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G. T. BAKER
DISPLAY ARRANGEMENT

2,556,640

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3 Sheets-Sheet 1

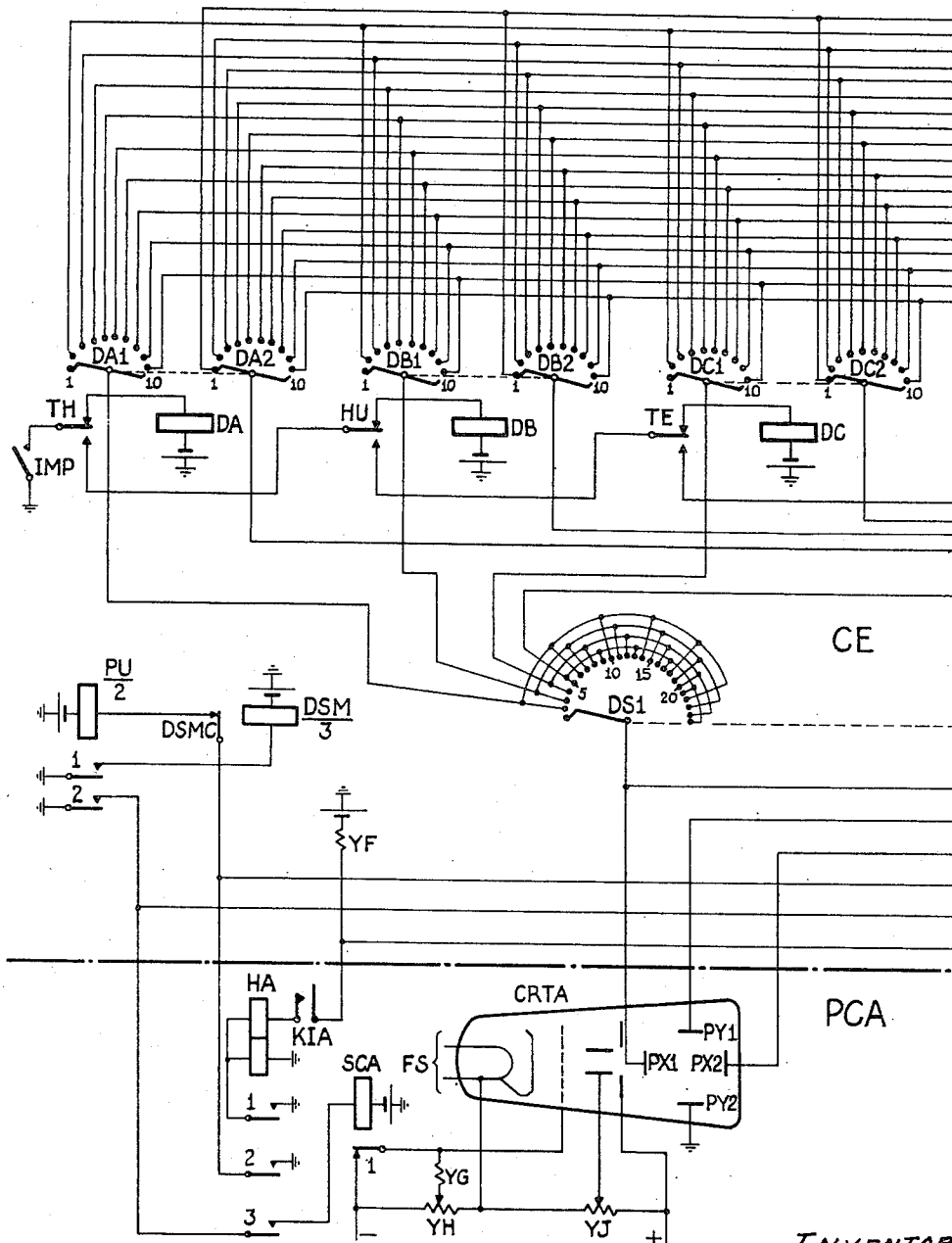


Fig. 1

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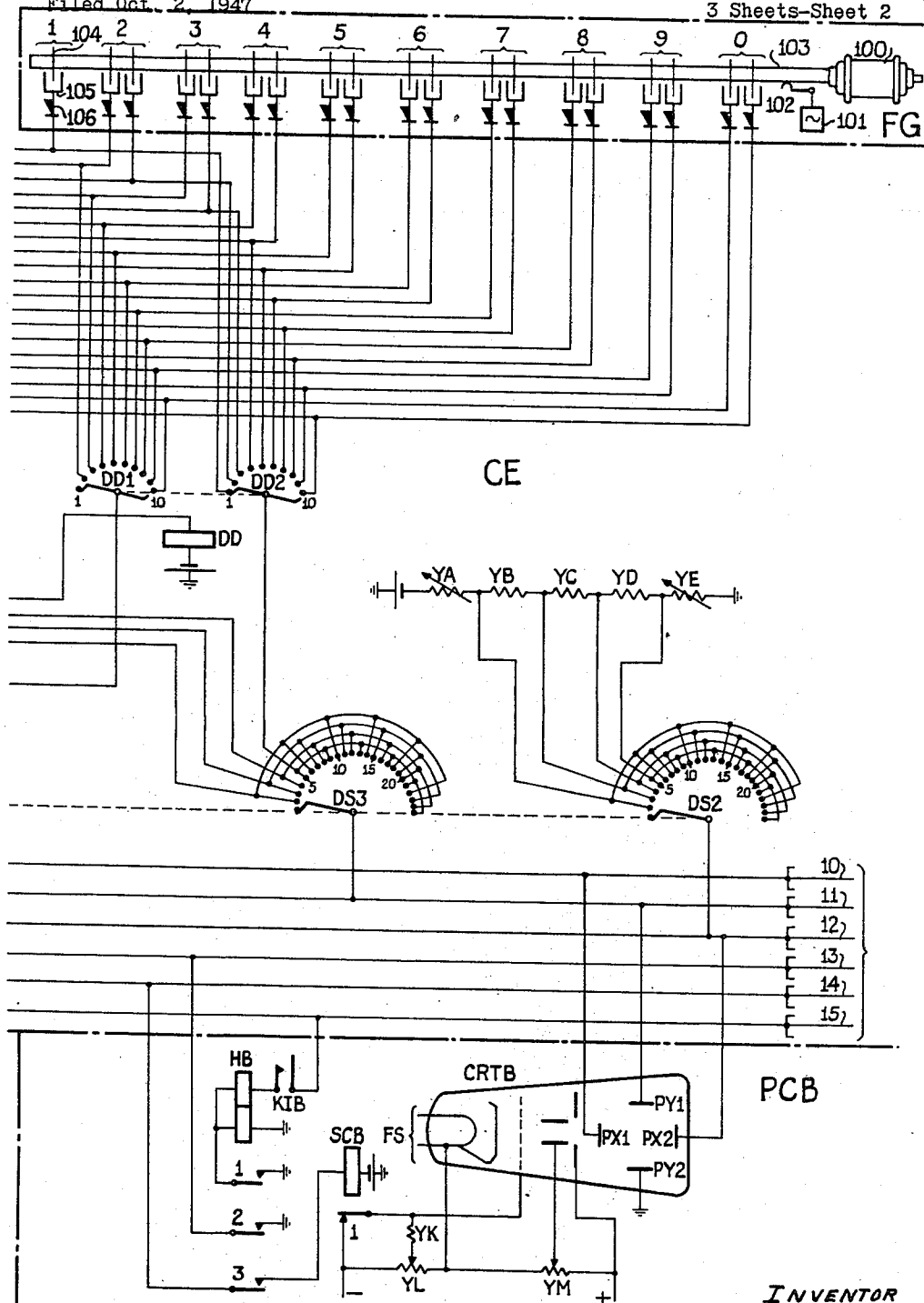


