

TITLE OF THE INVENTION

CRT Display Unit and Power Supply Control Method
Therefor

BACKGROUND OF THE INVENTION

5 Field of the Invention

The present invention relates to a CRT display unit and a power supply control method therefor, and more particularly, it relates to power supply control for increasing the life of a CRT.

10 Description of the Background Art

A CRT display unit is connected to a central unit, such as a host computer, which generates a synchronizing signal and a video signal, to display an image of the video signal. In this case, it is recommended that power
15 is applied to the CRT display unit independently of a power supply for the computer. If the power supply for the computer is also employed for applying power to the CRT display unit, this may lead to excessive capacity of a power supply switch for the computer. Further, the CRT
20 display unit is often installed in a position separated from the computer.

Under such circumstances, there have been proposed some CRT display units, whose power supplies are on-off controlled on the basis of signals from computers.

25 Japanese Patent Application Laying-Open No. 64-33586

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(1989) describes a technique of detecting presence/absence of a video signal from a computer for on-off controlling a power supply for a CRT display unit on the basis of the result of the detection. In such a power supply control method, however, no video signal is present when a CRT intentionally displays a homogeneous black picture image, and hence the power supply for the CRT display unit is disadvantageously erroneously turned off in this case.

On the other hand, each of Japanese Patent Application Laying-Open Nos. 60-1982 (1985) and 1-257893 (1989) describes a technique of detecting presence/absence of a synchronizing signal from a computer for on-off controlling a power supply for a CRT display unit on the basis of the result of the detection. In this power supply control method, however, the computer regularly transmits a synchronizing signal and hence the power supply for the CRT display unit cannot be turned off unless a power supply for the computer is turned off or the CRT display unit is disconnected from the computer.

Further, there has been developed a technique of switching the screen of a CRT to display of a homogeneous black image when the same display image continuously appears on the CRT for a constant period, in order to prevent burning of a fluorescent material which is applied to the screen of the CRT. Such switching of the display



to a black picture image is often carried out by application software called "screen saver", for example. When the "screen saver" operates in such a manner, however, it is difficult to distinguish the screen of the CRT from that in a cutoff state of the CRT display unit. On the other hand, the power supply for the CRT display unit is not turned off upon such operation of the "screen saver". Consequently, the CRT display unit may be left intact in an ON state of the power supply therefor. This leads to wasteful power consumption, as well as to reduction in life of the CRT due to a continuous ON state of a heater provided therein.

Accordingly, a first object of the present invention is to eliminate the aforementioned disadvantage in a CRT display unit provided with a "screen saver".

According to the present invention, as hereinafter described in detail, provided is a power supply control method for a CRT display unit which is adapted to turn off a power circuit after a lapse of a prescribed period of time as well as to turn off a heater after a further lapse of a prescribed period of time when a "screen saver" so operates that a CRT displays a homogeneous black picture image, in order to eliminate the aforementioned disadvantage.

However, the aforementioned "screen saver", which has



been developed in order to prevent a CRT screen from burning, may be adapted to display various patterns of animations for the purpose of amusement, in addition to display of a homogeneous black picture image. A typical
5 system of such a "screen saver" is provided with tens of types of patterns, for example, while the user can produce such patterns himself in response to his liking.

In such circumstances, an applicable range of such a power supply control method is inevitably narrowed if the
10 factor for starting the control for turning off the power supply for the CRT display is restricted to only the display of a homogeneous black picture image. Further, the software of the "screen saver", which has dependence on an operating system, requires dedicated programs for
15 various systems such as DOS, Windows, OS/2, UNIX and the like, for example.

When the same image is displayed on the CRT for a constant period of time and it is necessary to drive the "screen saver", on the other hand, all input operations
20 for the computer which are made by an operator are interrupted in general. There have been proposed some means for detecting such an interrupted state of the input operations in a hardware manner and displaying a homogeneous black picture image, for example, in order to
25 prevent the CRT screen from burning. According to

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Japanese Utility Model Publication No. 2-6467 (1990), for example, a CRT display unit comprises a timer so that a video signal is converted to a blank signal if no input operation is carried out for a period of time which is
5 previously set in the timer.

