



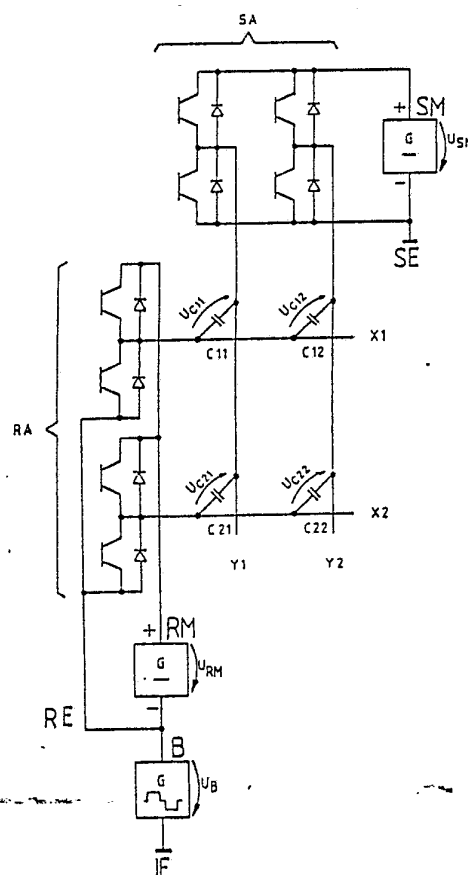
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification³ : G09G 3/30	A1	(11) International Publication Number: WO 83/ 03021 (43) International Publication Date: 1 September 1983 (01.09.83)
(21) International Application Number: PCT/FI83/00012 (22) International Filing Date: 17 February 1983 (17.02.83) (31) Priority Application Number: 820522 (32) Priority Date: 17 February 1982 (17.02.82) (33) Priority Country: FI (71) Applicant (for all designated States except US): OY LOHJA Ab [FI/FI]; SF-08700 Virkkala (FI). (72) Inventor; and (75) Inventor/Applicant (for US only) : HARJU, Terho, Teuvo [FI/FI]; Juhonkatu 1 D 27, SF-08200 Lohja 20 (FI). (74) Agent: DI, Seppo, Laine; Kasarmikatu 23 A, SF-01300 Helsinki 13 (FI). (81) Designated States: DE, FR (European patent), GB, JP, US.	Published <i>With international search report.</i>	

(54) Title: METHOD AND WIRING SYSTEM FOR DRIVING A PICTURE DISPLAY, PARTICULARLY AN AC ELECTROLUMINESCENT DISPLAY

(57) Abstract

A method and a wiring system for driving an AC electroluminescent display (C11, C12, C21, C22) based on the thin film technique and comprising a bi-dimensional matrix (X1, X2; Y1, Y2) consisting of X and Y electrodes, wherein line selection pulses are alternately applied to the X electrodes (X1, X2) and column modulation pulses corresponding to the desired luminance are applied to the Y electrodes (Y1, Y2). According to the invention, at least some of the display elements (C11, C12, C21, C22) are charged to a maximum basic voltage of variable polarity, which basic voltage has been selected so that the line selection pulses or the column modulation pulses alone are not sufficient to ignite any display element (C11, C12, C21, C22). The line selection and column modulation voltages are superimposed on the basic voltage, which voltages have been selected so that only the sum of the basic voltage, the line selection voltage (U_{RM}), and the column modulation voltage (U_{SM}) can bring each element to be selected (C11, C12, C21, C22) to the display state. In the solution in accordance with the invention, the withstand voltage required both from the line drive circuits and from the column drive circuits is only equal to the maximum value of the modulation voltages, about 30 V.



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	LI	Liechtenstein
AU	Australia	LK	Sri Lanka
BE	Belgium	LU	Luxembourg
BR	Brazil	MC	Monaco
CF	Central African Republic	MG	Madagascar
CG	Congo	MR	Mauritania
CH	Switzerland	MW	Malawi
CM	Cameroon	NL	Netherlands
DE	Germany, Federal Republic of	NO	Norway
DK	Denmark	RO	Romania
FI	Finland	SE	Sweden
FR	France	SN	Senegal
GA	Gabon	SU	Soviet Union
GB	United Kingdom	TD	Chad
HU	Hungary	TG	Togo
JP	Japan	US	United States of America
KP	Democratic People's Republic of Korea		

- 1 -

Method and Wiring System for Driving a Picture Display,
Particularly an AC Electroluminescent Display

The present invention concerns a
5 method in accordance with the preamble of claim 1. The
invention also concerns a wiring system to be
used for the implementation of this method.