Fig. 2

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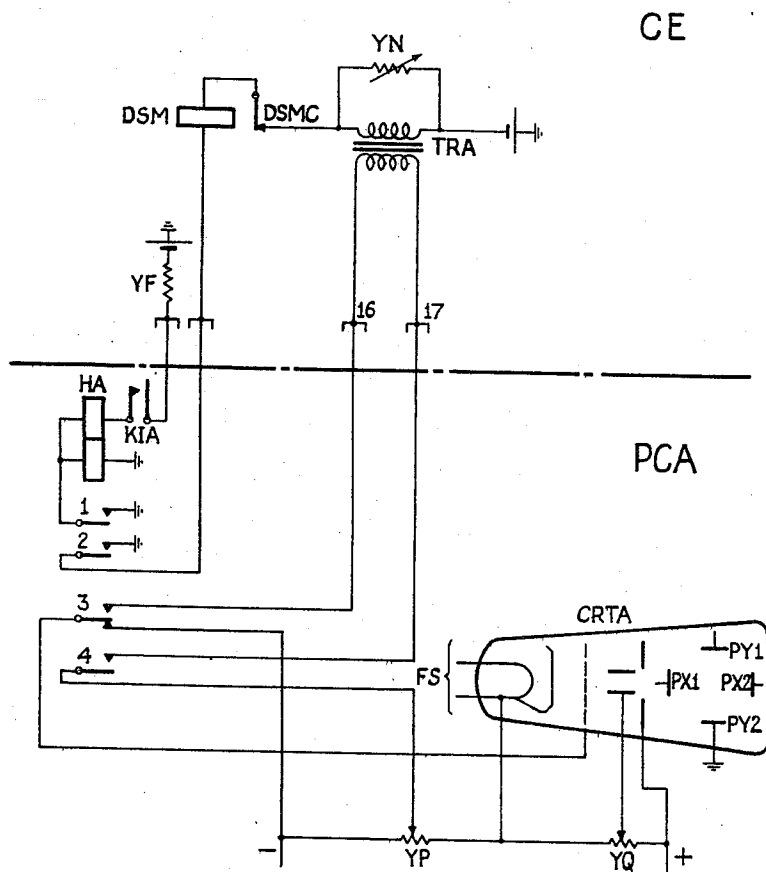


Fig. 3

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UNITED STATES PATENT OFFICE

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DISPLAY ARRANGEMENT

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5 Claims. (Cl. 177-337)

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The present invention relates to display arrangements and is more particularly concerned with display arrangements of the type disclosed in United States patent application Serial No. 750,142, now Patent No. 2,552,761 of May 15, 1951.

In this prior application, a cathode ray tube is used as the display device and is associated with arrangements which enable a character to be displayed on the screen by the application of variable and steady voltages to the deflection plates, the variable voltages causing the spot to trace an outline of the desired character on the screen while the steady voltage which is fixed for any one character determines the position of the centre of the character on the screen. By varying the steady voltage from character to character, successive characters may be caused to appear in sequence on the screen and by suitably predetermining the values of the steady voltage, the characters may be caused to appear on the screen in a prearranged formation. Each individual character will be repeated at high speed while the complete trace will also be repeated continuously as long as the particular display is required.

It will be understood that a satisfactory display is most easily obtainable when using a screen having a long afterglow characteristic. However, it has been found that in such a case some interference is visible due in part to the fact that the wipers of the uniselector which feed the voltages to the deflection plate cannot be adjusted to step absolutely simultaneously. It is one of the objects of the present invention to avoid this defect.

According, therefore, to one feature of the invention, in a display arrangement employing a cathode ray tube associated with means for applying variable and steady voltages to the deflection plates of the tube to cause a number of characters to be displayed on the screen of the tube, switching means are provided for blacking out the screen during the inter-character traverse as well as during fly-back.

In one arrangement according to this feature of the invention the switching means consist of a relay associated with the cathode ray tube and adapted to be operated when a display is to be exhibited, the relay being controlled by the magnet of the uniselector which feeds the voltages to the deflection plates of the tube or tubes so that it releases when the wipers of the uniselector are being stepped from one position to the next and prevents the flow of beam current during movement of the wipers.

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The provision of a control of this nature may also be applied to enable a plurality of cathode ray tubes to be associated with common equipment for providing the variable and steady voltages to the deflection plates.

According to this feature of the invention, in a display arrangement employing a plurality of cathode ray tubes associated with means for applying variable and steady voltages to the deflection plates of the tubes to cause a number of characters to be displayed on the screen of the tubes, the circuits which control the application of said voltages to the deflection plates are common to a plurality of tubes and are arranged so as to apply said voltages in parallel to the deflection plates of all the tubes, switching means being provided which control the blacking out of the screens of all tubes which are not required to exhibit a display.

