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MULTIPLE RATIO ELECTRICAL ENGRAVING MACHINE

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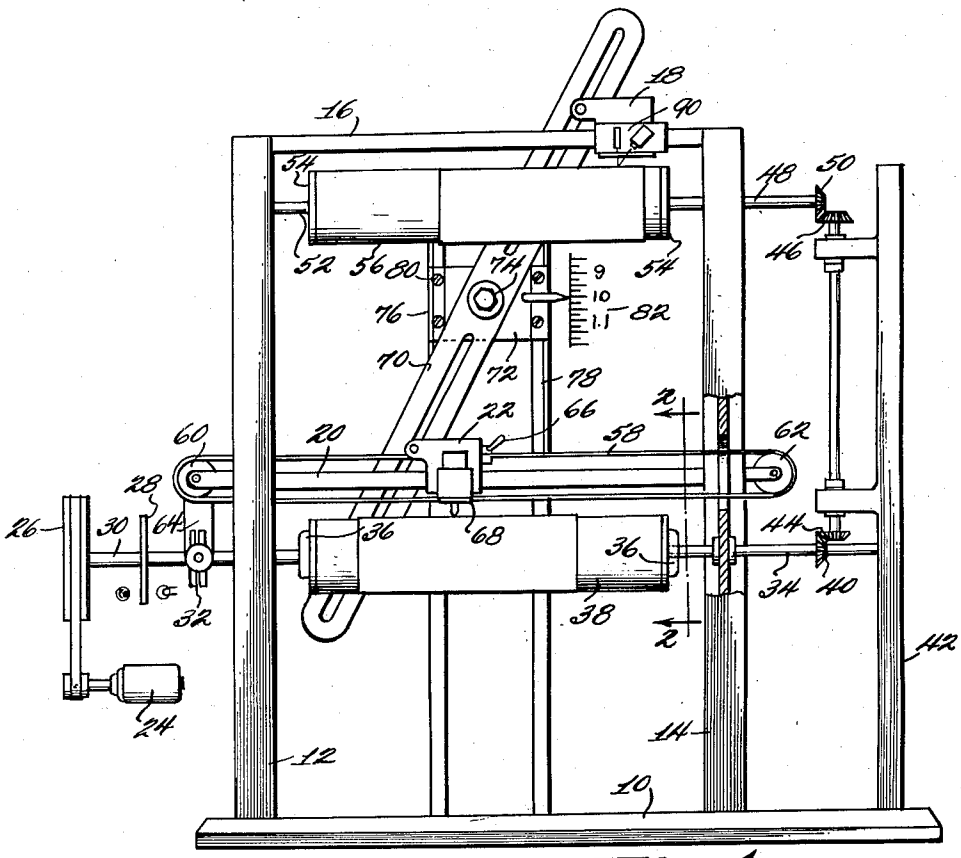

Fig. 1

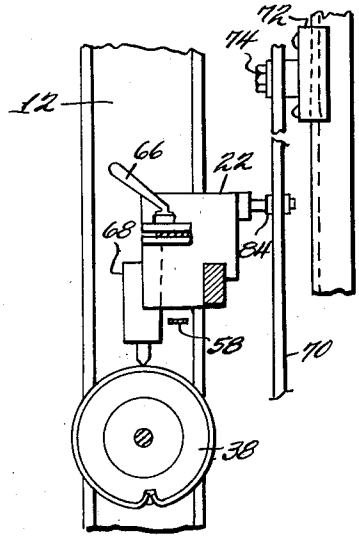

Fig. 2

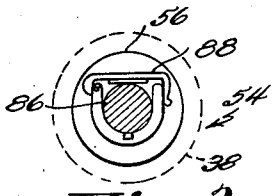

Fig. 3

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MULTIPLE RATIO ELECTRICAL ENGRAVING MACHINE

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2 Claims. (Cl. 178—6.6)

This invention pertains to screen or half-tone engraving machines and machines of similar type used for producing screened negatives or positives. Machines of this type have gone into wide use, particularly for the production of newspaper reproductions from original photographic prints, since they eliminate the costly and time-consuming production of photoengravings. However, direct electrical engravers and screen negative producers are also employed for other types of graphic reproduction, both in monochrome and in multiple color work.

A good example of a successful type of photoelectrically controlled engraver is shown and described in the U.S. Reissue Letters Patent No. 23,914, issued to J. A. Boyajean, Jr., as assignor to the owner of the present invention. Such machine, however, can itself produce only engravings which are to the same dimensional scale as the original photograph or other copy material which the machine is scanning. To permit the proportions of the original to be changed in reproduction, as is often desirable in order that the engraving may fit a certain space in the final printed matter, various expedients have been proposed. Thus, photographic enlargement of the "original" can be employed to produce an intermediate print of the proper size for scanning. Machines capable of scanning an enlarged or reduced optical image of the original have also been considered. All of these proposals have certain drawbacks, either introducing additional treating steps, or requiring considerably more complicated apparatus than that needed for same-size reproduction.

