

Oct. 6, 1959

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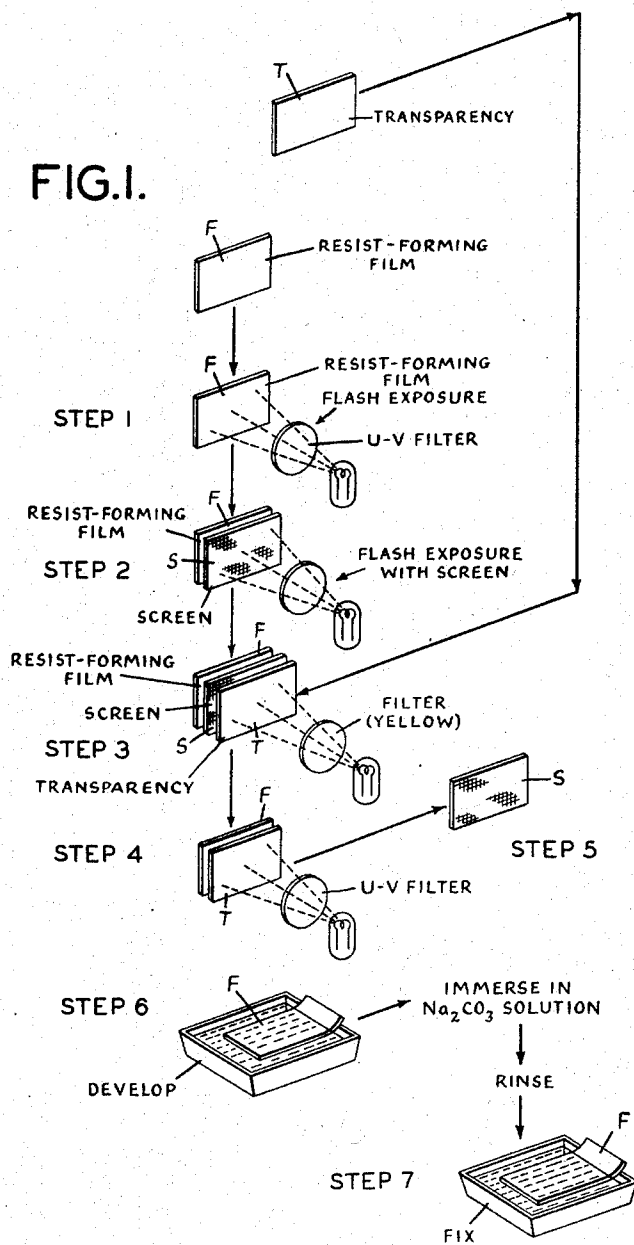
2,907,657

PROCESS FOR MAKING PRINTING MEDIA WITH RESIST-TYPE
ORTHOCHROMATIC FILM MATERIAL

Original Filed Aug. 6, 1953

3 Sheets-Sheet 1

FIG. I.



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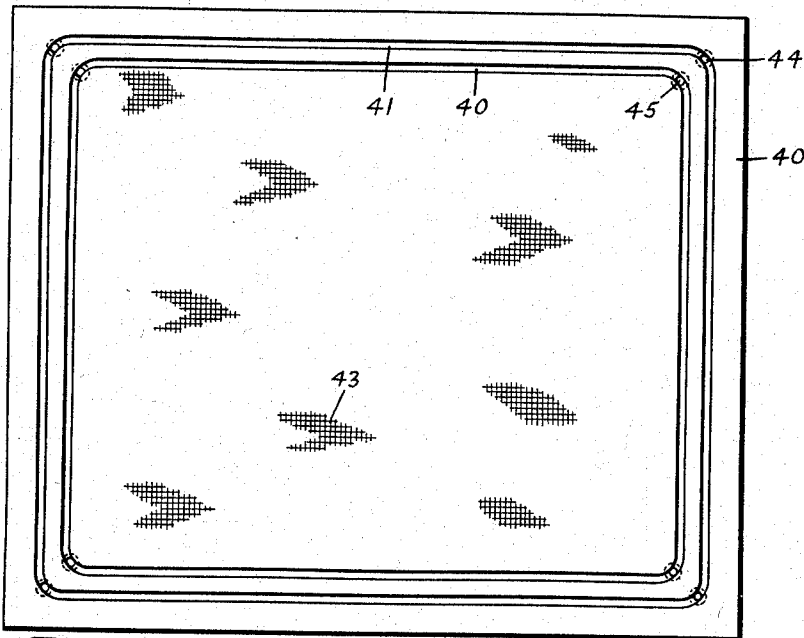


