

Nov. 7, 1939.

G. WASHINGTON, JR

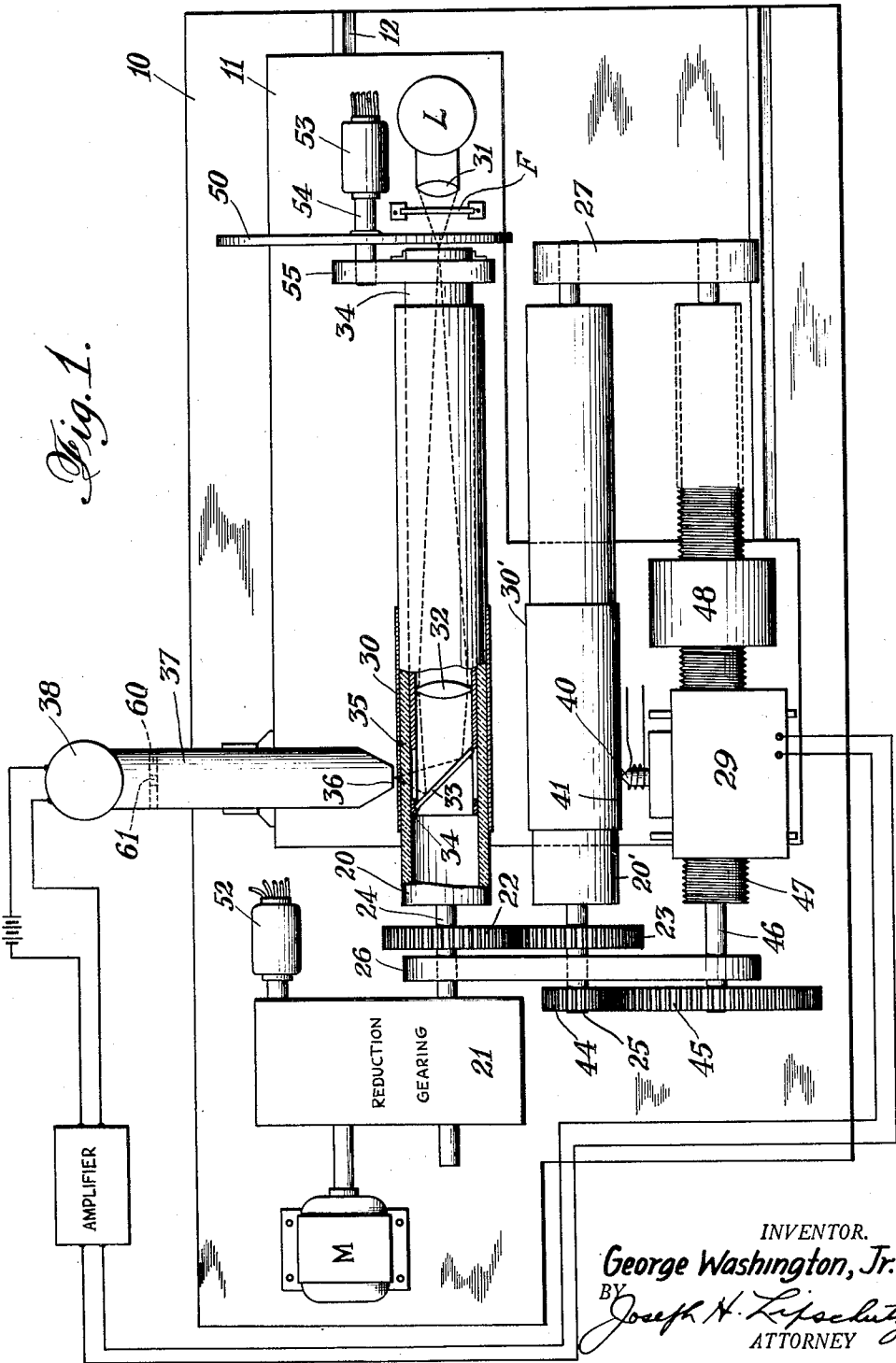
2,179,002

METHOD AND MEANS FOR REPRODUCING PICTURES

Filed March 4, 1936

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Fig. 1.