It is a principal object of the present invention to provide a simple and efficient form of photoelectric engraving or screen negative machine which is capable of providing, from a given original copy, engravings or screened reproductions selectively of different final proportions or dimensions. This is to be accomplished without requiring optical or photographic alteration of the size of the original copy, so that the final product, such as an engraving, can be made at once after a simple adjustment of the machine to the desired factor of proportionality in size.

A further object of the invention is to provide a machine of the above general type in which special provision is made for preparing, at will, engravings or like half-tone screened reproductions differing from the original copy size by certain standard or predetermined size factors, so that for a given standard size of original copy, the machine can be set very rapidly and accurately to provide a finished screened product of any selected one of a range of sizes. Thus, for example, the machine may be designed to derive directly from a standard 4 by 5 inch original photograph a final engraving plate whose size is suitable for one, two or three-column display, or other unit size, as in a newspaper or the like. The satisfactory achievement of this object of the invention permits great simplification of operations, and considerable savings in time, labor and material in printing operations.

Still another object of the invention is to provide a machine of the cylindrical scanner type in which the desired proportional change in engraving size in one direction (length or width) is accomplished by a simple lever system, while the corresponding change in size in the other direction (width or length) is obtained by selection of a cylinder of proper diameter, from among several interchangeable cylinders of different diameters. This separation of the control of the size proportionality factor between the two directions incidentally permits non-proportional changes in size, including the possibility of enlarging or reducing only one dimension of the original material. Such possibility permits the accomplishment of various useful ends, including selective distortion, and the accomplishment of slight size changes in one dimension only to make the engraving fit a special purpose. In the latter case, the size change would be accomplished by adjusting the lever system only, and utilizing scanning and engraving cylinders of the same diameter, so that the continuous ratio adjustment inherent in the lever system is utilized. For the reproduction of odd or non-standard sizes of originals, the machine may be set to produce that selected size change resulting in the next larger standard size of finished engraving, and the final engraving plate or similar sheet trimmed or cropped in one or both dimensions to satisfy the dimensional requirements involved. This is not a drawback in the general case, because most pictorial matter can readily be edge trimmed to a degree without loss of value, and indeed such trimming is commonplace in the graphic arts field.

While the above objects have been stated mainly in connection with the making of direct engravings on a plastic or metal sheet, the system is also advantageous where the sheet is a photosensitive material, such as photographic film or paper. In this case, the engraving head is replaced by a transducer which converts the signals obtained from the copy to a shaped optical beam producing exposure dots of variable size on the sheet, the sheet being later processed photographically to produce the desired screen pattern. Moreover, when used with this type of transducer, the sheet may consist of a suitable light-hardenable plastic or photopolymer, the dot exposure providing point-to-point selective polymerization. Such a sheet or plate, when developed as by subsequent washing or etching, can be used directly for printing purposes, or for duplication by known stereotype or matting processes.

The above and other objects and advantages of the invention will best be understood by referring now to the following detailed specification of a preferred embodiment of the invention, taken in connection with the appended drawings, in which:

Fig. 1 is a front elevation of a machine embodying the principles of the invention, with certain parts indicated diagrammatically.

Fig. 2 is a fragmentary sectional view, to a larger scale, of a portion of the machine, the section plane being indicated by the dash line and arrows 2—2 of Fig. 1.

Fig. 3 is a similar sectional view, taken on line 3—3 of Fig. 1, but illustrating the manner in which any of several interchangeable copy cylinders may be employed to effect a size change in one direction.

In the description which follows, a particular form of the invention, presently preferred, is treated in considerable detail, in order that those skilled in the art may apprehend the novel principles of the invention, and so that they may readily practice the same. However, it will be understood that these details are not intended as limiting the scope of the invention itself, which scope is indicated by the claims following the present description. Also, certain of the details of the machine which are well known of and in themselves, are indicated merely schematically, to avoid encumbering the description and drawings unnecessarily

As has been stated, the present embodiment of the invention is of the cylinder type; that is, the original photo

or copy is wrapped about a scanner cylinder, and the plastic, metal or similar sheet to be engraved is wrapped about a second cylinder, hereinafter called the engraver cylinder. In the Boyajean patent mentioned earlier, these cylinders are coaxial, one beside the other, and a flexible drive tape (driven in timed relation to the rotation of the two cylinders) operates to traverse a pair of carriages in a linear path along the respective surfaces of the two cylinders. One carriage carries a photoelectric system which scans each point of the original copy in a helical scanning pattern, and the other carriage supports a stylus motor driving an engraving stylus into the plastic or like engraveable sheet, to depths determined by the signal derived from the scanner device.

