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[15] **3,694,570**

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[54] AUTOMATIC ENGRAVING MACHINE

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[51] **Int. Cl.**.....**G01d 15/02,** H04n 1/06, H04n 1/24

[58] **Field of Search**.....33/23, 21, 22; 178/6.6 B

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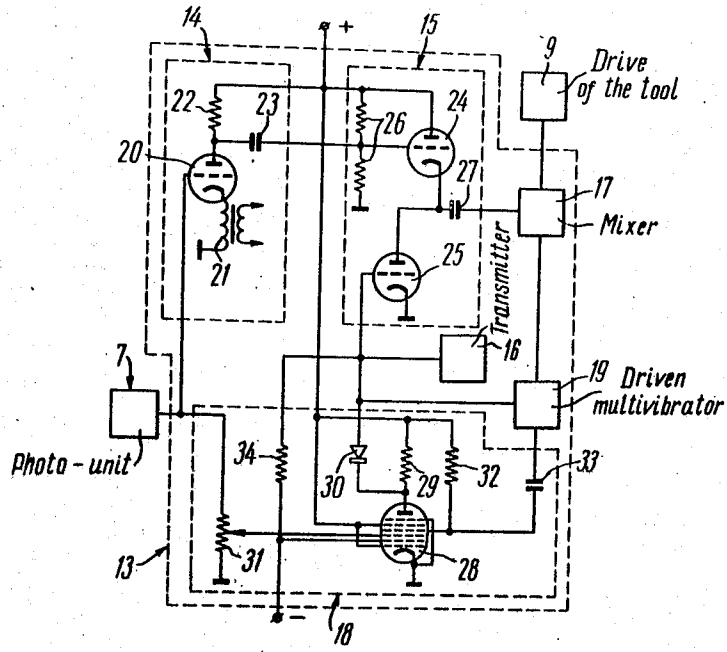
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[57] **ABSTRACT**

An automatic engraving machine, in which the device, converting the photoelectric current fed from a photo-unit moved along a rotary shaft with an original into electric signals applied to the drive of a tool engraving the rotating printing shaft while moving therealong comprises two channels. The first channel includes a modulator fed with the photoelectric current corresponding to the original and an electronic switch converting the signals fed from the modulator and acting on the drive of the tool. The second channel includes an electronic relay adjusted for a predetermined level of the photoelectric current fed from the photo-unit and electrically connected to the electronic switch of the first channel and through a driven multivibrator with the drive of the tool so that it operates during each intersection of the original boundary by the photo-unit, switching off the first channel and simultaneously triggering the driven multivibrator generating the electric signals corresponding to the boundary of the original.

