

[54] **AUTOMATIC DEVICE FOR MAKING
DRAWINGS**

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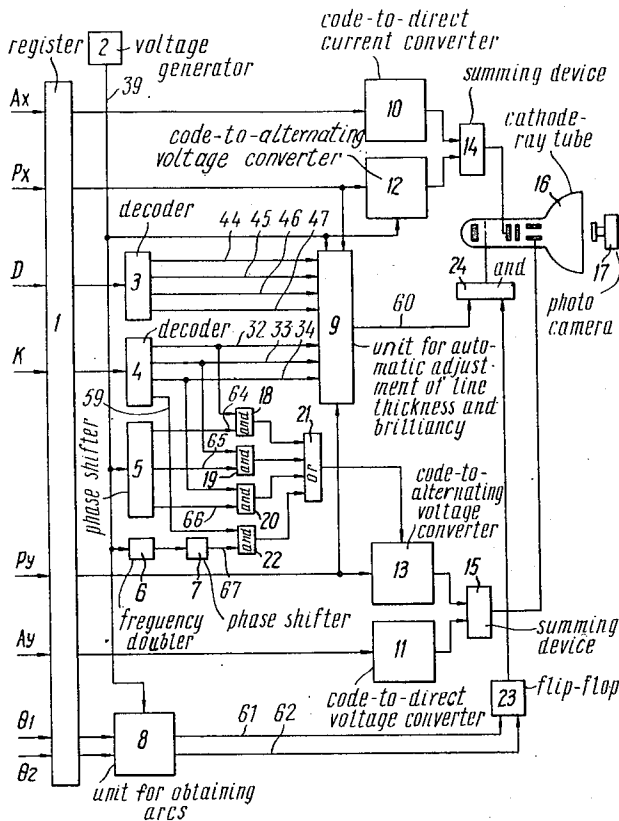
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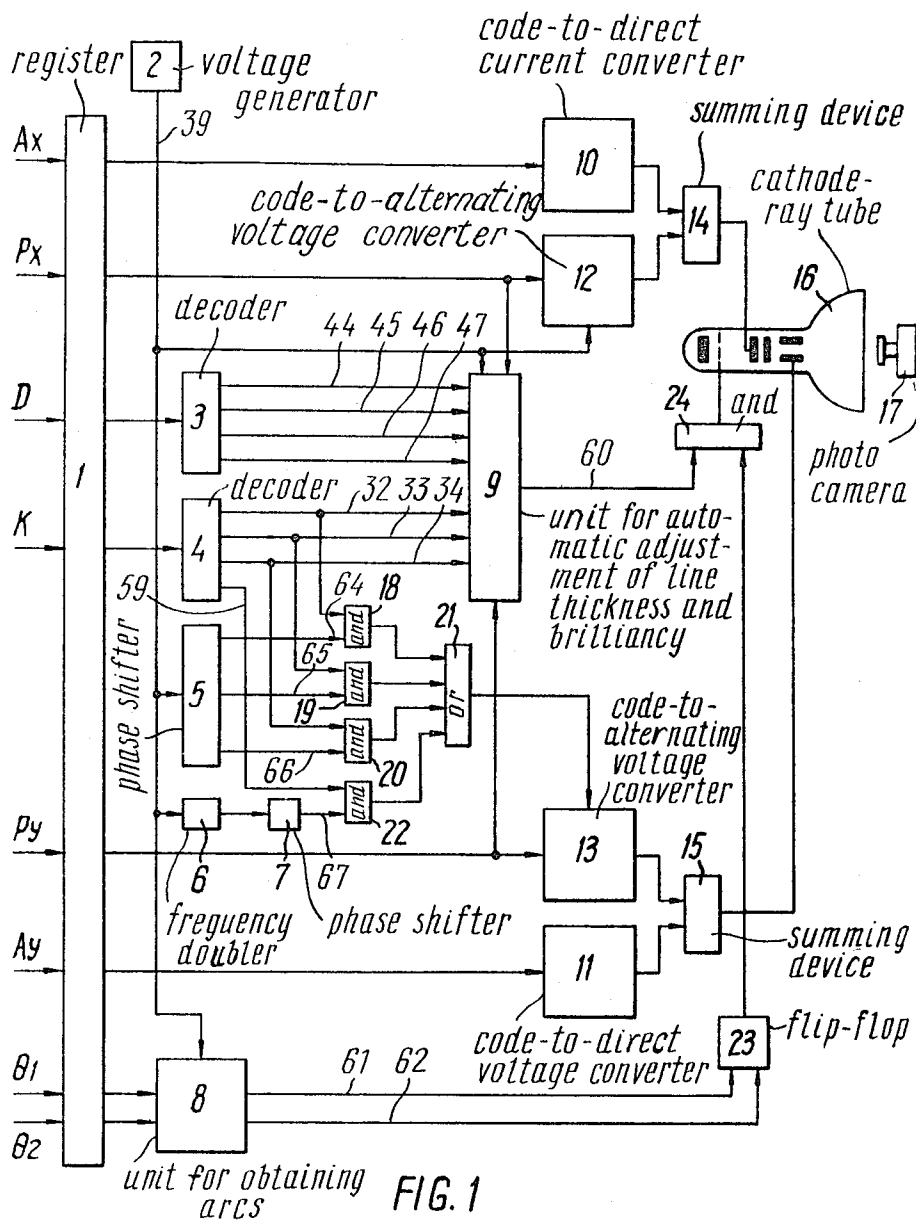
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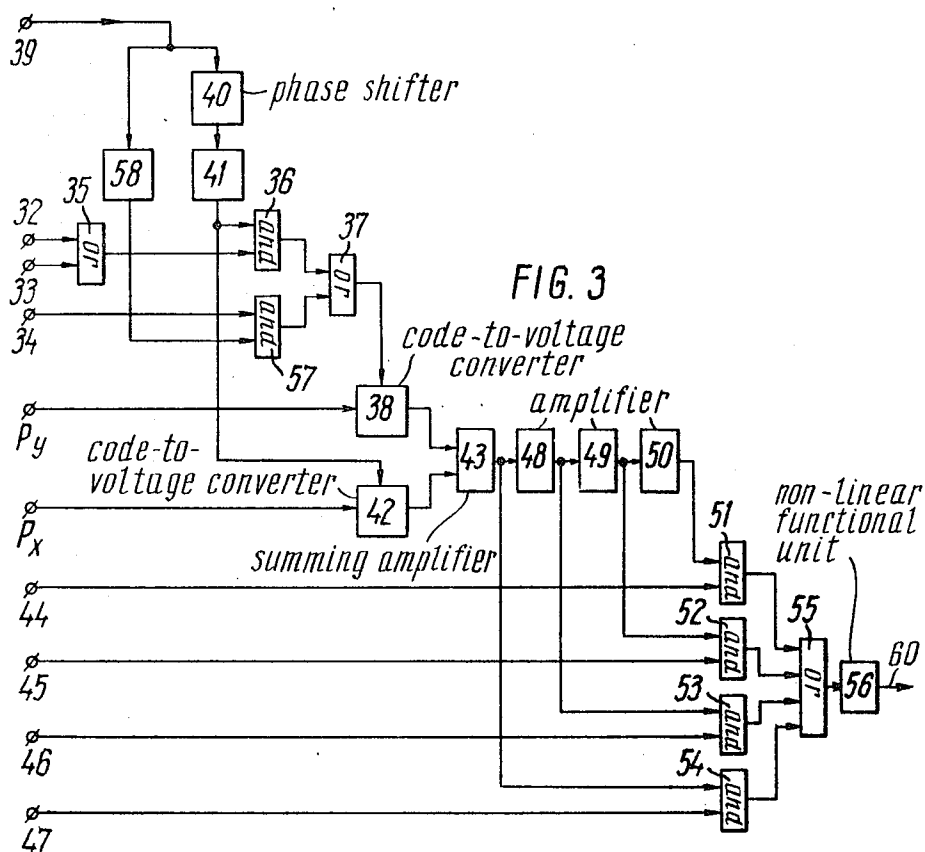
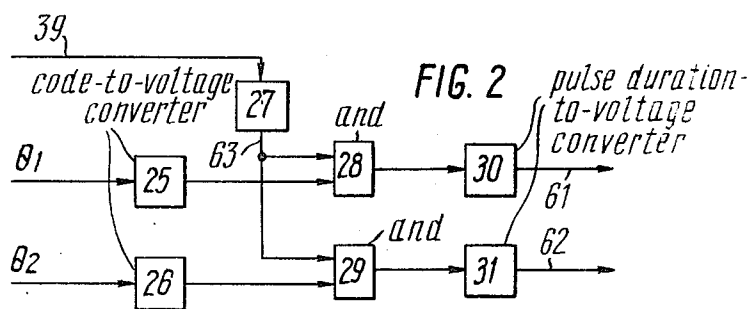
[57] **ABSTRACT**