In order to implement the "screen saver" in the aforementioned hardware manner, however, it is necessary to remarkably modify the interior of the computer in general. Thus, a relatively high cost is required for
10 such a modification. Further, such a modification is not easy for dealers other than a computer manufacturer.

Accordingly, a second object of the present invention is to implement a "screen saver" in a hardware manner, with no introduction of a remarkable modification to a
15 computer body.

SUMMARY OF THE INVENTION

The present invention is first directed to a CRT display unit which is connected to a central unit generating a synchronizing signal and a video signal, for
20 displaying an image of the video signal. This CRT display unit comprises a power supply circuit which includes a main power supply and an auxiliary power supply, a power circuit, which is driven by the main power supply, including a high voltage circuit, a deflection circuit and
25 a video circuit, a synchronous processing circuit for

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processing a synchronizing signal received from the central unit and supplying the processed synchronizing signal to the high voltage circuit and the deflection circuit, a video input processing circuit, which includes
5 video signal detection means for detecting presence/absence of a video signal from the central unit, for processing the video signal and supplying the processed video signal to the video circuit, and a CRT having an anode which is supplied with a high dc voltage
10 from the high voltage circuit, a deflecting yoke which is supplied with a deflecting current from the deflection circuit, a cathode which is supplied with a cathode drive signal from the video circuit, and a heater which is supplied with a current from the auxiliary power supply.
15 According to each of first and second aspects as described below, the CRT display unit according to the present invention comprises the aforementioned elements in common.

According to the first aspect of the present invention, the CRT display unit further comprises main
20 power supply control means for controlling the main power supply to turn on/off the power circuit when the video signal detection means detects presence/absence of the video signal, first timer means for clocking at least a period of time when the power circuit is turned off, and
25 auxiliary power supply control means for controlling the

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auxiliary power supply to turn off the heater after a lapse of a period of time previously set in the first timer means.

5 According to the aforementioned first aspect of the present invention, the power circuit is first turned off when the "screen saver" so operates that the CRT displays a homogeneous black picture image, i.e., when no video signal is present. When the period of time which is previously set in the first timer means elapses upon
10 continuation of such a state, the heater is then turned off. According to the present invention, therefore, it is possible to reduce wasteful power consumption as well as to increase the life of the CRT. When a video signal is detected before the heater is turned off after turnoff of
15 the power circuit, it is possible to quickly restore the CRT to an ordinary image display state.

In the aforementioned first aspect of the present invention, the main power supply control means preferably comprises second timer means for clocking the state with
20 presence of no video signal, and power circuit turnoff means for turning off the power circuit after a lapse of a period of time which is previously set in the second timer means. In this case, the power circuit is not immediately turned off even if the "screen saver" so operates that no
25 video signal is present, whereby it is possible to prevent

the power circuit from erroneous turnoff when application software intentionally displays a homogeneous black picture image, for example. Consequently, it is possible to carry out delicate power supply control.

5 The period of time which is previously set in the first timer means is preferably rendered variable, so that it is possible to carry out power supply control in response to requirement by an operator.

10 Further, the main power supply control means preferably comprises blanking signal generation means which supplies a picture blanking signal to the video circuit for a prescribed period of time when the video signal detection means detects presence of the video signal. As hereinabove described, the CRT is restored to
15 an ordinary image display state when a video signal is detected before the heater is turned off after turnoff of the power circuit, while the image is irregularized at the moment of such restoration. When a picture blanking signal is supplied for a prescribed period of time of 2
20 seconds, for example, at the moment of restoration as hereinabove described, it is possible to show the operator no irregular image.