FIG. 2.

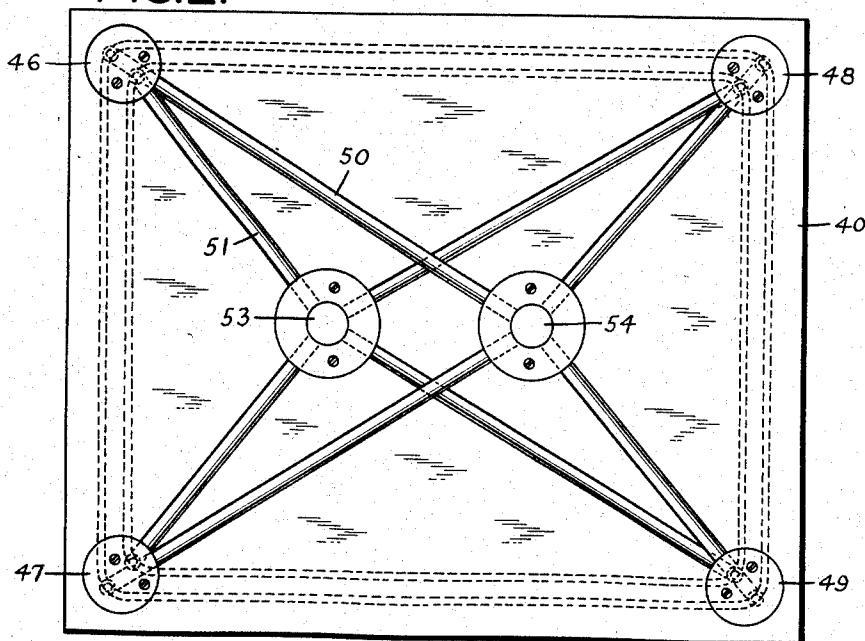


FIG. 3.

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FIG. 5.