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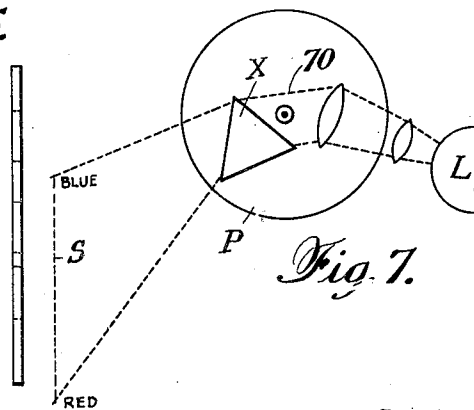
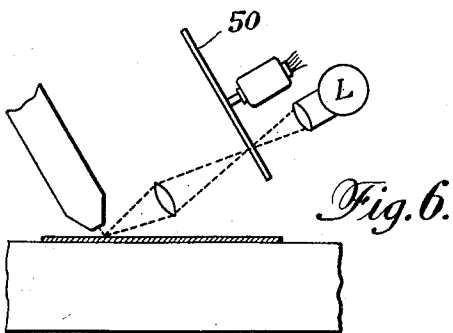
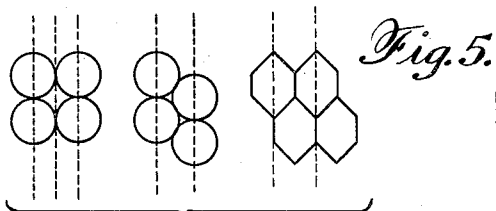
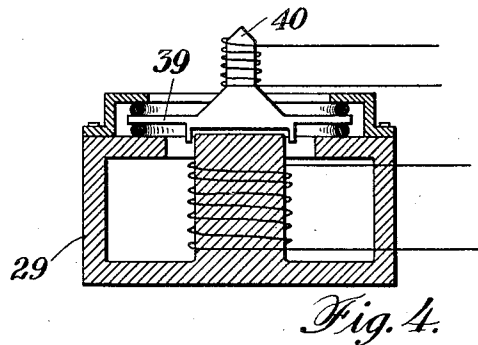
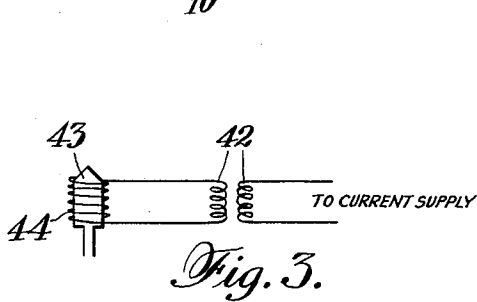
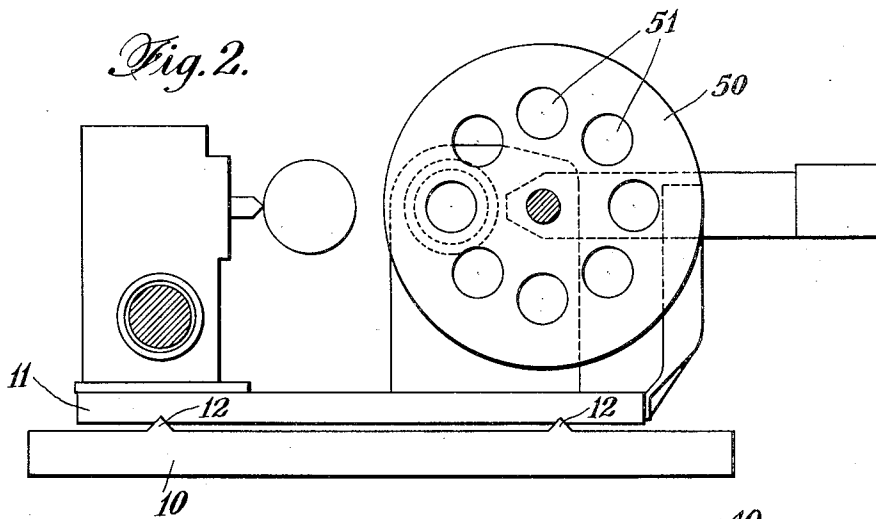
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METHOD AND MEANS FOR REPRODUCING PICTURES

