

(No Model.)

2 Sheets—Sheet 1.

N. S. AMSTUTZ.
METHOD OF ENGRAVING.

No. 569,595.

Patented Oct. 13, 1896.

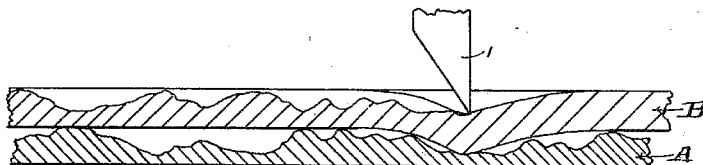


Fig. 1.

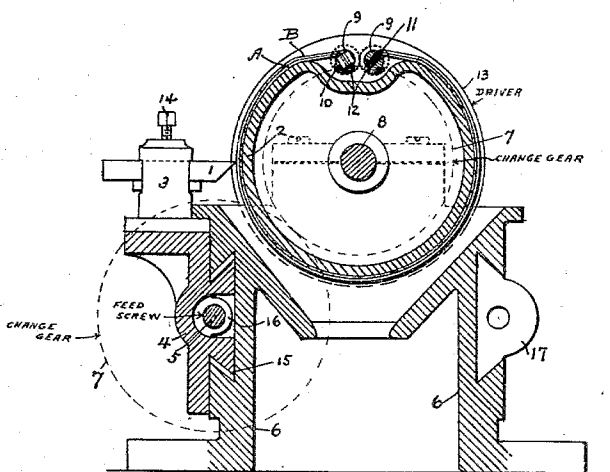


Fig. 2.

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(No Model.)

2 Sheets—Sheet 2.

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Fig. 3.

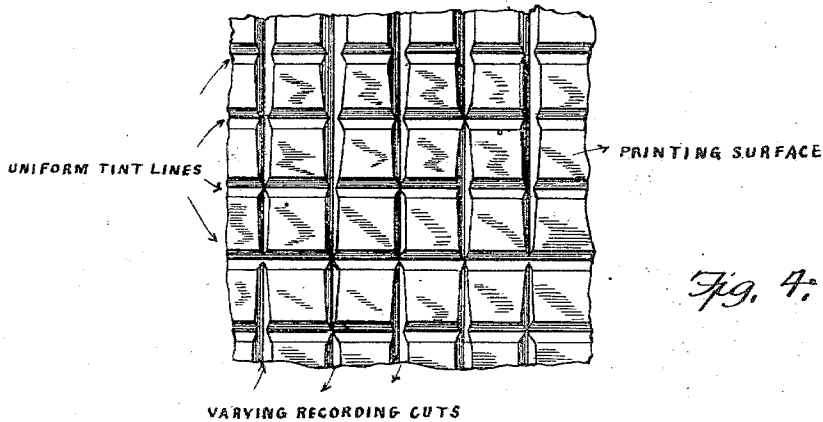
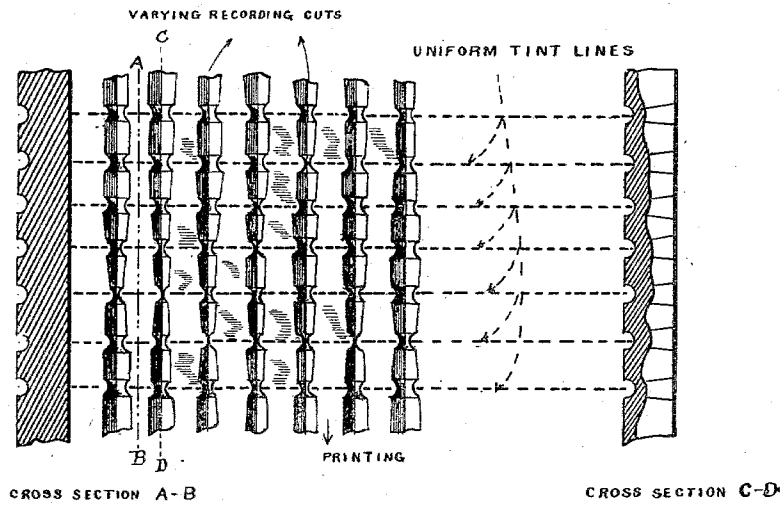


Fig. 4.

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UNITED STATES PATENT OFFICE.

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METHOD OF ENGRAVING.

SPECIFICATION forming part of Letters Patent No. 569,595, dated October 13, 1896.

Application filed April 27, 1895. Serial No. 547,372. (No model.)