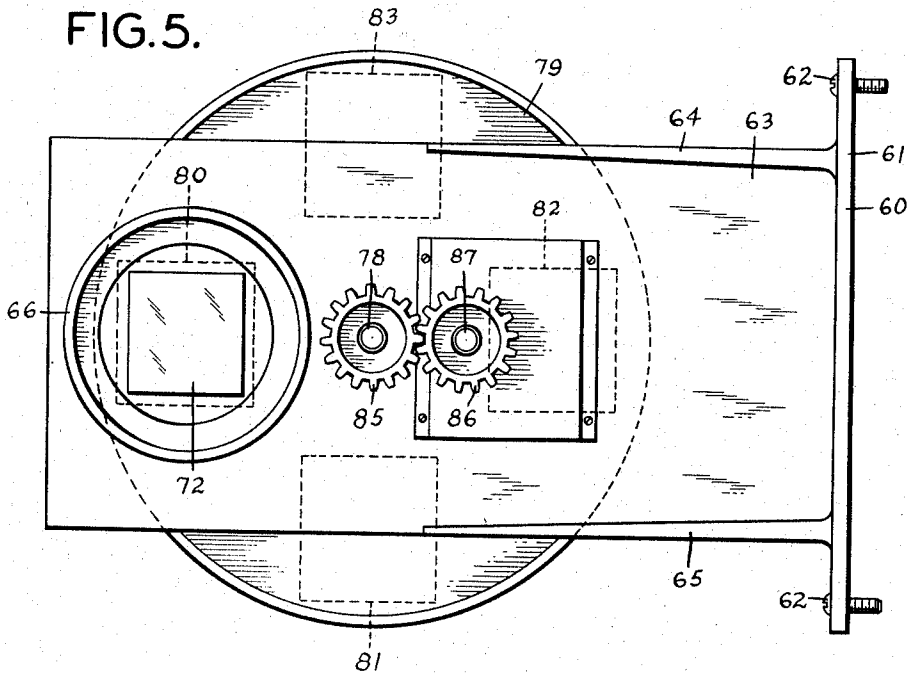
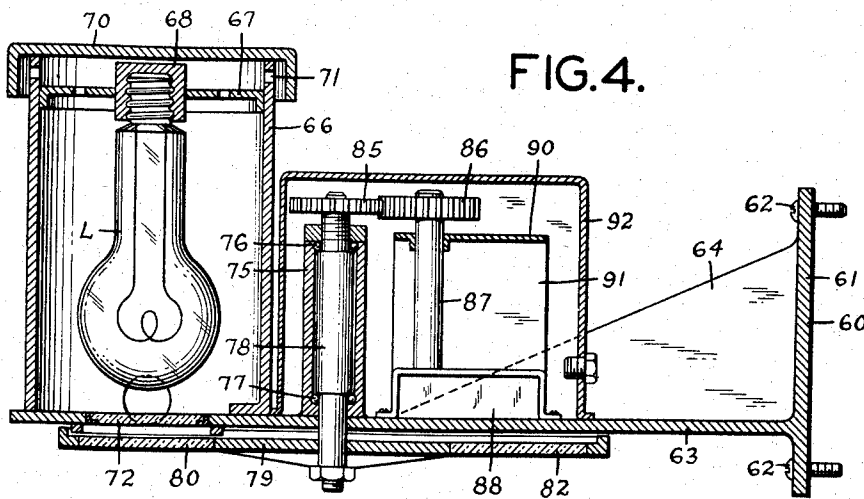


FIG. 4.



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PROCESS FOR MAKING PRINTING MEDIA WITH RESIST-TYPE ORTHOCHROMATIC FILM MATERIAL

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Application April 28, 1955, Serial No. 504,557

3 Claims. (Cl. 96—38)

This invention relates to processes for making printing media with resist-type orthochromatic film material and it relates particularly to an improvement over the method disclosed in the Hermann Kott U.S. Patent No. 2,628,903, dated February 17, 1953, and to novel apparatus for practicing the method.

This is a division of Kott U.S. application Serial No. 372,719, dated August 6, 1953, now abandoned.

As explained in U.S. Patent No. 2,628,903 a new type of resist-forming material is now available which has marked superiority in many ways over conventional carbon tissue. The new resist-forming material is a stripping film having a light sensitive silver halide emulsion mounted on a stripping membrane which is in turn supported by an acetate film base. The film has a fine grain orthochromatic emulsion which has a color sensitivity principally in the blue-green range. The film material is much more light sensitive than carbon tissue so that it can be properly exposed by means of an incandescent lamp in a few seconds.

As explained in U.S. Patent No. 2,628,903, the contrast of the resist-forming film can be varied by changing the spectral composition of the exposing light so that the film which normally is of relatively high contrast can be used in producing printing media of true tonal values.

The present invention involves improvements in the treatment of the resist-forming film during exposure in order to obtain better control of the tonal range of the subject matter and to improve generally the printing qualities of printing medium made by etching a printed surface through the resulting resist.

For a better understanding of the invention, reference may be had to the accompanying drawing in which:

Fig. 1 is a schematic flow sheet illustrating the steps involved in the preparation of a printing surface on a printing cylinder or the like in accordance with the present method;

Fig. 2 is a plan view of a vacuum frame for use in the treatment of the resist-forming material;

Fig. 3 is a bottom plan view illustrating the vacuum connections for the printing frame;

Fig. 4 is a view in side elevation of the mechanism for exposing the resist-forming material to varicolored lights of varying intensity; and

Fig. 5 is a plan view of the device shown in Fig. 4.