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2 Sheets-Sheet 2



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2,179,002

METHOD AND MEANS FOR REPRODUCING
PICTURES

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Application March 4, 1936, Serial No. 67,123

7 Claims. (Cl. 178-13)

This invention relates to a method and machine for making reproductions, such as printing plates and mats for use in forming printing press matrices, directly from a picture, form letter, map, drawing, etc., as well as from an ordinary black and white or colored photograph or transparency.

It has heretofore been proposed to have a cutting tool cut impressions in a printing plate directly, the amount of cutting being controlled by the amount of light reflected from a picture to be reproduced. This, however, is not a practical method for the reasons that the cutting tool leaves ragged edges in the print plate and also because the tool very soon becomes dull and the dull tool compresses the material to cause buckling of the plate. Furthermore, in order that the image shall be faithfully reproduced in the print plate it is necessary to make a large number of minute cuts at high speed, on the order of 600 per second, and at this speed the print plate material becomes soft and is displaced to give unevennesses which spoil the matrix. It is a principal object of my invention, therefore, to provide an entirely new method for impressing the image on the print plate, said method consisting in destroying the material of which the print plate is composed rather than cutting or compressing the same.

It is a further object of my invention to provide a novel method for reproducing a transparency, said method consisting in passing light through the transparency.

It is a further object of my invention to form directly from a picture a mat from which a printing press matrix may be formed directly.

It is a further object of my invention to provide a novel method and means for reproducing colored pictures, whether opaque or transparent.

Further objects and advantages of this invention will become apparent in the following detailed description thereof.

In the accompanying drawings:

Fig. 1 is a plan view with parts broken away disclosing an assembly of the mechanism constituting one form of my invention.

Fig. 2 is an end view with parts removed, disclosing the principal elements of the Fig. 1 device.

Fig. 3 is a wiring diagram illustrating the method of heating the image-impressing point.

Fig. 4 is a view, partly sectioned vertically, of a dynamic unit.

Fig. 5 is a series of diagrams illustrating the theory of operation of certain of the mechanism.

Fig. 6 is a plan view showing a modified light system.

Fig. 7 is a view similar to Fig. 6 disclosing utilization of a prism for use in color reproduction.

The mechanism which is illustrated in the drawings and which constitutes one embodiment of my invention, consists primarily of two fundamental parts, namely a fixed base-plate 10 and a movable carriage 11 mounted to slide on guides or runners 12. Upon the fixed base-plate 10 there is mounted the driving mechanism consisting of a motor M which rotates two cylinders 20 and 20' in one-to-one relationship through reduction gearing such as that contained in reduction gear box 21 and driving a pair of gears 22, 23 fixed to the shafts 24, 25 upon which the cylinders 20 and 20', respectively, are mounted. The said shafts 24, 25 are journaled in bracket 26 supported on base-plate 10. The shaft 25 may be additionally supported at its opposite end in bracket 27, also fixed to the base-plate 10.

The picture, printed matter or other representation 30 is wrapped around the cylinder 20 and held thereon by any suitable clamping means (not shown), and the printing plate 30' is wrapped around cylinder 20' and fixed thereon by any suitable clamping means (not shown). There will first be described the reproduction of the picture 30 upon the print plate or matrix 30' in the case where the picture is a black and white transparency. For this purpose the cylinder 20 is a hollow transparent cylinder, preferably of glass, as shown, and a beam of light is designed to be reflected through the wall of the cylinder on to the surface of the transparency 30 so that the amount of light which passes through the transparency will vary in accordance with the opacity of that point. For this purpose, there is mounted upon the carriage 11 a source of light L provided with an optical system 31 designed to cause a beam of light to be thrown upon a condenser lens 32, which converges the beam upon a mirror 33 fixed in a sleeve 34 slidable within the hollow cylinder 20. The said sleeve 34 is provided with a cut-out portion 35 through which the reflected beam of light may pass. The optical system is such that the beam of light is focused at 36 upon the transparency 30. The amount of light passing through the transparency depends upon the opacity of the transparency at that point, and the quantity of light so determined is caused to be transmitted into a lens system 37 where by suitable optical system the light is focused upon a light-sensitive cell 38 to vary the amount of current which passes through

