

# UNITED STATES PATENT OFFICE.

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## PHOTOGRAPHIC-PRINTING PROCESS.

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*To all whom it may concern:*

Be it known that I, JOHN EDWARD THORNTON, a British subject, residing at West Hampstead, London, England, have invented certain new and useful Improvements in and Relating to Photographic-Printing Processes, of which the following is a specification.

This invention relates to the production of kinematograph films.

The object of the invention is to prepare a printing belt or belts by which transparent kinematograph films of continuous indefinite length can be produced by mechanical printing of the pictures thereon with applied inks or colours as distinct from printing photographically with sensitive chemical media acted upon by light, and as distinct from applying colour to a photographically printed series of pictures.

The original picture film of continuous indefinite length is photographed in the ordinary way and from this the one or more printing belts are prepared by any of the processes known in photo mechanical printing such as photo-aquatint, mezzotint, mezzotype, collotype or processes analogous to photo lithography by which a plain or level printing surface is obtained on a material having an affinity for a greasy printing ink interspersed with portions having an affinity to a liquid such as water or glycerine or other suitable moisture repellant to greasy ink.

Photo-mechanical printing is defined as follows:—The actual operation of printing requires neither the use of a sensitive surface nor the action of light, nor subsequent development. Instead of such methods printing is effected by mechanical pressure of the film against a plate (in the form of a continuous belt) which has been prepared with a series of images by one of the photo-mechanical processes.

The medium used to form the image is therefore a printing or applied ink or colour instead of a sensitive salt. Various kinds of inks or colours can be used according to the particular type of engraved or other printing plate (herein termed "printing belt") used.

I prepare a strip or band of copper, steel, brass, aluminum or other metal, or a strip of gelatine, the gelatine being on a support-

ing base, or a strip of celluloid with a coating of gelatine or other colloid, prepared with a sensitive surface in any of the methods well known for photo-mechanical printing to receive an impression of the original picture film.

The prepared strip which is to form the printing belt is perforated or notched along its margins or centre to correspond precisely with the perforations or notches in the camera film and in the transparent kinematograph film of indefinite length.

Upon the prepared strip I produce a mechanical printing surface (hereinafter referred to as a printing belt) comprising a surface divided into a number of broken tone margins of fine lines, dots, or other markings, having an affinity for greasy printing ink and interspersed with spaces having an affinity for moisture, which when moistened will repel the greasy printing ink.

The gradations of light and shades are produced by varying the relative sizes or areas of the two parts of the printing surface.

In preparing printing belts from the original picture film more particularly of the individual elemental colours two or more of such printing belts may be made from each, one lightly exposed for the dense parts and the other fully exposed for the lighter tones. By printing from one or other of these printing belts or from both in succession a high degree of tint is reached and desirable or special effects for harmonizing harshness or other defects becomes practicable. Or one of such printing belts may be used for printing say a light shade or tone of blue or a greenish blue, and another for printing a deep blue or a purple blue to give better effect to the colours in the picture. This mode of operation is regarded as of special importance in relation to originals produced by the two-colour process.

These surface processes include all the variations that come under the head of planographic processes, which depend upon the opposition of an image in fatty ink to moisture, such as collotype, photo-litho, zincography, algraphy and the like.

For collotype the image is formed by the printing belt being covered with a layer of bichromated gelatine printed by light, and

washed to remove surplus bichromate. It is then treated with glycerine or various moisture-retaining solutions which are absorbed by the soft gelatine portions of the image not affected by light and repelled by the hardened light-affected portions. When ink or colour is then applied by inking rolls, the ink adheres only to the dry parts and is repelled by the damp portions. It is then transferred to the film by pressure. Such a printing belt can be made of celluloid or metal. For photo-litho, zincography, aligraphy and the like processes a grained metal belt is used, though in certain circumstances grained celluloid may be substituted.

For the collotype process the printing belt may be either metal, celluloid or other waterproof material coated with a layer of gelatine or other colloid of a hard kind and to promote the adhesion of the gelatine the band may be corrugated grooved perforated or roughened. Or as a preferred method, the band may be stamped or cut with numerous small and closely grouped slits or perforations into which the gelatine will penetrate.

A printing belt prepared by the collotype process as above described, has advantages in relation to the subsequent printing of the kinematograph film therefrom, in that a stiff water colour or water glycerine colour may be used instead of the usual fatty or printers' ink, as described in the eleventh article of a series of articles on photo collotype in the *British Journal of Photography* for 1879; this eleventh article commencing on page 410 of the volume, and the description of the use of stiff water colour inks being on page 411.

In the preparation of printing belts when printing through the screen it is desirable that the screen should be moved slightly—relatively to the belt—either laterally or longitudinally or both after each individual picture is exposed, so that the dots or points or lines on the printing surface of the printing belt, and subsequently the dots, points or lines printed therefrom upon the kinematograph film, will not fall in the same place in the successive pictures, and so, owing to the rapidity of projection and the persistence of vision, such dots or points will not be visible on the enlargement when projected upon a sheet or screen, the picture appearing as full tone grainless picture.

