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APPARATUS FOR PRODUCING PRINTING FORMS WITH VARIABLE REPRODUCTION SCALE

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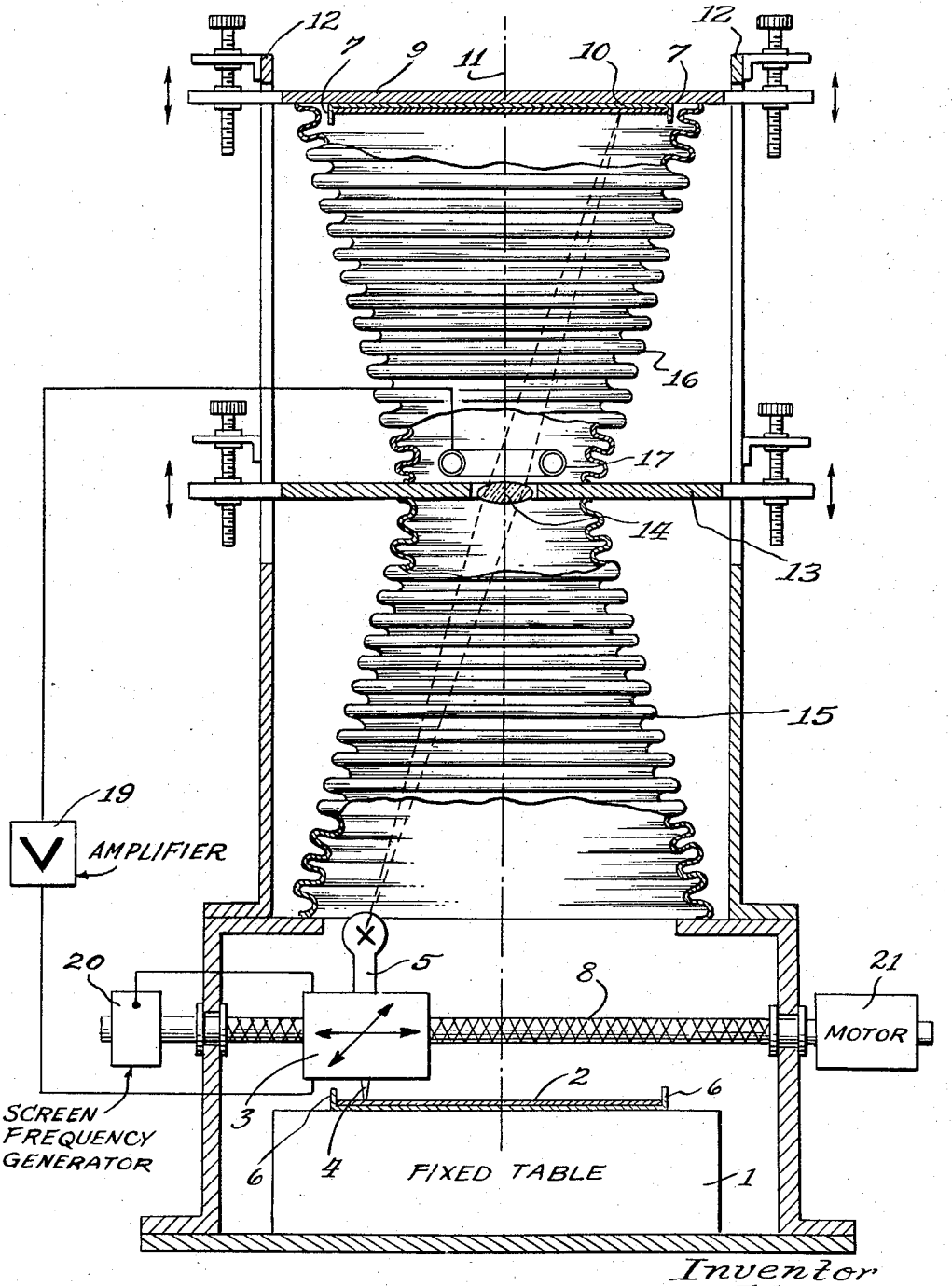

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APPARATUS FOR PRODUCING PRINTING FORMS WITH VARIABLE REPRODUCTION SCALE

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10 Claims. (Cl. 178—6.6)

This invention is concerned with apparatus for electromechanically producing printing forms or blocks with variable reproduction scale, by optical scanning of copies to be reproduced.