25 The CRT display unit according to the second aspect of the present invention comprises timer means which starts counting when the video signal detection means

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detects absence of the video signal for clocking a state with presence of no video signal, and the power supply circuit control means for controlling the power supply circuit to turn off the power circuit and the heater after
5 a lapse of a period of time which is previously set in the timer means, in addition to the aforementioned common elements.

According to the second aspect of the present invention, it is possible to reduce wasteful power
10 consumption while preventing the power circuit and the heater from erroneous turnoff operations even if the application software intentionally displays a black picture image for a relatively short period of time, as well as to increase the life of the CRT.

15 In each of the first and second aspects of the present invention, the CRT display unit preferably further comprises means for controlling the power supply circuit to turn off the power circuit and the heater after a lapse of a prescribed period of time from detection of presence
20 of no synchronizing signal from the central unit. In this case, it is possible to turn off the power circuit and the heater also when a power supply for the central unit such as a host computer is turned off.

According to each of the aforementioned first and
25 second aspects of the present invention, further, the



video signal detection means may not detect all color signals of red, green and blue but may detect only a red or blue color signal. Such a red or blue color signal is selected as the object of detection since a green color
5 signal may be transmitted from the central unit to the CRT display unit as a composite video signal on which a synchronizing signal is superposed, and the circuit is complicated in this case since it is necessary to eliminate the synchronizing signal from the composite
10 video signal if the green color signal is processed as the object of detection. When only a red or blue color signal is processed as the object of detection, on the other hand, the video signal detection means can be simplified in structure. Nevertheless, the video signal detection
15 means may sufficiently detect only a color signal of red or blue in order to detect presence of no video signal. Alternatively, the video signal detection means may detect both of the red and blue color signals.

The present invention is also directed to a power
20 supply control method for the aforementioned CRT display unit.

This power supply control method comprises a step of controlling the main power supply to turn off the power circuit in response to absence of the video signal, and a
25 step of controlling the auxiliary power supply to turn off

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the heater after a lapse of a prescribed period of time in such an OFF state of the power circuit.

In the power supply control method according to the present invention, the main power supply and the auxiliary
5 power supply may be so controlled as to turn off the power circuit and the heater after a lapse of a prescribed period of time from starting of a state with absence of the video signal..

According to the present invention, further,
10 attention is drawn to a computer of an open architecture type which is manufactured by IBM Corporation, for example, in order to attain the aforementioned second object. Such a computer of an open architecture type, whose interfaces are laid open to public, comprises some
15 option slots so that the user can insert option boards for varying the computer functions at need. The option boards can be manufactured by a manufacturer of such boards. According to the present invention, a graphics board is noted as one of such option boards. While a graphic board
20 originally comprises a circuit for supplying a video signal to a CRT display unit in order to display a picture which is based on an input signal from external input means such as a keyboard, for example, hardware for implementing the "screen saver" is added to such a
25 graphics board according to the present invention.



In more concrete terms, the graphics board according to the present invention comprises an input detection part for monitoring presence/absence of an interruption request which is generated upon receiving of an input signal from external input means for detecting presence of the input signal from the external input means, timer means starting a clocking operation when the input detection part detects presence of the input signal, and means for supplying a blank signal to the CRT display unit as a video signal when the input detection part detects no presence of an input signal again before a lapse of a period of time previously set in the timer means.

The external input means typically includes input operation means such as a keyboard and a mouse which are driven by the operator, as well as those based on an external communication system such as a network, a facsimile, a digitizer and a track ball.

When the external input means is formed by a keyboard, the input detection means detects an address signal which is supplied as an output to an address bus in response to manipulation of the keyboard. When the external input means is formed by a mouse, on the other hand, the input detection part detects an interruption signal which is supplied as an output in response to manipulation of the mouse.



When such external input means is formed by a plurality of elements such as a keyboard, a mouse and another external unit, the timer means preferably starts its clocking operation when the input detection part
5 detects presence of an input signal from any one of the external input means. Further, the input detection part is preferably adapted to select the external input means generating an input signal whose presence is to be detected.