To all whom it may concern:

Be it known that I, NOAH S. AMSTUTZ, a citizen of the United States, residing at Cleveland, in the county of Cuyaboga and State of Ohio, have invented certain new and useful Improvements in Methods of Reproducing Photographs, Sketches, &c.; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The invention relates to the art of reproducing photographs, sketches, &c., locally, for printing or other purposes; and it consists in first forming the subject to be reproduced with an uneven surface and then causing a graver or cutter to automatically interpret, in contiguous paths of cutting which vary in depth in proportion to the lights and shades of such relief-surface, the subject upon another surface that is superimposed upon the said subject, as will be hereinafter more fully explained, and specifically set forth in the claims.

In carrying out the invention I prefer to employ a device, such as is illustrated in the accompanying drawings, wherein the subject and the superimposed material upon which the subject is to be reproduced are moved contiguous to a fixed cutter having a cross-feed, but it will be apparent that the latter may be moved in a horizontal direction and the former held stationary.

Referring to the drawings, Figure 1 is a cross-section of a greatly-enlarged portion of a relief-surface and recording material with a cutter and support in diagrammatic relation thereto. Fig. 2 is a cross-section of a simple form of mechanism embodying the features of my invention in one form of adaptation.

The mechanism shown as an instance of adaptation in Fig. 2 comprises a bed or base frame 6, having guideways 15 formed for the support of the slide-rest 4, which is carried therein by feed-screw 5 through the nut 16, projecting from the slide-rest.

The feed-screw is supported by bosses 17, and at one end a change-gear 7 meshes with a similar gear upon the drum-shaft 8. The slide-rest 4 carries the tool-holder 3, which holds the recording-tool 1 through set-screw 14.

The relief-surface and recording material are held superimposed as follows: The drum 2 has provided a pair of slotted shafts 9, which have pinions 12 secured thereon. These pinions mesh with each other, and when the sheets A B are placed in the slots 11 and one of the shafts 9 is turned by a key placed upon the square end 10 they are drawn tightly against each other. A suitable pawl engages one of the pinions 12 and serves to lock them in position. The shafts 9 are held in heads of the drum or cylinder 2, which is of about the same diameter in the drawings as the driver 13.

The change-gears 7 can be replaced by others, so that any number of lines per inch can be used, depending upon the ratio of the change-gears to each other and to the feed-screw.

In practicing my method I first produce a photogelatin sketch or other relief-surface of the subject which is to be reproduced by any of the processes adapted to produce the same, whether such relief is in the shape of a positive or negative, according to the kind of the reproduction desired.

The relief-subject thus produced, which is indicated in the drawings by the letter A, is mounted upon the rotatable roller or drum support 2, and a reproducing-sheet of yielding material B, such as gelatin, celluloid, soft metals, &c., is placed directly against the relief-subject. The recording material is made, preferably, of a sheet or other yielding form, so as to be secured against the relief-surface in an easy manner. The cutter 1 is set with its point at a predetermined distance from the relief-surface support 2, a distance about the thickness of the film, more or less, upon which the subject is to be reproduced, and as the drum 2 is rotated the reproducing material will be caused to move under the cutter 1 in a to-and-fro direction, according to the unevenness of the relief-surface A, causing the cutter 1 to record cuts of varying depth in the reproducing material B, in this manner automatically executing an engraving from the relief-surface, which may be used for surface or "steel-plate" printing or embossing, as desired, according to whether the cutter has a pointed or blunt end, it being considered that an intaglio-surfaced subject comes within the

scope and general meaning of a "relief-surface;" because one is simply a counterpart of the other, and an uneven surface of any kind as being included under the general term "relief-surface," whether the unevenness varies between maximum and minimum points or not.

Should a blunted cutter be used and the cuts occur near enough to each other so as to overlap, then a duplicate relief-surface is produced which is serviceable for embossing, die-printing, &c. It is immaterial, however, whether the gravers, scorers, or cutters are of the chisel or rotary form or of any other type, so long as the record which is made by the tool is an indication of the design or subject reproduced, whether the same shall be used for one purpose or another. A rotary cutter would be preferable for engraving on thin sheets of steel or other materials other than celluloid or gelatin, the essential points to be attained being to cause the cutter to penetrate the material upon which the reproduction is to be made a greater or less depth, according to the variations in light and shade or surface of the subject to be reproduced, and transposing the relief-variations, when ink-printing surfaces are desired, into similar variations in lines at about right angles thereto, or if the reproduction is to be simply another relief or intaglio then the variations would be about on the same to-and-fro plane as the variations of the subject that is to be reproduced.

