

Sept. 14, 1937.

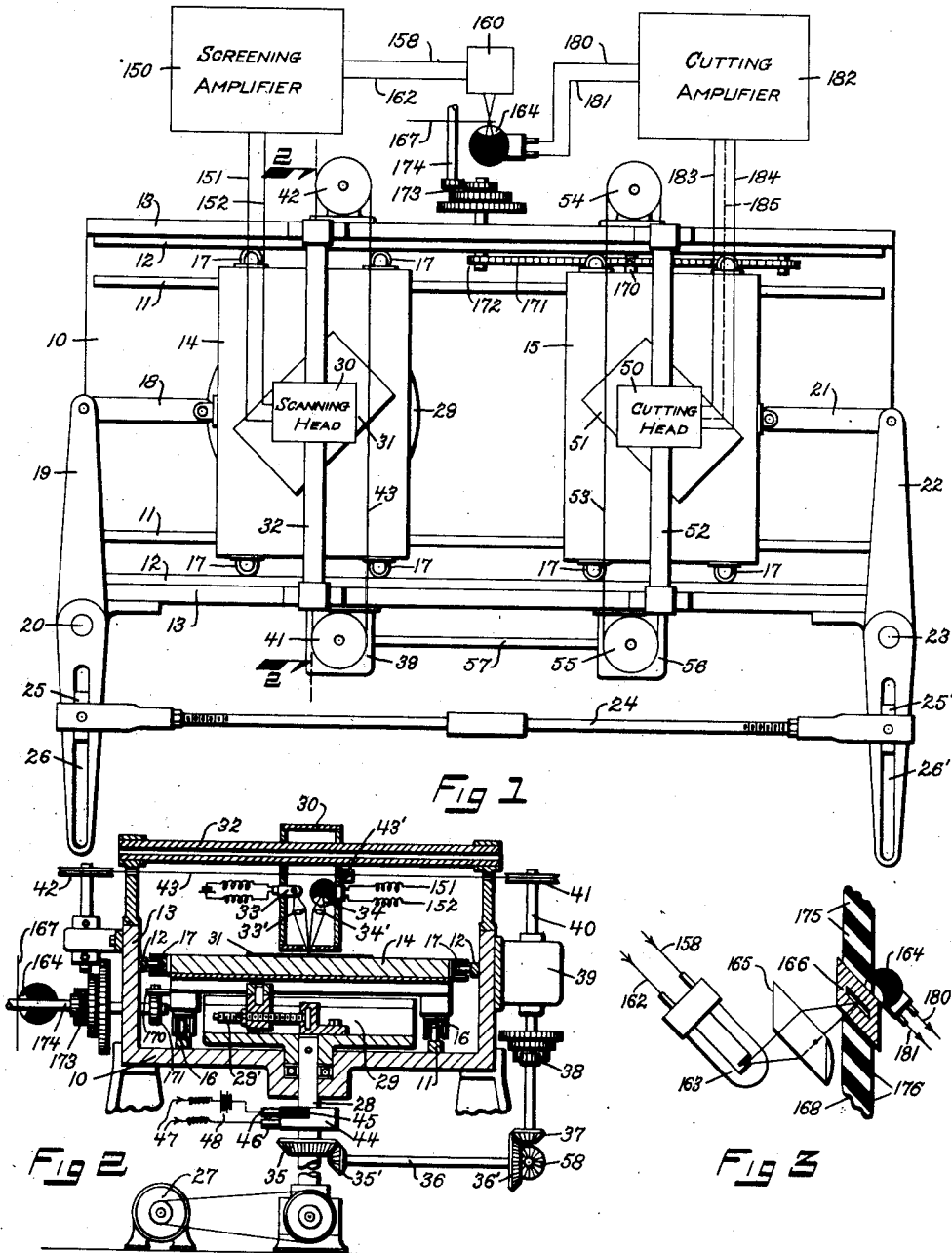
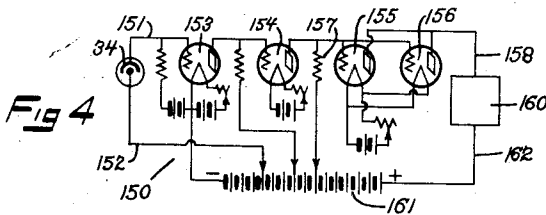
G. E. LOSIER

2,092,764

ELECTRIC MACHINE

Filed Dec. 2, 1932

3 Sheets-Sheet 1



GEORGE E. LOSIER
INVENTOR
BY *William A. Hughes*
his ATTORNEY

Sept. 14, 1937.

