This invention relates to a system for controlling the intensity of symbols displayed on a cathode ray tube and particularly to a system for providing symbols of constant intensity on a time shared display pattern where a single electron beam develops a plurality of symbols representative of information from independent sources.

In some systems such as in radar, many symbols are required to be displayed on the screen of a cathode ray tube having a single electron gun, which symbols may vary in shape, size and number as determined by the source of deflection signals applied to the deflection plates of the tube from separate sources of symbol information. In order to display a plurality of symbols, a time sharing arrangement is provided so that each symbol is formed during a different portion of a repetitive period with the retentivity characteristics of the phosphor on the screen of the tube retaining a presentation of each symbol while the others are being formed.

In the prior art, when a plurality of symbols are displayed on the screen of a cathode ray tube on a time shared basis, the relative intensity of the symbols, which is a function of the number of electrons striking a particular point on the phosphor of the screen in a given time interval, is set by individually controlling the actual time of write or formation of each symbol. A special gating circuit is provided for intensity setting of each symbol with a selected size and shape by controlling the time of application of each of the deflection signals to the deflection plates or the time the electron beam is formed by controlling the blanking pulses applied to the grid of the cathode ray tube and thus the time of writing of each symbol. However, as each symbol varies from the size or shape at which the gating circuit is selected as may be required by the information being displayed, the intensity varies because there is no means of adjusting the time of writing as the symbol varies. For example, as a large symbol is made smaller, the intensity of presentation increases and as a small symbol is made larger, the intensity of presentation decreases. It is difficult for an observer to accurately interpret a plurality of symbols when they vary in intensity. Another disadvantage of having a special gating circuit to provide a different time of writing for each symbol is the complexity of the gating circuitry. A further disadvantage of this prior art arrangement is that if the deflection voltages are removed for any reason, the beam intensity is applied continually to a single position on the screen so that destruction of the phosphor material may occur at such position.

An arrangement that is utilized to control intensity of a symbol on the screen of a cathode ray tube, in systems not having time sharing, differentiates the vertical and horizontal deflection voltages and after rectification of the differentiated voltages combines the rectified signals to form a current that is proportional to the rate of change of the deflection voltages, which signal is applied directly to the intensity grid of the tube. However, in display systems it is preferable to bias the cathode of the cathode ray tube at a low voltage relative to ground so that the auxiliary controls such as focus controls and the astigmatism controls are at a potential close to ground rather than to have the cathode at ground with the controls at a high potential. This type of arrangement with the auxiliary controls at a potential close to ground is especially required in aircraft systems for the safety of the pilot, in which systems time shared displays are often utilized. In order to utilize a very low potential at the cathode, a coupling capacitor is required between the intensity control circuitry and the intensity grid which is maintained within a few volts of that of the cathode, so that the intensity control circuitry for varying the potential applied to the intensity grid can be operated at a potential relatively close to ground. However, a coupling capacitor prevents certain differentials of the deflection voltages from passing therethrough, such as a sawtooth deflection voltage which has a differential that is a constant or a D.C. (direct current) voltage. Thus, some symbols cannot be displayed in a reliable manner when a coupling capacitor is utilized. Also, when the differential signals developed from the vertical and horizontal deflection voltages are combined algebraically rather than vectorially, the half wave rectification results in bright spots at certain portions of the symbols.

A display system that provides time sharing for displaying a number of symbols on the screen of the scope and that provides capacitive coupling between the control circuitry and the intensity grid, and that further provides protection against damage to the phosphor in the event of a failure of the deflection voltages would be very valuable to the art.

It is, therefore, an object of this invention to provide a cathode ray tube intensity control system for use with a time shared display arrangement in which the symbols are displayed with uniform intensity regardless of the size, number and shape of the symbols.

It is a further object of this invention to provide an intensity control system for a cathode ray tube for time sharing of a plurality of signals from separate sources that utilizes a clamping circuit to prevent destruction of the screen of the cathode ray tube in the absence of deflection voltages.