3 Claims, 3 Drawing Figures



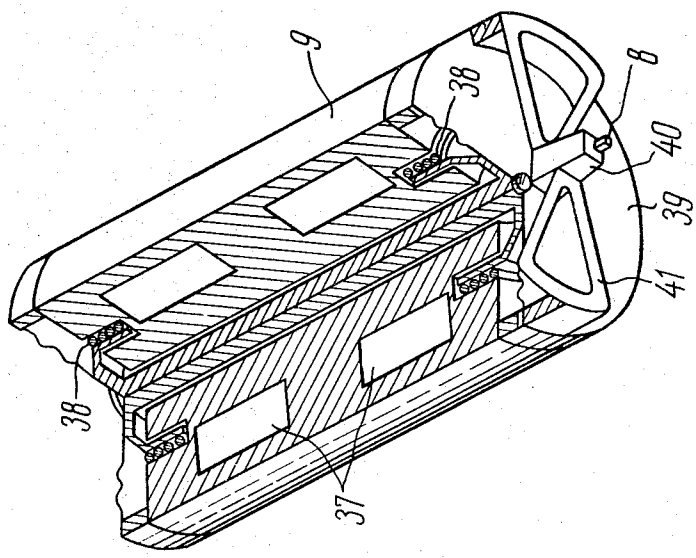


FIG. 3

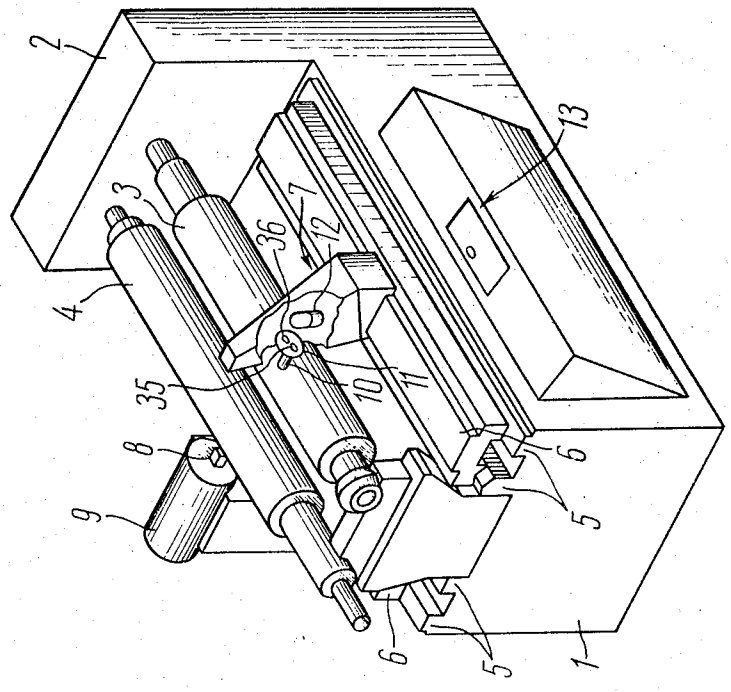


FIG. 1

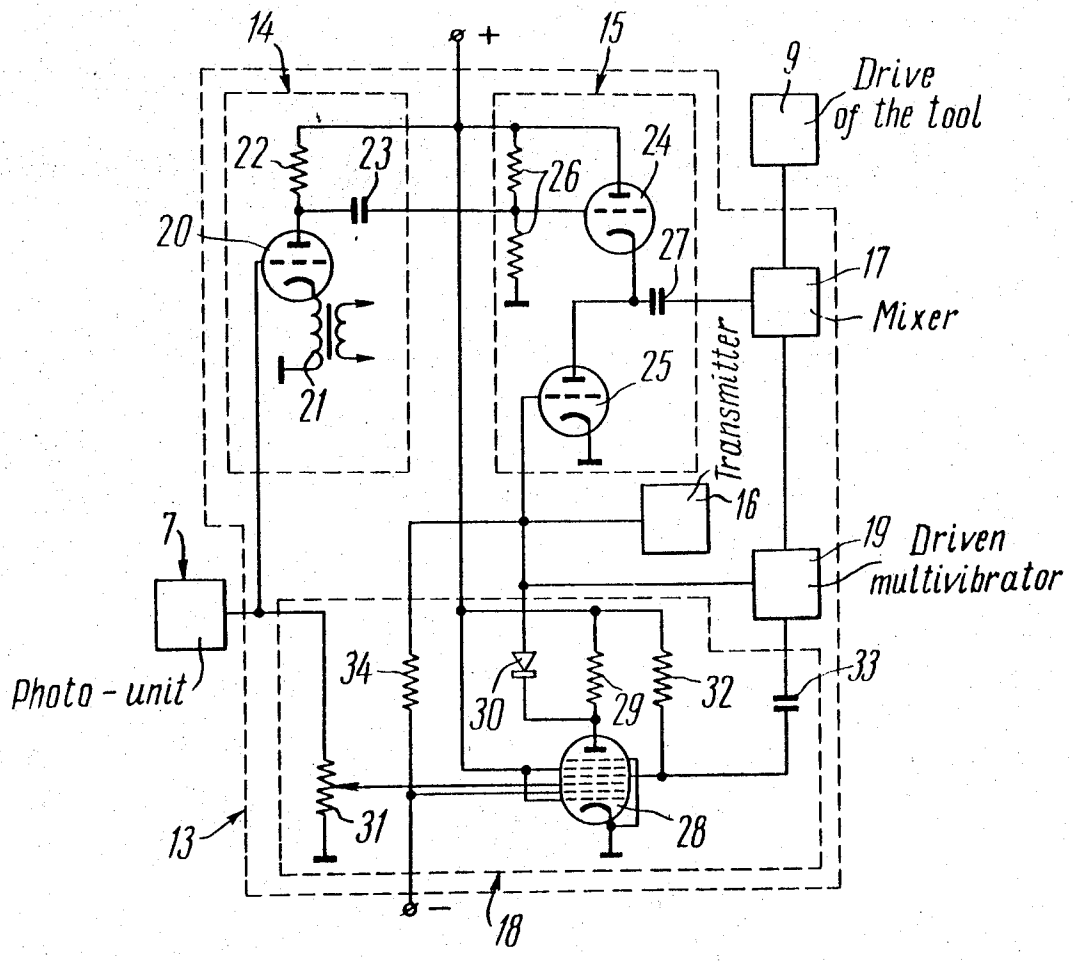

14
15
+
9
Drive of the tool
22
23
26
24
20
27
17
Mixer
21
25
Transmitter
16
7
19
Driven multivibrator
Photo - unit
34
30
29
32
33
31
28
13
18
−