G. E. LOSIER

2,092,764

ELECTRIC MACHINE

Filed Dec. 2, 1932

3 Sheets-Sheet 3

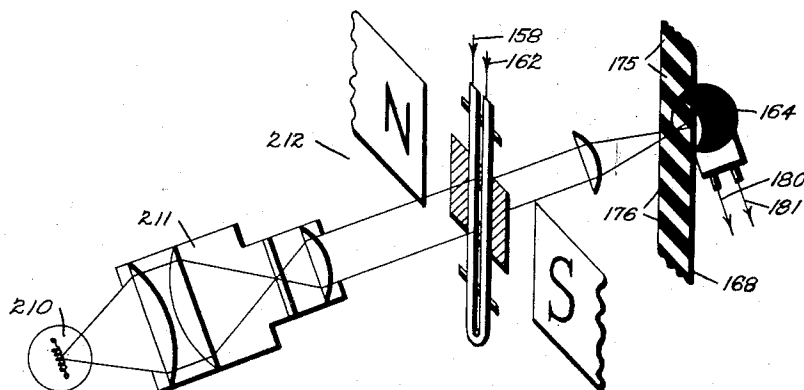


Fig 10

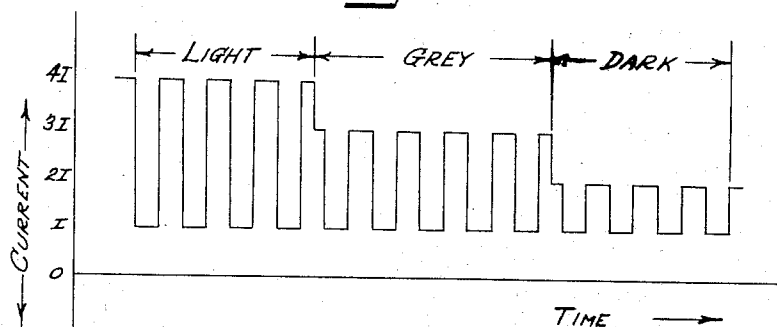


Fig 11



Fig 12

Fig 14

Fig 16

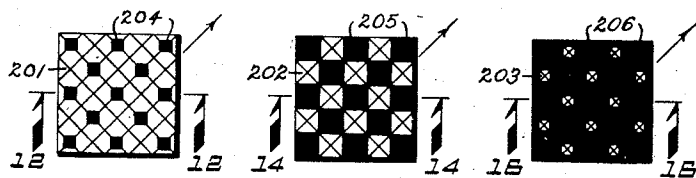


Fig 13

Fig 15

Fig 17



Fig 18

GEORGE E. LOSIER

INVENTOR

BY William A. Hughes

his ATTORNEY

UNITED STATES PATENT OFFICE

2,092,764

ELECTRIC MACHINE

George E. Losier, East Orange, N. J., assignor of
one-fifth to William A. Hughes, Newark, N. J.,
and four-fifths to Marion L. Losier, East
Orange, N. J.

Application December 2, 1932, Serial No. 645,384

6 Claims. (Cl. 178—6)

The present invention relates to a method and an automatic machine for cutting printing plates or other reproductions from an image, picture or pattern, and also to the printing plate or reproduction made with and according to the method and machine of the invention.

An object of the present invention is to provide a method and machine for performing the steps of the method for making reproductions if images, pictures and patterns such as making half-tone printing cuts or plates directly from the picture without the use of the chemical processes heretofore used.

