United States Patent [19]

Gaur

[11] **3,775,764**

[45] **Nov. 27, 1973**

[54] **MULTI-LINE PLASMA SHIFT REGISTER DISPLAY**

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[73] Assignee: **The National Cash Register Company**, Dayton, Ohio

[22] Filed: **Oct. 2, 1972**

[21] Appl. No.: **294,006**

[52] **U.S. Cl.** ... **340/324 R**, 315/169 R, 340/166 EL, 340/324 M

[51] **Int. Cl.** **G08b 5/36**

[58] **Field of Search** .... 340/324 R, 324 M, 340/166 R, 166 EL; 315/169 R, 169 TV

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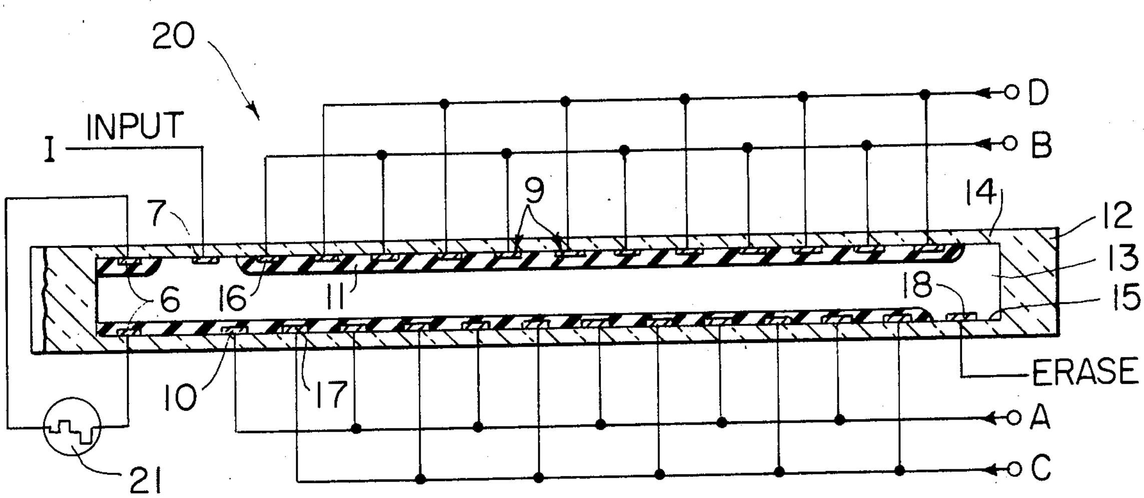
Attorney—J. T. Cavender et al.

[57] **ABSTRACT**

In the present invention at least two rows of plasma charge transfer devices have their holding arrays of electrodes connected to a common sequential potential source while the stepping and entering arrays of each row are connected to independent sequential potential sources. Each independent source is controlled by a logic means, such that an input character signal, applied to all the rows of transfer devices, will only be entered and stepped through those rows that are selected by the logic means for having the sequential potential applied to their stepping and entering arrays. Signals already entered in the rows not selected will be held in place.

