

Dec. 24, 1940.

W. J. WILKINSON

2,226,086

PRINTING

Original Filed Aug. 13, 1935

Fig. 1.

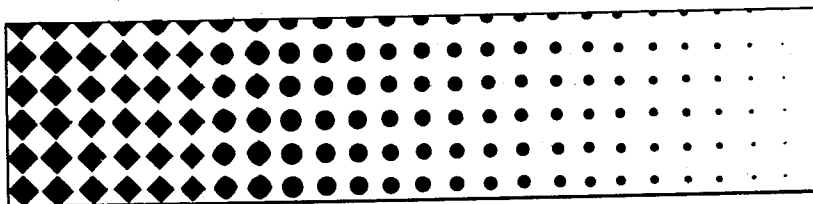
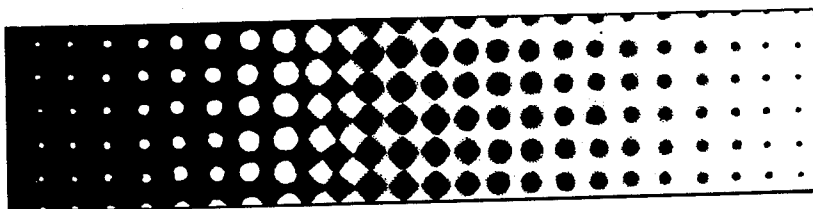


Fig. 2.



INVENTOR.
William J. Wilkinson,
BY *Walter M. Fuller*
ATTORNEY.

Patented Dec. 24, 1940

2,226,086

UNITED STATES PATENT OFFICE

2,226,086

PRINTING

William J. Wilkinson, Eastchester, N. Y., assignor
of one-half to Miehle Printing Press and Manu-
facturing Company, Chicago, Ill., a corporation
of Illinois

Original application August 13, 1935, Serial No.
36,019. Divided and this application August 19,
1937, Serial No. 159,896

5 Claims. (Cl. 101—401.1)

The present invention relates to the art of gravure printing and concerns more particularly a novel intaglio printing-plate, its process of manufacture, and an improved print from the plate presenting the original subject with great fidelity as to all tonal gradations.

Intaglio printing, as at present ordinarily practiced, involves the employment of a printing-plate made from a continuous-tone positive and a gravure-screen and in which plate the picture is depicted by a series of dots formed as ink-wells or depressions in the printing-surface of the plate, and the printing from such plate when inked, the ink being carried in the wells and pressure being applied to force the ink out of such wells onto the paper or other surface, such method being commonly used, for example, in the printing of Rotogravure sections of newspapers.

Such gravure printing, as usually carried out today, comprises the employment of an intaglio printing-plate in which such ink-wells are all of the same area but which vary in depth in conformity with the tones of the original interpreted, the ink-wells representing the blacks or solids of the subject being deepest, those corresponding to the lightest tones being shallowest, and those representing the intermediate tones being of harmonizing intervening depths. Since the deeper wells accommodate a greater quantity of ink than the shallower ones, the former of course, will deposit more ink on the paper and will, therefore, produce darker tones.

The image or design to be reproduced is transferred to the printing-plate by means of an intermediate medium, such as so-called "carbon-tissue," through which the plate is etched differentially to produce the ink-wells of varying depths, this being the only method employed commercially heretofore in making a gravure plate.

Such printing-plate is ordinarily produced by first making a continuous-tone negative of the subject and then making a continuous-tone positive therefrom, the positive being photographically printed on the light-sensitive gelatinous layer of the paper-backed carbon-tissue, and a Rotogravure screen is also photographically printed thereover on the same light-responsive stratum of the carbon-tissue by a second exposure. Such double-exposed carbon-tissue stratum or layer is thereupon secured face down on the surface of the metal printing-plate, its paper backing removed, and such coating developed, the developed coating being known in the trade as a "carbon-resist." The dots in such carbon-resist representing the different tones of the picture are all of the same size, which is determined by the equal areas of the screen openings, but these dot areas, however, are unequally pervious to the etching-fluid, depending on the tone of the zone of the subject interpreted. Etching-fluid then