Another object of the present invention is to provide a half-tone printing plate in which the printing points or elevations are substantially in the shape of frustums of pyramids whereby is obtained a printing plate which can be used for making thousands of copies of pictures without the "mushrooming" of such elevations such as occurs with the photo-chemically produced plates, but in which all the advantages of the photo-chemical half-tone are present, including the screen effect, the oblique rows of printing elevations and so on.

Another object of the present invention is to provide a half-tone printing plate which can be used with greater pressures and which will have a longer life than the heretofore used photo-chemically produced half-tone plates.

Other objects and advantages of the present invention will be apparent from the following description of the method, machine and plate of the invention and from the drawings and claims illustrating and describing the same.

The accompanying drawings, forming part of the present application, show, somewhat diagrammatically, an embodiment of the present invention, with alternative forms of certain parts, in which:

Figure 1 is a plan view, somewhat diagrammatic, of an apparatus embodying the invention;

Figure 2 is a section view in elevation, taken along the line 2—2 of Figure 1, looking in the direction of the arrows;

Figure 3 is an illustration, somewhat diagrammatic, of a screen-effect producing unit of the apparatus, including a screening tape;

Figure 4 is a diagram of the circuit of an amplifier used;

Figure 5 is a vertical elevation view in section of the plate cutting head, in place on a plate to be cut, taken along the line 5—5 of Figure 6, looking in the direction of the arrows;

Figure 6 is a section view, in part cut away,

taken along the line 6—6 of Figure 5, looking in the direction of the arrows;

Figure 7 is a bottom plan view of a portion of Figure 6, looking from the position of arrows 7—7;

Figures 8 and 9 are, respectively, side and back elevation views of the end of the cutting tool;

Figure 10 is an illustration, somewhat diagrammatic, of an alternate embodiment of a screen-effect producing unit such as is shown in Figure 3;

Figure 11 is a graph of current against time, showing relative strengths of current used in reproducing light, grey and dark portions of the picture;

Figures 12 and 13, 14 and 15, and 16 and 17 are sets of section elevation and plan views, respectively, of parts of the cut plate corresponding, respectively, to light, grey and dark portions of the picture, and corresponding, respectively in sets, to the "light", "grey" and "dark" portions of the plotting of Figure 11; and

Figure 18 is a somewhat diagrammatic view of a screening wheel, in part cut away, alternate in form to the screening tapes of Figures 3 and 10.

In the drawings a channel shaped bed 10 (see Figures 1 and 2) carries a pair of spaced apart bottom rails 11, 11 and a pair of side rails 12, 12, one on each of the channel sides 13, 13, which pairs of rails 11, 11, and 12, 12 respectively support and laterally guide a picture table 14 and a plate table 15 by means of the bottom rollers 16, 16 and side rollers 17, 17. Means for moving said tables 14 and 15 synchronously on said rails 11, 11 are provided comprising an arm 18 pivoted at one end to said table 14 and at its other end to a lever 19 which at an intermediate point pivots on a pin 20 fixed on a side 13 of said bed 10 at one end thereof. Similarly an arm 21 pivoted to said table 15 connects to a lever 22 which pivots on a pin 23 at the other end of said bed 10. A rigid turnbuckle arm 24 connects levers 19 and 22 in driving relation by means of slides 25 and 25' which are pivoted one to each end of said turnbuckle arm 24 and which are fixedly adjustable one in each of the slots 26 and 26' in the outer ends of said levers 19 and 22, respectively. By arranging the distance of said slide 25 from its corresponding pin 20 to be different from the distance of said slide 25' from said pin 23, the length of the stroke movement of said table 14 can be made to be different from that of said table 15, either greater or less to suit the needs of reduction or enlargement from the picture to the plate, as desired. Obviously, when the re-

production is to unit scale these distances are arranged to be the same.

Movement of said tables 14 and 15 is secured by means of a motor 27 which drives the slow speed vertical shaft 28 which passes through said bed 10 and drives a scotch yoke 29 (see Figure 2) which connects with the bottom of said table 14 in driving relation. The scotch yoke, a well known form of adjustable mechanical movement, is used on account of its adjustability to secure different lengths of strokes of movement of said table 14 (and of table 15) to suit various sized pictures to be reproduced. In the present case adjustability of the distance of movement of said table 14 for each revolution of said shaft 28 is secured through the adjusting screw 29'.

