than copper.

7. A photogravure printing member having an outer surface having a series of depressed cells therein, said cells having laterally continuous

metal walls of substantially equal depth, at least some of said cells having copper filling material at their base portions and filling at least parts of said cells, the depth of the copper varying in
5 said cells, said lateral walls being made of nickel at least up to the top of said copper filling material.

8. A photogravure printing member having an outer surface, said outer surface having depressed
10 cells therein, said cells having metal walls, at least some of said cells having etchable metal at

their inner base portions and completely filling the inner portions of said cells, said etchable metal fillings being of varying height in said cells in accordance with the varying tone of the picture to be printed and to determine the heights
5 of the bodies of ink which are taken up in said cells, said metal walls of the cells, at least up to the tops of said fillings, being made of metal which is inert to a force which can etch said
10 etchable metal.

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