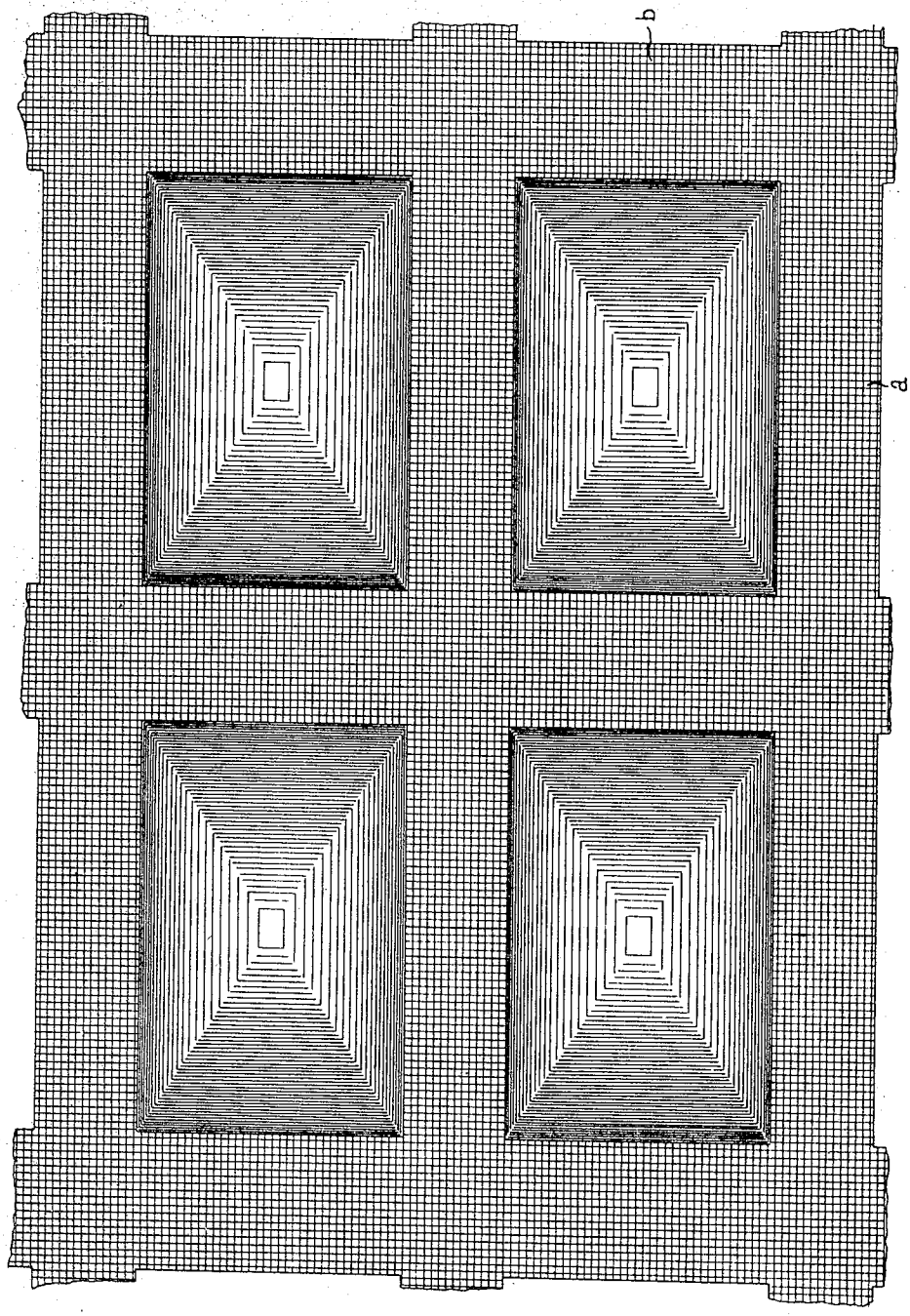
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CONTACT SCREEN FOR ROTOGRAVURE DIRECT PRINTING
AND OFFSET PRINTING SYSTEMS
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CONTACT SCREEN FOR ROTOGRAVURE DIRECT PRINTING AND OFFSET PRINTING SYSTEMS