With my method I am able to preserve a maximum amount of detail with the smallest number of lines per inch upon subjects having small detail, thus producing printing-surfaces capable of being used for the most rapid presswork upon daily papers, &c. This requisite detail cannot be attained by the present well-known half-tone process, because if the "mesh" of the cross-lines is made coarse enough to produce the necessary depth in etching them, for instance, the eye or mouth or nose of a small face would disappear entirely, no detail thereof being preserved at all, because the opening of the mesh may be larger than the detail to be reproduced. If perchance it should occur at the intersection of the lines of the mesh, then a very small indication might be obtained, but the well-known "perversity of inanimate things" is a criterion indicating, figuratively, the lack of dependence that can be placed upon these small details occurring at the proper place. It is impossible in my method to skip any details with the coarsest lines, provided the angle of the cutter is properly disposed in relation to the depth of cutting and the number of lines per inch, more especially the relation between the angle and the number of lines per inch, since with a greater number of lines the relative depth of cutting must be increased or must be greater in relation to the width of cut than in the wider cuts or coarser or smaller number of lines.

In half-tone engraving, as ordinarily practiced, the ratio of depth to the distance between centers of lines is almost a constant value, while the finer-lined subjects (more lines per inch) should have a greater depth, that is, the ratio between the depth and the distance-centers of lines is different than in coarse-line work, so that the fine-line reproductions will stand rapid presswork, stereotyping, &c. In order to clearly show what is meant, it is assumed that an ordinary half-tone with eighty lines per inch, or .0125 inch from center to center of lines, has a maximum depth of etching of the grooves between lines of one-eighth the distance they are apart at their centers. In other words the relation would be .0125/.00156, while with my system I am able to procure effects which numerically bear the following relations to each other: .0125/.005, the depth being .005 inch as against .00156 inch. In practice the relief-surfaces used vary in maximum relief from .002 inch to .004 inch and the reproducing material from .005 inch to .012 and .015 inches thick. If the cutter is so arranged that the maximum relief causes the cutter to slightly overlap a contiguous cut, so as to bring the apex of the pyramidal ridge formed between them just even or slightly below the normal face of the reproducing material, then the maximum white or black effect is produced, according to the kind of surface which is used, whether a positive or negative. When the relief is a minimum, then the cutter ordinarily penetrates the reproducing material the least or not at all. Thus it will be seen that no matter how small the detail (which may within its small area vary between a maximum white and black and still be lost with coarse half-tone lines) it will be indicated with my method, especially so with any plan of operation wherein the reproducing material is placed in the shape of a yielding film sheet or plate between the cutter and the relief-subject, because the small area of detail, even if it occurs between two contiguous paths of the cutting, will have a distinct effect upon the wall of the groove which occurs nearest to it, causing the material to be cut away more or less, as the case may be, independent of the other wall of the groove, thus making it possible for me to produce small faces of groups, &c., in coarse enough lines and relatively deep enough grooves for ordinary newspaper printing without sacrificing detail.

For ordinary newspapers or other printing, if I desire to have a cross-line effect, I first form parallel grooves of V or other shape upon one side of the material upon which the reproduction is to be made. These grooves are made about right angles to the path of subsequent travel, or I may so design my means for supporting my films as to make it possible to retain their "register" and cut them at about right angles to each other directly from the relief-surface.

When the grooves are first cut into the re-

producing material, the cutter as it subsequently passes over the other or same side of the material cuts uniformly across these grooves, regardless of the variation of the relief-surface, thus producing a cross-line effect.

If the grooves are on the under side of the reproducing material, then the cutting on the other side will be just a trifle shallower and narrower, as the cutter passes over the groove, thus breaking up the recording-cuts into periodic variations independent of the subject. When the grooves are formed on the face of the reproducing material, the ridges are broken up at right angles thereto, so that a "stipple" effect is produced in contradistinction to the suggestive cross-lines when the grooves are on the under side. When a blunt cutter is employed, the reproduction contains delicate relief-lines in conformity to the pattern on the under side. The useful effects of the grooves, as herein outlined, are made manifest by diagrams Figs. 3 and 4 of the drawings, Fig. 3 being an enlarged supposititious diagrammatic view of cuttings when reproducing material is patterned on the under side, and Fig. 4 a similar view when reproducing material is patterned on the recording-face.

