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H. R. FREUND

2,662,455

MEANS FOR GRAVURE PRINTING OF TYPOGRAPHICAL CHARACTERS

Original Filed June 8, 1949

2 Sheets-Sheet 1

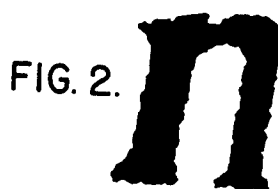


FIG. 3.

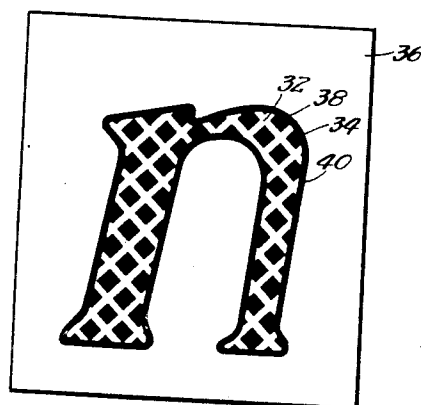
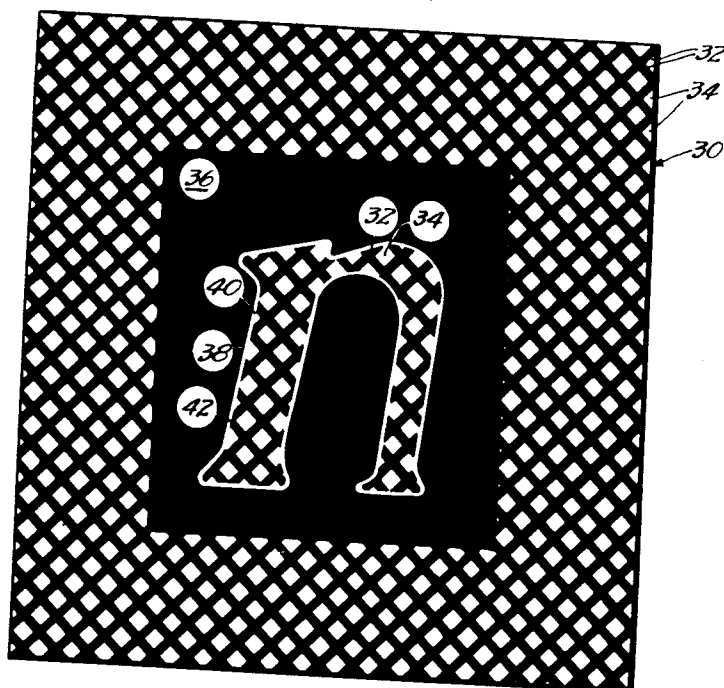


FIG. 4.

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FIG. 5.

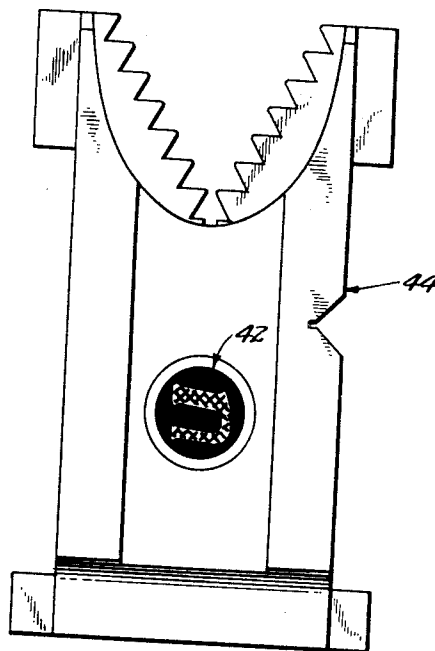


FIG. 6.

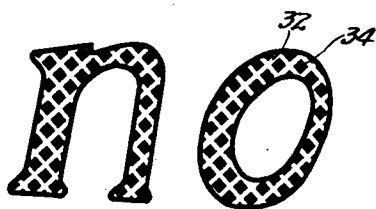


FIG. 7.