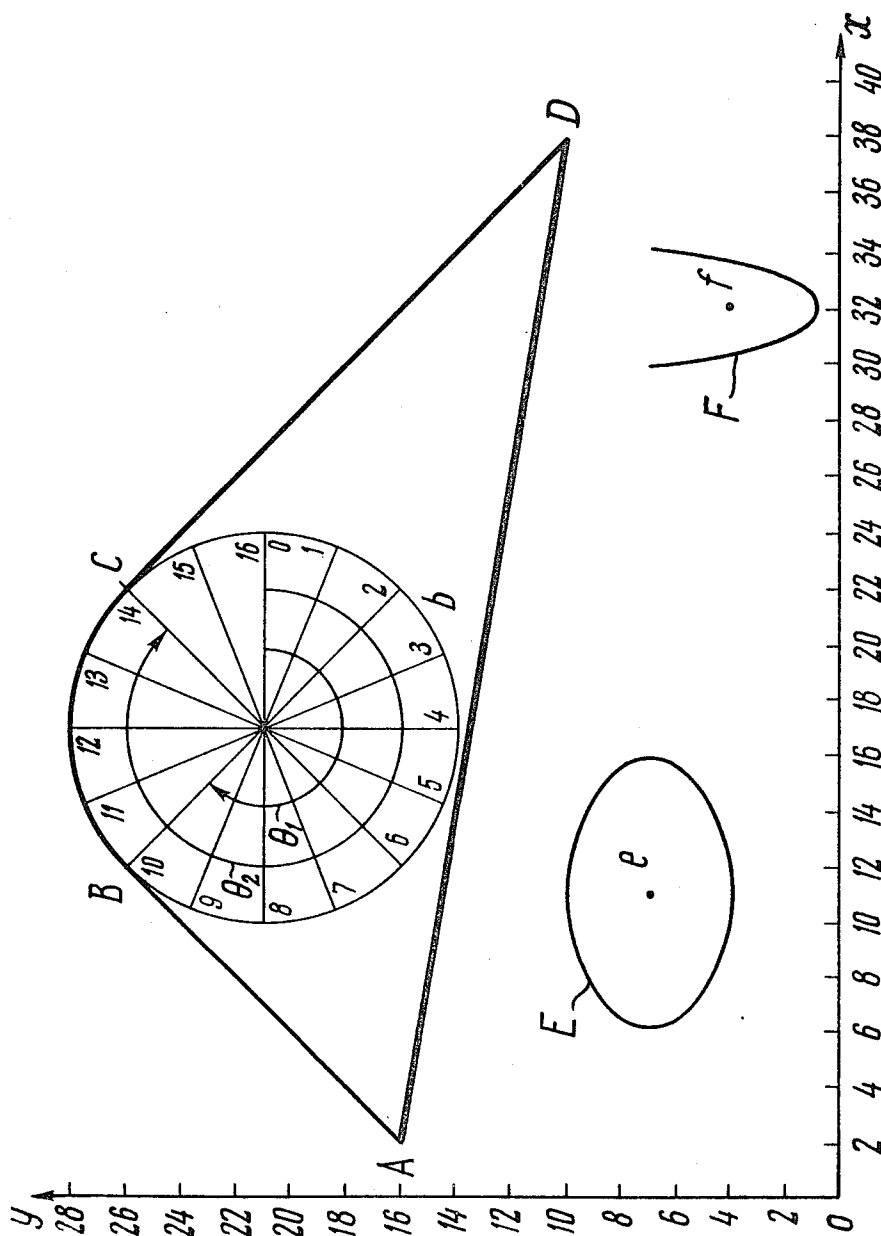
An automatic drawing device wherein use is made of codes set by digital computer, the codes describing the position of a line on the drawing, length of projection and the configuration of the lines.