In the present invention, the two cylinders, while generally of the type described by Boyajean, are not coaxial, but are arranged one vertically above the other with their drive shafts parallel and connected by gearing for simultaneous and synchronous rotation. Supports such as guide strips or ways are provided for the carriages, one of which is again driven by a flexible tape as described above. However, the other carriage is driven by the motion of the first carriage through an adjustable lever, whose effective center of rotation can be moved to lie at different distances from the points at which the lever is connected to the carriages. Thus, by varying the relative lever arms, any desired proportionality factor between the carriage traverse motions can be obtained, and this effects the desired relative size change in one direction. The size change in the other direction on the sheet is obtained by providing several different copy-carrying or scanning cylinders, so that the unity gearing between the cylinder shafts actually results in an effective change in the peripheral velocity of one cylinder relative to the other.

With the above explanation in mind, the drawings will readily be understood. In Fig. 1, reference numeral **10** designates a suitable base plate or support for the entire apparatus, and it is provided with a pair of upright columns **12** and **14**, shown as I-beams, and forming the main framework of the device. Near the upper ends of these I-beams, a transverse bar **16** extends horizontally between them, forming at once a frame element and also a horizontal guideway for the scanner carriage **18** which is slidable therealong. At an intermediate height, a second horizontal bar **20** connects the vertical beams or columns, also serving as a frame element and as a guideway for the engraver carriage **22**.

A main drive motor **24** is belted to a pulley-flywheel **26** whose shaft **30** carries a tone wheel **28** for dot signal modulation in a manner described in the Boyajean patent; for simplicity, the tone wheel **28** is shown as an optical wheel cooperating with a light source and photocell to produce the desired pulses in timed relation to the rotation of shaft **30**. The latter is connected by a manually operable clutch **32** to a cross-shaft **34** journalled in the uprights **12** and **14**. While the shaft is shown as one piece, it may effectively be two pieces terminating in couplings such as **36** so that the engraver cylinder **38** can be changed if desired. Rotation of shaft **34** thus rotates the engraver cylinder at a speed determined by motor **24**.

At the right end of cylinder **38**, shaft **34** or its equivalent extends through a suitable bearing in upright **14** and is secured to a bevel gear **40**. The extreme right end of the shaft **34** may be journalled in an auxiliary upright **42**, which also serves to support bearing brackets carrying a shaft provided with bevel gears **44** and **46**, which transmit the rotation to the upper cross shaft section **48** by a final bevel gear **50** secured thereon. The opposite section of the cross shaft is designated **52**, and both sections terminate, at their inner ends, at couplings **54** which permit the scanner cylinder **56** to be removed and replaced quickly and without dis-assembling the apparatus.

Returning now to the engraver carriage **22**, means are provided for causing the same to traverse slowly along its guide bar **20**. Such means may include a flexible but inextensible tape **58**, preferably metal, carried tautly upon wheels **60**, **62** supported by the uprights **12** and **14**, one wheel such as **60** being driven by a suitable pulley and a belt **64** from a speed-reducing transmission, not shown, but which may form a part of the clutch device **32**. Carriage **22** is releasably locked to one pass of tape **58**, as by a clamp **66** as in the case of the Boyajean machine. Carriage **22** supports a stylus motor **68** and stylus also as described in the prior patent, for cooperation with the engravable sheet wrapped about cylinder **38**. In this way, the carriage may be moved rapidly to the desired starting point, and then clamped to tape or belt **58** for regular traverse so that the stylus will trace the desired helical motion path on the cylinder. Preferably, the stylus motor **68** is carried in vertical ways on carriage **22**, to maintain proper stylus pressure on the sheet being engraved. Suitable limit switches are of course provided, in well known way, to prevent any possibility of driving the carriage **22** into contact with the supports **12** and **14** or other parts. After completion of one pass, the carriage may be returned manually to the starting position (at either end according to the design of the machine), either by de-clutching the drive at **32** or at clamp **66**.

In order to drive the other carriage **18** distances proportional to those traversed by carriage **22**, the former is driven along its guide **16** directly from the engraver carriage, and by a variable-ratio linkage whose major component is the lever bar **70**. This lever is pivoted (for example, at its center) for free swinging movements on a vertically movable carriage **72**. Numeral **74** designates the pivot bolt for this lever. The carriage **72** may, for instance, be slidable on ways **76**, **78** also extending upwardly from base **10** and suitably braced. Screws such as **80** permit the carriage **72** to be locked firmly in its adjusted position, which position determines the effective lever ratio between the arms of the linkage. A ratio scale **82** may be provided to enable the proportionality factor to be set as desired. Where pre-determined ratios are contemplated, suitable detent means may be provided for rapid setting.