According to a further feature of the invention, in a display arrangement having a plurality of cathode ray tubes and means for applying variable and steady voltages to the deflection plates of the tubes to cause a number of characters to be displayed on the screens of the tubes, the circuits for controlling the application of the variable and steady voltages to the deflection plates of the tubes are provided in common and serve to apply said voltages to the deflection plates of all the tubes, switching means being provided for causing the black-out of the screen of a tube exhibiting a display during the inter-character traverse and for causing the complete black-out of the screens of the tubes which are not required to exhibit a display.

The invention finds particular application to telephone systems in which it is necessary to display before an operator information such as calling subscribers' numbers, and according to a further feature of the invention, in a display arrangement for operators' positions in telephone systems, each operator's position is provided with a cathode ray tube and common equipment is provided for applying variable and steady voltages to the deflection plates of all the tubes to cause characters to be traced on the screens, the performance of a switching operation by an operator serving to ensure that the voltages applied to the deflection plates of all the tubes are rendered effective only on that tube individual to the operator's position.

It will be appreciated that while the above arrangements have particular application to the display of a calling subscriber's number which may for instance include four digits displayed

side-by-side on the screen the invention is obviously applicable to provide a more extended display by the application of suitable shifting potentials to the plates of the cathode ray tube. Several lines of characters could thus be obtained depending only on the size of the characters relative to that of the screen. The controlling factor in an extended display of this type, however, is of course the writing speed and a reasonably steady extended display would require a higher speed of operation of the figure generator which provides the varying voltages applied to the deflection plates.

With such an increased speed, however, the inter-character black-out control described above is not suitable and in this case the switching means comprise the interrupter contacts of the magnet of the unselector which feeds the voltages to the deflection plates of the tube or tubes, the interrupter contacts being connected in series with the magnet and the primary winding of a transformer the secondary winding of which is connected in the circuit of one electrode of the cathode ray tube in such a manner that the opening of the interrupter contacts causes a voltage surge to be developed in said secondary winding and applied to said electrode to prevent the flow of beam current.

The invention will be better understood from the following description of one embodiment shown in the accompanying drawings in which the invention is applied to display arrangements for operators' positions in a telephone system. In the drawings

Figs. 1 and 2 which should be arranged side-by-side with Fig. 1 on the left, show the common equipment CE and two operators' position circuits PCA and PCB while

Fig. 3 shows an alternative circuit for the application of the black-out potential to the cathode ray tubes.

Referring first to Figs. 1 and 2, the common equipment CE comprises a figure generator FG, figure selectors DA, DB, DC and DD and a layout selector DS. The figure generator is described in detail in applicant's co-pending United States application Serial No. 750,142 and is shown in diagrammatic form only herein. Briefly it consists of a motor 100 driving a shaft 103 to which a source of alternating current 101 is connected by means of brush 102. A number of capacitors are provided in the figure generator, each of which has two stationary plates and a movable plate, the movable plates for all the capacitors being mounted on the shaft 103 for rotation between the stationary plates. Thus the capacitor 105 has a movable plate 104 fixed to the shaft 103. Alternating current connected to the shaft 103 is fed through the capacitors and rectified such as by rectifier 106. The movable plates of the capacitors are not circular but are cut to shape as described in the above-mentioned application in such a manner that the varying voltage obtained by rectification of the alternating current serves when applied to the deflection plates of the cathode ray tube to cause the cathode ray beam to trace the outline of the appropriate character on the screen. It will be understood that the varying voltages are available continuously and the application of the appropriate voltages to cause the display of a desired sequence of four characters is effected by the setting of the four figure selectors DA, DB, DC and DD.

The figure selectors comprise a unselector for each character, four being used in the present

case since the display is limited to four characters but it will be understood that any other number may be employed as desired. The figure selectors are controlled by incoming trains of impulses which are fed to a circuit of which only the impulse-repeating contact IMP and the changeover contacts TH, HU and TE are shown. Each unselector is provided with two wipers and associated bank contacts, the wipers being connected to the bank contacts associated with wipers DS1 and DS3 of a further unselector, the layout selector DS, while the contacts are connected to the outputs of the figure generator. The necessity for two wipers arises from the fact that in general two varying voltages are required for the generation of a character and the corresponding contacts of the two banks of each unselector are connected to the appropriate pair of outputs from the figure generator, the wipers being connected to the X and Y plates through the layout selector DS. An exception to this takes place in the case of the digit "1" where obviously only one varying potential will be required and this will be applied to the Y plates. Contact 1 of banks DA1, DB1, DC1 and DD1 which feed the X plates are consequently disconnected.