applied to such resist encounters less opposition or resistance at those portions thereof corresponding to the darkest zones of the original subject and greater resistance at the lighter zones, and it accordingly produces a deeper etch at the former zones than at the latter zones where more resistance is encountered, the resist being more or less broken down or despoiled by the action of the etching-agent thereon during such operation. Owing to the varying degrees of permeability or hardness of the different sections of the resist due to their previous unlike light-exposures, an etching-fluid of one specific gravity only cannot be employed to etch the underlying plate through the resist with the required result.

Accordingly, in practicing this procedure, five strengths of etching-acid are ordinarily used progressively, the one of heaviest specific-gravity being used first, and, after this has been removed, its action is followed up by those of successively less specific-gravities. Expert judgment and capable discretion on the part of the etcher are necessary to determine the proper period of action of each strength of the etching-medium on the coated plate. After the etching has been completed, the carbon-resist is removed from the surface of the etched plate.

The above-specified procedure involves various details and features which are well-known to a person skilled in the art, the indicated steps having been set forth merely by way of illustration and in order to aid in an understanding of the present invention and the benefits accruing from its employment.

Gravure-plates, formed as explained above, necessarily possess certain inherent disadvantages and limitations; for example, if several such positives are to be employed in the production of a single, composite printing-plate, these positives must be of equal densities in order for all to be uniformly subject to the action of the etching-agent, when they are simultaneously etched. Since the carbon-resist is destroyed during the etching action, the plate-etching operation cannot be stopped at will to permit examination of the plate and the etching then continued, if required, to the correct point, due to the fact that when the carbon-resist becomes permeated or charged with the etching-fluid, its continued disintegration cannot be prevented, and, accordingly, great skill is required on the part of the operator to etch a plate having a given characteristic, and, the results cannot be duplicated with any degree of certainty. Furthermore, it is practically impossible to obtain an accurate registration of the one or more positives on the printing-plate because of the distortion introduced by the employment of the carbon-tissue in transferring the same to the plate.

A process of producing an intaglio printing-

plate has heretofore been suggested comprising photographing the subject in negative through a line-screen with the camera initially focused to obtain a checkerboard effect of the screen on the ground-glass of the camera, over-exposing such negative-plate sufficiently to cause the shaded and dark portions of the design of the subject to appear on the negative as variable-size, entirely-disconnected, transparent dots, the largest dots corresponding in tone and position to the darkest zones of the subject, such excessive or unusual light-exposure causing the negative, except for the dots, to be substantially opaque, and thereafter using this negative, through the medium of a positive plate or film made therefrom, an etch-resist, and an etching-fluid to form the intaglio printing-plate; or, stated somewhat differently, such procedure involves the making of a negative through a screen in such a manner as to cause the entire subject to be confined on the negative to substantially half of a complete screen tone range, and then using a positive made from such negative to produce the intaglio-plate. The object of this extraordinary use of the ordinary half-tone screen by over-exposure of the negative-plate through it is to obtain disconnected dots, instead of continuous solids, to represent the darkest parts of the subject. In following this prior art method, the half-tone screen is spaced at its correct focal distance in front of the sensitive plate which is to constitute the negative and the excessive light-exposure of the plate is depended upon entirely to lessen or restrict the effect of the screen so that the negative carries only in half intensity the tones of the original subject. In accomplishing this desirable result, however, the over-exposure eliminates all dot effects in the negative where the original subject was entirely white, so that the negative in those areas is completely opaque.

Whereas this procedure possesses merit and adapts itself for certain lines of work, such as textile printing, it has the disadvantage that the specified elimination of dot effects is not restricted in the negative to the completely-white portions of the subject, but such dot absence applies also to the light tones of the original subject, whereby this process does not result in the production of a print in exact conformity with all tones of the subject. Furthermore, such over-exposure exclusive of transparent dots in those parts of the negative corresponding to the whites of the original subject and to the adjacent light tones thereof precludes the possibility of the introduction of suitable or proper dots in such light tones by reducing the negative. The over-exposure kills such dots beyond possibility of their resurrection, and the result is that the print made from the positive printing-plate of such negative cannot faithfully and truly reproduce all tones of the original subject, those tones next to white necessarily being missing.