*The kinematograph film.*—The strip or film upon which the pictures are to be printed from the printing belts to produce the finished kinematograph film may be of the ordinary celluloid material now employed for kinematograph films or any other transparent film material.

*Mechanical printing of kinematograph films.*—In the mechanical printing of the films from the printing belts herein de-

scribed any suitable ink or colour may be employed that is adapted to the particular form of printing belt and the surface of the film upon which the print is to be made.

To prevent or minimize adhesion of the damp gelatine the receiving surface may be coated or sprayed with animal bile, or a solution of the commercial purified "ox-gall." The printing may be done by applying the ink to the printing belts by any well known printing method such as by a roller. The printing belts with perforations along their margins in which registering pins can operate, and the film also similarly perforated, are drawn together between rollers or pressing surfaces by which contact or pressure will be applied picture by picture. Sprocket teeth or claws are fitted to draw the two through the machine in correct register.

What I claim as my invention and desire to protect by Letters Patent is:—

1. A photo-mechanical printing belt for the production of continuous indefinite lengths of kinematograph positive film pictures, provided with perforations and a series of printing clichés formed on the surface and bearing pictures arranged in succession longitudinally thereon, each cliché being capable of printing a half tone image with all the gradation of a photograph by planographic methods, the cliché consisting of a large number of fine broken-tone markings, having an affinity for greasy printing ink, and the blank spaces between having an affinity for and being charged with a moisture repellant to greasy ink, and the gradation of image being formed by making the said printing dots, lines, or mosaic of varying size and area, so that they are capable of depositing varying areas of ink and thus forming a series of printed images of full gradation by the agency of applied ink and pressure and by planographic printing methods.

2. A series of perforated photo-mechanical printing belts for producing continuous lengths of kinematograph positive films as in claim 1, for printing the main part of each image by one printing belt, and intensifying parts of each image by printing from other printing belts, the corresponding parts of each image of the series being different in ink area for each belt, and requiring the printing from all belts in succession to complete the series of images and to differentially intensify each image of the series.

3. A series of perforated photo-mechanical printing belts for producing continuous lengths of kinematograph positive films, by means of a large number of fine broken-tone markings forming printing points of varying size and area, having greasy ink attracting character with intervening spaces of water-absorbing and greasy ink resisting character, as in claim 1, the said printing

points having their incidence varied in relation to the particular part of the picture image upon every printing belt of the series, in order that the grain of the picture may be obliterated by the successive printings and thus form a series of full-tone grainless film pictures by applied ink and pressure and superimposed printings and planographic printing methods.

4. A series of perforated photo mechanical printing belts for producing continuous lengths of kinematograph positive prints in multi-colour heliochrome, by means of a large number of fine broken-tone markings forming printing points of varying size and area as in claim 1, each colour of the composite heliochrome being formed upon a separate belt, which colors are subsequently printed on to the film by superimposed planographic printing, and by applied ink and pressure, to produce complete heliochrome continuous positive films.

5. A series of perforated photo-mechanical printing belts for producing continuous lengths of kinematograph positive prints in multi-colour heliochrome, by means of a large number of fine broken-tone markings or printing points of varying size and area as in claim 4, the composite heliochrome being split into a plurality of printings of each colour and each being printed from a different belt in which the printing points have their incidence varied in relation to the same particular part of the picture image, in order that the grain of one printing may be obliterated by the second printing of the same section of the picture, with the object of producing when the remaining colours of the image series have been similarly split and applied a series of grainless full-tone heliochrome kinematograph positive film pictures, by applied ink and pressure and superimposed planographic printings.

6. A continuous planographic printing belt as in claim 1, having its printing clichés produced by relief methods, in a large number of fine broken-tone markings of varying size and area, which receive varying quantities of greasy ink according to their varying areas, and yield it to an absorbent film surface by means of applied pressure, the

incidence of the screen markings on one picture being varied in relation to the adjacent pictures on the belt.

7. A continuous planographic printing belt, as in claim 1, having its surface grooved to promote adhesion of the clichés formed on its face and prevent their tearing off during inking and printing.

8. A photo-mechanical perforated planographic printing belt, having formed thereon by photo chemical means a series of printing clichés, each composed of a large number of fine broken-tone markings forming printing points, the gradation of each image being formed by making the said printing points of varying size and area, so that they are capable of depositing varying areas of ink to form pictures in the form of a continuous series upon a continuous indefinite length of kinematograph film.

9. A continuous printing belt as in claim 1, having its printing clichés produced by planographic methods, in a series of markings of varying area, having greasy-ink attracting character with intervening spaces of water-absorbing and greasy-ink-resisting character which receive varying quantities of ink according to their varying areas, and yield it to an absorbent film surface by means of applied pressure and planographic printing methods.

10. A continuous printing belt of indefinite length with planographic clichés thereon, formed with holes in its body that are filled with gelatinous spongy filling, which is also continued on to the back and front parts of the belt, to act as a moisture feed fountain by which moisture applied to the back of the belt whilst it is moving is gradually fed through the belt to the porous portions of the clichés attached to its face, when used for printing kinematograph films by planographic processes.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

JOHN EDWARD THORNTON.

Witnesses:

J. OWDEN O'BRIEN,  
W. J. A. HORSWORTHY.