11 Claims, 5 Drawing Figures



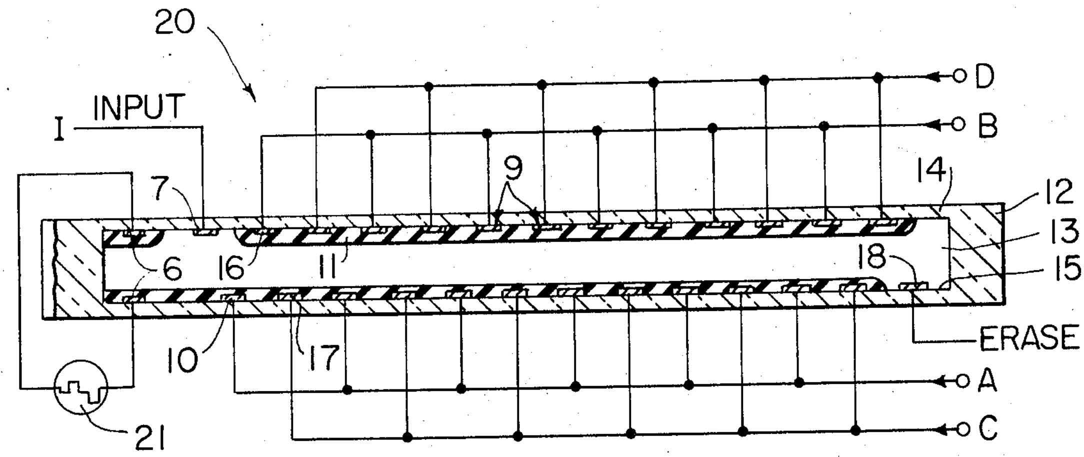

20
INPUT
I
D
B
7
9
14
12
13
6
16
11
18
15
10
17
ERASE
A
C
21

FIG. 2

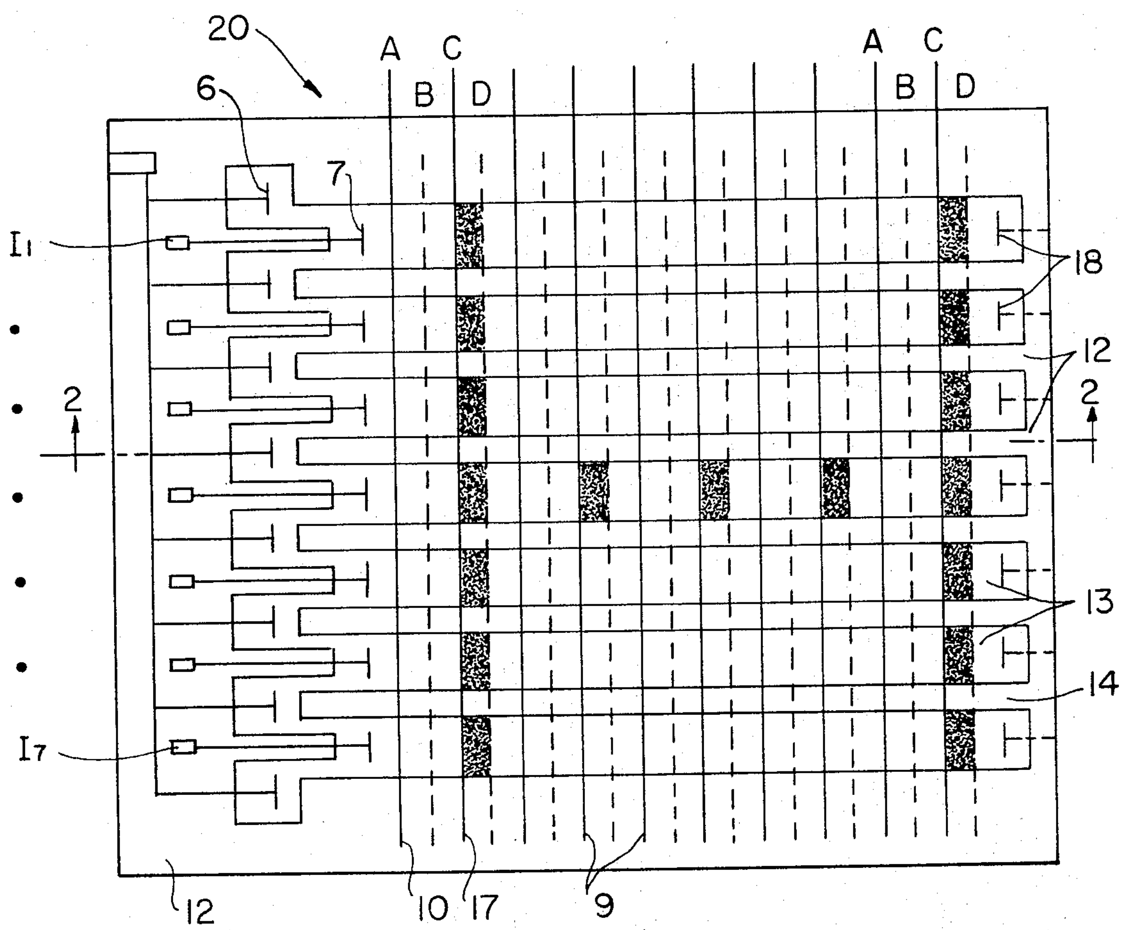

20
A
C
B
D
6
7
I1
18
12
2
13
14
I7
12
10
17
9

FIG. 1