Directly over said table 14 is a scanning head 30 for scanning a picture 31 carried by said table 14. Said scanning head 30 rides on the bar 32, mounted transversely across said bed 10 and with its ends fixed to said sides 13, 13, for movement of said scanning head 30 across said picture 31 while said table 14 is carrying said picture 31 longitudinally, the relative movement of said scanning head 30 with respect to said picture 31 being along a diagonal across said bed 10, in a manner and by means hereinafter fully described. Said scanning head 30 comprises a source of light 33, a condensing lens 33' which concentrates a beam of light from said source 33 at a point on said picture 31, a photo-electric cell 34 and condensing lens 34' which receives such a beam of light reflected from such a point on picture 31 and concentrates it on said photo-electric cell 34.

Means for moving said scanning head 30 on said bar 32 comprise a bevel gear 35, on said shaft 28, which drives a pinion 35' on a shaft 36 which drives a bevel gear 36' and pinion 37, which latter, through the set of interchangeable reduction gears 38 drives another set of reduction gears (not shown) in gear box 39 from the upper side of which extends the driven slow speed shaft 40 which carries a belt pulley 41 opposite which latter, on a side 13, is an idler pulley 42. Between said pulleys 41 and 42 there extends a belt 43 which connects with said scanning head 30 by a set screw 43' in driving relation. The driving gear train for said belt 43 is geared down to move said belt 43 at such a rate that said scanning head 30 is moved the distance of the size of the screen mesh to be simulated in the case of a one to one reproduction, or a predetermined coefficient thereof in case of reduction or enlargement, for each forward and back stroke of said table 14, that is, for each revolution of said shaft 28. Mounted on and insulated from said shaft is a commutator 44 having one part cut away for half the distance around its circumference in which place is set an insulating piece 45, with brushes 46, 46 bearing on the commutator so that for one half of a revolution of said shaft 28 said commutator 44 makes a circuit between said brushes 46, 46 and for the other half it breaks the circuit. Said brushes 46, 46 connect to the leads 47, 47 one of which includes a source of electric energy 48 for a purpose hereinafter described.

Over said table 15 is mounted a cutting head 50 in operative relation to a plate 51 on said table 15, in similar relation to that of said scanning head 30 with respect to said picture 31. Said cutting head 50 rides on a bar 52 mounted to said sides 13, 13, across said bed 10 and re-

ceives its motion from a belt 53 mounted on idler pulley 54 and driving pulley 55, which latter connects through a set of interchangeable reduction gears (not shown) in gear box 56, through a connecting shaft 57 and pinion 58 to said bevel gear 36. Through these driving means, said cutting head 50 will move in synchronism with said scanning head 30 when the latter moves, either in unit ratio for exact size reproduction or greater or less if enlargement or reduction is desired; the ratio being changeable through the gears of said gear box 56, or of gear box 39, or of gears 33 or any or all of them.

Said cutting head 50 (see Figures 5, 6 and 7) comprises a supporting rod 60, one end of which rides in locking engagement in the slot 61 in said bar 52. From the other end of said rod 60 there depends a bar 62 having a vertical slot 63 therein in which latter rides a slide rod 64 whose position in said slot 63 is fixed and vertically adjustable by means of the screw 65 which is threaded into said slide rod 64 at its lower end and has its upper end extending through an opening in said rod 60 where it has a knurled fixed head 66 bearing against the upper surface and a fixed washer 67 bearing against the lower surface of said rod 60.

Said slide rod 64 intermediate its ends carries a yoke 68 which extends transversely in the direction away from said bar 52 and which carries within itself an electromagnet 69 having a pole-piece 70 extending in the direction toward said bar 52. Said electromagnet 69 is energized by said source 48 through said leads 47, 47 in a manner and for the purpose hereinafter described. An armature bar 72, hinged to the lower end of said slide rod 64 through an offset 73, extends vertically upwards and carries at its upper end a transverse bar 74 which extends through an opening 75 in said slide rod 64 and carries an armature 76 in operative relation to said pole piece 70.