Known systems provide, for example, two tables disposed one alongside the other, one for carrying the copy to be reproduced, which is pointwise photoelectrically scanned along successive lines, and the other carrying the blank which is to be engraved in accordance with the showing of the copy, and an engraving tool, controlled by the action of photoelectric currents effecting the pointwise engraving on the blank. Upon completion of the scanning and coincident engraving of each line, the scanning and engraving elements are advanced by a distance corresponding to the spacing between lines, such distance being determined by the screen employed.

The enlargement or reduction in scale, on the printing blank, as compared with the scale of the copy is effected by suitable gear or lever mechanisms disposed between the drives for the table motion and the drives for the line advance.

There are also systems known in which the copy and the blank are mounted upon corresponding rotating drums. Both drums may execute axial advance motions and the scanning and engraving elements may be stationary; alternatively, both drums may be stationary and the respective scanning and engraving elements may be disposed for relative motion with respect to the circumference of the drums. The desired enlargement of reduction in scale, on the blank, as compared with the scale of the copy to be reproduced, is obtained either by the provision of drums of different diameter, rotating at identical speed, or by using drums of identical diameter rotating at different R. P. M. The ratio of advance motion of the scanning and engraving elements, corresponding to the desired enlargement or reduction in scale, is obtained by means of adjustable gears.

It has further been proposed in connection with systems employing tables as well as in connection with systems using drums, to provide for auxiliary motions, in the engraving direction, for the scanning or for the engraving tool or for both, relative to the tables moving with identical speed or relative to drums of identical diameter rotating with identical R. P. M., respectively, and to effect the desired ratio of the magnitude of the advanced motions of the scanning and engraving elements by suitable gearing.

Instead of using separate tables respectively for the copy to be reproduced and for the blank of the printing form to be made, there has been proposed the use of a single reciprocable table carrying on one side thereof the copy and on the opposite side the blank, with means for imparting to the scanning or to the engraving tool or to both auxiliary motions, in engraving direction, relative to the reciprocating table.

Other systems are known in which an enlarged or a reduced image is optically projected from the copy to be

reproduced, by means of an objective, upon a screen or a frosted glass plate, such projected image being photoelectrically pointwise scanned along successive lines, the resulting variable photocell currents being employed for controlling the cutting depth of an engraving tool which engraves upon the blank a reproduction of the optical picture on a scale corresponding thereto.

The invention proposes apparatus for electromechanically producing screened or unscreened printing forms according to copies to be reproduced, comprising means for selectively adjusting the reproduction scale. The copy is pointwise scanned by a scanning light beam and an engraving tool which is photoelectrically controlled effects the pointwise engraving on the printing form blank. In case of screened printing forms, a screening frequency may be superimposed on the control currents for the engraving tool. The copy to be reproduced and the blank which is geometrically similar to the copy are respectively mounted, each in an adjustable frame disposed on a corresponding table or holder, the copy and the blank being mutually oriented in parallel relationship so that corresponding edges are in parallel alignment such, that a line drawn through the centers of the copy and the blank along the symmetry axis thereof extends perpendicular thereto. The scanning system comprises an exchangeable punctiform light source rigidly coupled with an engraving system comprising an electromagnetic or dynamic drive device and an engraving tool, which is disposed close to the surface of the printing form blank; the light source and the engraving tool pointing in opposite directions, the light source facing the copy to be reproduced and the engraving tool facing the blank. Means are provided for moving the scanning and the engraving system line-for-line with respect to the blank, an adjustable advance step being executed at the end of each line corresponding in magnitude to the screening provided. Along the common symmetry axis, between the printing form blank and the copy to be reproduced is disposed an objective which may be variable or exchangeable or adjustable so as to provide for desired focal distance, such objective projecting a light beam onto the copy in the form of a light point. A plurality of photocells may be arranged equally spaced rotation symmetrical about the axis of the objective, between the copy to be reproduced and the objective and near to the latter; a ringshaped photocell may take the place of the plurality of photocells.