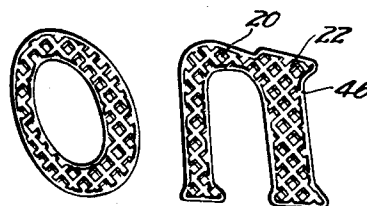
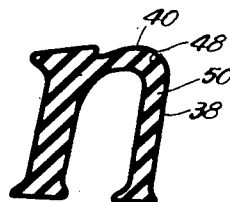


FIG. 8.



FIG. 9.



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2,662,455

MEANS FOR GRAVURE PRINTING OF
TYPOGRAPHICAL CHARACTERS

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Original application June 8, 1949, Serial No.
97,882. Divided and this application Novem-
ber 6, 1951, Serial No. 255,059

4 Claims. (Cl. 95—4.5)

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This invention relates to gravure printing and more particularly to typographical characters and character-bearing elements for use in the photographic composition of type matter intended for reproduction by gravure printing processes, and to means for making the same. This application is a division of my application Serial No. 97,882, filed June 8, 1949.

The type matter produced according to the invention is of fine quality and as sharp in outline as the finest reproductions obtained by letterpress printing, the means of the invention being designed to eliminate completely the jagged or serrated outlines which have characterized type matter heretofore produced by the gravure process. To this end, the individual type characters are so constructed that when photographic reproductions made therefrom are etched into the gravure printing surface, the lines of the familiar gravure screen pattern which ordinarily define each character terminate short of the outline of the character defining strokes such strokes being outlined in their entirety by an ink retaining channel or gutter. This novel effect is accomplished by drawing or otherwise manually preparing the individual master characters (the characters of a type font of a given style and size and from which enlarged or reduced images may be optically projected) with a screen pattern disposed in proper relation to the outline of each character. From this master there is made a character-bearing element or matrix suitable for use in one or another conventional form of photo-composing or photographic reproducing machine.

In the drawings:

Figure 1 is a plan view of a portion of a gravure printing surface showing, at enlarged scale, a typographical character etched therein, the printing surface having been prepared by conventional prior methods;

Figure 2 shows the printed impression made from the printing surface of Figure 1;

Figure 3 illustrates, at somewhat reduced scale, the first of several steps in one of the methods of preparing the printing surface according to the present invention;

Figure 4 illustrates a subsequent step in the process the commencement of which is illustrated in Figure 3, or the first step in an alternative process within the scope of the invention;

Figure 5 is a plan view, at enlarged scale, of a matrix embodying the present invention, prepared in accordance with the processes of Figures 3 and 4;

Figure 6 shows, at the scale of Figures 1 and 2,

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a portion of a composed page of type matter, in the form of a positive transparency, prepared in accordance with the invention;

Figure 7 is a plan view of a portion of a printing surface etched by the use of a positive transparency such as that shown in Figure 6;

Figure 8 shows a printed impression made from the etched printing surface illustrated in Figure 7; and,

Figure 9 illustrates an alternative form of typographical character which may be used in the practice of the invention.

The gravure printing process to which the means of the invention are directed is an intaglio process, that is, the printing is done not from raised surfaces, as in letterpress printing, but from depressions which hold the ink for transfer to the paper. The printing surface is conventionally in the form of a copper cylinder in which the depressions are etched and the paper is in the form of a web which is fed relative to the rotating cylinder. The cylinder is flooded with ink and the surplus ink is then wiped off the non-printing portions of its surface by a thin, flexible metal blade known as a "doctor." In order to hold the ink in the depressed printing areas etched in the cylinder, and to prevent the doctor blade from flexing into such depressed areas or from sweeping out ink in the rapid relative movement of the cylinder past the doctor, it is customary and indeed essential to provide in the depressed areas a network of upstanding ridges, usually in the pattern of a conventional line-screen, such ridges serving to support the doctor blade and at the same time to divide the depressed areas into a plurality of minute cells in each of which the printing ink is held by surface tension until the printing surface makes contact with the paper. The highly fluid ink used in gravure printing is rapidly taken up by the paper and dries partially by evaporation, due to its extreme volatility, and partially by adsorption into the paper.

The ink when applied to the paper spreads slightly from the precise shape of the individual minute ink cells of the depressions so that the screen pattern of the ridges in the printing surface disappears and the printed characters appear of substantially solid or uniform density of color.