It is a still further object of this invention to provide a system for time sharing the writing of a plurality of symbols on the screen of a cathode ray tube which differentiates the deflection voltages, passes the differential signals through full wave rectifiers and combines the rectified signals algebraically in a manner to provide symbols of constant intensity.

It is another object of this invention to provide a system for displaying a plurality of symbols of varying size, shape and number on a cathode ray tube by applying a summed signal indicative of the time rate of change of the horizontal and vertical deflection voltages combined with a carrier wave through a coupling capacitor arranged between the intensity control circuitry and the control grid, which system controls the intensity of the symbols when utilizing deflection voltages having a differential value that is a constant.

According to one feature of this invention, a system is provided for use with a time shared display pattern where several symbols are displayed simultaneously with one electron stream of a cathode ray tube in which all symbol traces are traced at an equal intensity regardless of shape, size or number of the symbols. Horizontal and vertical deflection voltages from sources of information to be displayed are applied on a time shared basis to the deflection plates of the cathode ray tube but also through differentiators to develop signals representing the derivative of each of the deflection voltages. The differential signals are applied to a full wave rectifier and then combined in a manner to obtain a signal representing the absolute value of the derivative and the instantaneous intensity requirements of the cathode ray tube. The sig-
als representing the absolute value of the derivative of the deflection voltages are then applied to a summing
network which continuously receives transient blanking
signals which blank out unwanted portion of the display such as the trace between symbols. The combined signal developed by the summing circuit which includes the intensity information combined with a car-
rier wave is then applied to a clipping circuit to establish
a stable unidirectional voltage to which the wave form
may be clamped. It is then passed through a coupling
capacitor and a clamping circuit which maintains the
clipping level at a preselected voltage and is applied to the intensity grid of the cathode ray tube. This clipping
and clamping arrangement prevents intensity changes
in the electron beam being added, removed or varied in size and further prevents burning of the screen of the cathode ray tube when the deflection voltages are removed. Thus, the
transient blanking signals are utilized as a carrier wave
for applying differential signals to the intensity grid, which differential signals may be either alternating or direct
current signals.

The novel feature of this invention, as well as the
invention itself, both as to organization and method of
operation, will best be understood from the accompany-
ing description taken in connection with the accompany-
ing drawings which:

FIG. 1 is a combined schematic circuit and block dia-
agram of the intensity control system for a cathode ray
tube in accordance with this invention;

FIG. 2 is a schematic diagram to illustrate one exam-
ple of a plurality of symbols displayed on the screen of the cathode ray tube of FIG. 1; and

FIG. 3 is a diagram showing waveforms of time versus
amplitude appearing at various positions in the system
of FIG. 1.

Referring first to FIG. 1, which is a schematic diagram of the intensity control system in accordance with this invention, each signal arrangement thereof will be de-
scribed. A source of vertical deflection signals 10 and a source of horizontal deflection signals 12 are provided to supply vertical and horizontal deflection voltages to a cathode ray tube 14. The sources of deflection signals 10 and 12 may include independent sources of symbol forming information such as range determining circuitry,
steering circuitry, and artificial horizon determining
device, all of which may be included in an aircraft control
system, for example. Circuits for developing the signals of the sources of horizontal and vertical de-

flection signals 10 and 12 are well known in the art such as described in Patent No. 2,578,466, "Disturbed
of-Sight Fire Control System" by R. J. Shank et al., issued
March 17, 1959. A source of blanking signals 18 is
provided to apply gating signals to the sources of defec-
tion signals 10 and 12 through a gating lead 26 so that
the deflection signals are obtained from each source of information in the aircraft for a time shared portion of
a repetitive period. The source of blanking signals 18
may be a conventional plurality of sequential flip flop
divider arrangement that develop a continuous sequence of similarly spaced pulses of equal time duration.