The layout selector DS has three banks DS1, DS2 and DS3 of which DS1 and DS3 feed the varying voltages to the X and Y plates as described above while bank DS2 serves to apply a steady voltage to the X plates of the tube in order to space out the characters on the screen.

The above described common equipment is multiplied over the operator's positions by means of the leads 10, 11, 12, 13, 14 and 15 while contacts 2 to 5 of banks DS1, DS2 and DS3 are multiplied over the bank in order that the display may be continuously repeated.

The unselector drive magnet DSM is controlled by the pulsing relay PU which is set in operation by equipment individual to the operators' positions. The equipment at each position for switching purposes comprises the two relays such as HA and SCA in position circuit PCA and the locking key KIA. When an operator requires a calling number to be displayed, she operates the key KIA which at contacts not shown serves to initiate identification and transmission of identity signals. The impulses representing these signals are repeated to the common equipment at contact IMP, the first train being effective on unselector magnet DA so that this unselector is set in accordance with the first train. At the end of the first train changeover contact TH operates and the next train is effective on magnet DB. After this train contact HU operates and the third train is effective on magnet DC while the fourth train is effective on magnet DD on the operation of contact TE.

The operation of key KIA also causes the operation of relay HA over resistance YF and both windings of the relay in series. Relay HA in operating short-circuits the high resistance right-hand winding, the relay holding over its low resistance left-hand winding thereby applying a guarding potential to lead 15 which prevents the operation of a relay such as HB in the event that the key KIB is operated at a time when the common equipment is in use.

Relay HA in operating at contacts HA2 causes the operation of the pulsing relay PU in series with the magnet interrupter springs DSMC and at contacts HA3 prepares the circuit of relay SCA which circuit is completed at contacts PU2 on the operation of relay PU. Relay PU in operating at

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contacts PU1 closes the circuit of the drive magnet DSM which energises and at interrupter springs DSMC opens the circuit of relay PU. Relay PU releases and opens the circuit of relay SCA and also the circuit for the drive magnet which thereupon releases and the wipers are stepped to position 2. The appropriate varying voltages are now fed over wipers DA1 and DA2 of the figure selector DA, wipers DS1 and DS3 respectively of the layout selector DS to the X and Y plates respectively of the cathode ray tube.

It will be noted that relay SCA is operated as long as the magnet DSM is energised and is released while the magnet is de-energised i. e. during the stepping of the wipers from one position to the next.

Relay SCA has one contact only and this is connected in the D. C. biasing arrangements for the cathode ray tube. When contact SCA is closed as shown in Fig. 1, full negative potential is applied to the modulating grid of the cathode ray tube and since the cathode is permanently connected to the junction of YH and YJ, which are connected across the positive and negative supply terminals, there will be no beam current through the tube. When relay SCA operates and the contact SCA1 is opened, the modulating grid is connected through YG to a point in resistance YH so that the potential applied to the grid is more positive, the values of the resistances being so chosen that beam current now flows.

It will be understood that relay SCA will remain in its released condition for slightly longer than the time taken for the wipers to step from one position to the next since its circuit is dependent upon the operation of relay PU which is in turn operated upon the closure of the interrupter springs DSMC. Hence the steady D. C. bias will have been applied to the plate PX2 for an appreciable period before the beam current again begins to flow so that the provision of the contact SCA1 will black-out the screen for the duration of the inter-character traverse and also during the fly-back period.