8 Claims, 4 Drawing Figures









AUTOMATIC DEVICE FOR MAKING DRAWINGS

This invention relates to the field of digital-to-graphical conversion of information and, more particularly, to automatic drawing devices for automation of designing processes through the use of digital computers.

There are known devices for obtaining graphical data in accordance with the preset digital codes, which make it possible to represent the computer output in the form of a drawing and utilize two-coordinate recording instruments.

Known devices are used to calculate the coordinates of each point of the line on the drawing either directly in a digital computer or in an intermediate digital unit (interpolator), which receives digital codes from the computer, said codes describing a segment of the line as a whole, for example, the coordinates of the beginning and end of the segment. By using the coordinates of the beginning and end of the segment the coordinates of every point of the line segment may be calculated also in the digital form and then converted by using the known method into the movement of the drawing element of a two-coordinate recording instrument.

It is likewise known that, if influenced by signals varying sinusoidally, the drawing element is deflected by said signals into two mutually perpendicular directions, owing to which said element traces a path which is a segment of a straight line, a circumference, an ellipse or a parabola, the horizontal and vertical projection lengths of said figures being proportionate to the amplitudes of the deflecting signals.

The known devices for obtaining graphical images of separate symbols by utilizing the above-mentioned figures (conventionally called interference or Lissjous figures) contain a definite set of units to generate any given symbol.

However, a disadvantage of such devices lies in certain limitations in representing the digital computer output in a graphical form.

For instance, the employment of the devices which calculate the coordinates of each point of a line complicates the processing of computer information. Transient phenomena unavoidable in each digit-to-point position conversion limit the speed of operation of said devices, this being an obstacle in the development of quick-acting digital computers and in the effective utilization of graphical-form visual output devices.

The devices for symbol generation can, however, produce only a definite set of symbols. When necessity arises to trace a figure beyond the set, the device should be modified.

An object of the present invention is to provide an automatic drawing device which would allow conversion of digital information into any lines on the drawing without preliminary calculation of the coordinates of each point of the line in digital form, without any modifications or readjustments in the above-mentioned automatic device or graphical output device.