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ABSTRACT OF THE DISCLOSURE

A contact screen for rotogravure direct printing and offset printing, both negative and positive, which has a plurality of points separated from one another by lines, and each point is made up of zones. The density gradation of each point varies progressively and differently in adjacent zones from between the center of that point and a side thereof. The lines which separate the points have at adjacent sides of a point different widths, and the number of lines in one centimeter at one side of the points is different from that at the adjacent side of the points. Preferably the point is rectangular in shape.

This application is a continuation-in-part of my application 737,980 filed on June 18, 1968 now abandoned, entitled "A Contact Screen for Rotogravure Direct Printing Systems."

The present invention relates to a contact screen for rotogravure direct printing and offset printing systems. Specifically this invention relates to a contact screen for grating negatives or positives to be transferred by a photomechanical system on emulsified copper plates or cylinders in order to obtain printing matrices to be printed on paper or other printable supports by the either direct printing or rotogravure autotypic system.

The same contact screen is used according to the present invention, for grating negatives or positives on plates, in order to obtain printing matrices to be printed on either paper or other supports with the direct or indirect offset printing system.

As it is known by the prior art in the first case (rotogravure), the photomechanical preparation system as commonly used for preparing rotogravure printing matrices are as follows:

(a) Rembrandt system (conventional rotogravure)
(b) Mertens system (autotypic rotogravure)
(c) Dultgen system.

Hereinafter an abridged specification will be set out of each of the three aforementioned systems, stressing out the fundamental features and the main drawbacks originated by their application.

REMBRANDT SYSTEM

This system includes in its initial stage the photographic reproduction of one original with one or more colors. To the negative or negatives (one negative if a single color is concerned or three or four negatives in case of trichromy or quadrichromy) the usual photographic techniques by contact or by blow-up are applied until obtaining a positive copy on a transparent support (a transparency). The obtained transparency or transparencies are subsequently submitted to a retouching operation whereby skilled oeprators will effect hand corrections in order to accentuate or attenuate determined values of the band of half tones which will become altered in respect of the original due to the two abovementioned photographic

stages (reproduction and printing). If the subject matter is a color one, the retouching is directed to correct the chromatic defects on the negatives or positives obtained by subtractive synthesis or using selecting electronic devices (electronic selecting devices). These operations are carried out by specialized skilled persons (chromists).

The positives, after their retouching, are sent to the mounting station, where on the ground of a "menabo" are set up on a crystal plate or on a sheet of transparent material. The so mounted material is sent to the transfer department where the following operations are sequentially carried out:

(a) In a printing press of a pneumatic type a sheet of emulsified paper, called "pigment paper" or "carbon paper" is contacted on its gelatin provided photosensitive side, with a screen normally made of crystal including opaque black squares and transparent lines; in the most common case the screen shows 70 lines per cm., the (line/point) ratio between the opaque part and the transparent part of the screen being 1/2.5;

(b) The screen+pigment paper unit is exposed to a light source for a prefixed exposure time (screen exposure).

It is now to be remarked that the "pigment paper" is a good common paper which makes support for an organic gelatin emulsion into which an insoluble pigment has been incorporated. Said emulsified paper, if dipped for three or four minutes into a potassium bichromate bath, and then dried, acquires the feature of becoming insoluble in hot water at 40–42° C., to an amount which is reversely proportional to the amount of light striking it, while the parts which are not exposed to light are soluble in hot water.

Therefore, after the application of the screen (stage b), the emulsion of the pigment paper will show a set of hardened lines in correspondence of the transparent lines of the screen, while the parts corresponding to the opaque squares, as they have not been struck by the light, will remain photosensitive.