FIG. 2

AUTOMATIC ENGRAVING MACHINE

The present invention relates to apparatus for making printing plates in textile, polygraphic and other industries and, more particularly, the invention relates to automatic engraving machines.

Known in the art are automatic engraving machines comprising a photo-unit with a diaphragm moving along a rotating shaft with an original and sensing through this diaphragm the luminous flux reflected from the original and carrying an information about the original. The photo-unit converts the luminous flux into a photoelectric current fed to a device converting the photoelectric current into electric signals fed to the drive of a tool engraving a revolving printing shaft, while moving along this shaft.

In the known automatic engraving machines the device converting a photoelectric current into electric signals comprises an amplitude and width-pulse modulators and this does not allow one to obtain on the engraving being made a contour line corresponding to the boundary of the original and having a depth differing from that of the engraving.

The main object of the present invention is to provide an automatic engraving machine, which makes it possible to produce on the engraving to be made a contour line corresponding to the boundary of the original and being different from the engraving by depth.

This object is accomplished by providing an automatic engraving machine comprising a photo-unit with a diaphragm moving along a rotating shaft with an original and through the above-said diaphragm sensing the light flux reflected from the original and carrying the information about the original, in which case the photo-unit converts the light flux into a photoelectric current and transfers the latter to a device transforming the photoelectric current into electric signals fed to the drive of the tool engraving a revolving printing shaft during the movement along this shaft; according to the invention, the device transforming the photoelectric current into electric signals comprises two channels, the first channel includes a modulator fed with photoelectric current from the photo-unit corresponding to the original and an electronic switch converting the signals fed from the modulator and acting upon the tool drive, while the second channel includes an electronic relay adjusted for a prescribed level of the photoelectric current fed from the photo-unit and electrically connected with the electronic switch of the first channel and through a driven multivibrator with the tool drive so that it operates at each intersection of the boundary of the original by the photo-unit, thus switching off the first channel and simultaneously triggering the driven multivibrator generating electric signals corresponding to the boundary of the original.

It is expedient that the diaphragm of the photo-unit has at least two apertures approximately of the same area disposed along the rotating shaft with the original so that during the intersection of the original boundary by the photo-unit, the diaphragm apertures are successively overlapped by the original, the electronic relay being adjusted to the photoelectric current level corresponding to the light flux fed through one aperture of the diaphragm.

Such a construction of the proposed automatic engraving machine makes it possible to accurately determine the boundary of the original and to apply it onto the engraving in the form of points or lines of a predetermined depth.

The present invention may best be understood by reference to the following description when taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a general view, partly in section, of the proposed automatic engraving machine;

FIG. 2 is a schematic diagram of the device for converting a photoelectric current into electric signals in the automatic engraving machine according to the invention;

FIG. 3 is a general view, partly in section, of the tool of the automatic engraving machine according to the invention.

The proposed automatic engraving machine has a frame 1 (FIG. 1) on which there is mounted a gearbox 2 used for rotating shaft 3 with a negative original and a printing shaft 4, on which there is applied a point or dash engraving.

The frame 1 is provided with guides 5, on which move supports 6 carrying a photo-unit 7 and a tool 8 with a drive 9 engraving the printing shaft 4, said photo-unit and tool being capable of moving along the shaft 3 and the printing shaft 4.

The photo-unit comprises an optic system 10, a diaphragm 11 and a photomultiplier 12 converting the luminous flux reflected from the original and fed through the optic system 10 and the diaphragm 11 into a photoelectric current.

The photo-unit (FIG. 1) is electrically connected with a device 13 transforming the photoelectric current into electric signals. This device 13 comprises two channels.

The first channel includes a modulator 14 fed with the photoelectric current from the photo-unit 7 corresponding to the original and an electronic switch 15 controlled by a transmitter 16 and transforming the signals fed from the modulator 14 and acting upon the drive 9 of the tool 8 through a mixer 17.