With this and other objects in view, the present invention resides in that the automatic drawing device, which makes use of codes set by a digital computer, comprises: a convertor for translating codes describing the position of a line on the drawing into d.c. signals proportionate to the codes involved; a convertor for translating codes describing projection lengths of a line into a.c. signals proportionate to the codes involved, a convertor for translating the code describing the configuration of a line (straight line, ellipse or parabola) into signals whose frequency and phase shifts are determined by the configuration of the line; and means for summing up the signals obtained separately with respect to each coordinate, said means being connected to the deflection systems of a two-coordinate recording instrument.

The convertor for translating the code describing the projection length of a line on the drawing with respect to one of the coordinates into a.c. signals proportionate to the code involved may be coupled, through "AND" and "OR" circuits connected to a line configuration decoder, to either a phase shifter or a frequency doubler and a phase shifter placed in parallel, whereas the convertor for translating the code describing the projection length of the line with respect to the

other coordinate into a.c. signals proportionate to the code involved as well as a phase shifter and a frequency doubler may be connected to an a.c. voltage generator.

It may be advantageous to connect the input of the two-coordinate recording instrument through an "AND" circuit to a line thickness decoder and to a line thickness and brightness automatic control unit associated with the latter, codes describing projection lengths and the configuration of the line being applied to the inputs of said control unit.

The line thickness and brightness automatic control unit may comprise: a convertor for translating the code describing the line projection length with respect to one of the coordinates into an a.c. signal, said convertor being coupled via "AND" and "OR" circuits, connected to the line configuration decoder, to series-connected a.c. voltage generator, phase shifter and rectifier for tracing straight lines or to series-connected a.c. voltage generator and rectifier for tracing ellipses; a convertor for translating the code describing the line projection length with respect to the other coordinate into an a.c. signal, said convertor being coupled to series-connected a.c. voltage generator and rectifier; a summing amplifier, whose input is connected to the convertors for translating projection length codes into a.c. signals, while its output is coupled to series-connected amplifiers, said amplifiers being coupled to the two-coordinate recording instrument via "AND" circuits connected to the line thickness decoder, an "OR" circuit and a non-linear functional unit.

It is also expedient to connect an arc tracing unit to the input of the two-coordinate recording instrument through an "AND" circuit and a flip-flop, the coordinates of the beginning and end of the arc and an a.c. generator voltage being applied to the input of said arc tracing unit.

An embodiment of the present invention is described hereinbelow by way of example with reference to the accompanying drawings, wherein:

FIG. 1 is a block diagram of the automatic drawing device of the invention;

FIG. 2 is a functional diagram of the arc tracing unit; and

FIG. 3 is a functional diagram of the line thickness and brightness automatic control unit.

FIG. 4 illustrates an example of a configuration drawn in accordance with the present invention.

The automatic drawing device comprises: a digital register 1 (FIG. 1) for storing digital information concerning a line to be traced; an a.c. voltage generator 2; a decoder 3 for delivering a control signal from anyone of its outputs, depending upon the thickness of the line; a convertor for translating the code describing the configuration of a line which comprises a decoder 4 for delivering a control signal from anyone of its outputs, depending upon the configuration of the line (straight line, circumference, ellipse or parabola), a phase shifter 5 for shaping signals phase-shifted by a definite angle relative to signals produced by the a.c. voltage generator 2, said phase shifter being employed for obtaining straight lines and ellipses, a frequency doubler 6 and a phase shifter 7, both employed for obtaining parabola; a unit 8 for obtaining arcs, said unit being used to receive signals corresponding to the beginning and end of an arc; a line thickness and brightness automatic control unit 9, said unit being connected to decoders 3 and 4 and to a phase shifter 5; convertors 10 and 11 for translating line position codes into d.c. signals; convertors 12 and 13 for translating line projection codes into a.c. signals; means 14 and 15 for summing up signals obtained in the above-mentioned signal convertors; a two-coordinate recording instrument fashioned as a cathode-ray tube 16 with a camera 17 in front of its display.

The automatic device of the present invention functions as follows.

Applied to the inputs of the register 1 in their respective order are: code A_x describing the abscissa of the mid-point of a line segment, code P_x describing the length of the line horizontal projection, code D describing the line thickness, code K describing the configuration of the line, code A_y

describing the ordinate of the mid-point of the line segment, code P_y describing the length of the vertical projection of the line segment, code θ_1 describing the beginning of a circumference arc and code θ_2 describing the end of said arc. The above-said codes are stored in the register 1. The employment of the register 1 makes it possible to obviate the idle time of the digital computer when drawing lines of various configurations (straight line, circumference, ellipse, parabola).

At the same time, sine a.c. voltage is delivered from the generator 2 to the convertor 12 and the phase shifter 5.