The alternative arrangement shown in Fig. 3 is intended for use in cases where a more extended display than the four digits of the calling party's number is required and where, in consequence, a higher writing speed is employed. Normally the full negative potential is applied to the modulating grid of the tube CRT over break springs HA3. When the common equipment is taken into use from one position, relay HA operates whereupon the modulating grid is connected via make springs of HA3, lead 16, high impedance secondary winding of transformer TRA, lead 17, make springs HA4 to a tapping on resistance YP which with YQ forms a potentiometer across the supply voltage. The modulating grid is thus rendered less negative and beam current flows. The primary winding of the transformer TRA consists of a few low resistance turns and the variable resistance YN is connected in parallel therewith. The primary winding is connected in series with the magnet DSM and the interrupter springs DSMC. The circuit is arranged so that as the interrupter springs DMC break to deenergise the magnet DM and step the wipers to the next position, the induced surge in the secondary winding renders the modulating grid negative to produce a momentary black-out. The duration of the black-out pulse may be varied by variation of the non-inductive resistance YN connected across the primary winding of the transformer.

With regard to the mounting of the cathode

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ray tube, in particular where it is employed at a demand operator's position for providing the number of the calling party, the tube may be mounted behind the front panel of a manual board. The screen will be largely concealed by an escutcheon plate and the number will be visible through a recess in the front of the manual board, the cowl thus formed providing a light screen. It will of course be appreciated that a cathode ray tube having a small screen will usually be used in these cases and a typical screen diameter will be four centimeters. The characters produced will then be approximately three to four millimeters high and a full display of five digits will occupy less than an inch width.

An alternative mounting position is in the desk of the manual position, the axis of the tube lying immediately beneath and parallel to the surface of the desk. The number is read by means of a mirror permanently fixed to the lid of the desk and sunk well below the surface. The recess is closed by a glass sheet flush with the surface and in this position the number is easily read since the tube is well screened from direct light.

A single power pack can be employed for a large number of tubes and would preferably be run from the mains with a standby vibrator unit for battery operation. High resistances are inserted at the source in all leads carrying high voltages so that contact with these leads cannot cause injury. In addition all wires are totally enclosed, the main run being in conduit and the final connection to the display in flexible metal tubing. The tube itself will preferably have a mu-metal screen, the whole sheathing being continuous and earthed.

I claim:

1. A character display arrangement comprising a cathode ray tube having a fluorescent screen, a grid electrode for controlling the flow of beam current in said tube and deflecting plates for said electron beam, means for producing a variable voltage and a steady voltage, a uniselector having a driving electromagnet and a plurality of wipers, means for feeding said variable and steady voltages over said wipers to said deflecting plates to enable characters to be traced in at least one row on said screen, a switching device operated by the release of said electromagnet to remove a blackout potential from said grid electrode and released by the operation of said electromagnet to apply said blackout potential to said grid electrode and means for delaying the operation of said switching device a predetermined time after the release of said electromagnet in order to black out the screen both during the inter-character traverse and fly-back periods.

2. A character display arrangement comprising a cathode ray tube having a fluorescent screen, a grid electrode for controlling the flow of beam current and deflecting means for the electron beam, means for producing a variable voltage and a steady voltage, stepping means for sequentially applying said variable and steady voltages to said deflecting means to cause the electron beam to trace the outline of a plurality of characters in different positions on said screen, switching means responsive to the operation of said stepping means for generating a potential while said stepping means moves from one position to the next and means for applying said potential to said grid electrode to prevent the flow of beam current in said tube during said movement.

3. A character display arrangement comprising a cathode ray tube having a fluorescent screen, a grid electrode for controlling the flow of beam current and deflecting plates for the electron beam, means for producing a variable voltage and a steady voltage, a uniselector having a driving electromagnet and a plurality of wipers, means for feeding said variable and steady voltages over said wipers in successive positions to said deflecting plates to enable characters to be traced on said screen, a switching device responsive to the operation of said driving electromagnet for generating a potential while said driving electromagnet steps said wipers from one position to the next and means for applying said potential to said grid electrode to prevent the flow of beam current in said tube during said movement.

4. A character display arrangement as claimed in claim 3 wherein said switching device comprises a relay which is operated only when a tube is to exhibit a display, said relay having a contact which in the unoperated position connects a source of negative potential to said grid electrode.

5. A character display arrangement as claimed in claim 3 wherein said switching device comprises a transformer the primary winding of which is in series with said uniselector magnet and magnet interrupter springs while the secondary winding is connected in the circuit of said grid electrode whereby the induced surge in the secondary winding occurring when said interrupter springs open is applied as a blackout voltage to said grid electrode.

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