the cell. This current after being suitably amplified by any standard amplifier may be caused to operate a dynamic unit 28 as shown in Fig. 1 and in greater detail in Fig. 4, to cause the armature 38 thereof to be repelled to a greater or lesser extent to cause a needle or tip 40 normally lying closely adjacent to the surface of the print plate or matrix 30' to be pressed into said print plate to a greater or lesser degree depending upon the quantity of light that has passed through the corresponding point of the transparency 30. The position of point 40 may be controlled by adjusting the dynamic unit which is mounted on the carriage on guide rods 28 for movement toward or away from roller 20'. The dynamic unit may be fixed in position by any suitable clamping means (not shown).

Instead of point 40 being a cutting tool or a compressing tool, each of which is subject to the defects already noted, namely uneven edges, buckling, etc., I provide means whereby the tip 40 actually destroys the material of the print plate to a greater or lesser degree, depending upon the degree of movement of tip 40 into the print plate. Such destruction is preferably accomplished by heating the tip 40 in conjunction with the proper selection of material comprising the print plate 30' so that said material will be destroyed by heat. Thus I have provided a heating coil 41 supplied with current from any suitable source of current, as shown in Fig. 3, preferably through a transformer 42, to cause the said tip 40 to be maintained at a temperature of at least 600 or 700 degrees. The material comprising the plate 30' may be any kind that will be decomposed by heat, and for this purpose a nitro-celluloid matrix has been found satisfactory. Other means than heat may be employed, as, for instance, an acid, such as sulphuric acid, which will decompose or destroy the material upon which it acts, and, of course, other materials than nitro-celluloid, such as ethyl cellulose, benzyl cellulose, and collodion, may be utilized provided they are decomposed or destroyed by the tip 40. The essential difference from methods heretofore employed is that instead of merely removing the material, it is disintegrated by any of the methods already mentioned, that is, heat or chemical action. The point 43 of tip 40 is conical, tapering toward the print plate, so that the degree to which the said point enters the matrix will control the amount of material which is decomposed and removed. There is thus formed in the plate a hole whose magnitude is a function of the amount of light which has passed through the corresponding point of the transparency 30. The maximum actuation of tip 40 is such that the holes in adjacent rows (formed as described below) just touch (as shown in Fig. 5).

It will now be apparent that if the light from light source L can be focused at a sufficiently large number of points on the surface of transparency 30, and the cone tip 40 can be caused to remove material at corresponding points on print plate 30' in proportion to the light passing through said points on transparency 30, then there would be obtained upon the printing plate 30' a reproduction of the picture or image on the transparency 30. It will, of course, be appreciated that the greater the number of points and the closer they are located, the better will be the reproduction on the print plate 30'. For accomplishing this purpose I provide means for causing the spot of light 36 to traverse a spiral path of very fine pitch completely covering the

surface of transparency 30. Also I provide for breaking up this light image so that it will strike the transparency 30 as a succession of spots instead of in the form of a continuous beam. The spiral path of light-spot 36 is effected by causing the carriage 11 upon which the source of light L, optical system 31 and sleeve 34 with its optical systems 32 and 33 are mounted, to be moved in translation while the sleeve 34 is rotated. The translatory movement of carriage 11 upon base-plate 10 may be effected from reduction gearing 21 driving through gears 22, 23 to further reduction gearing 44, 45 to rotate shaft 46 journaled within the standards 26 and 27, to rotate a worm 47. The said worm is threaded through a bearing 48 fixed to the carriage 11 so that as the worm rotates the carriage is moved in translation. The carriage 11 thus carries sleeve 34 in a linear direction within the hollow cylinder 20. The dynamic unit and the tip 40 being supported on carriage 20 11 are moved correspondingly in translation.