Heretofore, gravure printing surfaces have been customarily prepared for reproducing type matter or text by first composing the text in solid-face type, and taking a proof thereof on a sheet of paper. This proof is then photo-graphed, and a positive transparency—that is,

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a photograph having opaque letters on a transparent background—is formed from it. This is placed over a “carbon tissue”—a sheet of gelatin sensitized to light, by means of potassium bichromate for example, so that the normally water-soluble gelatin will be hardened and rendered insoluble by the action of light. The carbon tissue is then exposed to light through the positive transparency so that the gelatin is hardened everywhere except beneath the opaque letters of the transparency. To produce the required screen pattern within the letters, the carbon tissue is again exposed to light through a transparency provided with the desired screen pattern, for example in the form of two sets of equally spaced, parallel transparent cross-lines running perpendicularly to each other on an opaque background. This serves to harden the gelatin in the criss-cross pattern of the screen lines within the unhardened areas corresponding to the strokes of the letters of the text.

The carbon tissue is then placed against the copper cylinder, and is “developed” by washing with warm water to dissolve the soluble non-exposed portions of the gelatin. The cylinder then is etched, for example with ferric chloride, through the carbon tissue which serves as a “resist” and allows etching of the cylinder only where the gelatin has been washed away. The strokes defining the configuration of the respective typographical characters are thus etched as a network of tiny cells or depressions, with a criss-cross pattern of upstanding ridges separating and isolating the respective cells. This formation is illustrated in Figure 1 wherein the ridges 22 which extend completely across the strokes of the character divide the strokes into the sharp, square-cornered cells 20.

The printed impression made by such an etched printing surface is shown in Figure 2. The ink from each of the tiny ink retaining cells 20 has spread on the paper so that the screen pattern is obscured within the outline of the printed character. However, due to the separations between the ink cells 20 along the edges of the etched characters on the cylinder—the breaks produced in the outline of the characters by the ridges 22—the reproduced characters have the serrated or jagged outline indicated in Figure 2, a defect which up to the present has characterized all type matter printed by the gravure process.

There have been various attempts heretofore to remedy the defect described, but none of them has provided a practical solution. For example, it was suggested in Patent No. 843,947 to J. W. Ippers that the jagged outlines of large, solidly colored decorative design areas in intaglio printing upon textile material could be eliminated by terminating the ridges of the screen pattern short of the outline of the design to form an ink retaining dam or channel around the boundary of the design area. However, the method proposed to form such channel and the environment in which it was intended for use suggests no practical application in the art of producing readable type matter, which requires a degree of sharpness neither sought nor attainable in the textile art. The later Patent No. 2,456,608 to Harley C. Alger sought to apply the Ippers principle to gravure printing of type matter. This patent however, discloses an unworkable process which depends upon manually engraving the screen pattern in the printing face of metal type members. These were supposed to

be used in composing and printing a page of type matter to be photographed and used in etching the printing cylinder as above described. The patent is not clear whether or not the type members were to be of enlarged size. If not, the invention would be altogether impractical because with a metal type member of the same size as the desired ultimate printed reproduction, it would be impossible to engrave in its face, by hand or by any available mechanical means, the extremely fine screen patterns required in gravure work—often involving as many as 22,500 minute, perfectly square and sharp-cornered depressions per square inch of printing surface. Moreover, even if it were possible to make such metal type members, they would be perpetually susceptible to wear and damage to the extremely fine interstices of the engraving, and the extremely tiny ink cells would easily clog with ink and fine foreign particles from the atmosphere and from printing surfaces contacted by the type members.

If, on the other hand, it was Alger's intention that the metal type members be of a fairly enlarged size, the invention is impractical because of the obviously intolerable awkwardness of handling such type members. There is no available machine by which such large and heavy type could be mechanically composed, so that extremely slow and costly hand composition would be necessary. Even after the Alger patent, accordingly, the art has had no commercially practicable means for producing type characters of sharp outline by the gravure printing process.

The use of the gravure process for the printed reproduction of type matter has accordingly been avoided insofar as possible, although, for the printing of pictorial matter, gravure has many well recognized advantages over other processes. However, because of the manifest ineconomy of printing the type matter of a publication by a different process than that by which the pictorial matter of the same publication is printed, the art has heretofore had either to forego the advantages of gravure for pictorial work, or tolerate the inferior quality of type matter printed by gravure.