The deflection voltages from the sources 10 and 12 are respectively applied to a vertical deflection amplifier 24
and a horizontal deflection amplifier 26. The vertical de-

cfection voltages being 180 degrees out of phase from each other are applied from the amplifier 24 through leads
30 and 32 to vertical deflection plates 34 and 36 of the
cathode ray tube 14. Similarly, the horizontal deflection
devices 26, 40 degrees out of phase from each other
are applied through leads 40 and 42 to horizontal defec-
tion plates 44 and 46 of the cathode ray tube 14. The
vertical and horizontal deflection voltages in the sources
10 and 12 have a phase relative to each other as deter-
mined by the requirements of forming a desired symbol.
In response to the deflection voltages, the electron beam
developed from an electron gun, which includes a cathode

forms a pattern on the phosphor of a screen 50 of
the cathode ray tube 14, which arrangement is well known
in the art.

To provide intensity control of symbols formed on the
screen 50, a portion of one of the vertical deflection sig-
nals is applied from the amplifier 24 through the lead 30
and through a lead 52 to one plate of a capacitor 54 of a differentiating circuit 56. Also, a portion of one of
the horizontal deflection signals is applied from the ampli-
fer 26 through the lead 40 and through a lead 58 to one plate
of a capacitor 59 of a differentiating circuit 60. The
intensity control system in accordance with this in-
vention utilizes only one deflection signal for intensity
control so that the system is applicable to a system dif-
frent from that shown in FIG. 1, which drives the defec-
tion plates by controlling the voltage applied to only a
single plate in either the horizontal or vertical dimensions
with the other deflection plate in each dimension con-
trolled to control the potential on an intensity grid 74 of the cathode ray tube 14.

The differential signals are respectively applied from
the leads 64 and 66 to full wave rectifiers 78 and 80,
which are conventional bridge rectifier circuits, as well
known in the art. In the rectifier circuit 78, positive
differential signals follow a current path from the lead
64 through a diode 82 coupled to a positive lead 89,
through a lead resistor 84 and through a diode 86 to
ground. Negative differential signals follow a current
path from the lead 64 through a diode 88 coupled to a
negative lead 85, through the lead resistor 84 and through a diode 90 to ground. In a similar manner positive and
negative differential signals are applied from the lead
68 to the rectifier 80 and to ground to develop a positive
signal on a positive lead 94 and negative differential sig-
nals are applied from the lead 68 through the rectifier
80 to develop negative signals on a negative lead 96.

Full wave rectification of the differential signals is re-
quired because the derivatives of some waveforms such
as the negative alternations of a sine wave are negative.

In order to provide a signal indicative of the value of the differential signals, a summer 98 is provided to sepa-
rately combine the positive differential signals and the
negative differential signals and to combine the abso-
late value of the positive and negative signals to give
a signal proportional to the instantaneous sweep velocity
of the electron beam of the cathode ray tube 14. The
positive signals are applied from the leads 89 and 94
through respective resistors 104 and 106 to a lead 110
and to ground through a common resistor 112. Similarly,
the negative differential signals are applied from the leads
85 and 96 through respective resistors 116 and 118 and
to ground through a common resistor 113. The common
resistors 112 and 118 are tapped resistors having respec-
tive movable taps 126 and 128 to provide relative intensity
adjustment to the system.

The summed positive differential signal is applied from
the taps 128 to the grid of a triode 134 also of the differen-
tial amplifier 132. The anode of the triode 130 is coupled to a plus 150 volt terminal 136 and the anode of the triode 134 is coupled to the plus 150 volt terminal 136 through a signal forming resistor 140. The cathodes of the triodes 130 and 134 are coupled to
a minus 15 volt terminal 142 through a common resistor 146. An output lead 148 is coupled between the
resistor 140 and the anode of the triode 134 to receive a combined signal representing the sum of the absolute
value of the positive signal applied to the grid of the triode 130 and the negative signal applied to the grid of the
triode 130 and the negative signal at the tap 128 is effectively inverted and summed with the positive signal to appear
as a positive summed derivative signal at the anode of the triode 134.