An AC electroluminescent display based on the
thin film technique comprises a bi-dimensional matrix,
10 in respect of the drive circuits, consisting of X and Y
electrodes, in which matrix the X electrodes form lines
and the Y electrodes, on the other hand, form columns.

It is additionally characteristic of such a
display that

- 15 - the drive voltage is an AC voltage,
- a DC voltage component in the drive voltage
reduces the service life of the display,
- the necessary modulation voltage is lower
than half the entire drive voltage,
- 20 - after the refresh pulse, the luminance is
lowered at a time constant typically of
approximately 1 ms, and
- the capacitance of the display is high,
typically about 50 to 200 pF/mm².

25 In order to illustrate the prior art, refer-
ence is made to the following publications:

- (1) Gielow T.A., Holly R.H.: "Tactical Video Dis-
play", Report number DELET -TR-79-0251-1,
Sept. 1980, 17 p.
- 30 (2) Kurahashi K., Takahara K., Andoh Sh.:
"A Refresh Addressing Technique of AC-TFEL
Panels", Proceedings of the First European
Display Research Conference EURODISPLAY '81,
September 16-18, 1981, Munich, p. 216-219, and
- 35 (3) FI Patent Application 811,245 (Oy Lohja Ab).

In the method in accordance with the reference
publication (1), each line in its turn receives a high-



amplitude line selection pulse while the other lines are floating. At the same time, a modulation voltage corresponding to the desired luminance is applied to the columns. After the line selection pulses, a refresh pulse of reversed polarity is applied simultaneously to all lines. In this solution, it has been possible to reduce the withstand voltage required from the column drive circuits to the level of unipolar modulation voltage.

10 The method described in the reference publication (2) corresponds to the former method regarding its withstand voltage requirements. The methods differ from each other in the respect that, in the former method, high-voltage pulses are applied to the ground point of the line drive circuits, and the ground point of the column drive circuits is connected to the ground point of the entire drive system. In the method in accordance with the reference publication (2), the ground point of the line drive circuits is connected to the system ground, and the high-voltage pulses are applied to the ground point of the column drive circuits.

 In the reference publication (3), a method is described by means of which the withstand voltage requirement of the column drive circuits can be lowered by applying bipolar pulses to the lines and by applying the modulation both to the positive and to the negative drive pulses of the display.

 In all of the refresh methods mentioned above, drive circuits operating at high voltages are required for guiding the line electrodes. As is known in prior art, circuits of high withstand voltages are difficult to integrate and, therefore, expensive. In the methods in accordance with the reference publications (1) and (2), further drawbacks are the occurrence of a DC voltage component in the drive voltage of the display as well as the requirement of high withstand voltage of the column drive circuits, because of the



unipolar modulation. The requirement of two different drive circuits is also a considerable drawback.

The object of the present invention is to eliminate the drawbacks occurring in the systems of prior art. A further object of the invention is to provide a refresh method for driving particularly an AC electroluminescent display based on the thin film technique, which refresh method lowers the requirements of withstand voltage to be imposed on the drive circuits of the display, reduces the power consumption of the display, and permits a drive voltage completely free from a DC voltage component. A further object is to provide a wiring system for the implementation of the method.

The invention is based, e.g., on the following ideas:

- Preferably, the capacitances of the whole display are charged at a maximum basic voltage, however, so that the line selection pulses or column modulation pulses alone are not sufficient to ignite any display element.
- The line selection and column modulation voltages are superimposed on the basic voltage so that no change occurs in the voltage of the non-selected display elements. The absolute value of the semi-selected display elements is increased at the maximum by the line selection or column modulation voltage, and the absolute value of the voltage of the selected display elements is increased by the sum of the line selection voltage and column modulation voltage.
- The polarity of the basic voltage is preferably not reversed until after all the lines have, in their turn, received the line selection pulse.
- The apparatus includes two sources of DC



5 voltage, one of them being the drive voltage source of the line drive circuits and the other one the drive voltage source of the column drive circuits. Moreover, the apparatus includes an AC voltage source, which is connected in series with one of the DC voltage sources.

10 More specifically, the method in accordance with the invention is characterized by what is stated in the characterizing part of claim 1.

On the other hand, the wiring system in accordance with the invention is characterized by what is stated in the characterizing part of claim 7.