Extending oppositely from said bar 74 and fixed to said armature bar 72 is a support bar 77 which supports beneath it a permanent magnet yoke 78, which latter at its outer end carries an electromagnet 79 and at its inner ends carries the pole-pieces 80, 81 having therein, respectively, the oppositely facing slots 82, 83. Said field coil 79 is energized by direct current during operation of the mechanism. Clamped one on each side of said pole pieces 80 and 81, by means of the bolts 85 and 86, are the back plate 87 and the front plate 88. Said bolts 85 and 86 also hold between them the oval shaped coil 95 which extends horizontally edgewise through said slots 82, 83. Extending centrally lengthwise in the longitudinal opening 95 of said coil 95 is the flat armature 97 which carries, one at each end, the flexible loops 98, 98, each of which is mounted on one of said bolts 85, 86 which loops 98, 98 allow a small rotative movement of said armature 97 about an axis which is the median of said coil 95. To be actuated by such rotative movement of said armature 97 is a vertical tool holder 100 which connects at its upper end through a flexible link 101 to said armature 97, said link 101 being flexible in a direction at right angles to said coil 95. At its lower end said tool holder 100 terminates in a chuck 102 which carries a cutting tool 103.

Clamped between a shoulder 104 and an adjustable nut 105 on said tool holder 100 is a flexible annular diaphragm 106 which serves to hold the lower end of said tool holder 100 and to

steady it during movement. Said diaphragm 106 is attached by the four screw bolts 107, 107, near its edges, to a bar 108 fixed to the bottom of said yoke 78 under the pole piece end and extending outwardly therefrom with an opening 109 therein through which said tool holder 100 passes.

To one side from said tool holder 100, said bar 108 carries a vertical guide 115 through which extends a vertical slide bar 116 which has a longitudinal passageway 117 extending therethrough and carries a horizontal bar 118 projecting therefrom under said diaphragm 106 with an opening 119 therein into or through which said tool holder 100 passes. A longitudinal passageway 120 within said bar 118 connects at its inner end with said passageway 117 and at its other end terminates in a U-shaped opening 121 through the lower face of said bar 118 about said opening 119. In the bottom face of said bar 118 adjacent said opening 121 is another opening 122 which connects with said passageway 120 and which carries therein the supporting roller 123 which is adapted to ride on and to carry the cutting head 50 over a plate 51 to be cut by said tool 103. Means (not shown) for drawing a suction through said passageways 117 and 120 will draw chips cut from the plate and any dirt from under and through said openings 121 and 122. A brush 124 fixed in said opening 122 and bearing on said roller 123 will wipe off any chips or dirt adhering to the latter and release them to be carried away by such suction. A gear rack 125 fixed to said slide bar 116 engages a pinion 126 in said guideway 115 which latter carries a spindle 127 which passes through a friction bushing 128 in a wall of guideway 115 and terminates in a knurled head 129. By turning said knurled head 129 to move said pinion 126 on said rack 125, said cutting head 50 can be raised or lowered to suit the length of said tool 103 and to suit the length of the cutting stroke thereof.

In Figures 8 and 9 said cutting tool 103 is illustrated in detail in which the shank 135 carries at one end the cutting point 136 which has two cutting edges 137, 137 which taper to a point from said shank 135 and for making a plate of a given screen the angle A defined by said edges 137, 137 is predetermined the value of said angle A being smaller for fine screens than for larger ones. The bisecting line of said angle A is at right angles to the plate being cut. The face 138 of said cutting point 136 is cut upwardly and back from the perpendicular at an angle B to give the tool a bite, the back of the cutting point is cut backwardly from said two edges 137 to give them clearance and in the form here illustrated defines two faces 139, 139. To give bottom clearance, said cutting point 136 is cut upwardly and back from the tip at an angle C from the horizontal whereby a diamond shaped face 140 is defined in the embodiment of the tool illustrated in Figures 8 and 9.