The amplifier circuit 152 is provided to combine the
summed derivative signal from the lead 148 with the transient blanking signals from the source 18. The derivat-
ive signal and the blanking signals are applied respectively
through resistors 154 and 156 to a common point 160 and to ground through a common resistor 162. An
alternating combined signal including the blanking sig-
nal as the carrier wave for the differential signals is
applied from the common point 160 to a clipping circuit
166 which, as will be explained subsequently, determines
an absolute level for clamping operation. The alter-
nating combined signal is applied from the common point
160 to a lead 161 and through the shunting resistor 202 to
a diode 170 for clipping and to an arm 172 of a
tapped resistor 174 having one end coupled to a plus 50
volt terminal 176 and the other end grounded. The alter-
nating combined signal, after clipping, is applied from
the lead 178 which is operated class A so that no clipping or limiting occurs therein.

The alternating combined signal is applied from the amplifier 180 through a lead 182 to a coupling capacitor
184 so as to isolate a D.C. (direct current) bias of the
intensity grid 74 from the control circuitry previously
described. The coupling capacitor 184 is part of a clam-
ring circuit 186 which firmly clamps the clipping level of
the combined signal to provide reliable intensity control
and to prevent destruction of the screen 50 in the event
of a failure of the vertical and horizontal deflection sig-
als. The coupling capacitor 184 is coupled to a lead 188
which, in turn, is coupled through the cathode to
anode path of a diode 190 to a movable tap 192 of a
tapped resistor 194. One end of the resistor 194 is
coupled to a minus 2700 volt terminal 198 and the other
coupled through a biasing resistor 200 to the cathode
46 of the cathode ray tube 14. A shunting resistor 202 is
coupled from the tap 192 to the lead 188 to provide a
coupling path for the coupling capacitor 184.

Referring now to FIG. 2 which shows the screen 50 of
the cathode ray tube 14, as well as to FIG. 1, an exam-
ple of a signal may be time shared with a portion of the
signal being displayed as explained. A range circle 206 may have a diameter which varies to indicate to a pilot the remaining range between
his present position and a target, for example, thus vary-
ing from a large diameter circle to a very small diameter
circle at the center of the screen 50. A steering dot 210 may be provided to indicate to the pilot the direction
in which he is flying relative to a calculated position such
as a target, which dot is maintained with a constant size.
The position of the steering dot 210 on the screen 50
relative to the center of the screen 50 may indicate the
variation of the flight of a craft utilizing the display from a
desired flight path toward a target. A horizon line 212 may be provided to indicate the attitude of the craft
relative to a horizontal position, which line may vary in
size and may be utilized only during a portion of a flight.
The system in accordance with this invention may be
utilized to display other desired data in addition to those
as shown in FIG. 2 by using the time sharing arrangement thereof.

Referring now also to FIG. 3 which is a graph of
amplitude versus time as well as referring to FIG. 1, the
operation of the intensity control system will be further
explained. For the display shown in FIG. 2, a period of
time "t_1" to "t_5" will be utilized to form the three symbols, which period is continually repetitive as determined by
the source of blanking signals 18 and the sources of
deflection signals 10 and 12 synchronized with the source 18. Between the period "t_1" and "t_5", sine wave 216 of
a waveform 217 may be applied from the source 10 to the
vertical deflection amplifier 24 and similar signals 90
degrees out of phase from the signals 216 may be applied
from the source 12 to the horizontal amplifier 26 to de-
velop the range circle 206. Between times "t_1" and "t_5",
the steering dot 210 is formed by a pair of signals such as
218 from the sources 10 and 12. As is well known, the
steering dot 210 is developed by a pair of signals such as
218 having fixed levels for deflecting the electron beam
to the desired position on the screen 50. Between times "t_1"
and "t_5" the horizontal line 212 is formed from signals 222
of the waveform 217 from the source 10 and similar
signals in phase therewith from the source 12. The sig-
nals applied to the amplifiers 24 and 26 are then applied
180 degrees out of phase from each other from the am-
plifier 24 to the leads 30 and 32 and similarly from the
amplifier 26 to the leads 40 and 42.