Then the following operation will be carried out:

(c) The aforesaid pigment paper sheet is contacted with the mounting of the continuous hue transparencies in another printing press; and exposed to a light source (exposure of the transparencies).

After said exposure the hardened lines existing in the pigment paper will remain unaltered, while the photosensitive squares will be differently exposed to different amounts of light passed through the single parts of the transparency. Particularly in register with the white zones entirely transparent, of the transparency, the total hardening of the square occurs, while in register with the maximum black zones, the square will not be struck by the light so as to remain soluble. To the half tones of the transparency correspond, on the contrary, on the pigment paper, hardened layers having different thicknesses. The pigment paper after the laying of the screen and of the transparencies, will sequentially undergo the treatments as follows:

(d) It is applied by means of technologically suitable machines to the smooth surface of the engraving cylinder or plate;

(e) It will be developed by means of a water bath at pre-established temperature, stripping the paper which has only a support task and passage into solution of the parts of soluble emulsion (non-exposed parts) remaining on the contrary the exposed parts insoluble) fixed to the cylinder which will be subsequently cooled and dried.

Accordingly on the cylinder a dry gelatin layer will be obtained, subdivided into a grating consisting of crossed lines, perpendicular to one another having a constant thickness, and of squares defined by said lines and having a variable thickness, which is minor in correspondence

with the dark tones and progressively increasing up to a maximum in correspondence with the most clear and transparent tones.

The cylinder will be now submitted to a covering operation with bitumen which determines all the parts of the cylinder which must not be etched to be covered with bitumen.

Then the etching proper is made out, and particularly:

(f) The etching is effected by means of different baths of iron perchloride: the pigment gelatin is permeable to water, but it is not permeable to the iron perchloride which etches the copper surface and etches it in depth being the permeation of the perchloride through the gelatin conditioned by the amount of water contained in the perchloride itself and by the thickness of gelatin to be permeated.

The etching at differentiated depth is obtained operating with perchloride baths having different concentrations.

The thicker baths (45° Baumé) and therefore richer in perchloride will etch the sole black parts of the original which as aforesaid are represented on the copper by a very light layer of gelatin, through which the perchloride, although thick, can easily pass.

The less thick baths (42°–36° Baumé) on the contrary will etch the progressively clear parts; in fact the greater amount of water of the bath causes the thicker layers of gelatin to swell allowing the diluted salts to easily pass and to etch the metal. The etching is made with baths having decreasing concentration until obtaining the (very light) etching of the maximum lights.

When the etching operation is ended, the gelatin and the bitumen are removed. The cylinder or plate, washed and dried, is ready for printing.

The fundamental operations of the printing process can be summarized as follows. The cylinder, or plate-carrying cylinder, of the printing machine rotates partially immersed into a liquid ink bath; a sharpened steel blade cleans the surface of the cylinder removing the excess ink so as to leave filled only the etched cells, characterized, as aforesaid by different depths, to which correspond different ink contents. The cylinder, cleaned by the blade, contacts the paper under a determined pressure which determines the transfer of the ink to the paper itself being the different hues obtained in function of the different contents of the cells. To a different ink content (deep cell) correspond the darkest hues on the paper while the clearest hues are produced by the less deep cells. Thus on the paper the reproduction of continuous hue images will be obtained.

The Rembrandt system is that commonly used by the graphic factories which operate with high printing numbers in the printing field. Good results are obtained which depend, however to a determined amount, upon the capacity of the technical operators.

One of the drawbacks of said system is in fact that deriving from the difficulty of obtaining in each single operation the constancy of some operative technical conditions, and particularly:

thickness of the emulsion layer on the pigment paper;
pH value of the potassium bichromate;
drying status of the paper;
drying time;
gelatin preservation (the gelatin is easily alterable);
values of the pressure in the pneumatic press.