The second channel includes an electronic relay 18 adjusted for a prescribed level of the photoelectric current fed from the photo-unit 7 and electrically connected to the electronic switch 15 through a driven multivibrator 19 and the mixer 17 to the drive 9 of the tool 8 so that it operates during each intersection of the original boundary by the photo-unit 7, thus switching off the first channel and simultaneously triggering the driven multivibrator 19 generating electric signals corresponding to the boundary of the original.

The modulator 14 consists of a triode 20 whose cathode is connected to a carrier frequency transformer 21 while the anode is connected to a resistor 22 and a capacitor 23.

The electronic switch 15 consists of triodes 24 and 25 connected in series. The operating conditions of the triode 24 is set by a divider 26. The mixer 17 is connected to the cathode of the triode 24 through a capacitor 27. The grid of the triode 25 is electrically associated with the transmitter 16.

The modulator 14 may consist of a balanced modulator allowing the engraving to be made both from a negative and positive original.

The electronic relay **18** comprises a hexagrid **28** whose anode is connected with a resistor **29** and a Zener diode **30** connected to the grid of the triode **25**. The control grid of the hexagrid **28** is connected to the movable contact of a resistor **31** connected to the output of the photo-unit **7**. Connected to the output grid of the hexagrid **28** is a resistor **32** and a capacitor **33**, to which is connected the driven multivibrator **19** electrically associated with the grid of the triode **25** and with the mixer **17**. Connected to the grid of the triode **25** is a resistor **34**.

In the described version of the automatic engraving machine the diaphragm **11** (FIG. **1**) **1**) of the photo-unit **7** has two apertures **35** and **36** having an equal area and arranged along the shaft **3** with the original so that during the intersection of the original boundary by the photo-unit **7**, the apertures **35** and **36** of the diaphragm **11** are successively overlapped by the original In this case the electronic relay **18** (FIG. **2**) is adjusted for the level of the photoelectric current corresponding to the luminous flux fed through one aperture **35** or **36** or the diaphragm **11**.

The drive **9** (FIG. **3**) of the tool **8** comprises an electric magnet **37**, interconnected coils **38** mounted with the possibility of axial displacement and secured on the diaphragms **39** and a holder **40** of the tool **8** mounted through springs **41**.

The proposed automatic engraving machine operates a follows.

The photo-unit **7** (FIG. **1**) while moving along the rotating shaft **3** with the original, through the apertures **35** and **36** of the diaphragm successively senses the luminous flux reflected from the original and carrying an information about this original, converts the luminous flux into a photoelectric current and transfers the latter to the device **13** transforming the photoelectric current into electric signals.

The photoelectric current is fed to the grid of the triode **20** (FIG. **2**) of the modulator **14** and to the resistor **31** of the electronic relay **18**. After passing the modulator **14**, the electric signal corresponding to the photoelectric current is impressed on the grid of the triode **24** of the electronic switch **15**. From the output of the electronic switch **13** the electric signal corresponding to the original through the capacitor **27** is fed in the form of pulses to the mixer **17** and therefrom is fed to the drive **9** of the tool **8**. The duration and frequency of the pulses are set by means of the transmitter **16** which periodically renders the triode **25** of the electronic switch **15** conductive and non-conductive. Under the action of these pulses the tool **8** impresses an engraving on the printing shaft **4**.

When a boundary line of the original is intersected, the photo-current fed to the input of the electronic relay **18** is reduced to a value predetermined by resistor **31**, and a sudden change of the anode current is observed in the hexagrid **28**. In this case the driven multivibrator **19** is triggered, which cuts off the triode **25** of the electronic switch **15**, and through the mixer **17** applies a pulse of prescribed magnitude and duration to the drive **9**. The tool **8** then engraves an element of a contour line on the printing shaft (roll) **4**, the direction of the line being close to that of the generatrix of the shaft **4**. When the photo-unit **7** (FIG. **1**) intersects the boundary of the original, the apertures **35** and **36** of the diaphragm **11** are successively closed by the original and this changes the photoelectric current through the photomultiplier **12** from the prescribed value to a half and then to zero (or vice versa depending on the direction of movement of the photo-unit **7**).