The range circle signals 216 are then applied to the
differentiation circuit 56 and to the full wave rectifier
78 to form positive and negative differential signals whose
absolute values are summed in the differential amplifier 132 to form another differential signal 226 of a waveform 225. It is to be noted that the summed
differential signal 226 has a plurality of amplitude varia-
tions indicating the algebraic sum of the rate of change
of the vertical and the horizontal deflection voltages.
Because full wave rectification and summing is provided,
this algebraic sum is the instantaneous magnitude, which
is very nearly proportional to the rate of the sweep of
the electron beam of the cathode ray tube 14. Thus,
varying intensities due to error of algebraic addition as
compared to vectorial addition is greatly minimized
so that bright spots on the symbols caused by incorrect
algebraic addition at the periphery of the symbols for
example, are substantially eliminated. The summed
differential signal for the steering dot 210 is a D.C. signal
228 having a constant level and the summed differential
signal for the horizon line 212 is a signal 232 having
instantaneous variations in magnitude resulting from full
wave rectification and summing of the pair of sine waves
such as the signal 222.

The gating or blanking signal applied to the summing
circuit 152 is shown by a waveform 236 and during the
time of writing of each symbol has both a low and a high
voltage level. During times "t_6" to "t_8", "t_5" to "t_4", and "t_2" to "t_1", the blanking signal is provided for the electron beam
to move from one symbol to the other without forming a
trace on the screen 50. During times "t_1" to "t_5", "t_4" to "t_3", and "t_2" to "t_1", which are writing times, the symbols are
formed on the screen 50. All symbols are retained on the
screen 50 because of the reflectivity characteristics of
the phosphor material. It is to be again noted that the
gating signal of the waveform 236 may be utilized to control or synchronize the time sharing in the source
10 and 12 of the deflection voltages developed therein.
It is to be noted that for blanking out small portions of
the symbols such as the range circle 206, the gating
signals of the waveform 236 between times "t_2" and "t_3"
include short period volt change between the high
and the low voltage level thereof.

The differential signal of the waveform 225 in the
horizontal line 212 is then combined in the summing circuit 152 to form a gated or combined signal of a waveform 240 which is then utilized for indication that
current (acuating current) signal will always pass through the
coupling capacitor 184. It is to be noted that the differen-
tial signals 228 of the steering dot 210 is a D.C. signal
and would be blocked by the coupled capacitor 184 so
as to prevent intensity control if it were not for com-
bining the differential information with the alternating
signal of the waveform 236. The gated signal of
the waveform 240 is applied to the clipping circuit 166.
before being applied to the coupling capacitor 184 to positively establish a clipping level 244 so that the gating signal can be reliably clamped at this level. The gated signal of the waveform 240 after clipping is applied through the coupling capacitor 184 to the clamping circuit 186 as a waveform 246 with the clipping level 244 clamped at a desired clipping level 248. The voltage of the clipping level 246 is selected so that an electron beam with an intensity controlled by that voltage does not damage the screen 50 when applied continually there to. Thus, in the absence of deflection voltages the intensity grid 74 is maintained at the clamping level 248 and the electron beam does not have sufficient intensity to burn the phosphor on the screen 50. The clamping signal of the waveform 246 is then applied to the intensity grid 74 to control the intensity of the symbols on the screen 50.

Between the times \( t_3 \) to \( t_4 \), the electron beam projected on the screen 50 with an intensity determined by the clipping level 248 is deflected from a previous symbol position to the position of the range circle 246 on the screen 50. The clamping level 248 is selected so that no visible trace of the electron beam is formed on the screen 50. Between the times \( t_4 \) to \( t_5 \), the range circle 266 is formed with the instantaneous intensity control voltage of the waveform 246 varying as determined by the full wave rectifier operation. Similarly, the steering dot 210 is formed on the screen 50 during the times \( t_5 \) to \( t_6 \) with the intensity control voltage determined by the fixed level of the waveform 246.

In the absence of one symbol such as the horizontal line 212 during the times \( t_6 \) to \( t_6 \), for example, the intensity of the remaining signals remain constant with this system. If it were not for the clipping and clipping arrangement in accordance with this invention, an average D.C. value would be determined by the number of symbols being written thus causing the intensity of the symbols on the screen 50 to vary with the number of symbols presented. The clamping circuit 186 by clamping the gating signal at the clipping level 244 maintains a constant intensity on the screen regardless of the number of signals on the sources 10 and 12 that are desired to be displayed. It is again to be noted that the clamping circuit 186 provides absolute protection of the screen 50 during a failure of the deflection voltages, for example, because the clamping level 248 is selected to provide an electron beam intensity that will not damage the phosphor over any period of time. Further, the clamping level 248 is selected so that the electron beam between one symbol and the other will not form a visible trace on the screen 50.