The code A_x describing the abscissa of the line mid-point is applied to the convertor 10, whereas the code P_x describing the length of the horizontal projection is applied to the convertor 12. After being summed up and amplified by the means 14, the output voltages are delivered to the horizontally deflecting plates of the cathode-ray tube 16, said voltages varying according to:

$$K_1 A_x + \frac{1}{2} P_x (\cos \omega t) \text{ where}$$

K_1 is amplification factor,

ω is a.c. voltage cyclic frequency of the generator 2.

$K_2 A_y + \frac{1}{2} P_y \cos K_3 (\omega t + \psi)$ the vertically deflecting plates of the cathode-ray tube 16, K_2 being the amplification factor, $K_3 = 1$ for tracing straight lines and ellipses, $K_3 = 2$ for tracing a parabola, ψ is a phase angle equal to 0° , 90° or 180° depending upon the configuration of the line to be drawn.

The above-said voltage results from translation of the codes A_y and P_y into d.c. and a.c. signals and their summing up in the means 15.

The signal produced by the generator 2 is not delivered directly to the convertor 13; it is supplied through the phase shifter 5, one of "AND" circuits 18, 19, 20 and an "OR" circuit 21 in the case of tracing straight lines and ellipses, or through the frequency doubler 6, the 90° phase shifter 7, an "AND" circuit 22 and the "OR" circuit 21 in the case of tracing a parabola.

When necessity arises to trace an arc, codes θ_1 and θ_2 describing the beginning and end of the arc are supplied to the unit 8, said unit generating signals X and Y, which set the flip-flop 23 to "1" or "0" position. The output voltage of said flip-flop is applied to one of the inputs of an "AND" circuit 24, said circuit either permitting or inhibiting the delivery of a signal to the modulating electrode of the cathode-ray tube 16.

A more detailed description of the function of the arc tracing unit 8 follows hereinbelow.

The codes θ_1 and θ_2 describing the beginning and end of an arc are supplied to convertors 25 and 26 (FIG. 2), which translate the codes into proportional voltages. When a sine voltage is applied to a null indicator 27, the latter operates and sends a permissive signal to "OR" circuits 28 or 29 which are coupled to the convertors 25 and 26. This permissive signal indicates the beginning of the "voltage-to-time" conversion which is accomplished by convertors 30 and 31 of, say, the phantastron type, said convertors shaping the signals X and Y switching the flip-flop on and off.

Influenced by the signals coming from the summing means 14 and 15 (FIG. 1), as well as from the "AND" circuit 24, the electron beam traces with its end a required line in a required area of the drawing.

The lines thus induced on the screen are consecutively photographed onto a single frame by the camera 17.

Use is made of the line thickness and brightness automatic control unit 9 to set up an instantaneous brightness intensity level, said level being the function of the signal applied to either of the outputs of the decoder 3. Apart from this, the current of the beam for every point of the drawing is automatically controlled depending upon the variations in the beam velocity, whereby the uniform brightness of the line is provided.

To elucidate the process of control over the line brightness and thickness, refer to a block-diagram in FIG. 3.

Theory and experience have shown that, if an electron beam (or any drawing element in general) deflects sinusoidally, a sufficient extent of line brightness uniformity can be obtained on condition that the beam current in tracing straight lines varies according to:

$I_1(t) = m(D) \cdot (P_x + P_y) / \sin \omega t$ where $I_1(t)$ is beam current, and m is a constant, whose magnitude depends upon the circuit parameters and the line thickness D , whereas in tracing ellipses the beam current varies as follows:

$$I_2(t) = m(D) \cdot (P_x / \sin \omega t + P_y / \cos \omega t)$$

The above relationships (1) and (2) are accomplished in the line brightness and thickness automatic control unit.

When straight lines are being traced, a permissive signal is delivered from the decoder 4 (FIG. 1) to inputs 32 and 33 (FIG. 3), while inhibitive signals are applied to an input 34. This results in opening an "OR" circuit 35, an "AND" circuit 36, and an "OR" circuit 37, whereas a convertor 38 for translating codes describing the length of the line with respect to one of the coordinates into a.c. signals is coupled through an input 39 to series connected generator 2 (FIG. 1), phase shifter 40 (FIG. 3) and rectifier 41. Voltage $P_y / \sin \omega t$ appears at the output of the convertor 38.

Voltage $P_x / \sin \omega t$ is simultaneously shaped by a convertor 42, which is similar to the output voltage of the convertor 38.

The output voltages of the convertors 38 and 42 are summed up in a summing amplifier 43 and, depending upon the line thickness set by the signals from the line thickness decoder 3 through inputs 44, 45, 46 and 47, are delivered via one of amplifiers 48, 49 or 50 to "AND" circuits 51, 52, 53 and 54 and, further, via an "OR" circuit 55 to a non-linear functional unit 56. The unit 56 employing diodes, is designed to compensate the non-linearity of the recording instrument, in particular, the modulation characteristics of the cathode-ray tube.

When tracing ellipses, a permissive signal is applied to the input 34, inhibitive signals being applied to the inputs 32 and 33, whereby an "AND" circuit 57 opens and the convertor 38 is coupled to series-connected generator 2 (FIG. 1) and rectifier 58 via the input 39.