In practicing the invention, photographic negatives may be produced in the usual way. For multicolor work, the negatives may be normal separation negatives of the continuous tone type. For monochromatic work, a simple continuous tone negative is prepared.

Positives of closely controlled density are made from these negatives. The positives preferably are exposed and developed to have a minimum high light density of about .4 and a maximum shadow density of about 1.6. The gamma of the positives should be as close to .8 as possible. The optimum range for monotone reproduction is about 1.2 with a .4 minimum density and a 1.6 maximum density.

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For four color work, the optimum density range is about 1.0 with a density ranging from about .5 to 1.5.

Both the negatives and the positives can be retouched in the usual way to correct for variations in tonal range and the like.

The positives are used in the production of the resist and in order to afford proper register it is necessary to use either a lug or scribe system. When dealing with four colors, each positive must be related to a standard and must be suitably lugged for register with the master plate in accordance with conventional practice.

The resist-forming film must also be punched to receive the lugs so that the resist made therefrom can be properly registered on the printing cylinder. The apertures in the film fit the lugs on the lay-down machine to assure the tissues being positioned on the cylinder in accurate relation.

The critical factor in the production of a suitable resist is the manner in which the resist-forming film is exposed. In accordance with the new method, the resist-film is subjected to four different exposures involving different light intensities of two different colors in order to produce the proper range of contrast and tones in the resist and the printing surface of the printing medium.

The procedure involved will be explained with reference to the flow sheet shown in Fig. 1 of the drawings.

It has been found that it is advisable to first flash the resist-forming film F to reduce the contrast of the emulsion of the film as indicated in step 1 of the drawing.

The flash exposure also gives a more uniform etching result between color pages on the same cylinder. The flash exposure is made with ultra-violet light (Corning filter No. 5840) for six seconds with a 250 watt enlarging frosted bulb. A #213 General Electric enlarger bulb is suitable.

After the tissue has been flashed as described above, a half-tone screen S, such as an Eastman Magenta or Eastman Orange contact screen is placed over the resist-film F and the whole assembly is held together in a vacuum printing frame of conventional type or of a type described hereinafter. The assembly may then be given another flash exposure with yellow light of short duration which is sufficient to assure that the corners of the half-tone screen formulation just touch in the finished resist as shown in step 2.

Following the flash exposures, a continuous tone positive T is placed on top of the screen, emulsion side down and another exposure is made through the positive and the screen as shown in step 3. The screen exposure is made with a yellow Corning filter No. 3385 for a period of about 20 seconds with a 250 watt lamp of the type described above. The exposure should be such that it is carried to a point where the high light openings in the film F are just beginning to close up. After the screen exposure is completed, the positive and the screen are removed but the resist-forming film remains on the vacuum printing plate or frame. The positive is then returned into register with the resist-forming film and a tone exposure is made utilizing ultra-violet light for a period of 30 seconds as in step 4. The exposure should be relatively short so that its action is on the low density end of the density exposure curve of the film thereby producing a low contrast continuous tone image. A Corning filter No. 5840 and a 250 watt enlarging lamp of the type described is used in this exposure. The film is now ready for development.

Compensation can be made during the exposing of the resist-film for positives having a density range which is set too low or too high on the scale of densities. For example, if the positive has a range from about .2 to about 1.4, the exposure of the resist-forming film to the positive and the screen can be decreased for about five

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seconds for each point of change desired. Thus a decrease of 10 seconds in the exposure of the resist-forming film to the screen and the positive described above will bring the film to the proper tonal range. If the positive is too high in the tone or range, for example from .6 to 1.8, the range of the resist can be decreased by increasing the screen and positive exposure about 5 seconds for each 0.1 point of change desired, in this case, also an increase of about 10 seconds.