Thus, there has been described an intensity control system for a cathode ray tube utilizing line sharing for writing a plurality of symbols with a single electron gun, each symbol having the same writing time, which system provides symbols of equal intensity regardless of the size, shape and number of symbols displayed. This system provides a reliable means of determining the velocity of movement of the electron beam so as to minimize the difference between the algebraic sum and the vectorial sum of the rate of change of the vertical and horizontal deflection potentials, thus greatly reducing bright spots on the symbols. Further, the system provides a means for positively protecting the phosphor on the screen from burning during the failure of deflection voltages.

What is claimed is:

1. An intensity control system for controlling the intensity grid of a cathode ray tube having horizontal and vertical deflection plates and an electron beam which is time shared during repetitive periods to develop a plurality of symbols each being formed repetitively on a screen during symbol portions of the repetitive periods comprising a source of horizontal and vertical deflection signals coupled respectively to the horizontal and vertical deflection plates, said source controlled so that the deflection signals during each period represent a respective symbol, first and second differentiating means coupled respectively to said source of horizontal and vertical deflection signals, said first differentiating means controlling a source of clipping signals synchronized with said source of horizontal and vertical deflection signals for defining a blanking period and a writing period during each symbol period, second summing means coupled to said first summing means to aid said source of blanking signals to develop a combined signal, clipping means coupled to said second summing means to develop the time-sharing means, said isolating capacitor coupled between said clipping means and the intensity grid, a source of biasing potential, and the clipping means coupled between said source of biasing potential and said intensity grid, whereby the potential of said source of biasing potential is isolated from said second summing means and the plurality of symbols are formed on the screen with equal intensity.

2. An intensity control system for a cathode ray tube displaying a plurality of symbols on a screen by forming each symbol during a separate symbol period of a repetitive period with the symbols being retained on the screen by the retentivity characteristics thereof, the cathode ray tube having an electron stream, horizontal and vertical deflection plates and an intensity grid comprising a source of horizontal deflection signals, a source of vertical deflection signals, said deflection signals having phase and amplitude characteristics during each symbol period representative of a different one of said plurality of symbols, a horizontal and a vertical deflection amplifier coupled respectively to said source of horizontal and vertical deflection signals and coupled respectively to the horizontal and vertical deflection plates, horizontal and vertical differentiating means coupled respectively to said horizontal and vertical amplifiers, horizontal and vertical full wave rectifiers coupled respectively to said horizontal and vertical deflection signals and rectifiers for developing a summed signal representative of the sum of the absolute values of the differential of the horizontal and vertical deflection signals, a source of blanking signals synchronized with said source of horizontal and vertical deflection signals having a blanking level and a writing level during each symbol period, second summing means coupled to said first summing means and to said source of blanking signals for receiving said summed signal and the blanking signals to develop a combined signal, a clipping circuit coupled to said second summing means for establishing a fixed clipping level of said combined signal, a coupling capacitor coupled to said clipping circuit for passing the clipped combined signal to said output circuit, and an output circuit coupled to said coupling capacitor and the intensity grid for clamping the clipping level of said clipped combined signal, thereby controlling the intensity of the electron beam so that symbols are presented on the screen with an equal intensity.