The present invention affords for the first time practical methods and means for producing type matter of good quality by gravure. The process of the invention commences with the preparation by drawing (which term is used herein to comprehend drawing, painting and other forms of manual preparation such as composite mock-up), of a “master” typographical character such as is shown in Figures 3 and 4. One method of preparing such a character is illustrated in Figure 3 and comprises, as a first step, photographically enlarging a conventional gravure screen to provide an opaque negative photographic print 30 of the desired screen pattern. The particular screen pattern illustrated is known as a “cross-line” screen and comprises two sets of equally spaced parallel black lines 32 at right angles to each other on a white background. There are thus formed between the black lines 32 of the screen pattern square, sharp-cornered white spaces 34.

Any other form of gravure screen may be used, but preferably the screen should be of the same type or pattern as that used in the preparation of the cylinder for printing pictorial and display matter, so that the etching procedures for both the type matter and the display matter may be equalized in timing, acid concentration,

etc. insofar as possible. The screens most frequently used in gravure work have of the order of 120 to 175 lines per inch, with the width of the lines 32 equal to one-half or one-third the width of the inter-line spaces 34. In the particular screen illustrated the ratio of line width to inter-line space is 1:2.

The screen is enlarged by photographing to such scale as will render manual drawing of the type character most convenient. The actual scale used may be varied according to individual taste and will frequently depend upon the intricacy of the strokes and serifs of the particular type face, but a lateral enlargement of the order of 40 times has been found satisfactory.

As a second step, the artist "blacks out" as by inking, a portion of the opaque negative print 30 of the line-screen to form a background area 36, with an unblacked or open area 38 generally in the center of the background and corresponding in shape and size to the strokes which define the typographical character to be reproduced. Then the artist "whites in" a marginal area 40 around the outline of the strokes of the character, this area suitably being of a width of the order of that of the black lines 32 of the screen pattern. This leaves visible within such white marginal outline 40 the pattern of black lines 32 and white spaces 34 of the screen. As apparent, the white margin 40 has the appearance of merging with those white spaces 34 of the screen pattern which such margin touches or intersects, while the black lines 32 of the screen pattern have the appearance of stopping short of the outline of the open area 38 which defines the boundary of the character strokes. The character shown in Figure 3 is negative with respect to the ultimate printed reproduction, since the black background and the white spaces within the character strokes are reversed in such ultimate reproduction.

According to one method within the invention, the negative character of Figure 3 is photographed to form a positive such as shown in Figure 4, wherein the white lines 32 of the screen pattern terminate short of the character defining outline 38 while the black inter-line spaces 34 of the screen pattern merge with the black marginal outline 40.

Alternatively, the artist may prepare the positive character shown in Figure 4 directly without first preparing the negative shown in Figure 3. In doing so, he may either use an enlarged positive photographic print of a line screen—that is, a print having white lines on a black background—and "white in" the background 36 and "black out" the character defining area 38. Or, he may draw up the character including the screen pattern entirely by hand.

As a further step the character of Figure 4 is then photographed, this time to form a negative transparency of greatly reduced size (suitably of the same size as the ultimate printed character) with an opaque background 36 and opaque screen lines 32 but transparent marginal outline 40 and screen spaces 34. This transparency, as shown in Figure 5, may be cut to form a circular plaque 42 for mounting in a matrix generally indicated at 44. The matrix 44 will be recognized as of the form described in Patent No. 2,231,899 to H. R. Freund and used in conventional high-speed photocomposing machines such as that shown in Patent No. 2,391,021 to E. G. Klingenberg et al. Alternatively, the matrix may be of the type disclosed in Patent

No. 1,543,527 to R. J. Smothers wherein both the character and the background are opaque, but of contrasting colors; or, the character images, instead of being on circulating matrices, may be mounted upon a rotatable drum, as in machines of the type disclosed in Patent No. 636,062 to Francis H. Richards. In all such machines, the character images are serially exposed, either individually or a line at a time, to a photosensitive surface and such surface is afterward developed to form a positive transparency of the composed type matter. A portion of such transparency is shown in Figure 6; it has a transparent background and screen lines 32, with letters having opaque marginal outlines 40 and screen spaces 34.