Signal $P_y / \cos \omega t$ appears at the output of the convertor 38. The shaping of signal $P_x / \sin \omega t$ and subsequent process of controlling the line thickness and brightness is analogous to the above described shaping of this signal when drawing straight lines.

In the automatic drawing device, as described according to the specific embodiment of the invention, use is made of a cathode-ray tube with an electrostatic deflection system serving as a recording instrument.

To improve the speed of the device a multibeam tube can be employed. The application of a cathode-ray tube with an electromagnetic deflection system is also possible.

Furthermore, any conventional two-coordinate recording instruments, such as two-coordinate automatic recorders can be utilized as a recording instrument.

All the units mentioned in the description of the present invention (such as convertors, decoders, etc) are of the conventional type.

The operation of the device is described below in connection with the example illustrated FIG. 4.

The image comprises six lines of varying shapes and thicknesses. For the sake of simplicity, the number of states for each parameter is small, but clearly this number can be increased.

Each of the lines is described by the following codes.

The lines can be traced in any succession. Let us assume that they are traced in the order in which they appear in the table above.

Kind, K			Address code		Projection code		Arc code		Thickness	
Symbol	Name	Code	Ax	Ay	Px	Py	0 ₁	0 ₂	Name	D Code
AB	Straight line 1	0	7	21	10	10	0	16	Thin	0
BC	Ellipse (circle)	2	17	21	14	14	0	14	do	0
CD	Straight line 2	1	30	18	16	16	0	16	Medium	1
AD	Straight line 2	1	20	13	36	6	0	16	Thick	2
E	Ellipse	2	11	7	10	6	0	16	Thin	0
F	Parabola	3	32	4	4	6	0	16	do	0

Let us first see how signals pass through the device when AB is traced.

The codes of the line are transmitted from the digital device to the register 1 where they are stored throughout the time the line is being traced.

The code of the address Ax₁-7 is fed to the convertor 10. A constant voltage U'=7 is generated at the output of this convertor.

The code of the projection Px₁-10 arrives at the digital inputs of the convertor 12, voltage U=½ cos ωt (the oscillation amplitude of the generator voltages is assumed to be half the actual value to simplify description) being applied to the analog input of this convertor via the busbar 39 from the generator 2. The voltage U_{x_r}=5 cos ωt, resulting from the value U being multiplied by the input digital code, is formed at the output of the convertor 12.

The output voltages of the convertors 10 and 12 are summed up in the device 14, and the horizontal deflecting system of the vacuum tube 16 is fed with the signal U_{x_r}=U_{x_L}+U_{x₁}=7+5 cos ωt.

The code A_{y1}-21 arrives at the convertor 11, a constant voltage U_r=21 being generated at the output of the convertor.

The code of the line k=0 is fed to the decoder 4, causing the appearance of a permissive signal at its output terminal 32, the terminals 33, 34 and 59 showing inhibitive signals. The AND circuit is, as a result, open and the AND circuit 19, 20 and 22 are closed, whereupon the variable voltage ½ cos ωt is applied to the analog input of the convertor 13 from the output terminal of the phase shifter 5.

The code of the projection Py₁=10 is applied to the digital inputs of the convertor 13, the signal U_{y_r}=5 cos ωt being formed at the output thereof.

The output voltages of the convertors 11 and 13 are summed up in the device 15 and the signal U_{y_r}=21+5 cos ωt is applied to the vertical deflecting system of the vacuum tube 16.

Under the influence of the signals U_{x_r} and Y_{y_r} the light spot on the screen traces a trajectory corresponding to the line AB.

It is not necessary to use the unit 8 for tracing this line, as well as other straight lines, full ellipses and parabolas. To avoid complicated coding and commutation, however, the embodiment under consideration employs the unit 8 in these cases as well. If need be, a portion of the straight line could be traced separately, in accordance with the codes 0₁ and 0₂.

For tracing whole lengths, the codes of the beginning and end of the arc correspond to 0°(0₁-0) and to 360°(0₂=16 in this example). The operation of the unit 8 will be explained in more detail when the tracing of the line BC is considered as an example.

Let us now examine how the brightness and thickness of the line AB are adjusted.

The codes Px=10 and Py=10 are applied to the digital inputs of the convertors 42 and 38 of the unit 9 (FIGS. 1 and 3).

The input 39 of this unit is supplied with the voltage U=½ cos ωt from the generator 2.

As a result of a phase shift in the device 40 and rectification in the device 41 there forms a voltage ½/sin ωt/, which is applied to the analog input of the convertor 42 and to the first input of the AND circuit 36.

The input terminal 32 of the OR circuit 35 is supplied with a permissive signal from the decoder 4, which an inhibitive

signal is applied to the input terminal 34 of the AND circuit 57. This causes the opening of the AND circuit 36 and the supply of the analog input of the convertor 38 with a voltage

equal to ½/sin ωt/.