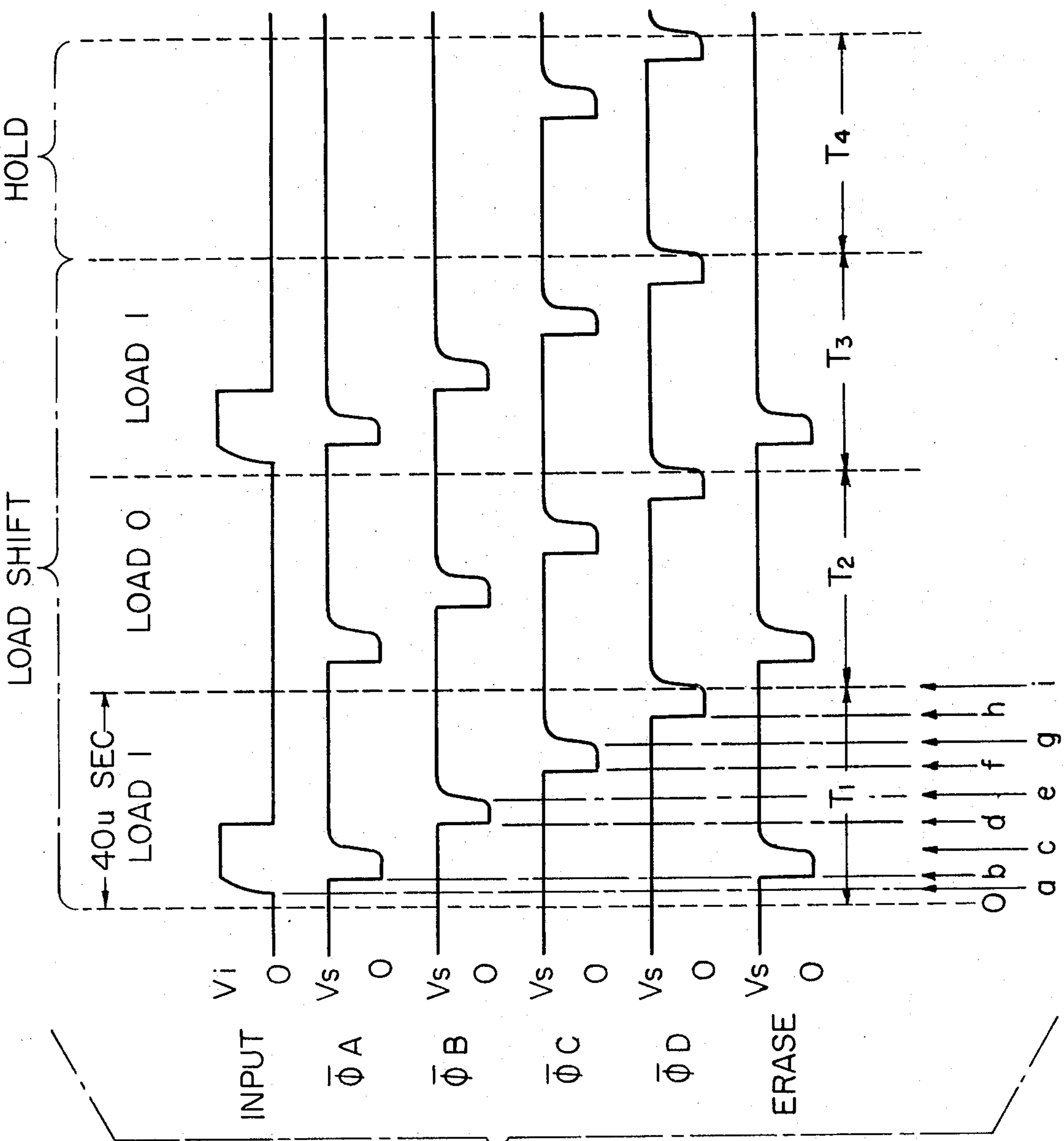
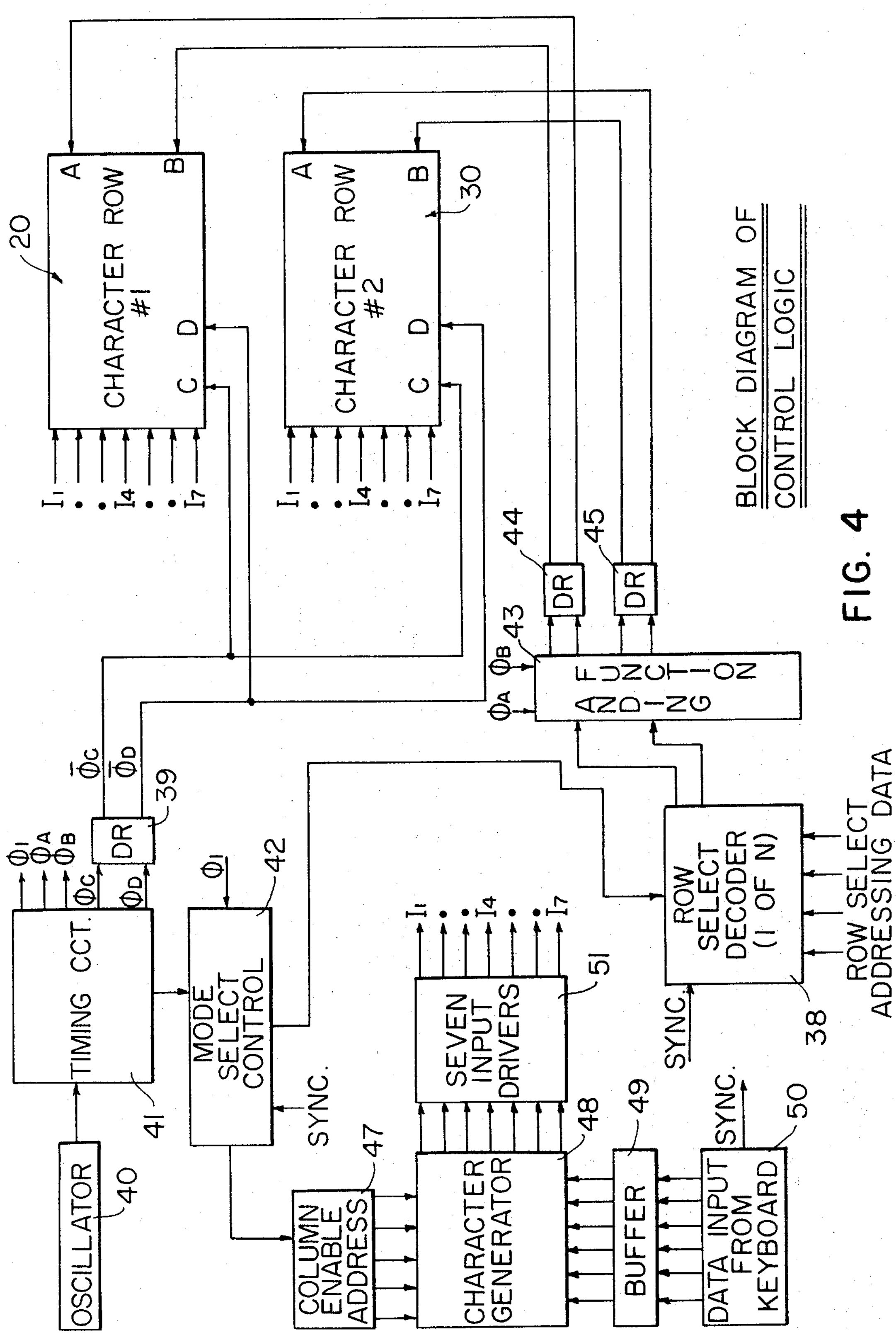

HOLD
LOAD SHIFT
40u SEC
LOAD I
LOAD O
LOAD I
T_1
T_2
T_3
T_4
INPUT
$\bar{\phi}$A
$\bar{\phi}$B
$\bar{\phi}$C
$\bar{\phi}$D
ERASE
Vi
Vs
O
O a b c d e f g h

