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PHOTO-ENGRAVING PROCESS

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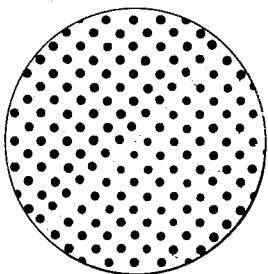


Fig. 1.

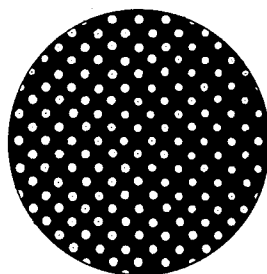


Fig. 2.



Fig. 3.



Fig. 4.

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PHOTO-ENGRAVING PROCESS

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mesne assignments, to Foto-Cut Process Cor-
poration

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3 Claims. (Cl. 95—5.6)

This invention relates to improvements in photo-engraving processes wherein tone values of a copy, with the assistance of photography, can be quickly, conveniently and inexpensively translated and converted into relief printing surfaces, from which exact reproductions of the original can be printed innumerable times.

In photo-engraving processes now common in the art, the use of what is termed a half-tone screen is employed, whereby the copy in being photographically transferred to the film or other sensitized surface is broken up into lines or dots. This sensitized surface is then subsequently dealt with chemically to form a relief plate, that is to say, the plate is so treated that portions of it, namely, lines and dots, which are to leave their inked impressions on the paper to be printed, stand out in relief, while all other portions are etched below the printing surface. Since the dots, therefore, form the printing surfaces, it is obvious that the finer the screen, with a resultant increase in the number of dots, the nearer the approach will be to continuous tones in the final printing.

Heretofore considerable difficulty has been experienced in using the etching process. A process necessary in forming the relief by placing the plate in a solution of nitric acid. In using nitric acid great care must be taken to stop its action before it has etched to too great a depth, or undercut laterally. Up to this point, of course, the relief is only perceptible and consequently the sides of all the relief areas must then be further dealt with for protection during further etching in finally forming substantially perpendicular walls on all sides of the portions in relief. This also applies to images of line drawings, and the like which have been transferred to the print plate without the use of a screen.

With processes now common in the art, the number of dots obtainable are of course governed by the efficiency of the etching process used, because as the dots become more numerous, the distance between them is lessened and the depth is likewise reduced. Therefore, it is apparent that the etching process must be done with great care in plates formed with a great number of dots.

At the present time the screens used contain from 50 to 175 lines per square inch. A lesser number of lines of course could be used, but not any greater amount than 175, due to the fact that present etching processes can only function within certain limits due to the fact that it is difficult to control the etching acid in preventing it from undercutting, especially in plates formed with a great many closely spaced dots.

In addition to the above, the old processes required approximately twelve tedious and expensive operations in skilled hands to complete the etching of the plate.

Accordingly therefore, the principal object of

my invention is to provide an efficient, quick and inexpensive process requiring approximately only four operations which need not be performed by skilled workmen, and which does not require the use of corrosive acids or the like in etching, thereby producing a more distinct and clear relief printing surface than has been heretofore obtainable.

These and other objects will appear as my invention is more fully hereinafter described in the following specification, and finally pointed out in the accompanying claims.

In the drawing:

Figure 1 is a greatly enlarged view of a fragment of a relieved portion of printing plate or other printing surface, showing what are known as highlight dots.

Figure 2 is a similar view showing what are termed shadow dots, the areas around which are printing surfaces, whereas in Figure 1 the dots are the printing surfaces.

Figure 3 is an enlarged edgewise view of any approved type of printing plate just before undergoing treatment with my improved process.

Figure 4 is an enlarged sectional view of the printing plate formed with a printing relief surface by means of my new process.

The process I use in producing an efficient and inexpensive photographic printing plate is as follows:

A screen photograph on a plate or film is first taken of a subject or copy. By using a prism in connection with the lense of the camera the copy being photographed is reproduced on the film or other photo-sensitized material in its true position. This film or negative is then placed in contact with a print plate, emulsion against emulsion, and printed by the action of light onto the plate. The emulsion on the print plate is of a gelatinous substance, impregnated with silver salts or silver bromide, and is more or less usual in the industry. It is to be understood however that my process is not limited to any particular type of plate since the process deals with the gelatinous substance and not with its base or support.

Next, this positive print plate, thus obtained, is developed in my especially adapted developer formula which is composed of the following ingredients:

Metol (mono-methyl-paramide-phenol-sulphate)	120 grains	
(C ₆ H ₄ OH.NH.CH ₃ ½H ₂ SO ₄)	4 ounces	115
Sodium sulphite (Na ₂ SO ₃)	400 grains	
Hydroquinone (para-dihydroxy-benzene) (C ₆ H ₄ (OH) ₂)	2 ounces	
Sodium carbonate (Na ₂ CO ₃)	40 grains	
Potassium bromide (KBr)	62 ounces	120
Water (H ₂ O)		

The developing solution completes the reduction of the silver salts started by light. The unexposed silver compounds, however, are left unchanged.