At the same time that the sleeve 34 is being moved in translation, the cylinder 20 is being rotated, as hereinbefore described. Therefore the point of light 36 traverses a spiral path on the surface of transparency 30. At the same time the tip 40 moving in translation and the cylinder 20 rotating, causes the tip 40 to traverse a spiral path on the print plate 30' in synchronism with the spiral path traversed by point of light 36.

In order to break up the light striking the transparency 30 into a plurality of closely positioned points, there is provided a shutter 50, shown also in Fig. 2, having a plurality of openings 51 which are designed to be successively brought into cooperating relation with the light beam from source L. Thus, as each opening 51 moves into position in front of the light beam, light will be flashed into the tube 20 and then cut off as the said opening passes beyond said light beam. As the next opening 51 moves into position, another flash of light is passed into the hollow cylinder. The shutter 50 may be driven from the motor M through the reduction gearing 21 by any suitable means such as a selsyn system comprising a transmitter 52 and a receiver 53, the shutter 50 being fixed to the shaft 54 of receiver 53. The said shaft may be mounted in a bracket 55 which also supports the sleeve 34 at its outer end.

Preferably, the cross section of tip 40 is made of the same shape as the cross-section of the beam of light striking the photo-cell 38. This is effected by positioning a diaphragm 60 in advance of the photo-cell, said diaphragm being opaque except for an aperture 61. If said aperture is circular, the cross-section of tip 40 is circular, and if the aperture is hexagonal, then the cross-section of tip 40 is likewise hexagonal.

Preferably, the reduction gearing between motor M and cylinder 20 is different from the reduction gearing between motor M and selsyn transmitter 52 by a slight amount sufficient to cause the light-spots on transparency 30 in adjacent rows to be slightly displaced, preferably by half a diameter of a maximum light-spot, as shown in the second and third diagrams of Fig. 5 whereby it will be seen that closer positioning of the adjacent rows of light-spots may be obtained. If the shutter 50 rotated in relation to cylinder 20 such that the revolutions of shutter 50 were in one-to-one relation to cylinder 20 or an even multiple or division of the rotation of cylinder 20, then the light-spots in adjacent rows would always be side by side as shown in the first diagram

of Fig. 5, whereas, if the rotation of the shutter 50 is caused to be slightly displaced from one-to-one or from an even multiple or division of said rotation of cylinder 20, then the light-spots in adjacent rows would be displaced.

The matrix or print plate 30' thus obtained may be used directly for printing purposes. If the transparency is a positive, then the surface of the print must be used as the vehicle for the ink and the finished print will be a positive. If the transparency is a negative, then the graves become the vehicle for the ink.

While I have described the mechanism as consisting of two separate cylinders 20 and 20', one to carry the original subject and the other to carry the plate, it is obvious that I may utilize but one cylinder and mount the original and the plate side by side on said cylinder. Two separate cylinders, however, permit the reproduction of larger prints.

While I have described my invention above as applied to a transparency, it will be apparent that it is equally applicable for the making of printing plates for reproducing opaque pictures and printed subjects. Thus, in Fig. 6, it will be seen that the only change necessary to adapt my invention for use with opaque pictures is to cause the light from source L to strike on the upper surface of opaque sheet 30" from which it will be reflected into the micro-tube 37. Everything else remains the same. The light source L, the shutter 50, and the driving mechanism therefor, are all mounted on carriage 11 to be moved in translation as before, and the operation in every respect remains the same. The image reproduced on print plate 30' in this case being a positive, the ink is applied to the surface and not to the graves.