3. An intensity control system for a cathode ray tube having an electron beam, an intensity grid, horizontal and vertical deflection plates for receiving during each of a plurality of repetitive symbol periods symbol information for developing a different one of a plurality of symbols, the symbol information being received from a source of horizontal deflection signals and from a source of vertical deflection signals, comprising means coupling the source of vertical deflection signals and the source of horizontal deflection signals respectively to the horizontal
and vertical deflection plates to cause the electron beam to be deflected in response thereto, first and second differential signals developed from the vertical deflection signals for developing first and second differential signals representative of the horizontal and vertical velocity vectors of the electron beam, first and second full wave rectifiers coupled respectively to said first and second differentiation circuits for separating positive and negative portions of said first and second differential signals, first summing means coupled to said first and second rectifiers for combining the positive portions of said first and second differential signals, said summing means coupled to said first and second vertical deflection signals, the summing means having a blanking level and a writing level for each symbol period, fourth summing means coupled to said third summing means and to said source of vertical signals to develop an alternating intensity control signal, a clipping circuit coupled to said fourth summing means for establishing a predetermined clipping level to said third summing means, a coupling capacitor coupled between said clipping circuit and said intensity grid, and a clamping circuit coupled to said third summing means for maintaining said clipping level of said alternating signal at a predetermined voltage, whereby the intensity of the electron beam is controlled in response to the velocity of deflection thereof and during each symbol period a symbol is formed on the screen and during each blanking period the electron beam is deflected to a position on said screen for forming a different symbol.

4. A system for developing a plurality of symbols on the screen of a cathode ray tube by time sharing separate symbol forming information to be displayed as individual symbols, the cathode ray tube having horizontal and vertical deflection plates, an electron stream and an intensity grid comprising a source of horizontal and vertical deflection signals representative of the separate symbol forming information, signal applying means coupled between said source and the horizontal and vertical deflection plates for respectively applying the horizontal and vertical deflection signals thereto, first and second differentiation means coupled to said source for respectively receiving a horizontal and vertical deflection signals to develop differential signals, first and second rectifying means coupled respectively to said first and second differentiation means, each of said rectifying means developing positive and negative portions of said differential signals, first summing means coupled to said first and second rectifying means for summing said positive portions, second summing means coupled to said first and second rectifying means for summing said positive portions, third summing means coupled to said first and second summing means for developing a summed differential signal representative of the absolute value of the differential signals developed by said first and second differentiating means, a source of alternating signals synchronized with said source of horizontal and vertical deflection signals, fourth summing means coupled to third summing means and to said source of alternating signals for developing a combined alternating signal, clipping means coupled to said fourth summing means for establishing a predetermined clipping level to said combined alternating signal, a coupling capacitor coupled between said clipping means and the intensity grid, and clamping means coupled to said intensity grid for maintaining said clipping level at a predetermined level whereby the intensity of the symbols is maintained substantially constant.

5. An intensity control system for time sharing a plurality of symbol information signals for displaying a plurality of symbols on the screen of a cathode ray tube having an electron beam and an intensity grid, first and second horizontal deflection plates, and first and second vertical deflection plates comprising a source of horizontal and vertical deflection signals having, during each of a plurality of symbol periods, a phase and amplitude relation for developing a respective symbol, first and second deflection amplifiers means coupled respectively to said source of horizontal and vertical deflection signals and to said horizontal and vertical deflection plates, first and second differentiation circuits coupled respectively to said first and second deflection amplifiers means for receiving horizontal and vertical deflection signals having a phase relationship similar to that of said source of horizontal and vertical deflection signals and for developing differential signals, first and second rectifier circuits coupled respectively to said first and second differentiation circuits for developing positive and negative portions of the horizontal and vertical differential signals, first summing means coupled to said first and second rectifier circuits for developing a summed signal of the absolute value of the positive and negative portions of the differential signals, a source of blanking signals synchronized with said source of horizontal and vertical deflection signals for developing blanking signals having a blanking level and a symbol writing level during each of said symbol periods, second summing means coupled to said first summing means and to said source of blanking signals for developing a combined signal with the summed differential signals appearing at the blanking level and at the symbol writing level of said blanking signals, a clipping circuit coupled to said second summing means for clipping said combined signal at a level to remove said summed signals therefrom from the blanking level thereof, a coupling capacitor coupled between said clipping circuit and the intensity grid for applying the clipped combined signal therethrough, a biasing source, and a clamping circuit coupled between said biasing source and said intensity grid for clamping the clipping level of said combined signal, whereby said biasing source is isolated from said clipping circuit by said coupling capacitor and said intensity grid is controlled so that the symbols developed on the screen have substantial equal intensity.