A leading purpose of the present new invention is to provide an improved method of printing in which the several above-specified and other disadvantages apparent to a person skilled in the art are avoided or eliminated, an especial object of the invention being to supply a different and better procedure to overcome the deficiency of the second of the prior art processes described, in that the new method is capable of making prints correctly and exactly representing all tones of the subject from the lightest to the darkest.

Among the principal aims of the new inven-

tion may be mentioned (a) the provision of an improved intaglio printing-plate and the process of making the same (b) the production of a print having novel characteristics, (c) the improvement of the definiteness and registration of the final print, (d) a procedure of forming printing-plates which may be locally strengthened or lightened as required to correct tone values and (e) an improved process of transferring a positive made through a half-tone screen to an intaglio printing-plate, various other objects and advantages of the invention being made apparent as the nature of the details of the invention are more fully disclosed hereinafter.

In the accompanying drawing, Figure 1 illustrates on an enlarged scale and more or less diagrammatically, a face view of the novel hemi-tone gravure printing-plate constituting one part of the present invention; and

Figure 2 illustrates in similar manner a gravure or intaglio print produced from such printing-plate.

In order that the novel intaglio printing-plate may have an ink-well formation in its printing-surface capable of accurately representing all tones of the original subject, a positive-transparency is made by photographing a continuous-tone negative of the subject through a conventional half-tone screen under such conditions of screen-position and of exposure that the dots on the positive-transparency are all of the same intensity but vary in area or size from the darkest to the lightest tones, the blacks or solids of the original subject being represented by practically-unconnected dots and the whites of the subject being entirely free from dots in the positive-transparency, while the dots representing the intermediate tones are of correspondingly graduated areas. Although such a positive-transparency is made through an ordinary half-tone screen, nevertheless the positive-transparency is unique and differs from an ordinary half-tone positive-transparency in that the latter does not have the specified dot characteristics. This new positive-transparency displays only about one-half of the tonal intensities of the ordinary half-tone positive, that is to say, it has only about one-half the contrast or density of a conventional half-tone positive, and for that reason it has been deemed well to characterize it as a "hemi-tone" positive-transparency.

Stated otherwise, a special or unconventional, hemi-tone positive-transparency is made from a continuous-tone negative of the original matter for use in forming the intaglio-plate with which the printing is accomplished. In making this exceptional or peculiar positive-transparency an ordinary half-tone or similar screen is so associated with, or placed at such a distance in front of, the light-sensitive plate or film on which the positive-transparency is to be made and through which screen the light is projected onto the plate, that the darkest parts of the original subject, such as deep shadows, appear in this positive-transparency merely as intermediate, checkerboard or middle tones, and the remainder of the positive-transparency is comprised of all lesser tones graduating properly down to practically an absence of dots. This uncommon or unusual, hemi-tone positive-transparency, therefore, does not represent the originally-photographed subject correctly as to tone values, since it is much flatter in appearance because it incorporates only about one-half of the tone value or contrast of the original. This positive-transparency is unique in

that, although it represents the entire range of tone values of the initial subject, all such values are actually present in the positive-transparency at about half intensity of the original, except pure whites which are the same in each. This peculiar positive-transparency is produced, not by over-exposure, but by placing the screen in front of the light-sensitive plate at the correct distance, differing somewhat from its true focal distance, to produce the indicated result. The spacing of the screen in front of the photographic-plate and the period of exposure of such plate are both less than would be used to produce an ordinary, half-tone positive-transparency with all other conditions the same.

Even the making of half-tone plates, as customarily practiced today, is, in a measure, a matter of trial due to the fact that the original subjects vary greatly, and heretofore there has been no satisfactory way of preliminarily evaluating them which would render predetermined procedure always feasible or possible.