Referring again to Figures 1 and 2 and others, said photo-electric cell 34 connects to the aperiodic screening amplifier 150 (see Figure 4) by the leads 151 and 152, which amplifier 150 comprises two high amplification tubes 153 and 154, which are connected in series with each other and with said photo-electric cell 34, and two power tubes 155 and 156 which are connected in parallel with each other and in series with said tubes 153 and 154, with a resistor 157 in parallel between said tube 154 and 155. From the plates of said tubes 155 and 156 a lead 158 connects to

one terminal of a screening system 160 and from the grids thereof through said resistor 157 and a source of electric energy 161 the lead 162 connects to another terminal of said screening system 160. The rest of the connections of said power amplifier 150 are conventional, as shown.

In one embodiment of the present invention, said leads 158 and 162 connect and carry power to an electric glow lamp 163 (see Figure 3) but any kind of electric lamp can be used in which the light therefrom will vary appreciably and without lag with the amount of current supplied thereto. In operative relation with said glow lamp 163 is a photo-electric cell 164 with a cylindrical condensing lens 165 between them to focus light from said glow lamp 163 onto the cathode of said photo-electric cell 164, a slit 166 being used to define a narrow beam. Between said glow lamp 163 and said photo-electric cell 164 is the movable light interrupting disk 167 (see Figures 1 and 18) (a movable ribbon 168 in Figure 3) which in the embodiment illustrated in Figure 1 is driven by said cutting table 15 through a stud 170, fixed to the latter and connected to a chain 171 (which can be a rack and pinion or other equivalent) through a sprocket 172, a gear train 173 and the shaft 174 on which latter said disk 167 is mounted. Said disk 167 (also said ribbon 168) is opaque, with openings or transparent sections 175, 175 spaced at regular intervals therein along the portion which passes under the light, the width of the openings or transparent parts being preferably equal to the width of the opaque sections 176, 176 between them.

From said photo-electric cell 164 leads 183 and 181 connect with the cutting amplifier 182 which can be a transformer, resistance or impedance coupled amplifier of types generally well known and its purpose is to amplify the current passed through said photo-electric cell 164 to sufficient strength to operate said cutting head 50. Leads 183 and 184 connect said cutting amplifier to said coil 95 (see Figures 5 and 6). When a push-pull type amplifier is used the lead 185 connects from the source of high potential of the amplifier to the midpoint of said coil 95.

In the operation of the above described embodiment of my invention for making a printing plate from a picture or other delineament, a picture 31 is placed on said table 14 laterally within the movement range of said scanning head 30. The said picture 31 can be aligned with the direction of movement of said table 14 or transverse thereto, but preferably for black and white printing it is placed at an angle of about forty-five degrees so that the black (or white) printed dots in adjacent rows are alternate or staggered (see Figures 13, 15 and 17 which show sections of the printing plate) whereby adjacent dots of a given shade, black or white, are adjacent only at the corners thereof thereby avoiding continuous bands of black or white of more or less continuous width in the longitudinal direction which produces an optical illusion which detracts from the desired effect in the picture. The manner of cutting is more fully explained hereinafter.

When a positive plate 51 is to be made from a positive picture 31, or a negative printing plate 51 is to be made from a negative picture 31, then said scanning head 30 and said cutting head 50 are moved in opposite directions across said bed 10; and, if a negative printing plate 51 is to be made from a positive picture 31, or a positive plate 51 is to be made from a negative picture

31, then said scanning head 30 and said cutting head 50 are moved in the same direction across said bed 10.

Said picture 31 and plate 51 being properly placed and fixed on their respective tables 14 and 15 by suitable means not shown, said scanning head 30 is brought to lower end of said bar 32 as shown in Figure 1 and the table 14 is moved to the right in Figure 1 far enough for the left hand corner of said picture 31 to be to the right beyond the line of travel of said scanning head 30. If said picture 31 is a positive and a negative plate is to be cut then said cutting head 50 is moved to the upper end of said bar 52 in Figure 1 and said table 15 is far enough to the right to bring the left hand corner of said plate 51 to the right of the line of travel of said cutting head 50.