FIG. 3



BLOCK DIAGRAM OF CONTROL LOGIC

FIG. 4

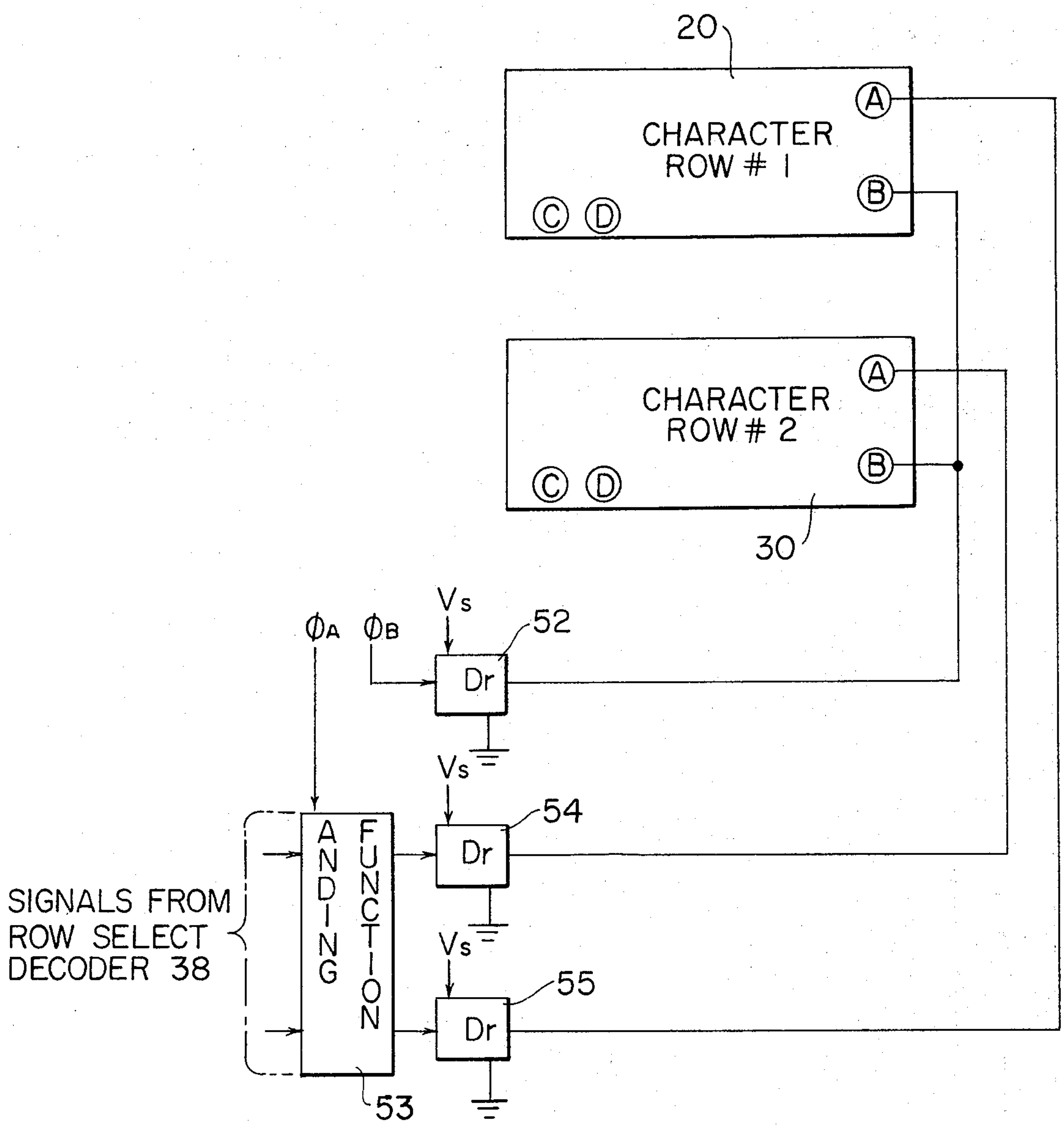

20
CHARACTER ROW # 1
A
B
C
D
CHARACTER ROW # 2
A
B
C
D
30
ØA
ØB
Vs
52
Dr
Vs
54
Dr
Vs
55
Dr
ANDING FUNCTION
53
SIGNALS FROM ROW SELECT DECODER 38

FIG. 5

MULTI-LINE PLASMA SHIFT REGISTER DISPLAY

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention utilizes rows of plasma charge transfer devices wherein information can be serially entered into all the selected rows without disturbing the information contained in any of the nonselected rows.

2. Description of the Prior Art

The present invention is a direct improvement of the invention disclosed in U. S. Patent application Ser. No. 255,547, entitled "Plasma Charge Transfer Device", by W. E. Coleman et al., which application is assigned to The National Cash Register Company, the assignee of the present invention. The teachings of the referenced application are incorporated by reference into the present application as though set forth in full detail herein. In the referenced application when a plurality of plasma charge transfer devices are connected in parallel it is necessary to have an AND gate for each set of line inputs servicing one transfer device. Enabling the AND gate servicing a selected transfer device allows the signals present on the line inputs to be entered and stepped through the transfer device. To hold information, in place, within the nonselected transfer devices, requires additional electronics. If it is desirable to enter information into one plasma charge transfer device while maintaining (holding) the information in the other rows of plasma charge transfer devices then it is necessary to have individual electronics for applying the sequencing and holding potentials to each row. A logic means is then used to control the input AND gates and the sequencing and holding electronics to achieve the desired results.

Simplification of the electronics needed to accomplish the desired function can be achieved by taking advantage of certain commonalities in the electronics. The present invention directs itself to this simplification.

SUMMARY OF THE INVENTION

The present invention is an improvement in plasma discharge systems wherein two or more rows of plasma charge transfer devices are used. Each plasma charge transfer device generally contains at least one channel, formed as an envelope, wherein an ionizable gas is held. Multiple parallel channels are frequently used so as to allow a segment of a desired character to be formed in each channel, with all the channels in a transfer device forming the complete character. A plurality of electrodes are positioned sequentially and alternately along opposite surfaces of each channel. The electrodes are arranged such that every other electrode on each of the opposing surfaces of individual channels is connected together to form first and second pairs of oppositely positioned arrays, which arrays can be called the stepping and holding arrays in accordance with their function. An input electrode is provided for each channel and arranged with respect to the nearest oppositely located electrode in the first pairs of arrays such that a selected potential occurring between the input electrode and the nearest electrode will cause a plasma discharge within the channel. The present improvement in the aforementioned system is the provision for pairs of channel drive means corresponding in number to the plasma charge transfer devices for sequentially applying potentials to the first pair of arrays of opposing electrodes of each channel to effect a shifting of the plasma discharge to the second pair of arrays of opposing electrodes.