In a further modification of my invention I provide a method whereby reproduction in natural colors may be made of colored subjects, said subjects being either transparencies or opaque. I shall first illustrate this form of my invention with relation to a colored transparency. Said transparency is wrapped around the cylinder 20 and the entire process takes place as before with the following changes: For each colored transparency 30 I make a plurality of separate print plates 30'. In making the first of said print plates I interpose between the light source L and the photo-cell a colored filter F as shown in Fig. 1. This filter may, for instance, be a red filter and therefore only the red parts of the transparency 30 will be transmitted to the print plate 30'. In a screen plate colored transparency the image is formed by a silver deposit on a colored screen. This deposit affects the magnitude of a flux while the color of the screen affects the quality. In other words, the light flux passing through the colored screen plate 30 first is reduced by the opacity of the silver deposit and is then further reduced by the filtering action of the color of the screen. Thus, with the red filter interposed in front of the light source, only the red in the colored transparency will be reproduced in graves in plate 30' in accordance with the intensity of the silver deposit. Similarly, a second print plate 30' may be made with a green filter interposed in front of light source L, and finally a third print plate 30' may be made with a blue filter in front of light source L. In reproducing the picture, three separate printing operations are superimposed one upon the other, each printing operation utilizing one of the three print plates 30'. Each of these plates is engraved for one

color element of the colored transparency. Let us take the plate on which the blue element has been engraved. The original surface represents all the color elements (red, green, blue). All the surface for the blue has been engraved or removed, and, therefore, the remaining surface represents the red and green elements. Inasmuch as red and green are complementary to blue, the resultant color is yellow, and, therefore, this plate becomes the yellow printer. In the same manner the red element plate becomes the blue-green printer and the green element plate, the magenta printer.

Taking the yellow, blue-green and magenta printers and covering their respective surfaces with the proper colored ink in such a manner that no ink enters in the graves, the ink is transferred to paper by super-imposition, therefore a colored print results similar to the transparency.

The printing of plates made from color separation negatives must be done in a different manner from those made from color transparencies, because the color separation has already been made in the negatives. The opaque portions of the negative represent the color element and the clear parts represent the complementary color. The light flux passing through the clear parts engraves the print plate and therefore the graves represent the complementary colors. In printing from such print plates, the graves are filled with ink and the surface of the plate wiped clear. Then the ink in the graves is transferred to the paper. The finished print will, therefore, appear the same as the original subject.

If the member 30 is not a transparency, but an opaque sheet on which a colored picture is impressed and which it is desired to reproduce, then the reflection system shown in Fig. 6 is employed with a suitable filter interposed. Also, instead of employing colored filters, I may interpose a prism P between the light source and the image 30 to produce a spectrum indicated diagrammatically at S, Fig. 7. The prism may be rotatably mounted at 70 so that a selective portion of the spectrum corresponding to the red, green and blue filters may be utilized as desired.

In accordance with the provisions of the patent statutes, I have herein described the principle and operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof, but I desire to have it understood that the apparatus shown is only illustrative and that the invention can be carried out by other equivalent means. Also, while it is designed to use the various features and elements in the combination and relations described, some of these may be altered and others omitted within the scope of the claims without interfering with the more general results outlined, and the invention extends to such use.

Having described my invention, what I claim and desire to secure by Letters Patent is:

1. The method of making reproductions on printing plates directly from the subject to be reproduced, the material of said plates being adapted to be decomposed by heat, said method consisting in scanning the subject with light, transforming into a plurality of electrical pulsations the variations in light transmitted by the subject, operating an engraving tool in synchronism with said light, heating said tool to a degree such that rapid thermal decomposition of the material of the printing plate is effected when said tool comes in contact with said plate, and causing the tool to penetrate said material to a

degree corresponding to the respective electrical pulsations.

2. A machine for making printing plates directly from a subject to be reproduced, comprising a printing plate, the material of said plate being adapted to be decomposed by heat, supporting means for the subject and the printing plate, a light beam cooperating with said subject, an engraving tool cooperating with said plate, means for heating said tool to a degree such that rapid thermal decomposition of the plate material is effected when said tool comes in contact with said plate, means whereby said light beam scans said subject, means for operating said engraving tool in synchronism with said light beam, means for transforming into a plurality of electrical pulsations the variations in light transmitted by the subject, and means for causing said tool to penetrate the material of the printing plate to a degree corresponding to the respective electrical pulsations.