15 Signals 5/sin ωt/ and 5/sin ωt/ are formed at the outputs of the convertors 42 and 38 and summed up in the device 43 so that the output of this summing amplifier shows a voltage equal to k·10/sin ωt, where k is the scale factor that depends on the parameters of the circuit.

20 Thus, a signal k·10/sin ωt/ is formed at the output of the summing amplifier 43. The amplitude of this signal is numerically equal to the length of the line being traced, its variation law being inverse of the law of brightness variations of the line. As a result, brightness is satisfactorily adjusted along one line or during the tracing of the lines of varying length.

The signal formed by the device 43 corresponds to the smallest intensity of recording i.e., it is used for tracing the thinnest lines. This signal is applied to the first input of the AND circuit 54.

30 The thickness code D=0 is applied to the decoder 3, causing a permissive signal to appear at its output terminal 47, while inhibitive signals are available at the terminals 44, 45 and 46. As a result the AND circuit 54 (FIG. 3) is open and the AND circuits 51, 52, and 53 are closed, a signal which has an intensity corresponding to the thinnest line traced being supplied to the modulating electrode of the vacuum tube 16 from the amplifier 43 via the circuits AND 54, or 55, non-linear unit 56, busbar 60 and the AND circuit 24.

40 The signal from the output of the unit 9 will continue to arrive at the vacuum tube 16 as long as the flip-flop 23 is in the "1" position, i.e., up to the moment when the code 0₂ is 16. After that the beam is switched off and the tracing of the line AB is over.

45 The tracing of the line BC is then started. It must be emphasized at this point that any line, for instance, F, can be started, and the tracing of the line BC is only due to the adopted order of lines.

The inputs of the device (register 1) are supplied with the codes of the line BC. In the manner described above a deflecting signal U_{x₂}=17+7 cos ωt is formed in the channel X.

50 The code of the line K=2 is applied to the decoder 4, causing a permissive signal to appear at its output terminal 34, while no permissive signals appear at the terminals 32, 33 and 59. As a result, the AND circuit 20 is open and the AND circuits 18, 19 and 22 are closed. For the same reason the AND circuit 57 of the unit 9 (FIG. 3) is open and the AND circuit 36 is closed.

60 The analog input of the converter 13 is supplied with a voltage

$$-\frac{1}{2} \sin \omega t.$$

The code P_{y2}=14 is applied to the digital inputs of the convertors 13 so that a signal U_{y₂}=-7 sin ωt is formed at the output of the convertor.

65 Considering that A_{y2}=21 it is not difficult to see, in view of the above arguments, that a deflecting signal equal to U_{y₂}-21 sin ωt is formed in the channel Y.

The combined action of the signals U_{x₂} and U_{y₂} causes the light spot to move along the circumference BC in the clockwise direction.

70 The application of the code K=2 causes a voltage ½/cos ωt/ is supplied to the analog input of the convertor 38 of the unit 9 (FIG. 3) through the rectifier 58, AND circuit 57 and the OR circuit 37. A signal 7/cos ωt/ is formed at the output of the convertor while a signal 7/sin ωt/ is formed at the output of the

converter 42 in the same manner as during the tracing of the line AB.

It is clear that the input of the non-linear unit 56 is supplied with the signal $k(7/\sin \omega t + 7/\cos \omega t)$ through the AND circuit 54 and the OR circuit 55. This signal is nearly proportional to the recording speed. A variation in the recording intensity in accordance with the above-mentioned law ensures a satisfactory adjustment of the brightness during the tracing of the arc BC.

The code $0_1=10$ is applied to the inputs of the converter 25, while the code $0_2=14$ arrives at the inputs of the converter 26 of the unit 8 (FIG. 2). The operation of these converters is similar to that of the converters 10 and 11. Constant voltages proportional in value to 0_1 and 0_2 , respectively, are formed at the output terminals of these converters. These signals are applied to the first inputs of the AND circuits 28 and 29, but cannot reach the inputs of the converters 30 and 31 until the other inputs of the AND circuits 28 and 29 are supplied with a permissive signal (actuating pulse). An actuating pulse is shaped in the null indicator 27 at the moment when the sinusoidal deflecting voltage passes through zero. The actuating pulse is directed from the output of the device 27 to the AND circuits 28 and 29, which are thus opened by it. The output voltages of the converters 25 and 26 are applied to the input terminals of the converters 30 and 31. From this moment corresponding to the position of the beam at point 0 of the circumference BC (FIG. 4) the converters 30 and 31 begin the "voltage-to-time" conversion. A pulse is shaped at the output of the converter 30 after a time period corresponding to ten angular units and sets the flipflop 23 to the position "1", corresponding to the point B in FIG. 4.

The AND circuit 24 opens, illuminating the vacuum tube.

The output of the converter 31 produces a signal after a time period corresponding to 14 angular units after the beginning of the actuating pulse. This corresponds to the point C in FIG. 4. The flip-flop 23 is set to the position "0", and the AND circuit 24 closes, discontinuing illumination. The tracing of the arc BC is over.