10 Thus, the present invention is further provided with a function of the "screen saver", which supplies a blank signal to the CRT display unit as a video signal when no input signal is received from the external input means for a prescribed period of time, with respect to an extension
15 graphics board which is inserted in an option slot provided in a computer of an open architecture type.

Thus, according to the inventive graphics board, it is possible to provide a computer of an open architecture type with a "screen saver" function simply by inserting
20 the graphics board in its option slot. The input detection part which is provided in the graphics board simply monitors presence/absence of an interruption request generated upon receiving of an input signal from the external input means, whereby no modification is
25 required on the body of the computer. In other words, the



"screen saver" function can be provided by merely modifying the graphics board, whereby it is possible to provide the "screen saver" function on the side of the manufacturer of such a graphics board.

5 According to the present invention, the graphics board is selected as an option board for providing a "screen saver" function. The graphics board, which necessarily supplies a video signal to the CRT display unit and is connected to a line of an interface signal
10 between a CPU and an input/output unit provided in the computer, is most suitable for detecting absence of an input signal from the external input means for a prescribed period of time and driving the "screen saver".

 When the graphics board according to the present
15 invention is employed, it is possible to drive a "screen saver" with no regard to an operating system or application software employed in the computer to display a homogeneous black picture image on the CRT, thereby enabling regular application of the aforementioned power
20 supply control method for a CRT display unit according to the present invention. Thus, it is possible to widen the applicable range of this power supply control method.

 The foregoing and other objects, features, aspects and advantages of the present invention will become more
25 apparent from the following detailed description of the



present invention when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block diagram showing an electrical structure provided in a CRT display unit according to an embodiment of the present invention;

Fig. 2 is a block diagram showing a video signal detection circuit 20 included in a video input processing circuit 17 shown in Fig. 1;

Fig. 3 is a flow chart showing a power supply control procedure executed by a CPU 15 shown in Fig. 1;

Fig. 4 illustrates some typical state transitions implemented in a power save mode which is obtained along the power supply control procedure shown in Fig. 3 in relation to power consumption;

Fig. 5 is a flow chart corresponding to Fig. 3, showing a power supply control procedure executed in another embodiment of the present invention;

Fig. 6 is a block diagram showing a graphics board 51 included in still another embodiment of the present invention and electrical elements on a computer side related thereto; and

Fig. 7 schematically illustrates a mother board 52 provided in a computer body holding the graphics board 51 shown in Fig. 6 and some external input/output units.

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DESCRIPTION OF THE PREFERRED EMBODIMENTS

Fig. 1 is a block diagram showing an electrical structure provided in a CRT display unit according to an embodiment of the present invention. This CRT display unit is connected to a central unit such as a host computer, for example, generating a synchronizing signal and a video signal, to display an image of the video signal.

The CRT display unit comprises a power supply circuit 3 which is connected to a commercial ac power supply 1 through a main power supply switch 2. This power supply circuit 3 includes a main power supply 4 and an auxiliary power supply 5.

The CRT display unit further comprises a power circuit 9 including a high voltage circuit 6, a deflection circuit 7 and a video circuit 8, which are driven by the main power supply 4.

A CRT 10 comprises an anode 11 which is supplied with a high dc voltage from the high voltage circuit 6, a deflection yoke 12 which is supplied with a deflecting current from the deflection circuit 7, a cathode 13 which is supplied with a cathode drive signal from the video circuit 8, and a heater 14 which is supplied with a current from the auxiliary power supply 5.

The CRT display unit further comprises a CPU 15, a

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synchronous processing circuit 16 and a video input processing circuit 17, which are driven by the auxiliary power supply 5.