One set of drive means is made common to all the second pairs of arrays of opposing electrodes and is used to sequentially apply potentials to the opposing electrodes for shifting the plasma discharge along those channels when sequential potentials are also applied to the first pair of arrays, or for holding the plasma discharge in place between opposing electrodes of the second pairs of arrays when the sequential potential is not applied to the first pairs of arrays via the associated channel drive means. A logic means is provided for applying potentials sequentially to the selected channel drive means to cause the plasma discharge to shift in the selected channel while applying a holding potential to the channel drive means not selected.

In a second embodiment of the present invention each of the first array electrodes in the first array pairs are connected to individual channel drive means, while all of the second array electrodes in the first array pairs are connected to a common channel drive means.

The logic means then applies potentials sequentially to the individual and common drive means associated with a selected channel to cause shifting of the plasma discharges within the selected channels while restraining the sequencing potentials from the individual channel drive means servicing the nonselected channels.

From the foregoing it can be seen that it is a principal object of the present invention to provide an improved plasma discharge transfer system;

It is another object of the present invention to provide a plasma discharge transfer system wherein portions of the electronics used to operate the system are shared;

It is a further object of the present invention to minimize the electronics associated with multi-row plasma discharge transfer systems;

It is still another object of the present invention to provide a multi-line character display system of the serial-address type wherein characters can be entered into selected rows independently of the nonselected rows.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a top view, partially in schematic form, of a 5 × 7 plasma charge transfer device;

FIG. **2** is a sectioned view, partially in schematic form, taken along the section lines **2—2** in FIG. **1**;

FIG. **3** illustrates wave forms useful in understanding the operation of the invention of FIGS. **1** and **2**;

FIG. **4** is a block diagram of two of the plasma charge transfer devices of FIGS. **1** and **2** connected in accordance with the present invention in a first preferred embodiment; and

FIG. **5** is a block diagram, for use with the block diagram of FIG. **4**, illustrating a second preferred embodiment of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGS. **1** and **2** a plasma display transfer device **20** is shown schematically as a 5 × 7 display matrix. The display matrix comprises an enclosure or substrate **12** formed of any suitable dielectric material, such as clear glass. Parallel rows **14** formed in the substrate **12** define a plurality of channels **13** containing an ionizable gas, such as neon and nitrogen. A plurality of electrodes **9** are located on the inner wall **15** of the substrate, opposite one another, in parallel alignment but laterally offset. An input electrode **7** is positioned at one end of the formed channel **13.** A keep-alive cell is formed by a pair of electrodes **6,** capacitively coupled to the ionizable gas, and connected to an alternating voltage source **21** of sufficient magnitude to ionize the gas within the keep-alive cell. The ionized gas within the keep-alive cell insures a sufficient quantity of ionized particles being available at the first cell which cell is formed between the input electrode **7** and the first electrode **10.** Each succeeding pair of opposing electrodes forms another cell. An erase electrode **18** is positioned within channel **13** at the end opposite the keep-alive cell. A dielectric coating **11** covers all of the electrodes except the input electrode **7** and the erase electrode **18.** All of the odd positioned electrodes on one side of the transfer device **20** are electrically connected together to terminal A. All the even positioned electrodes on the same side of the transfer device are connected to terminal C. In a like manner, on the opposite side, odd positioned electrodes are connected to terminal B, and even positioned electrodes are connected to terminal D. The electrodes connected to terminal A in conjunction with the electrodes connected to terminal B form a first array pair. The terminal A connected electrodes are positioned first sequentially in the channel and as such will hereinafter be called the first array of the first array pairs. The terminal B connected electrodes are positioned second sequentially in the channel and as such will hereinafter be called the second array of the first array pairs. Similar nomenclature will apply to the terminal C and D connected electrodes being called first and second arrays respectively, of the second array pairs. The seven input electrodes **7** are labeled I_1 through I_7.

Each cell of a channel can be used to form dots. These dots can be lit via the plasma discharge between opposing electrode pairs. By using multi-parallel channels it is practical to create a visual display in the form of an alpha-numeric dot matrix where the alpha-numeric characters, A to Z, and, **0** to **9**, are formed by an array of **35** dots, **7** dots high and **5** dots wide. Other symbols can also be formed using the available dot matrix. Increasing the array, along its width, enables the displaying of multiple characters which can be used to create words. By placing the multi-channel plasma charge transfer devices in parallel it is possible to form a page display of characters. The display of FIG. **1** although showing only one character, the letter H, is used for example only, with the more practical device having a multiple character display ability.

The ionizable gas between any opposing electrodes effectively forms a gas cell dischargeable when subjected to a suitable potential. By alternating the applied potential step by step (sequentially) along the length of the column the gaseous discharge is transferred successively through the length of the channel. When a gaseous discharge is located between two adjacent opposite electrodes a charge is formed on the positive and the negative electrodes so as to produce a wall charge (trapped charge). The voltage attributed to the wall charge has a polarity opposite to the applied voltage which initiated the discharge, and upon reversal of the applied voltage, after discharge, the applied voltage and wall charge add together to cause another gaseous discharge (with current flow in opposite direction).