If in making the new specified hemi-tone positive-transparency, the contrast therein is found to be too great to meet the conditions hereinbefore set forth, then the screen-distance should be somewhat decreased, whereas, if such positive-transparency has too little contrast to comply with the specification, then a somewhat greater screen-distance should be tried.

Under usual conditions, the screen-distance may be about three-fourths that which would be used for the production of a half-tone and the exposure may be in the neighborhood of approximately one-third that which could be satisfactorily employed for the making of a half-tone; but it is to be understood that these factors are variable depending upon other features, such as the characteristics of the original subject, the intensity of the light, the speed of the emulsion, etc.

One skilled in the art, however, will experience no substantial difficulty in producing a hemi-tone positive-transparency having the properties referred to.

In this specification, where the term "tone-value" or its equivalent has been used in reference to the original subject, it is intended to mean the relative position of the tone of any particular color in a scale which represents the full range of the color in question; when employed in relation to the continuous-tone negative, it signifies the value of the density or opaqueness of the tone; when used in reference to the hemi-tone positive-transparency, it specifies the relation between the total area of the opaque dots to the area of the transparent surface in a unit area of the tone under consideration of the positive-transparency, it being borne in mind that all dots in the positive-transparency are of equal density regardless of size; and when employed in reference to the hemi-tone gravure printing-plate, hereinafter referred to in more detail, it means the relation between the area of the ink-wells to the area of the non-printing surface in a unit area of the tone under consideration in the printing-plate.

To compensate for the stated absence of adequate and full-tone amplitude in this extraordinary hemi-tone positive-transparency, the etching of the intaglio printing-plate is carried out long enough to assure that the many practically-independent etched wells in the surface of the plate are deep enough to accommodate sufficient ink so that when the printing is done there will be enough ink applied to the print by all wells to permit a proper spreading thereof whereby to

give the print a full range of tone-gradation from the darkest shadows or solids to the brightest highlights; this ink enlargement or spread of the dots on the print making good or overcoming the lack of full intensity of the positive-transparency. Such spreading of the ink on the print takes place in more or less degree for all printed dots.

One main reason for making and using such a singular or unexampled hemi-tone positive-transparency is this: If the positive-transparency were made with tones of the exact values in the original, the ink-wells in the darkest portions of the etched metallic printing-plate would either be run together into excessively large wells from which the ink-removing doctor-blade would extract their ink or their walls would so thin that they would wear out unduly quickly with practically the same result.

Another, and perhaps preferable, mode of practicing the invention, which procedure is not however essential, but which has certain advantages of affording more leeway or greater latitude in the time of light exposure in making the positive-transparency and of the production of sharper and more clearly defined dots and which may be accomplished by a slight change in the indicated distance between the screen and the film which is to form the positive-transparency, or by a slightly longer exposure, or both, comprises making a positive-transparency under conditions such that the whites of the subject have extremely fine dots in the positive-transparency which are capable of being entirely removed by an ordinary reducing operation, and, in eliminating these by such reduction, all of the remaining dots of the positive-transparency will be reduced a certain uniform extent, the specified reduction being controlled so as to remove the dots on the whites without entirely eradicating the dots representing the next darker shade.

In this way, all of the tone values of the picture are preserved, although the positive-transparency, when viewed by itself, as stated above, shows less contrast and appears flatter than the original subject.

A further principle of the invention resides in the transfer of the positive-transparency directly to the printing-plate without the use of carbon-tissue and in such a way that the subsequent etching can be easily controlled. To the accomplishment of this result, the surface of the printing-plate is coated with a resist of such a nature that it remains substantially unimpaired and intact during the entire etching period, whereby the etching may be interrupted at any time, the plate examined, and certain areas painted out with a protective varnish or the like, as desired, before continuing the etching.