Also must be taken into consideration the drawbacks due to the presence of residues of photographic products on the gelatin surface, and to the lack of uniformity of the values of the pressure of application of the pigment to the surface of the copper.

Other practically unavoidable drawbacks are those inherent to the changes of the times and of the development temperatures.

Furthermore, the different cooling of the cylinder which occurs time by time, the sublimation of the potassium bichromate contained in the gelatin contacting the surfaces of the copper and hygrometric changes inside the gelatin itself, the modifications of the pH of the iron perchloride in the etching bath, the different hardness and molecular structure of the copper in the single plates, the lack of uniformity of laying of the support of the pigment paper with the drawbacks originated, for the register in the more color print, will affect to a great amount the possibility of obtaining constant results.

Finally also the different techniques adopted by the engraver in each operation engraving, in order to obviate, at least partially the aforesaid drawbacks, are to be considered as they introduce a further obstacle to the practical obtention of prints relatively stable features.

THE MERTENS SYSTEM

The Mertens system, commonly called "autotypic" is grounded on principles entirely different from those of the Rembrandt system.

The positive is directly screened by a screen placed between it and the negative. The used commonly screens have 60 lines with a 1/2.5 ratio.

The copying operation of the mounting of the screened positives occurs directly on the copper surface previously emulsified with photosensitive gelatin by exposure to a suitable light source. When the development has been made; thus the transfer will be obtained of the images consisting of little squares having different sizes. Specifically, the sizes of the little squares vary from a maximum for the black masses down to a minimum having a dot form for the transparent tones.

The treatment of the plate, carried out by a single iron perchloride bath produces in all cells an etching having the same depth. It is to be noted, however, that it is impossible to obtain, by this system, too deep an etching as the structure of the screen fills in the stripes after extended etchings. At the moment of printing, the different hues are determined by the amount of ink contained in the single cells, and therefore, being constant the depth of the cells themselves, by said surfaces.

The advantages deriving from the greater simplicity and quickness of this system with respect to the "Rembrandt" system, are evident, and particularly it is to be noted that specialized engraving operators are unnecessary.

It is to be noted, however, that the good final result of the "Rembrandt" system cannot be achieved: in fact, while by the use of the pigment paper it is possible to obtain all hues of the half tone band, by the Mertens system the first passages of the blacks are practically fused, while in the last passages from the lightest half tone to the white, the discontinuities cannot be avoided. Also the use of a 60-line screen, instead of a 70-line screen, in order to have a greater fractionable surface does not give a satisfactory result; the comparison of the passage of the half tones with a graduation of Kodak greys supplies at the most 5 to 6 passages, versus the 10 passages which can be normally obtained by the conventional Rembrandt system.

Therefore, the Mertens system, even if largely used in the wrapping field, for etching dashed matrices, with no half tones, gives no assurance of good results for engraving the half tones.

DULTGEN SYSTEM

This system adopts the pigment paper, but it is different from the conventional system in the positive preparing stage: from one single negative, in fact, two positives are obtained, one in continuous hue, with tenuous tones, the other screened by contact.

The two positives are superposed in perfect register and copied on pigment paper by a single exposure to the light source. The other steps are identical to those of the conventional system. After the etching, cells are obtained having different depth and surface.

It is to be noted that advantageously, more modulations

in the grey gradation are obtained, increasing, however the difficulties and the risks of the Rembrandt system.

This system is used by certain British and American firms which in order to obtain good graphical results accept the greater costs due to use of greater amounts of photomechanical materials, to the longer working times and to the need of specialized labor.

As aforesaid, the use of the contact screen in the Mertens and Dultgen printing systems, although eliminating most of the drawbacks of the conventional systems (Rembrandt) does not afford entirely satisfactory results under the technical standpoint (Mertens) and requires too high costs (Dultgen).

The conventional type contact screen used in these systems has the features as follows:

the geometrical shape of the point is the square form;
the line/point ratio is equal on all sides;
the photographic contrast is equal on all sides.