The resist-forming film is developed in step 5 with a hardening developer followed by treatment with a solution of sodium carbonate in step 6. Any suitable hardening developer can be used such as, for example, a pyro developer of the kind disclosed in U.S. Patent No. 2,628,903 or pyro-hydroquinone-metol-sulfide-bromide developers dissolved in water and containing a suitable wetting agent. A typical developer of the type referred to may consist of:

Metol	6 oz. 298 grains
Pot. metabisulfite	33 oz. 329 grains
Sodium sulfite	60 oz.
Hydroquinone	13 oz. 19 grains
Pyrogalic	40 oz.
Pot. bromide	10 oz.
Eumercine concentrate	10 cc.
Water to make fifty gallons.	

When using the new developer, the development is carried on for about two minutes, after which the film is drained for 10 seconds then immersed in a 10% solution of sodium carbonate for about two minutes, then rinsed in water and fixed in a solution of hypo with boric acid as indicated in step 7. The film is fixed for about three minutes and is then washed for about 15 minutes and dried. Variations in the developing procedure may be necessary when utilizing different developers but the preceding developing and fixing operations are found to be satisfactory and produce uniform results. The dried, exposed resist-film at this stage is insensitive to light and may be laid on a cylinder C or plate under high intensity illumination. Moreover, the exposed resist-film may be held in storage or may be shipped long distances without deterioration because of its durability and light insensitivity.

The resist-film is laid down on a cylinder C or plate in exactly the same way as conventional carbon tissue. The cylinder is wetted and the film is rolled onto the cylinder. It is advisable in using a squeegee roller to release the roll immediately so that it does not come in contact with the back of the laid film. The resist-film has a gelatin coating on the base, and when wet the coating will adhere to the lay-down roller and may cause detachment of the resist. When a resist has been laid on the plate or roller, the acetate film base can be removed by lifting a top corner and peeling it downwardly. The membrane now covering the emulsion is impermeable to water and may be rolled over without damage.

After the resists have been laid on the cylinder C, the membrane on the back of the emulsion can be removed in any of several different ways. For example, a solvent containing one-third ethylene glycolmonoethyl ether (Cellosolve), one-third acetone and one-third alcohol and a small percentage of water is poured over the tissue while revolving the cylinder or moving the plate at a moderate rate of speed. The solvent should thoroughly wet the membrane. After the membrane has been allowed to soak for at least two minutes a soft rubber squeegee is run along the cylinder to strip off the membrane. It may be necessary to repeat the soaking and squeegeeing operations to remove all of the membrane.

The resist is developed on the cylinder to remove the soluble parts thereof which have not been hardened by light by revolving the cylinder in water maintained at a temperature of about 120° F. for about 10 minutes. The resist is then wiped using cotton soaked in water which

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will remove the soluble parts of the resist. The cylinder is then cooled by revolving it in cold water until all parts of the cylinder are at the same temperature (room temperature).

The resist may be dried by applying alcohol while revolving the cylinder slowly. One application of a 65% alcohol-35% water solution followed by an application of undiluted alcohol is usually enough to insure uniform drying. If the procedure outlined above has been followed properly all of the exposures have been adjusted to control the etching procedure and the cylinder will now etch properly under standardized conditions of time and concentration of the etching agent. The etching agent is fresh iron perchloride. The following times and concentrations are recommended for the etching operation:

- (1) Open etch for one to one and one-half minutes at 44° Baumé density;
- (2) Etch three minutes at 44° Baumé;
- (3) Etch four minutes at 42° Baumé;
- (4) Close with 10 minutes etching with a 40° Baumé solution of the etching agent.

After the cylinder or plate has been etched, the resist-film may be removed from the cylinder or plate with diluted glacial acetic acid.