The novel printing-plate possesses a non-printing surface corresponding to the whites of the picture and the remainder of which contains a plurality or aggregation of ink-wells representing the tone dots of the picture, these wells being of different areas and approximately uniformly etched as to depth, the wells representing the darkest tones being practically separate and distinct, the tones next to white being represented by small wells, and the areas representing the whites being entirely free from wells. All of the ink-wells, however, are sufficiently deep to permit the plate to be topped, as by means of an ink roll-up without filling in of the finer wells, and re-etched as desired. As long as the kind of resist employed remains on the plate, such inking prior to re-etching is not required, but after the

resist has been removed, the applied ink acts as a resist whereby the wells may be etched deeper.

Various other capacities and characteristics of the invention will become apparent as the same is more fully disclosed in the following detailed description and pointed out with more particularity in the appended claims.

More specifically, in producing the hemi-tone positive-transparency of the unconventional type, a continuous-tone negative is made from the original subject to be reproduced in the manner common in the photographic art; but, if the original be a photograph, the negative from which it was made may be employed for this purpose, and, in either instance, the negative may be retouched if desired.

For color work, a set of continuous-tone separation-negatives, one for each color, is made photographically through color-filters in the usual way, and these are retouched or corrected as required so that each negative contains its proper color values.

Each negative, produced in this manner, is then placed before a camera, and while properly illuminated, is photographed through an ordinary half-tone or equivalent screen, the exposure being such and the screen being so positioned with reference to the positive-transparency being made that the dot-formation is produced on the positive-transparency in which the largest dots, representing the blacks or solids, are practically separate and distinct from, and do not touch, one another, except possibly at their corners as in a checker-board effect, while the smallest dots on the whites are so fine that they may be readily cut or removed in a reducing step. This desirable dot-arrangement is obtained by selecting the proper distance between the half-tone or other screen (for example 150 lines to the inch) and the sensitized plate undergoing exposure and using the correct lens aperture and time for the exposure, such screen-distance and exposure both being less than those which would produce an ordinary half-tone positive with all other conditions the same.

This positive-transparency may be made on a wet-plate, if preferred, in order that the subsequent development thereof may be more readily controlled; and, in the case of color work, when registration is particularly essential, each of the positive-transparencies may be made by contact printing on a dry-plate using a half-tone or similar screen in a manner such that the above-mentioned dot-formation is secured.

In either case, the positive-transparency is developed and then reduced by any standard reagent, depending upon the type of plate employed, and during this procedure the entire positive-transparency is reduced a sufficient amount to eliminate entirely or substantially completely the minute dots on the whites, but not enough to eradicate the dots representing any of the next darker tones of the picture, this reduction step also tending to remove any fringe effect of the dots and to cause them to be more clearly defined and with sharper demarcation. This positive-transparency, however, will appear to have less contrast than the original subject or the negative, this characteristic being of material importance in the subsequent step of printing with the corresponding printing-plate, inasmuch as it provides a continuous support in the heavily inked parts of the plate for the ink-wiping doctor-blade.

Expressed differently, this peculiar and noteworthy hemi-tone positive-transparency is produced by using a half-tone or analogous screen at

such a chosen distance from the light-sensitive film as to provide the specified result with proper exposure, the positive-transparency not truly depicting the negative from which it is made, because it displays the tones of the continuous-tone, preferably but not necessarily somewhat-thin, negative in discontinuous dots of about one-half less value or area than they should be, the result being that such positive-transparency looks unduly shallow or more or less lifeless as it is without the full tone contrasts present in the corresponding negative. If such positive-transparency were made with a full gradation of tones and variations in density in complete and exact conformity with those of the negative from which it is made, then the portions of the plate etched therefrom presenting the deepest shadows, instead of having a large number of independent nicely-walled-in ink-wells, would have relatively large areas of one well each and of such size that there would be substantial danger of the ink-scraping doctor-blade scooping out their ink contents when it is wiping off the excess ink from the remainder of the printing-plate. By making this positive-transparency such that the deepest shadows or solids of the original subject are represented by conventional middle tones, instead of full black tones, there is the assurance that the ink-wells will be separate from one another with substantial intervening walls, the latter, as indicated, precluding the doctor-blade from extracting the ink from the larger wells. It is necessary, however, to make amends for this lack of full or adequate tone amplitude throughout the positive-transparency, and, accordingly, when the printing-plate is etched through a resist made from such positive-transparency, the etching is carried to a sufficient depth in the plate to permit each well to accommodate an amount of ink greater than that merely necessary to print a dot corresponding to the exact area of the well, the result being that after each such dot is printed, its ink spreads on the print sufficiently so that the final print is dense enough throughout to present a true and correct reproduction of the original subject.