3. A machine for making printing plates directly from a subject to be reproduced, comprising a printing plate, cylindrical supporting means for the subject and the plate, a light beam cooperating with said subject, means for causing said light beam to traverse a helical path to scan said subject, an engraving tool cooperating with said plate, means for heating said tool to a degree such that rapid thermal decomposition of the plate material is effected when said tool comes in contact with said plate, means for causing said tool to traverse a spiral path in synchronism with said light beam, means for transforming into a plurality of electrical pulsations the variations in light transmitted by the subject, and means for causing said tool to penetrate the material of the printing plate to a degree corresponding to the respective electrical pulsations.

4. A machine for making reproductions on printing plates directly from a transparency, comprising a hollow light-transmitting cylinder for supporting the transparency, a printing plate, means for supporting the printing plate, a light system for transmitting a light beam into said cylinder and focussing said beam on said transparency, means for causing relative rotary and axial movement between said transparency and said light beam whereby said beam scans said transparency, an engraving tool cooperating with said plate, means for heating said tool to a degree such that rapid thermal decomposition of the plate material is effected when said tool comes in contact with said plate, means for causing relative rotary and axial movement between said tool and said plate in synchronism with the movements of said light beam relative to said transparency, means for transforming into a plurality of electrical pulsations the variations in light transmitted by the subject, and means for causing said tool to penetrate the material of the printing plate to a degree corresponding to the respective electrical pulsations.

5. A machine for making printing plates directly from a subject to be reproduced, comprising a printing plate, cylindrical supporting means for the subject and the plate, a light beam coop-

erating with said subject, means for causing relative rotary and axial movement between said subject and said light beam whereby said beam scans said subject, a shutter, means for operating said shutter for periodically shutting off and passing said beam, the movement of said shutter relative to the rotary movement between said subject and said light beam being so adjusted that the points where the light beam strikes said subject in adjacent circumferential rows are relatively displaced, an engraving tool cooperating with said plate, means for heating said tool to a degree such that rapid thermal decomposition of the plate material is effected when said tool comes in contact with said plate, means for causing relative rotary and axial movement between said tool and said plate in synchronism with the movements of said light beam relative to said subject, means for transforming into a plurality of electrical pulsations the variations in light transmitted by the subject, and means for causing said tool to penetrate the material of the printing plate to a degree corresponding to the respective electrical pulsations.

6. A machine for making printing plates directly from a subject to be reproduced, comprising a printing plate, supporting means for the subject and the printing plate, a light beam cooperating with said subject, an engraving tool cooperating with said plate, means for heating said tool to a degree such that rapid thermal decomposition of the plate material is effected when said tool comes in contact with said plate, means whereby said light beam scans said subject, a shutter, means for operating said shutter for periodically shutting off and passing said beam, means for operating said engraving tool in synchronism with said light beam, means for transforming into a plurality of electrical pulsations the variations in light transmitted by the subject, and means for causing said tool to penetrate the material of the printing plate to a degree corresponding to the respective electrical pulsations.

7. A machine for making reproductions on printing plates directly from a subject to be reproduced, comprising a printing plate, means for supporting the subject and the printing plate, a light beam cooperating with said subject, a diaphragm having an aperture of predetermined size and shape through which said beam is adapted to pass, an engraving tool cooperating with said plate, means for heating said tool to a degree such that rapid thermal decomposition of the plate material is effected when said tool comes in contact with said plate, means whereby said light beam scans said subject, means for operating said engraving tool in synchronism with said light beam, means for transforming into a plurality of electrical pulsations the variations in light transmitted by the subject, and means for causing said tool to penetrate the material of the printing plate to a degree corresponding to the respective electrical impulses, said tool being tapered toward the printing plate and having a cross-section similar to the aperture in said diaphragm.

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