In said screen the transparence of the single squares decreases from the center toward the sides, with the consequence that in the central zone the transparence is complete, while in the lines the squares are opaque.

When such a screen is placed between a continuous hue negative and a photosensitive film and exposed to a light source, it occurs that a light amount dosed by the half tones of the negative passes integrally only in register with the center, decreasing progressively toward the edges of the screen, without passing through the lines, reproducing on the positive as many squares having an equal intensity but a different size.

The image obtained by such a system affords few passages in the grey gradation; in fact with reference to the screens used at present, if the grating technique adopted is that providing the obtainment of as many passages as possible in the grey gradation, the differences of surfaces between one square and the other are so little that when the printing operation is carried out, the squares will group three by three with entirely unsatisfactory results (confused images). If on the contrary the adopted technique is that of establishing a great difference between one passage and the other, the number of passages will decrease, and the obtained images will be flat and granular.

Therefore, the purpose of the present invention is that of providing a contact screen in a direct rotogravure printing (autotypic system) which will remove most of the drawbacks of the conventional systems allowing a work with remarkably reduced costs. The main advantage of the screen according to this invention is that of allowing the embodiment of prints with a number of passages of the half tones greater than that which can be obtained by the conventional systems; twelve passages on the grey gradation with respect to the standard Kodak scale.

Another advantage of the screen according to the present invention resides in the obtainment of an improved amount of contrast and softness, being furthermore the double tones obtained in a simplified way with respect to the Dultgen system (superposition of two hardly embodied photographic positives).

A further advantage consists in that by adopting a screened positive directly transferred on emulsified copper with no intermediate passage on the pigment paper, all difficulties of the conventional Rembrandt system will be overcome, and particularly the engraving will be carried out in a single iron perchloride bath without need of exceptional technical qualities for the operators.

Moreover, it is to be noted that the direct transfer to the copper, of the screened positive eliminates a photographic step, allowing a remarkable improvement of the detail. Accordingly the times and costs of working will be remarkably decreased due to most simple operations and to a minor consumption of photomechanical materials and products.

The etching occurs at constant depth (25–30 microns)

and therefore the differences of etching produced by the different molecular structures of the copper of the single plates or by a different pH of the iron perchloride bath will have no effect on the print: in fact the depth differences of the cells in the plate due to the aforesaid causes (variability of the molecular structure and/or of the pH of the etching bath) will not be greater than two or three microns, remaining thus far minor than the depth of the engraving (25–30 microns). The "covering power" of the single cell will remain always constant.

A further advantage of this invention consists in that the copper emulsifying will be effected by a synthetic photosensitive gelatin having a composition technologically suitable to afford results constant through the time.

It has also been found, according to this invention, that the use of the same screen, as above described, in the direct or indirect lithographic printing offset system either in black and white or in colors, allows the obtainment of results remarkably improved as to their cleanliness of image and yield of colors, in comparison with those obtainable by the conventional offset systems.

As it is known from the prior art, in the offset printing, in order to obtain grated transparencies use is made of several types of contact screens, among which the conventional chessboard screens, the elliptical point screen, the Respi screen or the double point screen are the most commonly used screens.

The use of these screens allowed the obtainment of good grated positives. However, it is to be noted that said screens do not ensure, in the final result, a satisfactory yield, being remarkable in several cases the deflections from the original (low fidelity), and particularly the loss of shape of the blacks, the low cleanliness of the last passages, the kneading and the consequent flattening of the hard tones, etc.

In the offset printing remain therefore, remarkable difficulties due to the presence of the cited drawbacks. Particularly it is to be noted that, in order to obtain, by the offset system, a printed image in half tone, in one or more colors, maintaining to a sufficient extent all the brightness of the natural images characteristic of the naked eye vision, it is necessary that the screened transparency will show the maximum number of passages from the first blacks up to the most tenuous final tone. It is also indispensable that each passage will be clearly scanned particularly in the harder tones.