From what precedes, it should be clear that in the hemi-tone positive-transparency the solids of the subject are represented by dots arranged in approximate checkerboard-design and it may be mentioned that, when such dots are etched in the metal printing-plate, the action of the etching-agent may round out the sides of the corresponding ink-wells somewhat but still retaining the general or approximate checkerboard feature.

The hemi-tone positive-transparency having been made in the manner indicated, it is ready for reproduction in the printing-plate. The surface of a copper-plate, which is to form its printing surface, is sensitized by applying thereto a light-sensitive coating of a solution of shellac and a bichromate commonly called "cold enamel." If the surface of the plate were covered with a thin coating of light-sensitive glue or gelatine, then exposed through a positive-transparency to the action of light, and then developed, the coating would be so thin that it could not successfully resist the action of an etching-fluid, and to bring out its full acid-resisting properties, it must be baked. Such a glue-coating is known in the trade as a glue-top, and after the baking, it is characterized as a glue-enamel. Inasmuch as the specified cold-enamel coating is adequately resistant to etching-acid without the baking required for the special glue-top, the tendency of a thin plate, when heated, to buckle or warp is

avoided, and, in any case, it would be difficult to heat or bake a plate of large size properly and evenly. This unconventional and unprecedented hemi-tone positive-transparency is photographically-reproduced in such light-responsive cold-enamel coating, the positive having been previously stripped from its support and placed face down on the coating to assure that the final print will not be reversed right to left, whereupon such coating is developed, for example, by the use of alcohol, leaving on the plate a coating impervious to the action of the etching-medium, but containing numerous free small passages or openings there-through corresponding to the dots of the positive-transparency and through which the etching-fluid has free and unimpeded access to the surface of the copper-plate. The positive design or picture is then etched through such resist apertures into the surface of the underlying metal plate to the required depth, a suitable single-strength only of the etching-agent being required, thus avoiding the necessity for the great care heretofore essential in etching gravure-plates.

In the use of this new method in color-printing, it has been found to be of the utmost importance to secure registration of all parts of cooperating intaglio-plates, this being particularly essential in the case of large subjects. Precise registration is facilitated by placing dependence on the employment for each color of the cold-enamel light-sensitive coating on its copper printing-plate, which procedure entirely overcomes the normal and intrinsic uncertainties incident to the use of a deformable or distortable carbon-tissue, such customary intermediate tissue agency employed in the production of gravure-plates being subject to serious inaccuracies which prevent the securing of faithful reproductions, because the gelatin and its paper support of the carbon-tissue cannot be depended upon to afford correct registration due to the vagaries of variable expansion with or across the grain of the paper, the humidity and the temperature, of course, entering into the situation.

Any areas of the printing-plate, such as borders, to be protected from the action of the etching-fluid, may be preliminarily painted over with asphalt-varnish, after which the unvarnished parts of the plate are etched with a standard etching solution for a sufficient period of time, this operation requiring from three to eight minutes, depending upon the solution employed. Such etching may be interrupted at any time to permit the plate to be washed, dried, and examined, because the resist has remained in place in uninjured condition, and any portions of the plate that have been adequately etched may be painted over with asphalt-varnish before continuing the etching, which is then prolonged until the entire printing-plate has been etched the needed amount.