The processes taking place during the tracing of the other lines of the image in FIG. 4 are similar to the above and will readily be understood by those skilled in the art.

During the tracing of the lines CD and AD the line code is $K=1$. A permissive signal, therefore, is available at the terminal 33 of the converter 4, while the analog input of the converter 13 is supplied with a signal from the terminal 65 of the phase shifter. This signal is $-\frac{1}{2} \cos \omega t$.

The tracing of the ellipse E with the center at the point e is similar to that of the line BC, except that for tracing a full ellipse the arc codes are $0_1=0$ and $0_2=16$.

When the parabola F is traced, the line code $k=3$ predetermines the appearance of a permissive signal at the terminal 59 of the decoder 4. As a result, a voltage $\frac{1}{2} \cos 2\omega t$ is applied to the analog input of the converter 13 via the frequency doubler 6, phase shifter 7 and AND circuit 22 and the OR circuit 21. During the tracing of the parabola F the codes A_x and A_y correspond to the coordinates of the point f .

Though the present invention is described herein in conjunction with a preferred embodiment thereof, it will be clear to those skilled in the art that various changes and modifications can be made without departure from the spirit and scope of the invention.

These changes and modifications are considered to be within the scope of the invention as set forth in the claims that follow.

What is claimed is:

1. An automatic device for making drawings by using digital codes of separate line, the codes describing the coordinates of the centers of said lines, the projection lengths on the coordinates, the coordinates of the beginning and end of an arc, the thickness, configuration of separate lines, such as, straight lines, ellipses, parabola, said automatic device comprising: a receiving register for storing the codes received; a first converter of codes describing the horizontal coordinates of the line centers into d.c. electric signals proportionate to said codes,

said first converter being connected to said receiving register; a second converter of codes describing the vertical coordinates of the line centers into d.c. electric signals proportionate to said codes; said second converter being connected to said receiving register; a third converter of codes describing the lengths of horizontal projections of the lines into a.c. electric signal proportionate to said codes; said third converter being connected to said register; a fourth converter of codes describing the lengths of vertical projections of lines into a.c. electric signals proportionate to said codes; said electric signals being sinusoidal; said fourth converter being connected to said receiving register; a fifth converter of a code describing the line configuration into signals whose frequency and phase shift are determined by the line configuration; said fifth code converter being connected to one of said two converters of codes describing the lengths of the line projections and to said receiving register; an a.c. voltage generator, connected to said fifth code converter and to that of said two converters of codes describing the lengths of the line projections not connected to said fifth code converter, a first device for summing up the output signals of said first and third code converters; a second device for summing up the output signals of said second and fourth code converters; a two-coordinate recording instrument provided with systems deflecting the drawing element and with a device for recording density control, said recording instrument being connected to said first and second summing-up devices.

2. An automatic device as claimed in claim 1, wherein said converter of a code describing a line configuration being a phase shifter coupled to one of said converters of a code describing the projection length through "AND" and "OR" circuits connected to a line configuration decoder, said a.c. voltage generator being connected to said phase shifter.

3. An automatic device as claimed in claim 2, wherein connected to said a.c. voltage generator being series-connected are means for frequency doubling and the second phase shifter, said second phase shifter being connected to said "OR" circuit through the "AND" circuit.

4. An automatic device as claimed in claim 1, wherein connected to the input of said two-coordinate recording instrument through an "AND" circuit is a line thickness and brightness automatic control unit, the inputs of said control unit being connected to said line configuration decoder and line thickness decoder, the line thickness decoder being connected to said receiving register, to which the codes describing the projection lengths and the line configuration are delivered.

5. An automatic device as claimed in claim 4, wherein said line thickness and brightness automatic control unit comprises additional converters of codes describing horizontal and vertical projection lengths into a.c. electric signals, said additional code converters being connected to said receiving register, and one of said additional code converters being coupled to said a.c. generator through a first rectifier, the other of said additional code converters being coupled to the same a.c. generator through series-connected phase shifter and second rectifier when tracing a straight line, said other additional code converter being coupled to said a.c. generator through the first rectifier when tracing ellipses, said line thickness and brightness automatic control unit also including a summing-up amplifier whose input is connected to said additional code converters and whose output is connected to three series-connected amplifiers, each of said amplifiers via "AND" circuits connected to said line thickness decoder, an "OR" circuit and a non-linear functional unit being coupled to said two-coordinate recording instrument.

6. An automatic device as claimed in claim 1, wherein said a.c. electric signal produced by said third converter is sinusoidal.

7. An automatic device as claimed in claim 1, wherein said a.c. voltage generator produces a sinusoidal signal.

8. An automatic device as claimed in claim 4, which comprises an arc tracing unit having input terminals connected with the output of said generator and said register, the output terminal being connected through said AND circuit and said flip-flop to the input of said recording instrument.

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