6. An intensity control system for a cathode ray tube to display a plurality of symbols on the screen thereof in response to time shared information, the cathode ray tube including first and second horizontal deflection plates, an electron beam and an intensity control grid comprising a source of horizontal deflection signals, a source of vertical deflection signals, said horizontal and vertical deflection signals having a phase and amplitude relation representative of said plurality of symbols, first inverting means coupled to said source of horizontal deflection signals for developing first and second horizontal deflection voltages being 180 degrees out of phase from each other, second inverting means coupled to said source of vertical deflection signals for developing first and second vertical deflection voltages being 180 degrees out of phase from each other, said first horizontal and vertical deflection voltages having a phase and amplitude relation similar to that of the horizontal and vertical deflection signals at said source, said first inverting means being coupled to the first and second horizontal deflection plates for applying said first and second horizontal deflection voltages thereto to deflect the electron beam horizontally, said second inverting means being coupled to said first and second vertical deflection plates for applying said first and second vertical deflection voltages thereto to deflect the electron beam vertically, a first differentiation circuit coupled to said horizontal deflection voltages for receiving said first horizontal deflection voltages to develop a first differential signal representing rate of horizontal deflection of said electron beam, a second differentiation circuit coupled to said second inverting means for receiving said first vertical deflection
voltages to develop a second differential signal represent ing the rate of vertical deflection of said electron beam, a horizontal full wave rectifier coupled to said first differentiation circuit, a vertical full wave rectifier coupled to said second differentiation circuit, a first sum ming means coupled to said horizontal and vertical rectifier for combining negative portions of the rectified first and second differential signals, a second summing means coupled to horizontal and vertical rectifiers for combining the positive portions of said first and second differential signals, differential amplifier means coupled to said first and second summing means for combining said positive and negative portions to develop a summed signal from the absolute values of said positive and negative portions, said summed signal representing the rate of deflection of said electron beam, a source of blanking signals synchronized with said source of horizontal and vertical deflection signals, third summing means coupled to said differential amplifier means and to said source of blanking signals for developing an alternating signal, a clipping circuit coupled to said third summing means for clipping the lower level of said alternating signal at a preselected clipping voltage, a coupling capacitor coupled to said clipping circuit, a clamping circuit coupled to said coupling capacitor for maintaining said clipping level at a preselected clamping voltage, said clamping circuit being coupled to the intensity grid for controlling the intensity of the electron beam in response to the velocity of deflection thereof so as to present the plurality of signals on the screen with equal intensity.

7. An intensity control system for developing a plurality of symbols on the screen of a cathode ray tube and for time sharing information from a source to develop each of the symbols during a different symbol period, the cathode ray tube including a screen, an electron stream, an intensity grid, a cathode, and horizontal and vertical deflection plates coupled to the source for responding to horizontal and vertical deflection signals during each symbol period to deflect the electron stream so as to develop a symbol on the screen comprising a source of blanking signals having a blanking voltage level and a writing voltage level during each symbol period, first and second differentiation means coupled to said source for developing first and second differential signals indicative of the rate of change of the horizontal and vertical deflection signals, said differential signals having alternating and direct current characteristics, first and second full wave rectifiers coupled respectively to said first and second differentiation circuits, first summing means coupled to said first and second rectifiers for developing a summed signal indicative of the absolute value of said first and second differential signals, second summing means coupled to said source of blanking signals and to said first summing means for developing a combined signal utilizing the blanking signals as a carrier wave, a clipping circuit coupled to said second summing means for establishing a clipping level to said combined signal, a coupling capacitor coupled between said clipping circuit and the intensity grid, a potential source coupled to the cathode of said cathode ray tube, a coupling circuit coupled between said potential source and the intensity grid for maintaining said clipping level at a predetermined clipping level, said coupling capacitor isolating said potential source from said second summing means and said combined signal passing through said coupling capacitor to control the intensity of said symbols when said differential signal has either alternating characteristics or direct current characteristics.

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