It is sometimes desirable to prolong the etching of the darker portions of the plate for a greater length of time than the lighter sections in order to produce ink-wells in those parts of the surface of the plate of depth enough to retain the required quantity of ink and all the wells should be etched to a depth such that the plate can be topped, if desired, for re-etching after the cold-enamel has been removed and a proof taken. The etching is terminated, however, before adjacent wells become connected with one another in any material degree through the breaking down of their walls. Such printing-plate may be cleaned and examined at any time and re-etched

as required prior to the removal of the cold-enamel, and, after the etching has progressed to the required point, the cold-enamel is removed by a strong cyanide or a lye solution and the plate is then ready for the printing-press. After a proof has been taken, the plate may be topped with ink and re-etched or corrected as needed, the ink, under these circumstances, acting as a resist.

In the finished, etched printing-plate, the various ink-wells are of different areas corresponding in position and size to the dots of the hemi-tone positive-transparency from which they were formed, but these wells are of approximately the same depth. It will be understood, therefore, that use is made of conventional disconnected, middle-tone dots in the positive-transparency and corresponding conventional, practically-disconnected, middle-tone wells in the printing-plate for the deepest shadows or solids and regular gradations from these to dot-free or well-free whites, as the case may be, which are designed and adapted to faithfully and correctly reproduce all the tonal changes of the original in the print.

Again, this patentee's disposition or system of hemi-tone ink-wells, since they are all of approximately the same depth, conforms to the generally-accepted, ordinary-half-tone formation, which is known to render a true tone-gradation from solid to white and this does not apply to the commonplace, gravure, ink-well arrangement.

When this patentee's inked plate in the printing operation, after its surplus ink has been wiped off by the doctor-blade, is brought into contact with the paper, which need not be of a superior grade, but may be of the ordinary newspaper kind, the ink of all these numerous wells is transferred to the paper and the ink of such multiplicity of printed dots spreads or expands on the surface of the paper in a manner to reproduce accurately and precisely all the tone-values of the initial subject. It is the intention that the ink-wells in the plate in substantial checker-board-design representing the blackest or deepest shadows or solids shall be of such size and capacity that, although they are practically unconnected, the spreading of their ink (approximately 100%) on the paper will be sufficient to cover the entire area of the printed surface corresponding to such portions of the subject, and the ink employed should be of such viscosity, determined by the depth of the etching and of the separation of the wells, that the dispersion of the ink on the printed surface will thus faithfully duplicate all tones and shades of the original.

By the employment of the present invention with its non-requirement for the use of carbon-tissue, the prints are produced with exact registration for color work, with the minimum amount of labor, with the least complexity of operation, and with the fewest steps. These prints are outstanding and noteworthy in that a selected restricted range of tone dots is made use of to represent all tone values of the original subject, none being omitted, and, although, in the shadows, the conventional middle-tone or checkerboard-arranged dots are present as virtually, or to all intents and purposes, disconnected ink-wells in the intaglio-plate, they are lost on the print through the adequate spreading of the ink to produce a rich ink layer forming a desirable continuous-tone.

Although the process set forth in detail above is one requiring reduction of the positive-trans-

parency in the manner stated to remove the dots from the whites, it is to be remembered that this reduction is not necessitated by reason of an over-exposure comparable to that referred to in one prior-art process and it is to be understood, furthermore, that the positive-transparencies can be made in a manner to avoid the original production of dots entirely in the whites of the positive-transparency, and, accordingly, such a positive-transparency requires no reduction, although in such case the dots and the corresponding wells in the printing-plate may not be quite as sharp as if the reduction method were followed.

Summarizing, somewhat, some of the paramount advantages and cardinal benefits incident to the employment of the present invention, and which are of marked commercial value, are as follows:—Once a proper positive-transparency has been made and knowing the gravity of the etching-fluid, the temperature, and the time period for the production of a printing-plate therefrom, any number of such plates can be made which are, for all practical purposes, exactly alike, a result heretofore incapable of accomplishment. Again, persons of ordinary ability in the art may practice the new procedure with gratifying results and without resort to the highly technical skill and careful judgment which have been essential, in the past, in the making of gravure-plates. Also step-and-repeat machines may be employed for composing the matter to be reproduced directly on the printing-plates. In addition, local re-etching of the plate and continuation of the etching may be resorted to, if desired. Furthermore, faithful and exact reproduction of the original subject in the print is rendered possible of accomplishment with ease and facility.