The resulting plates have been found to give uniform printing results including excellent color rendition when used in multicolor work. The exposure and etching operations are closely related and are essentially standard for practically all conditions. Control starts with the density of the original positive transparencies and the operations thereafter involve controlled exposures to lights and different colors, and a controlled etching which assures the reproduction of faithful tonal values throughout.

The preparation of the resist can be facilitated with newly developed equipment which is described herein-after. Inasmuch as the resist-forming film is on a film base and is relatively durable, very substantial changes can be made in the printing frame for holding the resist-forming film and screen. As shown, in Fig. 2 of the drawings, the printing frame may consist essentially of a plate 40 formed of aluminum, or other metal or strong plastic which has a pair of parallel grooves 41 and 42 cut in its surface and spaced apart a short distance. The grooves extend completely around the plate, within its margins. The surface within the area bounded by the groove 42 preferably is etched shallowly with a fine screen pattern 43 to facilitate the movement of air between the surface and the resist-forming material supported on it. Holes 44 and 45 are drilled through the plate at the corners of the grooves 41 and 42 to enable the grooves to be evacuated by means of a vacuum pump (not shown). As shown in Fig. 3, the back of the plate has cover plates 46, 47, 48 and 49 secured thereto covering the back ends of holes 44 and 45. The cover plates 46 and 49 are drilled and connected by means of conduits 50 and 51 to conventional vacuum or check valves 53 and 54 which are connected to a vacuum pump so that upon operation of the pump, air will be drawn through the valves 53, 54 and through the conduits and the holes 44 and 45 and the grooves.

When the sheet of resist-forming film is laid on the plate 40 and the vacuum pump is started, the film will be drawn down tightly against the plate by evacuation of the air between the film and the plate 40 through the groove 42. The etched pattern 43 of the plate, allows air to escape therefrom so that the resist-film is held flush against the surface of the plate.

When the contact or other half-tone screen is laid over the film, the edges of the screen overlie the groove 41. The vacuum will also draw the screen down tightly against the film so that intimate contact is obtained between them. Inasmuch as the device does not include the usual glass cover plate and vacuum blanket, the air is exhausted more quickly and the formulation of "Newton rings" and dust marks is avoided. The positive

transparency is laid on top of the screen during one state of the printing operation as described above to produce the screen print, and replaces the screen in the later operation. The transparency rests against the screen or the resist-forming film depending upon the presence or absence of the screen. Inasmuch as the screen and/or resist are held flat on the plate, intimate contact between them and the transparency without the need for a cover glass or pressure on the transparency results.

The printing frame can be used equally well in other printing operations, for example, when exposing the resist-forming film or other film to screened and continuous-tone positives.

The exposure of the resist-forming material can be facilitated by means of a suitable mechanism for supplying light of the proper intensity and color for the desired periods of time. As shown in Figs. 4 and 5, I have provided a mechanism by means of which light of suitable intensity and color can be directed on the resist-forming material to provide open and screened flash exposures of the resist-forming material, and the exposure of the film through the screen and continuous tone transparency combination and through the continuous tone transparency, alone.

The lighting apparatus includes a bracket 60 to be supported on a wall or standard on the back of a table which carries the printing frame 40. The bracket has a base plate 61 provided with screw holes 62 to anchor it to the support and a substantially horizontal arm 63 which is suitably braced by means of webs 64 and 65 at its opposite edges. The arm 63 carries at its outer end a lamp housing 66 of cylindrical or other suitable shape having a spider 67 therein to support a socket 68 for receiving the lamp bulb L. The top of the lamp housing is provided with a removable cover 70 and has a suitable ventilating and light trapping labyrinth 71 therebetween. In alignment with the lamp housing 66 and in the arm 63 is an opening to receive a pane of opal glass 72 or other light diffusing medium. Light is transmitted through the opal glass 72 and the filters to be described hereinafter.