The various electric circuits and sources of light are now energized and said motor 27 is set in motion, whereupon said tables 14 and 15 begin their synchronous forward and backward movements and said scanning head 30 and cutting head 50 commence their slow movement across the picture 31 and plate 51, respectively. During forward movement of said table 14 said commutator 44 is in the "open circuit" part of its rotation and said electro-magnet 69 is de-energized leaving said cutting head 50 down in the plate cutting position, and during the backward movement of table 14 the circuit between said source of electric energy 48 and said electro-magnet 69 is closed through said commutator 44 and said cutting head 50 is lifted out of the plate cutting position. This movement of said cutting head 50, by said electromagnet 69, into and out of plate cutting position is through movement of said armature bar 72 on its hinged connection at the lower end of said slide rod 64.

Light from said source of light 33 is reflected from a point on said picture 31 to said photo-electric cell 34, the amount of light reaching the latter being proportional to the degree of light or shade at the point of reflection. Likewise the value of the current which flows through said photo-electric cell 34 and the circuit connected thereto, including said screening amplifier 150 and glow lamp 163 is proportional to the amount of light reaching said photo-electric cell 34.

Said glow lamp 163 is now energized and gives off light which varies in strength as the degree of the light and shade of the points passing under said scanning head 30 varies, and light therefrom illuminates and affects said photo-electric cell 164. Said light interrupting disk 167 is now rotating and entirely cutting off successive portions of the light passing to said photo-electric cell 164 whereby the current flowing through said photo-electric cell 164, said coil 95 of cutting head 50 and the circuit therebetween varies in alternate succession to a minimum in accordance to the normal "dark" conductivity of said photo-electric cell 164 when the light is cut off therefrom and also varies in accordance with the degree of lights and shades on said picture 31. The graph in Figure 11 indicates the values of this current when the scanning head 30 is passing successively over light, grey and dark section of the picture 31. Figures 12, 14 and 16, respectively, show, enlarged cross-sections of parts of said plate 51 having cut therein, respectively, the depressions 201, 202 and 203 by said tool 103, the depths of these said depressions being proportional to and the areas of the horizontal or print-

ing faces of the elevations 204, 205 and 206 between said depressions 201, 202 and 203, respectively, being inversely proportional to the values of those parts of the current curve in Figure 11 marked, respectively, light, grey and dark. Face views (also enlarged) of the plate parts shown in Figures 12, 14 and 16 are shown, respectively, in Figures 13, 15 and 17, with the printing faces of the elevations 204, 205 and 206 blackened in with ink to indicate the relative degree of shading and light on those parts of an image or picture printed from a plate 51 having elevations 204, 205 and 206 thereon of various areas of horizontal or printing surface. The slanting arrows indicate the direction of movement of the cutting tool 103 in going over the plate 51 during the cutting operation. Where the depressions in the plate 51 run in together as Figures 12, 13 and 14, 15 the elevations (204, 205) are in the forms of frustums of four-sided prisms, with the top faces of the frustums forming the ink receiving areas. The depressions 201, 202, and 203 have their lower portions (if not all) in inverted four-sided hollow pyramidal contour. Figures 14 and 15, for example, illustrate a section of printing plate of the invention in which the area cut away was equal to the printing area (made up of the faces of elevations 205, 205) which is left. Here the depressions 202, 202 are in the form of inverted four-sided pyramids. In Figures 12 and 13 the depressions 201, 201 are in the form of inverted four-sided pyramids which run in together at their bases, the cut-away surface area being greater than the printing area left. In Figures 16 and 17, the form illustrated has the printing area greater than the cut-away surface area. Here again the depressions 203, 203 are in the form of inverted four-sided pyramids. In some cases the lateral faces of said depressions 201, 202 and 203 are not true planes but can be slightly concave, due to the shape of the energy curve of the current supplied to said coil 95 and the resultant movement of said cutting tool 103 with respect to said plate 51 as the two are moved, the former up and down and the latter horizontally. In the claims however the depressions and elevations are described as being pyramidal or substantially pyramidal.