The screens used today and of which a specific mention of which has been made in the preceding disclosure, cannot ensure the scanning of passages in the strong tones. Particularly, although a difference of size between the point of the maximum black and the immediately subsequent passages exists, this difference does not appear in the printing. In fact the slight swelling of the point due to the water bath and by the crushing by the pressure determines the closure of the points in the first passage of the strong tones, eliminating each difference between the inking surfaces in correspondence to the maximum black. There derives the known drawback of the "kneading" of the dark masses.

It is also to be noted that, generally speaking, the conventional offset screens of the contact type, have a 1/1 ratio. On the screen therefore, the surface which prints and covers is equal to that of the transparent white part. Therefore, in order to obtain a greater covering power to the dark masses of the screened positive, it is necessary to use negatives showing a strong contrast; the mass of light which then enters in the higher tones is capable of increasing the point until causing the almost total closure. Even if said result can be easily reached, it is to be remarked that the size of the point in the half tones will be altered with an excessive consequent darkening of the half tone itself. Otherwise it is also to be noted that it is practically impossible to obtain a grated positive showing a good fidelity to the original when one starts from a too contrasted negative.

In order to obtain an acceptable final result, the operator must treat the grated positive manually, using a brush, or potassium ferricyanide, or he must use other contrivances, until re-establishing with the naked eye the ratios and the size of the points. The obtained results do not have, of course, the necessary precision being obtained exclusively by the visual evaluation of the operator.

The present invention is directed to the use of a contact screen in a direct or indirect offset printing system, removing most of the drawbacks which would be otherwise unavoidable when the common contact screens, at present existing on the market will be used.

The main advantage of the screen according to this invention is that of allowing the embodiment of prints with a number of passages in the half tones greater than that which is obtained by the conventional means; twelve passages in the grey gradation with respect to the standard Kodak scale.

Another advantage of the screen according to this invention resides in obtaining a better degree of contrast or softness, its use allowing the double tone to be obtained, and this result has never been obtained by the conventional direct or indirect offset printing system. In fact in order to obtain contrasted images in the strong tones and in the high lights, and soft and detailed in the medium tones, the commonly adopted practice in the direct or indirect offset printing is that of printing twice in superposition the image: one time with a highly soft positive, and subsequently with a skeleton zone positive which serves for reinforcing and detailing the dark masses. The screen according to the present invention allows on the contrary the embodiment of the double tone during the printing stage, by the adoption of a single grated positive, a single transfer and therefore a single passage operation in the print.

Another very important advantage of the screen according to this invention consists in that the same grated positive can be indifferently used with an equal success either by the direct or indirect offset printing system, or by the rotogravure printing system, and this result never has been attained, starting from a single grated positive.

A further advantage of the screen according to this invention is the fact that, considered the rectangular structure of its grating, the phenomenon called "moiré" is almost entirely removed; in fact it has been found that with prints obtained with erroneous inclinations, have given nevertheless, optimum results.

The specific object of this invention is a contact screen for direct rotogravure printing and direct or indirect offset printing of any sizes, shapes and colors, either positive or negative, with rectangular grating, characterized in that each rectangular element is defined by two stripes at different spacing, with values of the ratio between the opaque and transparent part (line/point ratio) preestablished and different on the short side and on the long side of said rectangular element, respectively, being the contrast degree of photographic contrast (hue) of the internal nuances in each single rectangle, strong in said short side and weak in said long side.

It has been found in fact, according to the present invention, that the choice of a rectangular grating allows in the rotogravure autotypic printing and in the direct or indirect offset printing exceptional results which cannot be obtained by the conventional screen the internal grating of which has square elements.

In fact, it would be practically possible to photographically divide into more parts sufficiently spaced from one another, a very large square screen, however with the result that in the final effect the grating would be visible by the naked eye.