5 A synchronizing signal from the host computer (not shown) is supplied to the synchronous processing circuit 16 through a synchronizing signal input terminal 18, while a composite video signal superposed with such a synchronizing signal is supplied to the synchronous processing circuit 16 through a video signal input terminal 19. The synchronous processing circuit 16 performs processing such as waveform shaping, polarity decision and/or synchronization separation of the composite video signal, so that the as-processed desired synchronizing signal is supplied to the high voltage circuit 6 and the deflection circuit 7 as well as to the CPU 15.

20 A video signal from the host computer is supplied to the video input processing circuit 17 through the video signal input terminal 19. The video input processing circuit 17 performs processing such as amplification of the video signal, so that the as-processed video signal is supplied to the video circuit 8. The video input processing circuit 17 includes video signal detection means for detecting presence/absence of the video signal

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from the host computer. This video signal detection means is illustrated in Fig. 2 in detail.

As shown in Fig. 2, a video signal detection circuit 20 is adapted to detect presence/absence of a blue color signal, so that an analog signal serving as such a blue color signal is applied as an input to a voltage amplifier 21 to be amplified therein. An output of the voltage amplifier 21 is supplied to a base of a transistor 22. When the voltage supplied to the base is reduced below a prescribed value, the transistor 22 is so switched that a prescribed voltage is applied as an input to a monostable multivibrator 23. The monostable multivibrator 23 generates a signal having a pulse width of 38 msec. exceeding a vertical scanning period as a video signal detection signal, which in turn is supplied to the CPU 15.

Referring again to Fig. 1, the CPU 15 comprises main power supply control means which controls the main power supply 4 to turn on/off the power circuit 9 when the video signal detection circuit 20 detects presence/absence of a blue color signal, first timer means which clocks an OFF state of the power circuit 9, and auxiliary power supply control means which controls the auxiliary power supply 5 to turn off the heater 14 after a lapse of a period of time previously set in the first timer means, as clearly described later with reference to a power supply control

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procedure. The main power supply control means comprises second timer means for clocking a state with presence of no video signal, power circuit turnoff means for turning off the power circuit 9 after a lapse of a period of time previously set in the second timer means, and blanking signal generation means which supplies a picture blanking signal to the video circuit 8 for a prescribed period of time when the video signal detection circuit 20 detects presence of a video signal. The CPU 15 further comprises means for controlling the power supply circuit 3 to turn off the power circuit 9 and the heater 14 after a lapse of a prescribed period of time upon detection of presence of no synchronizing signal from the host computer.

In relation to the CPU 15, further provided are a forced on/off switch 24, a power save on/off switch 25 and a time setting switch 26. The forced on/off switch 24 supplies the CPU 15 with a signal for controlling the power supply circuit 3, in order to forcibly turn on/off the power circuit 9 and the heater 14 with no regard to a power supply control state by the CPU 15. The power save on/off switch 25 supplies the CPU 15 with a signal for switching the device between the so-called "power save mode" for turning off the power circuit 9 and the heater 14 along a prescribed procedure upon operation of the aforementioned "screen saver" and another mode. The time

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setting switch 26 is so driven as to change the time which is set in the first timer means. According to this embodiment, the first timer means is adapted to restart clocking when the video signal detection circuit 20
5 detects presence of no video signal. A period of time for 63 minutes is previously set in the first timer means, and this period of time can be varied in a range of 8 to 63 minutes through the time setting switch 26. On the other hand, a period of time for 3 minutes is previously set in
10 the second timer means, and this period of time is fixed. However, the period of time which set in the second timer means may also be rendered variable, as a matter of course.

Fig. 3 is a flow chart showing a power supply control
15 procedure which is executed by the CPU 15. Fig. 4 illustrates transition of some typical states implemented in a power save mode obtained along the power supply control procedure shown in Fig. 3 in relation to power consumption.

20 Mainly with reference to Fig. 3, the main power supply switch 2 (Fig. 1) is turned on at a step 101, to start the procedure shown in Fig. 3. Upon such operation of the main power supply switch 2, the auxiliary power supply 5 first rises as shown in Fig. 1, thereby driving
25 the CPU 15, the synchronous processing circuit 16 and the

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video input processing circuit 17.