The electronic relay **18** (FIG. **2**) through the use of the resistor **31** is adjusted for a half value of the photoelectric current which corresponds to the luminous flux fed to the photomultiplier **12** from the original through one aperture **35** or **36** of the diaphragm **11**. At all changes of the photoelectric current from the prescribed value to a half, the electronic switch **15** is controlled by transmitter **16** while at the moment of operation of the electronic relay **18** the electronic switch **15** is controlled by the multivibrator **19**. At any change in the photoelectric current from zero to a half of the prescribed value, the anode current in the hexagrid **28** is very low, while the anode voltage exceeds the breakdown voltage of the Zener diode **30**. In this case the Zener diode **30** conducts the current and opens the triode **25** of the electronic switch **15** (in this case the transmitter **16** does not affect the operation of the electronic switch **15**). Under these operating conditions the signal fed from the modulator **14** is applied to the mixer **17**. Under the action of this signal the tool **8** makes a contour line of the engraving in a direction perpendicular to the generatrix of the shaft **4**.

The electric signals fed from the mixer **17** to the drive **9** of the tool **8** pass through the coils **38** (FIG. **3**) and interact with the field of the electric magnet **37**. Due to this interaction the coils **38** move in the direction to the printing shaft **4** and push the holder **40** to the tool **8** with a force proportional to the value of the signal fed to the coils **38**. The holder **40** is returned to the initial position by the springs **41**. As a result, an element of the original image is engraved on the printing shaft **4**.

The proposed automatic engraving machine makes it possible to produce point and dash engravings with clearcut contour lines of a predetermined depth throughout the whole perimeter of the engraving on materials having Brinell hardness up to 130 kg/mm^2. This machine can be used for making engraving with a depth of up to 0.3 mm with a resolution of 12 to 100 lines per centimeter.

The printing shafts engraved by means of the proposed automatic engraving machine can be used for printing in textile and polygraphic industry as well as for stamping and coloring a metal foil, synthetic films, wall paper and artificial leathers.

We claim:

1. An automatic engraving machine comprising, in combination; a frame; a printing shaft rotatably mounted on said frame; a tool mounted on said frame for reciprocal motion along said printing shaft; a drive means for said tool; a shaft supporting an original rotatably mounted on said frame; a photo-unit mounted on said frame and adapted to move along said original-supporting shaft; an optical system for said photo-unit for passing luminous flux reflected from said original upon movement of said photo-unit along said original-supporting shaft; a diaphragm for said photo-unit positioned behind said optical system in the light path of the luminous flux reflected from said original; a photo-multiplier for said photo-unit positioned behind

said diaphragm in the light path of said luminous flux for sensing said luminous flux and converting the latter into photo-electric current; means mounted on said frame and being electrically connected with said photo-unit for converting the photo-electric current emitting from said photo-multiplier into electric signals, said means comprising two channels; a first of said channels including a modulator connected to said photo-multiplier and receiving the photo-electric current from said photo-multiplier corresponding to said original; an electronic switch for said first channel being connected to said modulator and to said drive means for said tool for converting the signals emanating from said modulator into signals actuating said drive means the second of said channels including an electronic relay connected to said photo-multiplier and being adjusted for a preset level of the photo-electric current emitted from said photo-multiplier, said electronic relay being electrically connected with said electronic switch and being operative at every change of the photo-electric current corresponding to an intersection by said photo-multiplier of a boundary line on the original, and so as to act upon said electronic switch for preparing the latter to the transformation of signals fed from said modulator; the second of said channels including a driven multivibrator connected to said electronic relay, to said switch, and to said driving means for the tool, and being operative at each switch-over of said electronic relay so as to act upon said electronic switch by interruption of the signals fed from said electronic switch to said driving means, and simultaneously being adapted to act upon said driving means for the tool whereby said tool engraves an element of a contour line on said printing shaft during rotation of said last-mentioned shaft.

2. An automatic engraving machine according to claim 1, wherein said photo-unit diaphragm includes at least two apertures of approximately equal cross-section located along the axis of said original-supporting shaft, said aperture, during the intersection of a boundary of said original by said photo-unit upon movement along said original shaft, being successively overlapped by said original, said electronic relay being adjusted for a level of said photo-electric current corresponding to the luminous flux passing through one of said diaphragm apertures, so as to ensure formation of a contour line in a direction extending perpendicular to the generatrix of said printing shaft.

3. An automatic engraving machine according to claim 1, wherein the first of said channels is provided with a sensor, said sensor being electrically connected with said electronic switch and being adapted to act upon the latter by closing and opening said switch at a preset frequency after operation of said electronic relay.

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