This positive transparency is then placed against the carbon tissue and the carbon tissue is exposed to light through the transparency. No separate exposure of the tissue to a line-screen is necessary, since the individual characters formed in accordance with the invention already contain the required screen pattern. Where the same carbon tissue is used for preparing the gravure cylinder to print pictorial matter as well as type matter, the portion of the carbon tissue embodying the type matter may be masked to prevent exposure thereof while that portion of the tissue embodying the pictorial matter is exposed, as it must be, to the line-screen.

The carbon tissue is next applied against the cylinder and developed and the cylinder then is etched through it. The surface of the cylinder will then appear as shown in Figure 7, wherein each of the characters of the type matter etched on the cylinder has within its outline the depressions 20 corresponding to the screen spaces 34, and upstanding ridges 22 corresponding to the lines 32 of the screen pattern. Around the entire outline of the character there is a channel or gutter 46 merging with the depressions 20 adjacent thereto, and causing the ridges 22 to terminate short of the outline of the character.

In printing, the depressions 20 and the continuous channel 46 after the action of the "doctor" blade are left filled with ink, which, spreading evenly from such continuous channel 46 around the outline of each character, will form an impression upon the paper having straight, sharp and even outline defining edges 38, such as shown in Figure 8.

An alternative form of character is illustrated in Figure 9. This is formed according to any of the methods described above, but has a single-line screen instead of a cross-line screen—that is, it has only one set of spaced parallel lines 48, whereby elongated, inter-line spaces 50 are formed across the strokes of the characters and merge with the marginal outline 40 formed around the character according to the invention. The lines 48, as in the previous embodiments, terminate short of the character defining outline 38, so that the embodiment of Figure 9 affords the advantageous results described above. Figure 9 accordingly illustrates one of the alternative forms of gravure screen which may be utilized in the practice of the present invention.

No matter which of the methods described is employed, only one "master" set of typographical characters need be manually prepared for a particular style and size of type, and for a particular screen. From this "master" set, any number of sets or fonts of character-bearing elements or matrices may be made, and these may

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be used again and again in the composition of type matter.

It will be apparent that the invention provides commercially practicable methods and means for enabling the production of type matter of the required fine quality by the gravure printing processes. However, it should be emphasized that the particular methods and means shown and described are intended as merely illustrative of the invention and in no way restrictive thereof.

I claim:

1. A type character-bearing element for use in the photographic reproduction of type matter by the gravure process, said element bearing, against an opaque background, a typographical character translucent except for an internal pattern of spaced, opaque lines extending substantially throughout the entirety of said character but terminating short of the outline thereof to leave a substantially continuous translucent margin extending around said outline.

2. A type character-bearing matrix for use in the photographic reproduction of type matter for printing by the gravure process, said matrix having an opening through the body thereof, a plaque mounted in said opening having an opaque background and bearing a typographical character translucent except for an internal pattern of spaced, opaque lines extending substantially throughout the entirety of said character but terminating short of the outline thereof to leave a substantially continuous translucent margin extending around said outline.

3. In a photographic recording machine of the type wherein type characters are serially exposed to a photosensitive surface to form a

photographic record of composed type matter, the combination therewith of a type character-bearing element bearing, in an opaque background, a typographical character translucent except for an internal pattern of spaced, opaque lines extending substantially throughout the entirety of said character but terminating short of the outline thereof to leave a substantially continuous translucent margin extending around said outline.

4. In combination with a photocomposing machine of the type wherein type character-bearing matrices are serially and individually exposed to a photosensitive surface to form a photographic record of composed type matter, the combination therewith of a type character-bearing matrix for use in the photographic reproduction of type matter for printing by the gravure process, said matrix having an opening through the body thereof, a plaque mounted in said opening having an opaque background and bearing a typographical character translucent except for an internal pattern of spaced, opaque lines extending substantially throughout the entirety of said character but terminating short of the outline thereof to leave a substantially continuous translucent margin extending around said outline.

HERMAN R. FREUND.

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