15 By means of the invention, remarkable advantages are achieved. Thus, the withstand voltage required both from the line drive circuits and from the column drive circuits is only equal to the maximum values of the modulation voltages, about 30 V. The prior art refresh methods have required a withstand
20 voltage of about 60 V from the column drive circuits and a withstand voltage of about 200 V from the line drive circuits. A lower withstand voltage requirement facilitates the integration and results in less expensive and more reliable circuits.

25 Both of the drive circuits may be of the same type, which reduces the number of circuit types to be integrated.

The drive voltage of the display does not contain a DC voltage component, which increases the
30 service life of the display.

The power consumption of the display is low, because the amplitude of the line selection pulses and of the column modulation pulses is low and because the frequency of the basic voltage may be low, even
35 lower than 25 Hz.

In the wiring system, only one high-voltage AC voltage source is required, whereas, in the prior art

solutions, up to four pulse sources have been commonly required. This reduces the cost of the apparatus and improves its reliability.

The invention will be examined below in more detail with the aid of the exemplifying embodiment in accordance with the attached drawings.

Figure 1 shows one wiring system in accordance with the invention as applied to a 2 x 2 matrix display.

Figure 2 is a graphical presentation as a function of time of the various drive pulses related to the wiring system shown in Fig. 1.

In Fig. 1, the display matrix comprises the lines X1 and X2 as well as the columns Y1 and Y2. At the crossing points of the lines and columns, the display elements C11, C12, C21 and C22 are located. The voltages measured at the elements from the X electrodes to the Y electrodes are denoted with U_{C11} , U_{C12} , U_{C21} and U_{C22} , respectively. The ground point SE of the column drive circuits SA is preferably connected to the ground point JE of the entire drive system. The ground point RF of the line drive circuits RA is connected to the AC voltage U_B generated by the AC voltage source B.

In Fig. 2 it is assumed that the display element C22 is in the display state corresponding to the maximum luminance and that the voltage U_{RM} across the line drive circuits RA, which voltage U_{RM} is in series with the AC voltage U_B , is equal to the voltage U_{SM} across the column drive circuits SA. Thus, thereat, $U_{RM} = U_{SM} = U_M$.

The formation of the drive voltages of the display elements C11, C12, C21 and C22 is examined at a moment at which the line X2 is in the selected state. When U_B is positive, the selected line X2 receives the voltage $\hat{U}_B + U_{RM}$, whereas the non-selected line X1 receives the voltage \hat{U}_B . At the same time, the selected column Y2 is connected to the ground point SE and the non-selected column Y1 to the voltage U_{SM} . Thus, the

positive amplitude of the basic voltage (U_{BIAS}) is formed by subtracting the maximum value U_{SM} of the column modulation voltages from the positive peak value \hat{U}_B of the AC voltage. When U_B is negative, the selected line X2 is connected to the voltage $-\hat{U}_B$ and the non-selected line to the voltage $-\hat{U}_B + U_{RM}$. The selected column Y2 is now connected to the voltage U_{SM} and the non-selected column Y1 to the ground, so that the absolute value of the negative amplitude of the basic voltage (U_{BIAS}) is equal to the peak value \hat{U}_B of the AC voltage reduced by the line selection voltage U_{RM} . From Fig. 2 it is seen that, when the line selection voltage U_{RM} and the maximum value U_{SM} of the column modulation voltages are chosen equally high ($U_{SM} = U_{RM} = U_M$), the voltages of all of the display elements C11, C12, C21 and C22 are AC voltages, the peak values being \hat{U}_B in the cases of semi-selected display elements C11, C12, C21 and $\hat{U}_B + U_M$ in the case of selected display element C22. From Fig. 2 it is also seen that, when the line X2 receives a selection pulse, the display element C11 is non-selected and, consequently, receives only the basic voltage (U_{BIAS}), whose amplitude has an absolute value of $\hat{U}_B - U_M$.

Within the scope of the invention, it is also possible to conceive solutions differing from the exemplifying embodiment described above. Thus, differing from the example of Figures 1 and 2, it is possible to reverse the polarity of the basic voltage more frequently than after each field. The frequency can be increased even to several cycles per line.

The line selection voltage U_{RM} and the maximum value U_{SM} of the column modulation voltages are equally high in the example of Figures 1 and 2. They may also be different. Symmetry of the drive voltage can then be maintained by selecting the positive and the negative amplitude of the AC voltage U_B to differ as to their magnitudes by the difference between

the line selection voltage U_{RM} and the maximum value U_{SM} of the column modulation voltages.