Upon completion of the foregoing steps, the plate is now ready for my relief bath which consists of the following ingredients:

Cupric sulphate ($\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$)	384	grains
Potassium bromide (KBr)	336	grains
Potassium bichromate ($\text{K}_2\text{Cr}_2\text{O}_7$)	12	grains
Chromium trioxide (CrO_3)	3.5	grains
Water (H_2O)	16	ounces

This relief bath tends to swell the silver bromide which was previously accumulated to form the dots, and to further solidify the dots. The gelatinous substance, now remaining in the areas around the dots, being now more or less devoid of silver salts is unaffected by the silver conversion action of the cupric sulphate and bromide but is hardened by the chromic acid and bichromate of potassium and could not be washed out except with the use of extreme heat in the water bath which of course would be ruinous to my process. The heating is done by immersing the plate in water, heated to about 75 degrees Fahrenheit and allowed to remain from 3 to 10 minutes, during which time the water's temperature is steadily increased. This heating process swells the entire gelatinous surface then after the bath when the water is expelled or removed by drying from the gelatinous surface, those portions of the gelatin containing the metallic silver remain in a swelled and hardened condition and which form the relief of the dots subsequently to be used as a printing surface, while those areas surrounding the dots return to their normal unswollen condition. The shrinking must be closely watched until the desired depth is reached, and the time required for such shrinking determines the length of time the plate is allowed to remain in the heated water.

As a result of the shrinking process it will be noted that the gelatin has congealed at the bottom of each depression so formed and has firmly embedded itself therein. This final disposition of the gelatin not only forms each and every dot with smooth well defined side walls for the purpose intended, but in addition, also renders the plate useful for lithographing purposes since the absorptive qualities of the gelatin for water, will repel the grease impregnated ink used by the lithographer.

Another important feature of the printing plate produced by my improved process is obtained by the cushioning effect of the gelatinous background whereby the printing dots, or rather the printing surface is rendered far more durable than printing plates heretofore produced. Moreover, my printing surface being more or less yieldingly mounted to the plate readily accommodates itself to various grades of paper ranging from the inexpensive and coarse newspaper material to the better grades of smooth hard surfaced paper.

Furthermore, the printing surface formed by my process is of such hardness that wax or lead or other impressions can be made from it.

While I have shown and described a process of forming a relief printing plate composed of a multiplicity of dots in relief, it is to be understood that this process is equally effective and efficient in producing a printing plate of line drawings, black and white copies, and the like.

Having thus described my invention, what I claim as new and desire to protect by letters patent is:—

1. A process of forming a relief printing plate by first printing thereon by the action of light an image of the copy to be subsequently formed in relief on said plate then subjecting the plate to the following solution: mono-methyl-paramidophenol-sulphate 120 grains, sodium sulphite 4 ounces, para-di-hydroxy-benzene 400 grains, sodium carbonate 2 ounces, bromide potassium 40 grains, and water 62 ounces, this solution due to its action on the silver bromide on the plate reduces those portions affected by light to a metallic state and leaves those portions of the plate not affected by the light in their gelatinous state, then subjecting the plate to the action of the following relief bath solution: cupric sulphate 384 grains, potassium bromide 336 grains, potassium bichromate 12 grains, chromic acid $3\frac{1}{2}$ grains, and water 16 ounces, then immersing the plate in water heated to approximately 75 degrees Fahrenheit causing the entire gelatinous surface of the plate to swell to a predetermined thickness then removing the plate from the heated water and allowing it to dry thereby causing the gelatin around the relief portions of the plate to return to their normal unswollen condition.

2. A process of producing a photo-engraving plate consisting in photographing a copy onto a sensitized film or plate, printing the image thus obtained onto a positive print plate by the action of light, then developing the print plate in the following formula: mono-methyl-paramidophenol-sulphate 120 grains, sodium sulphite 4 ounces, para-di-hydroxy-benzene 400 grains, sodium carbonate 2 ounces, bromide potassium 40 grains, and water 62 ounces, thereby transforming the silver bromide in the positive print plate to a metallic state only in those parts of the plate that have not been affected by the light in the light printing operation, and also thereby preserving those parts of the plate affected by the light in their gelatinous state, then bathing the plate in the following relief bath solution: cupric sulphate 384 grains, potassium bromide 336 grains, potassium bichromate 12 grains, chromic acid $3\frac{1}{2}$ grains, and water 16 ounces, then immersing the plate in water heated to approximately 75 degrees Fahrenheit then gradually increasing the temperature of the water, causing the entire gelatinous surface of the plate to swell to a predetermined thickness then removing the plate from the heated water and allowing it to dry thereby causing the gelatin around the relief portions of the plate to return to their normal unswollen condition.

3. A process of producing a photographic printing plate consisting in photographing a copy onto a sensitized film or plate, printing the image thus obtained onto a positive print plate by the action of light, then developing the print plate in a non-hardening developer, chemically hardening the emulsion adjacent the image, then immersing the plate in water heated to approximately 75 degrees Fahrenheit, then gradually increasing the temperature of the water causing the entire gelatinous surface of the plate to swell to a predetermined thickness, then removing the plate from the heated water and allowing it to dry thereby causing the gelatin around the relief portions of the plate to return to their normal unswollen condition.

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