Referring now to FIG. **3,** there appears a timing diagram showing the voltage pulse sequence as applied to terminals A, B, C and D, input electrode **7,** and the erase electrode **18.** The timing diagram illustrates the two major modes of operation of the plasma discharge transfer devices, namely the load and shift operation, and the hold operation. The four signals ϕ_A to ϕ_D are phased sequentially. The increments of time T_1 to T_3 correspond to the load and shift operation. The time increment T_4 corresponds to the hold operation. The T_1 time group is divided into nine subincrements *a* to *i*. In a typical case T_1, T_2, T_3 and T_4 would be 40 microseconds each with the time between the increments 0 to *a* and *a* to *b* being equal to 2.5 microseconds. All the time periods between the remaining increments are set to 5 microseconds. The potential V_s is a potential the magnitude of which when added to a wall charge of like polarity gives rise to a potential greater than the firing potential so as to cause a discharge. In the absence of a like wall charge adding to the potential V_s, the potential V_s has a magnitude less than the firing potential. The input signal V_i is a potential of a magnitude which ionizes the gas between the input electrode **7** and the first electrode **10** when the first electrode is at ground potential, absent a wall charge. For a binary type display a "1" can correspond to a lit cell, with a "0" corresponding to an un-lit cell. If such is the case, the presence of a V_i pulse on the input electrode **7** enters a binary "1" into the charge device channel when the first array electrode (terminal A) is switched to ground potential.

For example, in operation at time T_{1a} the input electrode **7** is switched from 0 volts to V_i but no discharge takes place between the electrodes labeled **7** and **10** because the potential difference between these electrodes is not yet high enough to cause ionization due to the presence of the potential V_s on electrode **10.** At time T_{1b} all the electrodes connected to the A terminal, which includes electrode **10,** are driven to a zero potential while the input electrode potential has reached the peak value V_i. At this point in time the voltage differential between electrodes **7** and **10** exceeds the ionization (firing) voltage so as to cause a gaseous discharge to form therebetween. This discharge however, is extinguished in a short period of time (0.2 to 0.5 microseconds) because the wall charge created by this discharge is trapped on the dielectric material covering the first electrode **10.** The input electrode **7,** being directly coupled to the gas discharge, does not store a charge. Additionally, no charge is deposited on the walls adjacent any of the other electrodes since there has been no gaseous discharge between them, even though all other electrodes connected to the A terminal were simultaneously switched from the potential V_s to the potential **0.**

At the time increment T_{1c} all the first array "A" electrodes are returned to the potential V_s while the input electrode **7** is maintained at the potential V_i so as to prevent a back-firing discharge between electrode **10** and electrode **7.**

At the time increment T_{1d} all the electrodes connected to terminal B are driven to a **0** potential while all the electrodes connected to terminals A, C and D are held at the V_s potential which creates a potential difference between the electrodes connected to terminals A, and C, and the electrodes connected to terminal B. The wall charge present on the first electrode **10** adds to this applied voltage thereby increasing the potential difference between electrodes **10** and **16**, the latter being the first elecrode connected to terminal B, to a value greater than the firing potential which in turn causes a gaseous discharge between electrodes **10** and **16**. This discharge causes a reversal in the polarity of the wall charge adjacent to electrode **10**. A positive charge is formed on the wall adjacent electrode **16**. No additional discharge occurs at any other electrode particularly because of the lack of sufficient potential difference therebetween without the existence of any wall charge.

At time T_{1e} all the electrodes connected to terminal B are driven to the potential V_s leaving the trapped charge on the wall adjacent electrode **16** as it was immediately after the discharge which occurred at time increment T_{1d}.

At time T_{1f} all the electrodes connected to the terminal C are driven to a **0** potential while all the electrodes connected to terminals A, B and D are held at the potential V_s thereby creating a potential difference between the electrodes of terminals B and C, which together with the potential difference caused by the trapped wall charge present adjacent the electrode **16**, causes a gaseous discharge between the electrodes **16** and **17**, thereby reversing the polarity of the trapped charge on the wall adjacent electrode **16** and creating a positive charge on the wall adjacent electrode **17**. Electrode **17** is the first electrode connected to terminal C.

At time T_{1g} all the electrodes connected to the terminal C are again driven to the potential V_s leaving the trapped charge at the first electrodes of terminal C as it was immediately after the discharge which occurred in time T_{1f}.

At time T_{1h} the electrodes connected to terminal D are driven to **0** which together with the trapped charge causes a discharge between electrode **17** and the first electrode connected to terminal D to again cause a reversal in polarity of the charge adjacent the electrode connected to the terminal C. When this occurs a positive charge is formed adjacent the first electrode connected to terminal D.

At time T_{1i} all the electrodes are driven to the potential V_s, leaving the trapped charge as it was at the end of the discharge which occurred at time T_{1h}.

The potential V_s is switched periodically to ground (**0** potential) and applied to the electrodes connected to the terminals A, B, C and D in a sequencing order so as to cause the discharge to step thru the channel. The sequence of potentials associated with the time period T_1 corresponds to a movement of the discharge thru the channel to the second array pairs of holding electrodes connected to the C and D terminals.

The signals shown for the second time group labeled T_2 are identical to the signals in group T_1, except that the input signal now corresponds to a "binary zero". For this case no discharge will occur and the associated input cells will remain un-lit. But as the sequence of signals is applied to all the electrodes connected to terminals A, B, C and D the signal indicative of a binary-one entered during the time period T_1 is stepped through the channel to the next sets of electrodes.

At any point in time the device can be placed in a hold mode so that the discharges present within a channel will be held in place. This is accomplished as shown in the time period T_4, by holding the electrodes connected to terminals A and B at the potential V_s while driving the electrodes connected to terminals C and D at the same rate. During the time period T_4 the erase electrode **18** is maintained at the potential V_s. Any wall charge present on the dielectric adjacent the last electrode, connected to terminal D, will remain at that location because the potential between electrode **18** and the wall charge combined with the potential on terminal D is not sufficient to cause a discharge to terminal **18**. When an erase action is desired terminal **18** is switched to ground and with the proper polarity of wall charge coupled with the potential V_s being applied to terminal D a discharge will take place. With no dielectric coating on electrode **18** the charge cannot build and is erased from the channel.