Between the ends of the arm 63 and inwardly of the lamp housing, is a tubular sleeve 75 to receive a pair of bearings 76 and 77 which support a shaft 78. The lower end of the shaft 78 carries a disc-like plate 79 which serves as a support for the several filters used in flashing and exposing the resist-forming material. As best shown in Fig. 5, the filters 80, 81, 82 and 83 are mounted in apertures equiangularly spaced around the disc 79 so that they can be brought successively into alignment with the opal glass 72 and the lamp housing 66. If desired, the filter holder disc 70 can be rotated manually step by step to bring the filters beneath the glass 72 to light transmitted. Also, if desired, a conventional manually set timing mechanism can be provided for controlling the exposure with the lamp by connecting the timing mechanism in the electrical circuit to the lamp.

On the other hand, in order to facilitate the making of the exposure, it may be desirable to rotate the filter and disc 79 electrically to permit shifting of the filters more expeditiously. To that end, the shaft 78 may carry at its upper end a gear 85 which meshes with gear 86 on the upper end of a drive shaft 87 which is actuated by means of a small electric motor 88 supported on the arm 63. The upper end of the shaft 87 is journaled in a flange 90 on an upwardly extending plate 91 secured to the base plate. The drive assembly may be mounted in and covered by a housing or casing 92 carried on the upper side of the arm 63.

It will be understood that the operation of the lighting device described above may be controlled by an electric timing mechanism of suitable type. For example, a commutator type of switch driven by a timing mechanism may be provided to cause, in sequence, flash exposures through the filters 80 and 81 for the open and screen flashes of

the resist-forming material and successive timed exposures through the filters 82 and 83 with the screen and transparency combinations and the transparency, alone. Timing mechanisms of the type referred to are well known in the art and are believed to require no description herein.

On the other hand, if desired, separate individually adjustable timing mechanisms may be provided for controlling the stepping of the filter disc and exposure of the light through the several filters. Either system assures automatic operation of the lamp, and rotation of the filter disc to position the filters successfully between the lamp and the resist-forming material.

The above-described method and apparatus has been found to produce resists of exceptionally good quality and especially of subject matter to be reproduced in colors. The ink pockets produced by the operation are exceptionally uniform in corresponding tones, that is, although the ink pockets vary in size and in depth for different tones or intensities, the size and depth of the pockets is very uniform for any given tone or intensity. As a result, the color work produced with such plates compares favorably with that produced by the most carefully controlled and regulated processes and yet the plates are produced with almost a routine exposure and etching of the printing surface.

It will be understood that the process and apparatus described above are susceptible to some variation and therefore the forms of the invention described herein should be considered as illustrative and not as limiting the scope of the following claims.

I claim:

1. A method of preparing a resist for intaglio type printing plates, cylinders and the like, comprising subjecting a high contrast, silver chloro-bromide resist-forming emulsion to a direct flash exposure with light high in ultra-violet radiation and a flash exposure with yellow light through a half-tone screen, then exposing said emulsion to light rays from a predominantly yellow light source through a black and white continuous tone transparency of a subject and a half-tone screen having opaque and transparent areas for a time sufficient to produce a screened image in said emulsion which, when developed, has a high contrast, the exposure being stopped just short of the point where the high-light openings close up, exposing the emulsion to light rays from a light source high in ultra-violet radiation through a continuous tone transparency of said subject, without said screen, for a sufficient period of time to produce a continuous tone image in such emulsion, which when developed, has low contrast and is in register with said screened image in such emulsion, said exposure with said ultra-violet source through said transparency being very small as compared with the yellow light exposure so that its action is on the low end of the density exposure curve of the resist-forming emulsion, the yellow light exposure through the transparency with said screen and the ultra-violet light exposure through the transparency without said screen being in any order, developing said emulsion and fixing the emulsion.

2. A method set forth in claim 1 comprising the steps of transferring the fixed emulsion to an etchable printing surface, developing the emulsion to remove relatively unexposed and unhardened portions thereof, and etching the printing surface through said emulsion.

3. The method set forth in claim 1 in which the transparency has a tonal range of densities between about 0.4 and 1.6.

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