At either end of lever **70**, it is slotted as at **84**, **86**, and in each slot is received a corresponding bearing sleeve extending rearwardly from the respective carriage **18** and **22**. One such sleeve is better shown in Fig. 2, which shows the parts associated with carriage **22** to a larger scale. The pin-and-slot connections ensure strictly proportional motions of the two carriages, and if the lever arm pivot is exactly in the center of the distance between the carriage pins or sleeves, the ratio will be unity. By adjusting carriage **72**, deviations in either direction (enlargement or reduction) are readily obtained. This will accomplish the desired change in scale in one direction of the copy and engraving; to wit, the direction parallel to the cylinder axes.

To allow for scale changes in the other direction with respect to the original copy and the engraving, provision is made for substituting either for the cylinder **38** or the cylinder **56** a cylinder of different diameter. In the form shown, and most conveniently, the cylinder **56** is replaced, and as stated above, provision is made so that the substitution can be made without dis-assembly. The couplings **54** permit this to be done. Fig. 3 details one possible arrangement, a coupling **54** being shown as a flange **84** at one free end of one section of shaft **48**. The flange has an approximately semi-circular recess **86** into which a stub shaft at the end of the cylinder may be dropped, and locked in place as by a pivoted catch **88**, and the stub shaft may be keyed to the flange, as indicated in Fig. 3, for positive drive. A cylinder of larger size than cylinder **56** is illustrated in dash lines at **88**.

The photoelectric scanner assembly on carriage **18** is preferably mounted thereon by means of a double-action support **90** which permits it to be adjusted both vertically

(toward and away from the cylinder 56) and horizontally. The former motion is desirable to permit accurate focusing of the scanner system on the periphery of the cylinder, where a different size is substituted, and the horizontal motion permits proper phasing of horizontal position of the scanner to allow for slight misplacement of the copy on that cylinder. This permits the first line of the engraving to represent accurately one margin of the area of the original desired to be reproduced.

As was stated earlier, the sheet carried by cylinder 38 may be a photosensitive material such as photographic paper or film, or even a light-hardenable photopolymer or the like. In this case, the engraving head or stylus motor 68 will be replaced by a suitable optical beam output transducer controlled in the same manner by the signals from the scanning head on carriage 19. Such an optical output transducer is shown and described in the copending application of the same inventor, Serial No. 455,177, filed September 10, 1954, and owned by the assignee of the present invention.

In view of the above, it will be realized that the novel aspects of the invention do not depend upon the use of any particular output device, whether an engraver or exposing transducer, nor indeed upon whether the final sheet is an engraving or merely a screened negative or positive planographic reproduction or photograph. Hence no limitation is to be implied by the fact that this description has been directed to certain specific kinds of processes and products, and to the appropriate corresponding output devices.

A very useful application of this machine is in the newspaper field in conjunction with a camera of the high-speed self developing type such as the Land "Polaroid" camera and film. Since the size of the film or print from the camera would always be standard, and the column widths in the newspaper would also be multiples of a single column width, exact sizes of cylinders could be furnished for enlarging or reducing such a photograph to any desired multiple of the newspaper column width. The advantage of such an application would be the complete elimination of the photographic laboratory in the process of getting a picture of interest into a printing plate. The picture taken by the photographer would be removed from the camera as a reflection copy, placed on the appropriate size cylinder 56, and the engraving or other screened reproduction made very quickly after the original copy had been exposed.

For the purposes of the present description, the signal channels connecting the scanning head, the tone wheel output, and the engraving or exposing output device have been omitted for clarity. Such channels and the necessary amplifiers are well shown in the Boyajean patent, and the disclosure therein of such parts is to be considered as included herein for purposes of reference.

What is claimed is:

1. A photoelectric machine for making screened plates directly from original copy and to altered dimensional proportions, comprising a pair of cylinders adapted respectively to receive the original copy and an image receiving plate in wrap-around fashion, means for rotating said cylinders in synchronism, respective carriages mounted to traverse paths adjacent the cylinders and parallel to the cylinder axes, scanning means carried by one carriage for scanning copy on one cylinder, pattern-reproducing means carried by the other carriage for operating upon a plate on the other cylinder, power means for driving one of said carriages at a rate proportional to the rotational speed of the cylinders, and a variable-ratio linkage connecting the other carriage for movement thereof from the first carriage, said linkage comprising a single bar having a pin-and-slot connection with both carriages, and means for adjusting the position of the pivot axis of said lever with respect to the carriages.

2. The combination of claim 1, in which said cylinders are disposed in spaced parallel relationship, and in which the linkage comprises a lever pivoted upon a pivot support adjustable with respect to its distance from the respective carriages.

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