When the hemi-tone positive-transparency is made from the negative by the direct-contact method and 150-line screen is employed, it has been found that the proper distance between the screen and the plate undergoing exposure is approximately .190 inch.

When such a positive-transparency is made in the camera, however, the operator adjusts the screen to secure a correct position thereof to produce a positive having the stated characteristics, but this does not mean that the hemi-tone positive-transparency will be like what the operator sees on the ground-glass of the camera.

If the darkest tones of the subject are represented by quite small areas in the printing-plate, it is not essential that their ink-wells in all instances be entirely disconnected, the principal aim being to provide a printing-plate on which the ink-removing doctor-blade will have proper support at all times so that it may efficiently perform its functions without withdrawing an undue quantity of ink from any of the wells.

The manners of practicing this invention have been described for the purposes of illustration, but it will be apparent to persons skilled in the art that various changes or modifications may be availed of and that the different features of the invention may be used in various combinations for the improvement of known printing processes. The invention is, accordingly, to be defined in accordance with the scope of the following claims when interpreted in view of the state of the prior art.

This application is a division of my co-pending patent application Serial No. 36,019, filed August 13th, 1935, the latter being a continuation in part

of another of my co-pending applications Serial No. 755,649, filed December 1, 1934.

I claim:

1. A hemi-tone intaglio printing-plate depicting at approximately one-half of their tone-values all tones of an original subject, having tones adjacent to white, by ink-wells of different areas etched in its printing-surface, the solids, if any, of the subject being represented by relatively-large, practically-unconnected ink-wells occupying approximately one-half of each said solid area of the printing-plate and all lesser tones of the subject being represented by separated ink-wells of lesser areas in conformity with the tones which they depict.

2. A hemi-tone intaglio printing-plate depicting at approximately one-half of their tone-values all tones of an original subject, having tones adjacent to white, by substantially-moireless approximately-equal-depth ink-wells of different areas etched in its printing-surface, the solids, if any, of the subject being represented by relatively-large practically-unconnected ink-wells occupying approximately one-half of each said solid area of the printing-plate and all lesser tones of the subject being represented by separated ink-wells of lesser areas in conformity with the tones which they depict.

3. A hemi-tone intaglio printing-plate depicting at approximately one-half of their tone-values all tones of an original subject, having tones adjacent to white, by approximately-equal-depth ink-wells of different areas etched in its printing-surface, the solids, if any, of the subject being represented by relatively-large practically-unconnected ink-wells in approximate checkerboard design, and all lesser tones of the subject being represented by separated ink-wells of lesser areas in conformity with the tones which they depict.

4. An intaglio printing-plate depicting all tones of an original subject, having tones adjacent to white, by tone-values sufficiently less than those of an ordinary inverse half-tone, by ink-wells of different areas and of approximately the same depths, to represent the solids, if any, of the subject by relatively-large practically-unconnected ink-wells and to represent all lesser tones of the subject by ink-wells of lesser areas in conformity with the tones which they depict, a portion of said lesser tone ink-wells having substantially circular contours, said printing-plate being characterized in that any four of its ink-wells are grouped around a non-printing area and have their centers located equi-distant from the center of said non-printing area, said non-printing area in all tones being never substantially less in size than that of any one of its said grouped ink-wells.

5. An intaglio-print characterized by the fact that it represents a reproduction of all tones of an original subject, having tones adjacent to white, by virtue of a substantially-even tone of velvety nature representing the solids, if any, the white areas of the print being practically free from dots, and the tones of the print between the solids and the white areas being depicted by varying-sized dots corresponding in areas to the tones represented, said latter dots having more or less ragged perimeters, all ink portions of the print, solids and dots, being of substantially the same density, the middle-tones of the print being formed of dots in substantially checkerboard-design and the tones of lesser values being represented by approximately round dots.

WILLIAM J. WILKINSON.