If on the contrary a rectangular grating, we shall have at our disposal a long side allowing the subdivision in sufficiently spaced parts, while the short side, by rendering closer the lines, will render the grating thicker, so that the grating will not be visible by the naked eye.

Therefore, by the technical solution as aforesaid (rectangular grating) the fusion of the passages in the intermediate tones will be eliminated, as the soft nuance being placed on the longest side will be well divisable.

Furthermore, the strong contrast of the nuance on the short side allows a net scission of the high contrasts black, half-tone, white and which, added to the thinner of the passages of the half tone determined on the long side, enhances the passages and prevents the fusion thereof.

The differences of ratio of the stripes, allow the stripe on the long side to support with no drawback (rotogravure) a strong etching of the iron perchloride even in the case of very prolonged engraving, or (offset), the increase due to the water bath and to the printing pressure.

When the screen according to this invention will be used, in the plate, in case of rotogravure printing, a parallelepiped shape etching will be obtained, having a different surface structure and equal depth. In the case of direct or indirect offset printing, the use of the screen according to this invention determines in the plate an etching having a parallelepiped shape having a different surface structure. In both cases (rotogravure and offset) the differences determine in the printing stage, a strong inking in the first strong tones; the rectangle is complete and the stripes very thin. In the immediately subsequent passage, the rectangle will be submitted to a dimensional decrease greater on the long side and minor on the short side to which corresponds a far minor volume with respect to that of the first tones.

In the intermediate half hue, the passages are softly gradated with numberless variations on both the long and the short side: the differences on the short side prevent the fusion and the final points will be very fine and largely spaced from one another. In the last passages the printing effect is tenuous, almost white, resulting the passage to the absolute white, gradual with non discontinuance phenomenon.

The present invention will be now described with particular references to the attached drawing showing only by way of non limiting example, one preferred embodiment of the invention.

In the drawing, one part of the screen according to this invention has been shown in enlarged scale, including four rectangular shaped elements and the stripes defining them.

With particular reference to said drawing, *a* and *b* are the stripes or lines along the long and short, respectively, sides of the rectangles. The degrees of different nuance existing in each single rectangle (point) of the grating of the screen along the directions perpendicular to one another of the sides, are diagrammatically denoted by subdivision stripes or lines differently spaced apart from each other. It will be noted that starting from the edges, and proceeding towards the center the subdivisions will be thicker in the longitudinal direction and more scattered in transverse direction, allowing this different subdivision a photographic contrast which is soft on the long side and strong on the short side.

Finally, the line point ratio (opaque part/transparent part ratio) is different on the two sides, with a value of 1/3.5 on the short side and 1/2.5 on the long side, allowing the embodiment of stripes having a sufficient spacing to resist (rotogravure) the etching treatments even in case of very extended engravings, and (offset) to the cited swelling phenomena.

The present invention has been described with particular reference to one specific embodiment thereof, being however understood that executive variations could be practically adopted without departing from the scope of the present industrial privilege.

Having thus described the present invention, what is claimed is:

1. A contact screen for rotogravure direct printing

and offset printing both negative and positive having a plurality of points separated from one another by lines and each point has zones having density gradation therein varying progressively and differently in adjacent zones from between the center of said point and a side thereof; said lines separating the points having at adjacent sides of a point different widths; and the number of said lines in one centimeter at one side of the points is different from that at the adjacent side of the points.

2. A contact screen as claimed in claim 1, wherein said points have a rectangular shape with a short side and a long side; and each point has four triangular shaped zones, said density gradation varying from the side of a point to the center of said point in the identical way in symmetrically opposite triangular zones.

3. A contact screen as claimed in claim 2, wherein the lines separating the points from one another have a width at the short side of each rectangular point which is greater than that at the long side of each rectangular point.

4. A contact screen as claimed in claim 3, wherein the width of the line at the short side of each point has a ratio to the length of the long side of each rectangular point of 1:3.5 and the width of the line at the long side of each point has a ratio to the length of the short side of each point of 1:2.5.

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