Referring now to FIG. **4**, two rows of plasma transfer devices **20** and **30** are shown with each row comprised of seven identical channels. Within each row all of the C, D, B and A arrays are connected together, respectively. All of the corresponding inputs in each row are electrically connected together, i.e., I_1 of character row **1** to I_1 of character row **2**, etc. . . An oscillator **40** provides a basic timing frequency ϕ_1 which signal is received by a timing circuit **41**. The timing circuit transforms the basic frequency into four sequential (phased) signals, the order sequence of which is denoted by the subscripts A to D. In this particular embodiment the C and D array of electrodes are continuously connected to a driver means **39** containing a pair of drivers, one connected between each input and output line. The output of the driver means is a pair of signals corresponding to the two adjacent phased signals from the timing circuit **41** in which two adjacent phased signals are denoted by ϕ_C and ϕ_D. During the operation of the system, the driver **39** applies the two signals $\overline{\phi_C}$ and $\overline{\phi_D}$ to the corresponding C and D arrays, as shown in FIG. **4**, to effect a sequencing potential whereby if a wall charge is present on one of the electrodes adjacent the electrode to which the potential is being applied a plasma discharge will occur.

A row select decoder **38** receives as its input a row select address signal. The address signal can be applied to the row select decoder by means of a keypunch, toggle switch, punched card or other well known means. The outputs of the row select decoder are fed to an ANDing means **43**. Only two outputs are shown coming from the row select decoder because only two rows of devices **20** and **30** are used. If more rows are used, then selection signals from the decoder **38** have to also increase correspondingly in number. The ANDing function block **43** also receives the two adjacent phased signals ϕ_A and ϕ_B. When coincidence occurs between these two phase signals and the row select signals the two signals are fed as inputs to either the channel drive **44** and/or the channel driver **45**, depending on whether one or both rows have been selected. The channel driven circuits are simple pairs of gating circuits which are connected, one each, between each input line and output line of a driver. The gating circuits (driver) apply the positive potential V_s to the A and B arrays electrodes and sequentially switch to applying a zero potential in accordance with the levels of signals ϕ_A and ϕ_B, respectively. As channel driver **44** is selected, the character row **20** will be energized on the A and B arrays such that input information appearing on the input terminals I_1 through I_7 will be input into the respective row channels and stepped through the channel, for so long as the A and B arrays are energized. The character row **30** receiving only the C and D array electrode signals will not load or shift any information contained on its input electrodes I_1 to I_7 due to the absence of the sequencing signals on its A and B array electrodes. If the row select decoder had provided an output signal such that channel drivers **44** and **45** were both activated, then identical messages would be fed at the inputs and stepped simultaneously through the channels of each of the character rows.

The character signals that are input to the selected rows are formed using a character generator **48.** Selection of the particular character is accomplished by first selecting the character through a keyboard convertor **50,** which provides an output signal in parallel format along seven output lines to a buffer **49.** The buffer operates to control, time-wise, the entrance of the keyboard data into the character generator. The output lines from the character generator drive seven corresponding input drivers **51** between the potential V_i and ground, which potentials are applied directly to the input electrodes I_1 through I_7. A mode select control means **42** provides a synchronization signal to the row select decoder **38** and the column enable address **47,** to synchronize the input signals with the sequence phase array signals ϕ_A through ϕ_D. In the present embodiments a character consists of a 5 × 7 dot matrix. Each column of the dot matrix is stored in the character generator **48,** which may be a read only memory. When a key is depressed on the keyboard, data appears at the output of the character generator in column by column form. The occurrence of a column of data at the generator output is controlled by the column enable address circuit **47.**

A second embodiment of the invention is disclosed in FIG. **5.** This embodiment is identical to the embodiment of FIG. **4** except for the commonality of the terminal B array electrode driver **52.** In this embodiment the B, C, and D arrays in each of the character rows are driven from common drivers. Independent channel drivers are provided for the A arrays of each row. Data present on the input electrodes of a particular row will not be entered unless the potential on the A array is applied as per FIG. **5.** The row select decoder **38** provides a selection signal on one or both of its output lines which signals or signal is received by the ANDing function means **53,** ANDing circuit also receives the shift signal ϕ_A. When the signals from the row select decoder **38** and the shift signal ϕ_A coincide for a particular driver, an output is fed to that driver, which output causes the selected driver to gate the potential signal V_s to the A array electrodes thereby enabling the character row for either loading or shifting information. The B array is connected directly by means of driver **52** to the phase signal ϕ_B. No control signal is fed to this driver and it remains in operation for so long as the ϕ_B signal is applied to its input.

While there have been shown what are considered to be the preferred embodiments of the present invention, these embodiments have been shown by way of example and explanation only and are not to be taken as limiting the invention, which is limited only by the spirit and scope of the appended claims.

What is claimed is:

1. In a plasma discharge system having at least two plasma charge transfer devices wherein each of the transfer devices is comprised in part of an envelope defining at least one channel containing an ionizable medium, a plurality of electrodes positioned sequentially and alternately along opposite surfaces of said channel, said electrodes being arranged such that every other electrode on each of the opposing surfaces is commonly connected together to form first and second pairs of oppositely positioned arrays, an input electrode means within each channel arranged with respect to the nearest oppositely located electrode in said first pair of arrays such that a selected potential occurring between said input electrode and the nearest oppositely located electrode will cause a plasma discharge to exist in the channel wherein the improvement comprises:

channel drive means corresponding in number to said plasma charge transfer devices for sequentially applying potentials to said first pairs of arrays of opposing electrodes for shifting the plasma discharge to said second pairs of arrays of opposing electrodes;

drive means common to all of said second pairs of arrays of opposing electrodes for sequentially applying potentials to opposing electrodes of said second pairs of arrays for shifting said plasma discharge along those channels when sequential potentials are also applied to said first pairs of arrays, and to hold said plasma discharge between opposing electrodes of said second pairs of arrays for those channels when sequential potentials are not applied to said first pairs of arrays; and

logic means for applying potentials sequentially to selected channel drive means so as to cause the plasma discharges within the channel serviced by the selected channel drive means to shift while holding all other plasma discharges within the nonselected channels.