In Figure 10 is illustrated an alternative embodiment of the scanning system above described and in which an electric lamp 210 (or other constant source of light) is positioned in operative relation to throw a beam of light on said photo-electric cell 164, an optical system 211 being used to concentrate said beam of light. A light-valve 212 connects to said leads 158 and 162 and operates in a manner well known in response to variations in current passing through said leads 158, 162 to regulate the distance of the opening of the light valve whereby the light impressed on said photo-electric cell 164 is proportional to the degree of light reflected from said picture 31, as successive parts thereof pass under said scanning head 30, the light interrupting ribbon 163 or disk 167 being used as above described to interrupt the light passing to said photo-electric cell 164.

The method and apparatus of the present invention, in addition to use in a unit machine, are applicable to use in an arrangement in which the cutting head is at a point distant from the scanning transmission of current from one to the other being accomplished by wire connection or by a radio system, with suitable amplifying units when required and with suitable means for synchronizing the scanning head and the cutting

head. In such case a number of cutting heads could be set up in operated relation to one scanning head and several reproductions made simultaneously. In such case positives and negatives could be made at the same time on different cutting heads governed by the same scanning head.

The plate cut by the apparatus of the present invention and certain features in the method of cutting employed in the use of this apparatus are described and claimed in my U. S. Patent Number 2,032,541 issued March 3, 1936, application for which was filed Sept. 5, 1934, Ser. No. 742,715 and was copending herewith. Other features of the method used in the employment of the apparatus of the present invention are claimed in my copending application Serial Number 647,884, filed December 19, 1932.

Having thus described my invention what I claim and wish to protect by Letters Patent is—

1. In a machine for reproducing a picture on the surface of a printing plate, the combination of means for directing a beam of light to travel over the picture and a photo-electric cell for receiving the reflected beam from the picture, and an electro-mechanical plate-cutting device, a second photo-electric cell, electrically connected to said electro-mechanical device; a source of light in operative relation to said second photo-electric cell; and means controlled by first said photo-electric cell adapted to control the amount of light passed to said second photo-electric cell in accordance with the amount of current passing through first said photo-electric cell; and means for regularly interrupting the light to said second photo-electric cell.

2. In a system for transforming light energy into mechanical energy, in combination, a light source, a photo-electric cell in operative relation to said light source, an electric power-amplifier having its input side connected in operative relation to said photo-electric cell, a second light source connected in operative relation with the output side of said electric power-amplifier, a second photo-electric cell in operative relation to said second light source, a second electric power-amplifier having its input side connected in operative relation to said second photo-electric cell, an electro-mechanical cutting tool connected in energized relation to the output side of said second electric power-amplifier, and light interrupting means between said second light source and the photo-electric cell which is in operative relation thereto.

3. In a machine for reproducing a picture on the surface of a printing plate, in combination, means for directing a beam of light to travel over the picture, a source of electric light, means for transforming the variations in the light reflected from the picture into variations in an electric current passing through said source of electric light, a plate cutting tool, a circuit for passing an energizing current to said plate cutting tool, a photo-electric cell in said circuit and in operative relation to receive light from said source of electric light, and a light interrupter between said source of electric light and said photo-electric cell.

4. In a machine for reproducing a picture on the surface of a printing plate, in combination, means for directing a beam of light to travel over the picture, a source of electric light, means for transforming the variations in the light reflected from the picture into variations in a continuous electric current passing through said source of electric light, a plate cutting tool, a circuit for passing an energizing current to said plate cutting tool, a photo-electric cell in said circuit and in operative relation to receive light from said source of electric light, and a light interrupter between said source of electric light and said photo-electric cell.

5. A machine for reproducing a picture on a surface of a plate, comprising a transmitter including an electric lamp and means for scanning the picture and transforming the variations of shading into variations of current flow to said electric lamp, a translator including a plate cutting tool and a photo-electric cell which is in light receiving relation with said electric lamp, and means between said electric lamp and said photo-electric cell for periodically interrupting the light path therebetween.

6. A machine for reproducing a picture on a surface of a plate, comprising a transmitter including an electric lamp and means for scanning the picture and transforming the variations of shading into variations of current flow to said electric lamp, a translator including a plate cutting tool and a photo-electric cell which is in light receiving relation with said electric lamp, and means for periodically stopping flow of light from said electric lamp to said photo-electric cell.

GEORGE E. LOSIER.