In the example of the Figures 1 and 2, the non-selected lines are always connected either to the positive pole or to the negative pole of the line selection voltage source RM depending on the phase of the AC voltage U_B . If the line selection voltage U_{RM} is selected at least twice as high as the maximum value U_{SM} of the column modulation voltages, the non-selected lines may be allowed to float while the selected line receives the selection pulse. This reduces the power consumption.

Differing from the example of Fig. 1, it is possible to use a bridge coupling so that to the ground points RE, SE of both the line drive circuits RA and the column drive circuits SA, pulses unipolar in relation to the system ground are supplied at opposite phases in relation to each other.

In the example of Figures 1 and 2, a case has been discussed in which the luminance of the display elements has only two levels. It is evident that the method in accordance with the invention can also be employed in connection with picture displays. Besides the burst-length and pulse-width modulations, it is also possible to use amplitude modulation for adjustment of the luminance, for example, in the way suggested in the reference publication (3), by selecting the column modulation voltage corresponding to the desired luminance between zero and the maximum value U_{SM} .

30



WHAT IS CLAIMED IS:

1. Method for driving a picture display, particularly an AC electroluminescent display (C11, C12, C21, C22) based on the thin film technique and comprising a bi-dimensional matrix (X1, X2; Y1, Y2) consisting of X and Y electrodes, according to which method

- line selection pulses are alternately applied to the X electrodes (X1, X2) and
 - column modulation pulses corresponding to the desired luminance are applied to the Y electrodes (Y1, Y2),
- characterized in that
- at least some of the display elements (C11, C12, C21, C22) are charged to a maximum basic voltage (U_{BIAS}) of variable polarity, which basic voltage has been selected so that the line selection pulses or the column modulation pulses alone are not sufficient to ignite any display element (C11, C12, C21, C22), and
 - the line selection and column modulation voltages are superimposed on the basic voltage (U_{BIAS}), which voltages have been selected so that only the sum of the basic voltage (U_{BIAS}), the line selection voltage (U_{RM}), and the column modulation voltage can bring each element to be selected (C11, C12, C21, C22) to the display state.

2. Method as claimed in claim 1, wherein the AC voltage source (B) is connected in series with the line selection voltage source (RM), characterized in that the basic voltage (U_{BIAS}) is formed out of the AC voltage (U_B) by subtracting therefrom the line selection voltage (U_{RM}) if the AC voltage (U_B) is negative, and by subtracting therefrom the maximum



value (U_{SM}) of the column modulation voltages if the AC voltage (U_B) is positive.

3. Method as claimed in claim 1, wherein the AC voltage source (B) is connected in series with the column modulation voltage source (SM), characterized in that the basic voltage (U_{BIAS}) is formed out of the AC voltage (U_B) by subtracting therefrom the line selection voltage (U_{RM}) if the AC voltage (U_B) is positive, and by subtracting therefrom the maximum value (U_{SM}) of the column modulation voltages if the AC voltage (U_B) is negative.

4. Method as claimed in claim 1, characterized in that the polarity of the basic voltage (U_{BIAS}) is not reversed until after all the lines (X1, X2) have, in their turn, received the line selection pulse.

5. Method as claimed in claim 1, characterized in that the line selection voltage (U_{RM}) and the maximum value (U_{SM}) of the column modulation voltages are of equal magnitude as compared with each other.

6. Method as claimed in claim 1, characterized in that the line selection voltage (U_{RM}) and the maximum value (U_{SM}) of the column modulation voltages are of different magnitudes as compared with each other, and the symmetry of the drive voltage is maintained by selecting the positive and the negative amplitude of the AC voltage (U_B) to differ as to their magnitudes by the difference between the line selection voltage (U_{RM}) and the maximum value (U_{SM}) of the column modulation voltages.