2. The improved plasma discharge system according to claim **1** wherein corresponding input electrode means of said at least two plasma charge transfer devices are connected together such that identical potentials are applied to corresponding input electrode means of each plasma charge transfer device.

3. The improved plasma discharge system according to claim **1** wherein said logic means is comprised of:

a four phase signal source for providing two adjacent phased signals to said drive means;

a selecting means for providing signals indicative of the selection of a plasma charge transfer device; and

means responsive to the selection signals from said selecting means for receiving and gating another two adjacent phased signals from said four phase signal source to the channel drive means associated with the selected plasma charge transfer device.

4. The improved plasma discharge system according to claim **3** wherein said logic means further comprises:

input data means for providing signals indicative of a selected character;

character generator means for transforming said provided signals into a preset sequence of signals corresponding to the selected character and for feeding said preset sequence of signals to said input electrode means so as to cause associated discharges to occur in said plasma charge transfer devices with the positioning of the discharges being proportional to the configuration of the character selected.

5. In a plasma discharge system having at least two plasma charge transfer devices wherein each of the transfer devices is comprised in part of an envelope defining at least one channel containing an ionizable medium, a plurality of electrodes positioned sequentially and alternately along opposite surfaces of said channel, said electrodes being arranged such that every other electrode on each of the opposing surfaces is commonly connected together to form first and second pairs of oppositely positioned arrays, an input electrode means within each channel arranged with respect to the nearest oppositely located electrode in said first pair of arrays such that a selected potential occurring between said input electrode and the nearest oppositely located electrode will cause a plasma discharge to exist in the channel, wherein the improvement comprises:

a potential source, the potential level of which is sufficient to cause a plasma discharge between electrodes when a static charge of correct polarity exists on one of the electrodes;

a plurality of first and second channel driver means, corresponding in number to the number of plasma charge transfer devices, with the first driver means connected to the electrodes of the first pair of arrays on one surface of said channels and the second driver means connected to the electrodes of the first pairs of arrays on the opposite surface of said channels, said first and second channel driver means operatively connected to said potential source for controllably connecting associated electrodes to said potential source;

a first and second drive means, with the first drive means connected to all electrodes of the second pairs of arrays positioned on one surface of said channels and the second drive means connected to all electrodes of the second pairs of arrays positioned on the opposite surface of said channels, said first and second drive means sequentially connected to said potential source for connecting associated electrodes sequentially to said potential source;

logic means for selecting and sequentially controlling said first and second channel drive means so as to cause the plasma discharges within the channel serviced by the selected channel driver means to shift while holding all other plasma discharges within the nonselected channels.

6. The improved plasma discharge system according to claim 5 wherein corresponding input electrodes of said at least two plasma charge transfer devices are connected together such that identical potentials are applied to corresponding input electrodes of each plasma charge transfer device.

7. The improved plasma discharge system according to claim 5 wherein said logic means is comprised of:

a four phase signal source for providing two adjacent phased signals to said first and second drive means respectively;

a selecting means for providing signals indicative of the selection of a plasma charge transfer device; and

means responsive to the selection signals from said selecting means for receiving and gating another two adjacent phased signals from said four phase signal source to the channel driver means associated with the selected plasma charge transfer device.

8. The improved plasma discharge system according to claim 5 wherein said logic means further comprises:

input data means for providing signals indicative of a selected character;

character generator means for transforming said provided signals into a preset sequence of signals corresponding to the selected character and for feeding said preset sequence of signals to said input electrode means so as to cause associated discharges to occur in said plasma charge transfer devices with the positioning of the discharges being proportional to the configuration of the character selected.

9. In a plasma discharge system having at least two plasma charge transfer devices wherein each of the transfer devices is comprised in part of an envelope defining at least one channel containing an ionizable medium, a plurality of electrodes positioned sequentially and alternately along opposite surfaces of said channel, said electrodes being arranged such that every other electrode on each of the opposing surfaces is commonly connected together to form first and second pairs of oppositely positioned arrays, an input electrode means within each channel arranged with respect to the nearest oppositely located electrode in said first pair of oppositely positioned arrays such that a selected potential occurring between said input electrode and the nearest oppositely located electrode will cause a plasma discharge to exist in the channel wherein the improvement comprises:

a signal source for providing first, second, third and fourth sequentially phased signals, means for applying said third and fourth phased signals to said second pairs of oppositely positioned arrays of opposing electrodes to effect a sequencing potential between said electrodes;

means for applying said second phased signal to the array of electrodes in said first pairs of oppositely positioned arrays of electrodes which are located adjacent said input electrode means;

a plurality of drive means, corresponding in number to the number of plasma charge transfer devices, for controllably applying said first phased signal to the array of electrodes in said first pairs of oppositely positioned arrays of electrodes which are located opposite said input electrode means upon receipt of a selection signal; and

logic means for providing a selection signal to particular drive means so as to cause the channel associated with said drive means to enter and shift discharges within said plasma charge transfer devices.

10. The improved plasma discharge system according to claim 9 wherein corresponding input electrodes of said at least two plasma charge transfer devices are connected together such that identical potentials are applied to corresponding input electrodes of each plasma charge transfer device.

11. The improved plasma discharge system according to claim 9 wherein said logic means further comprises:

input data means for providing signals indicative of a selected character;

character generator means for transforming said provided signals into a preset sequence of signals corresponding to the selected character and for feeding said preset sequence of signals to said input electrode means so as to cause associated discharges to occur in said plasma charge transfer devices with the positioning of the discharges being proportional to the configuration of the character selected.

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