Accordingly, the enlargement or reduction of the printing form image as compared with the copy image, is accomplished optically. However, there is no projection of the entire copy and subsequent scanning of the optical picture, as in known systems, but the original copy itself is being scanned and the length of lines, the magnitude of the advance steps and the screening points of the blank are respectively magnified or reduced respectively as light paths and light dots.

The advantage of the invention resides in having to move back and forth, with respect to the printing form blank, line-for-line only the combined scanning and engraving systems, thus doing away with complicated gearing for enlargement or reduction, required when using separate drives for the scanning and engraving tool, respectively, as is necessary in connection with systems using independently actuated scanning and engraving means.

The foregoing and other objects and features of the invention will appear from the description which is rendered below with reference to the accompanying drawing.

In the drawing, numeral 1 indicates a fixed table provided with a frame 6 which is suitably made adjustable so as to accommodate printing form blanks 2 of different size. Numeral 3 designates the combined scan-

ning and engraving device provided with an engraving tool 4 facing downwardly in the direction of the blank 2 and a scanning device including a punctiform light source 5 facing in opposite direction. The combined scanning and engraving device 3 is moved back and forth, line-by-line, with respect to the blank 2, by a screw 8 driven by a motor 21. Switch means (not shown) may be provided and actuated by the frame or extensions thereof, at the respective end positions of the frame, for reversing the screw rotation upon completion of the engraving of each line so as to move the scanning-engraving head or device 3 back into start position for the next successive line.

Instead of using a single thread screw the rotation of which is reversed when the scanning-engraving head reaches the end of a line, a screw as shown in the drawing, with two oppositely directed threads may be provided, which rotates always in the same direction, thus automatically taking care of returning the scanning-engraving head at the end of each line and thereafter advancing it for the engraving of the next line.

Upon concluding the engraving of each line, the combined scanning-engraving device 3, which also may be referred to as a carriage, is moved or advanced transversally by a distance determined by the screening, corresponding to two engraving lines. This may be accomplished in known manner, for example, by disposing the screw 8 as a bridge between two further screws extending perpendicular thereto at the ends thereof. The stepwise transverse advance motion may be produced in known manner upon conclusion of the engraving of each line, for example, by means of a ratchet actuated by a pawl controlled by switch means actuated by the frame 6 or bracket extensions thereof. There are numerous other known ways of accomplishing the desired operation, which need not be described as they do not contribute to an understanding of the invention.

The engraving may be effected in known manner by parallel cutting, that is, by cutting lines extending in parallel with an edge of the printing form blank, or by diagonal cutting wherein the lines extend diagonally of the blank. The screening, that is, the number of lines per centimeter, may be adjusted independent of the desired reproduction scale.

Another table or holder 9 is disposed above the table or holder 1, in parallel therewith. The table 9 carries an adjustable frame 7 for mounting a copy 10 which is as to shape similar to the printing form blank 2. The copy 10 is oriented so that its edges extend in parallel to corresponding edges of the blank. The center of the copy 10 is disposed vertically above and in alignment with the center point of the blank, such alignment being indicated by dot-dash axis of symmetry 11. The table 9 is arranged vertically adjustable along the guide members 12, by suitable and desired means, and, accordingly, the copy 10 can be spaced as desired from the blank 2.

Between the blank 2 and the copy 10, there is disposed a frame 13, which is likewise vertically adjustable along the guide members 12, and carries an objective 14. The latter may be exchangeable for an objective with different focal distance or its focal distance may be adjustable.

Expandable bellows 15 and 16 enclose the space between the copy 10 and the objective 14 and between the latter and the blank 2, respectively, to exclude outside light therefrom.

The punctiform light source 5 is projected by the objective 14 onto the copy 10 as a light dot, which lies relative to the axis of symmetry 11 always at a diametrically opposite point. Accordingly, the point-by-point and line-by-line scanning of the copy 10 and simultaneous engraving on the blank 2, will produce a printing form carrying an engraved image which is reversed as compared with the image on the copy 10, as it must be, so as to produce with the resulting printing form pictures or images which correspond to the copy 10.