My process is entirely automatic. The relief-surface can be used repeatedly, and the speed in actual practice is about ten square inches per one-tenth minute of time, thus making an engraving comprising twenty square inches in two minutes' time.

One of the great advantages of my invention is the possibility of reengraving a subject within a few minutes, thus affording facility for correction, &c.

By changing the adjustments of depth of the cutter, or recording-tool, which is not possible with chemical-etching process, the reproductions serve as ordinary printing-plates. Stereotypes, electrotypes, &c., can be made from them directly, or the films may be mounted upon suitable supports and used for printing purposes without any other interventions. The reproductions, when a blunt cutter is used, may also be utilized as embossing printing-plates, &c.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The method of reproducing photographs, sketches, &c., consisting in causing an unevenly-surfaced subject to automatically present a superimposed recording material, more or less against a recording-tool, substantially as specified.

2. The method of reproducing photographs, sketches, &c., consisting in causing an unevenly-surfaced subject to automatically present a recording film, sheet or plate more or less against a recording-tool, the recording material being placed between the subject and the tool, substantially as specified.

3. The method of reproducing photographs, sketches, &c., consisting in first producing a

composite plate or sheet by placing an unevenly-surfaced subject and a reproducing material, one against the other and then progressively subjecting the reproducing material to the action of a recording-point as the material is automatically directed by the uneven subject, substantially as specified.

4. The method of reproducing photographs, sketches, &c., consisting in causing an unevenly-surfaced subject to automatically move a superimposed recording material to and from an adjacent recording-tool, according to the configuration of the subject.

5. The method of reproducing photographs, sketches, &c., consisting of first producing a composite plate or sheet by placing a variable-surfaced subject and a reproducing material one against the other, and then progressively subjecting the reproducing material to the action of a graver or cutter disposed at a predetermined distance from the point of support, whereby the reproducing material is caused to conform substantially to the undulations of the relief or intaglio surface and receive cuttings of varying depth.

6. The method of reproducing pictures, sketches, &c., consisting of first producing a composite plate or sheet by placing a subject in relief or intaglio and a reproducing material one against the other, then placing said composite plate or sheet between two points, one of which is a graver or cutter, arranged at a predetermined distance from each other, and causing the graver or cutter to produce cuttings of varying depth upon the reproducing material according to variations of the relief or intaglio surface, substantially as specified.

7. The method of reproducing pictures, sketches, &c., consisting in progressively presenting the different portions of a reproducing material to the action of a graver or cutter while the reproducing material and a variable-surfaced subject are superimposed.

8. The method of reproducing pictures, sketches, &c., consisting in progressively subjecting a relief-surface and superimposed film or sheet to the action of a graver or cutter which is held in a fixed position relative to the thickness of the films or sheets.

9. The method of reproducing pictures, sketches, &c., consisting in forming the subject in the shape of a relief or intaglio surface, and placing contiguous thereto a suitable cutter and causing a sheet of any suitable material to engage the relief-surface between such cutter and such surface, the said sheet of material and relief-surfaced subject being held in absolute register and by means of the relief-surface causing the cutter to penetrate the sheet deeper and shallower according to the configurations of the relief-surface, substantially as specified.

10. The method of reproducing relief or intaglio surfaces, consisting in placing the material upon which the reproduction is to be made between such surface and a contig-

uous cutter, and holding the surface and material in register, and while so held moving the cutter in parallel paths in one or more directions across the material, whereby the unevenness of the surface causes the cutter to penetrate the material to a greater or less depth, thereby reproducing in lines upon such surface a facsimile of the subject.

11. The method of reproducing relief or intaglio surfaces, consisting in forming parallel grooves upon a reproducing material, placing said material between such surface and a contiguous cutter and then moving the material and surface at about right angles to the grooves, whereby the unevenness of the relief or intaglio surface will cause the cutter to penetrate deeper or shallower into the material.

12. The method of engraving, consisting first in forming a subject with an uneven surface; second in resting against said surface

yielding material; third in fixing a graver or cutter at a predetermined distance from the support of said uneven surface, and fourth, in giving motion to either the said subject and yielding material, or to the said graver or cutter.

13. A relatively-fixed cutter, a subject comprising a variable surface, a holder for supporting the said surface, said holder supported at a uniform distance from the cutter, and means for progressively presenting the different portions of a reproducing material, interposed between said cutter and variable surface, to the action of the cutter while it and the relief-surface are superimposed.

In testimony whereof I affix my signature in presence of two witnesses.

NOAH S. AMSTUTZ.

Witnesses:

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F. D. LESLIE.