7. Wiring system to be used for the application of the method as claimed in claim 1, which wiring system comprises:

35 - an AC electroluminescent display (C11, C12, C21, C22) based on the thin film technique and comprising a matrix (X1, X2; Y1, Y2) consisting

- of X and Y electrodes,
- line drive circuits (RA) for applying line selection pulses alternately to the X electrodes (X1, X2),
 - 5 - column drive circuits (SA) for applying column modulation pulses to the Y electrodes (Y1, Y2),
 - a line selection voltage source (RM) for the generation of line selection voltage (U_{RM} , U_M),
 - a column modulation voltage source (SM) for the generation of column modulation voltages,
 - 10 c h a r a c t e r i z e d in that
 - the line selection voltage source (RM) and the column modulation voltage source (SM) are DC voltage sources, and
 - 15 - the wiring system includes an AC voltage source (B) required for the generation of the basic voltage (U_{BIAS}), which source (B) is connected in series either with the line selection voltage source (RM) or with the column modulation voltage source (SM),
 - 20 wherein the voltages of the different voltage sources (B, RM, SM) have been selected so that the basic voltage (U_{BIAS}) becomes symmetric and so that, on one hand, the line selection pulses or the column modulation pulses
 - 25 alone are not sufficient to ignite any display element (C11, C12, C21, C22) but, on the other hand, that only the sum of the basic voltage (U_{BIAS}), the line selection voltage, and the column modulation voltage brings
 - each element (C11, C12, C21, C22) to be selected to the
 - 30 display state.
8. Wiring system as claimed in claim 7, c h a r a c t e r i z e d in that the DC voltages (U_{RM} , U_{SM} , U_M) generated both by the line selection voltage and by the column modulation voltage sources
- 35) (RM, SM) are equally high.
9. Wiring system as claimed in claim 7, c h a r a c t e r i z e d in that the AC voltage



source (B) is connected in series with the line selection voltage source (RM).

10. Wiring system as claimed in claim 9, characterized in that the ground point
5 (SE) of the column modulation voltage source (SM) is at the same potential with the ground point (JE) of the AC voltage source (B).