The reproduction scale may be altered or adjusted within certain limits by adjusting the position of the copy 10 and of the objective 14, as well as by an exchange of the objective with different focal distance or changing the focal distance of the corresponding objective. The magnitude or size of the exchangeable punctiform light source 5 depends solely upon the screen used and may be in the case of enlargement on the order of 1:1 equal to the diameter of the screening points. Assuming a certain screening and also adjustment according to a certain enlargement or reduction of the copy, to appear on the printing form, the objective will automatically produce the punctiform light source 5, upon the copy, in the correct size, which is respectively equal to the enlarged or reduced diameter of the screening points.

Within the enclosed projection chamber, near the objective 14, there may be arranged rotation symmetrically and uniformly spaced about the objective axis 11, a plurality of parallel-connected photocells or, if desired, a single ringshaped photocell 17, coaxial with the objective axis 11. The photocell means employed ascertain the relative brightness of the light dots scanned upon the copy 10. The photocell means is disposed near the objective 14 but spaced as much as possible from the copy 10, to reduce the effect of the different spacing of the individual scanned light dots from the photocell means and further, to avoid blocking of the scanning beam by the photocell means. The photocell means will in such arrangement ascertain in the neighborhood of the copy image margins less brightness of the scanned light dots than is actually present, due to greater distance from the light dots, but such brightness drop toward the copy margins will be in the same order of magnitude as the brightness drop of an objective upon picturing marginal dots. It is on account of weakness of light of the scanned light dots, due to the great distance of the photocell means from the image copy, advisable to use photocell means with multiplier means for secondary electrons, socalled photo-multipliers.

The photoelectric currents produced by the photocell means, which fluctuate according to the brightness of the scanned light dots, are amplified at 19 and control in known manner the depth of penetration or cutting of the cutting tool 4 which effects the pointwise line-by-line engraving on the blank 2.

In case of producing screened printing forms, a screening frequency is in known manner superimposed upon the control voltages for the engraving system; this may be done by means of a screen frequency generator, for example, a sound wheel or rotor 20, coupled with the drive for the scanning-engraving device 3 for positive synchronization with the motion of the engraving means. The screening frequency effects periodic motion of the engraving tool with respect to the printing form blank independent of the picture or copy image modulation, thereby producing the point or dot screen.

Changes may be made within the scope and spirit of the appended claims.

I claim:

1. Apparatus for electromechanically producing printing forms bearing images of copies to be reproduced according to a desired variable reproduction scale, comprising means for disposing a copy to be reproduced and a printing form blank to be correspondingly engraved, each in an individual holder therefor, means for variably adjusting the spacing between said copy and said blank, a scanning-engraving device comprising respectively a punctiform light source facing said copy and an engraving system having an engraving tool facing said blank, drive means for moving said device including said light source and said tool to move the latter line-by-line relative to said blank, an objective dis-

posed between said light source and said copy for projecting said light source thereupon in the form of a light dot, means for varying the spacing of said objective with respect to said light source and said copy, photocell means disposed rotation symmetrically about the axis of said objective at a point between said objective and said copy, and circuit means interconnecting said photocell means and said scanning-engraving device.

2. Apparatus according to claim 1, comprising means for enclosing the space between said copy and said objective and between the latter and said light source, respectively, against ingress of extraneous light.

3. Apparatus according to claim 2, wherein said copy and said printing form blank are oriented one with respect to the other with corresponding edges extending in parallel and with a line drawn through the center of said copy and the center of said blank extending perpendicular thereto.

4. Apparatus according to claim 3, comprising an objective with adjustable focal distance.

5. Apparatus according to claim 3, comprising photocell means consisting of a plurality of individual photocells.

6. Apparatus according to claim 3, comprising photocell means consisting of a single ring-shaped photocell.

7. Apparatus according to claim 3, comprising means included in said circuit means for amplifying the currents produced by said photocell means for the control of the operation of said engraving tool.

8. Apparatus according to claim 3, comprising a generator for producing a screen frequency, and circuit means for employing said screen frequency for the control of the operation of said engraving tool.

9. Apparatus according to claim 3, comprising means for amplifying the currents produced by said photocell means, and a generator for producing a screen frequency, said amplifying means and generator being connected in said circuit means for the control of said engraving tool.

10. Apparatus according to claim 9, comprising means for coupling said generator with said drive means.

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