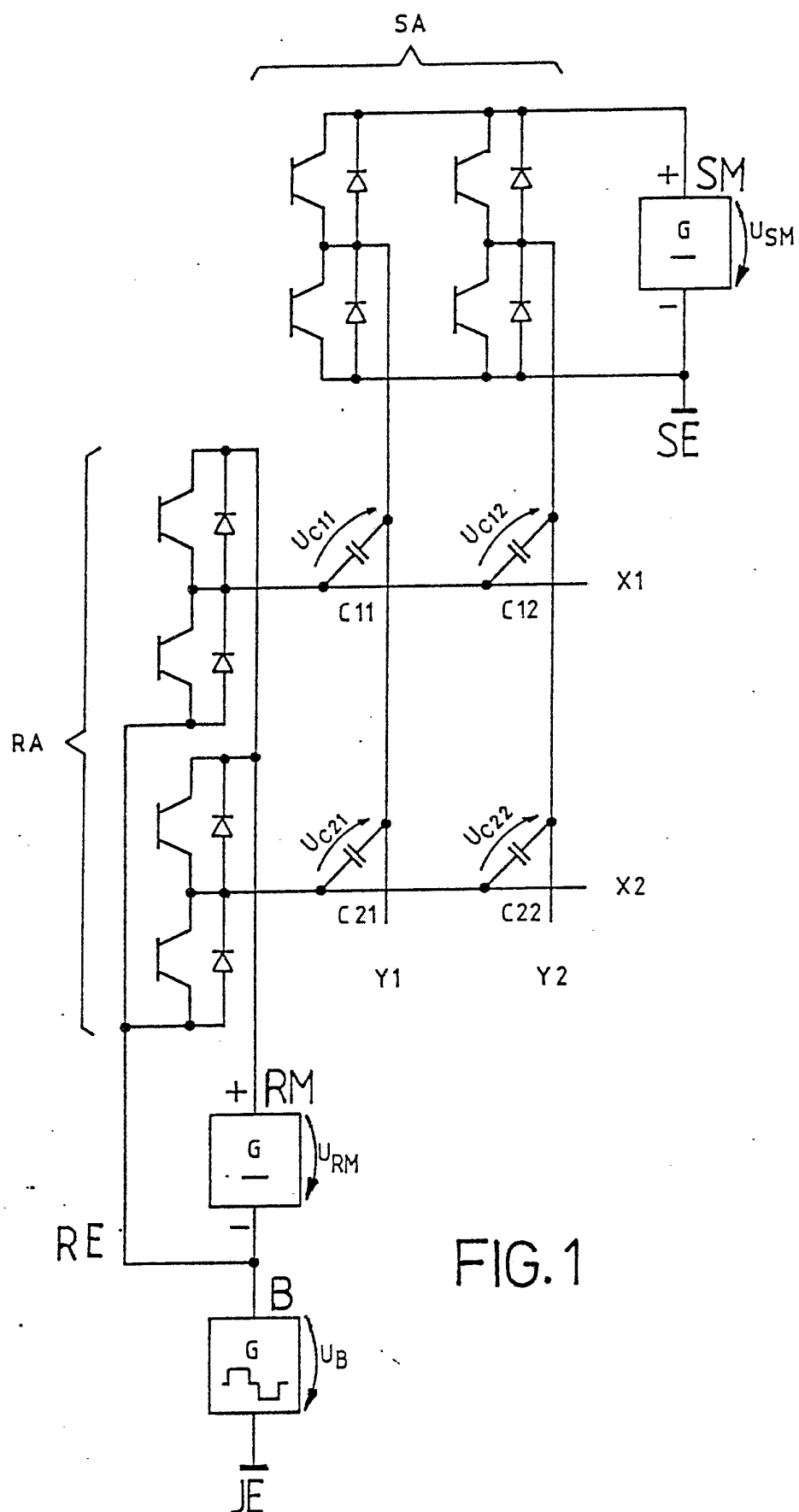


FIG. 1

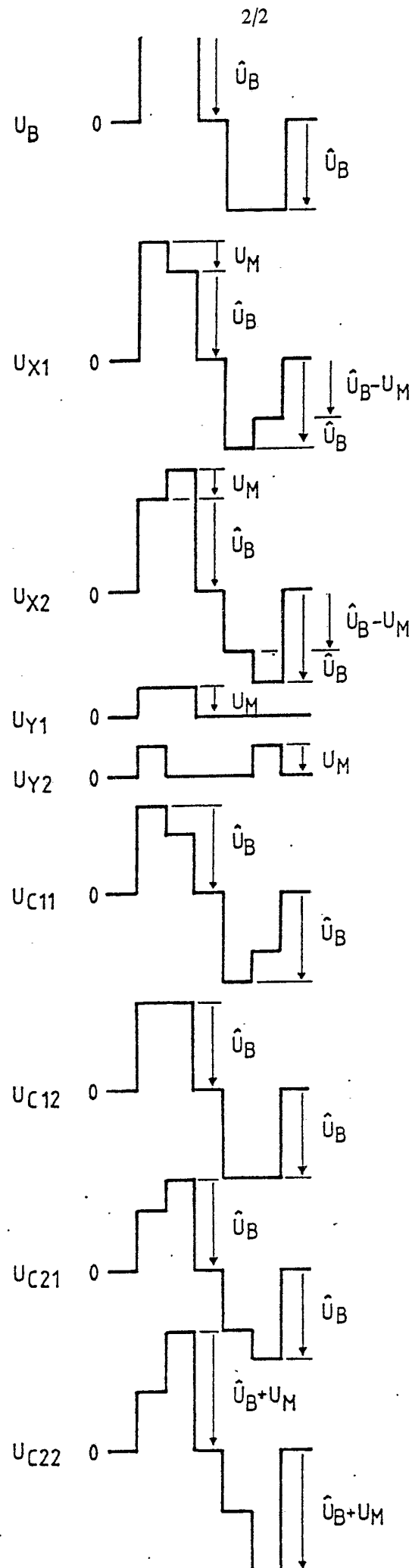


FIG. 2

INTERNATIONAL SEARCH REPORT

International Application No PCT/FI83/00012

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ³		
According to International Patent Classification (IPC) or to both National Classification and IPC 3		
G 09 G 3/30		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁴		
Classification System	Classification Symbols	
IPC 3	G 09 G 3/30, 3/32	
IPC 2	G 09 F 9/32	
US C1	340:324, 760, 781	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁵		
SE, NO, DK, FI classes as above		
III. DOCUMENTS CONSIDERED TO BE RELEVANT ¹⁴		
Category [*]	Citation of Document, ¹⁶ with indication, where appropriate, of the relevant passages ¹⁷	Relevant to Claim No. ¹⁸
A	EP, A1, 0 016 926 (INTERNATIONAL BUSINESS MACHINES CORPORATION) 15 October 1980	1-10
P	GB, A', 2 097 166 (OY LOHJA AB) 27 October 1982	1-10
<p>* Special categories of cited documents: ¹⁵</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"Z" document member of the same patent family</p>		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search ¹	Date of Mailing of this International Search Report ²	
1983-05-20	1983-05-27	
International Searching Authority ¹	Signature of Authorized Officer ²⁰	
Swedish Patent Office	Jan Silfverling	