Then, initialization is carried out at a step 102 to set a period of time for 63 minutes in the first timer means (shown as "timer F" in Fig. 3) and a period of time
5 for 3 minutes in the second timer means (shown as "timer S" in Fig. 3). The first and second timer means start clocking simultaneously with such setting.

Then, a determination is made at a step 103 as to whether or not the forced on/off switch 24 (Fig. 1)
10 generates an ON request. If the determination is of yes, the process is led to steps 117, 118, 119 and 120, so that the CPU 15 generates a main power supply control signal and a heater control signal at the step 119 for
15 controlling the main power supply 4 and the auxiliary power supply 5 to turn on the power circuit 9 and the heater 14 respectively. Thus, the CRT 10 makes display.

If the determination at the step 103 is of no, on the other hand, the process is led to a step 104, so that a determination is made as to whether or not the forced
20 on/off switch 24 generates an OFF request. If the determination is of yes, the process is led to a step 108, so that the main power supply 4 and the auxiliary power supply 5 are controlled to turn off the power circuit 9 and the heater 14.

25 If the determination at the step 104 is of no, on the

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other hand, the process is led to a step 105, so that a determination is made as to whether or not a synchronizing signal is received from the host computer through the synchronizing signal input terminal 18. If the

5 determination is of no, a determination is made at a step 107 as to whether or not such a state with presence of no synchronizing signal is continuous in excess of 3 seconds. If the determination is of yes, the power circuit 9 and the heater 14 are turned off at a step 108. Such a state

10 with presence of no synchronizing signal in excess of 3 seconds corresponds to an OFF state of a power supply for the host computer or a state of disconnection between the host computer and the CRT display unit. When the determination at the step 107 is of no, on the other hand,

15 the power circuit 9 and the heater 14 are not turned off and the process is returned to the step 103. Such a waiting time for 3 seconds is provided before turning off the power circuit 9 and the heater 14 in consideration of a possibility of mode switching in the host computer, so

20 that the power circuit 9 and the heater 14 are not erroneously turned off by absence of the synchronizing signal caused by such mode switching.

If a synchronizing signal is detected at the aforementioned step 105, on the other hand, the process is

25 led to a step 106. At the step 106, a determination is

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made as to whether or not the device is switched to a power save mode by the power save on/off switch 25 shown in Fig. 1. If the determination is of yes, the device enters a power save mode at a step 109.

5 When the device thus enters a power save mode, a determination is made at a step 110 as to whether or not it is necessary to change the setup time in the first timer means (timer F), i.e., a period of time from turnoff of the power circuit 9 to turnoff of the heater 14. While
10 the setup time of the timer F is variable within the range of 8 to 63 minutes from a state with presence of no video signal (5 to 60 minutes from turnoff of the power circuit 9), this time is previously set at 63 minutes at the step 102. In order to set a shorter period of time, the
15 operator keys data therefor, for example. Therefore, the determination at the step 110 is made as to whether or not such data is keyed. When it is necessary to change the setup time in the timer F, the time setting switch 26 shown in Fig. 1 is manipulated to change the same at a
20 step 111. Simultaneously with such change of the setup time, the timer F restarts clocking.

 When the determination at the step 110 is of no or the change of the setup time is finished at the step 111, on the other hand, the process is led to a step 112. At
25 the step 112, a determination is made as to whether or not



a video signal is transmitted from the host computer to the video signal input terminal 19 shown in Fig. 1 and a blue color signal, for example, is detected by the video signal detection circuit 20 (Fig. 2) included in the video input processing circuit 17. If the determination is of
5 yes, the process is led to the aforementioned step 117. If the determination is of no, on the other hand, the process is led to a step 113.

At the step 113, a determination is made as to
10 whether or not a state with presence of no video signal is continuous in excess of 3 minutes, i.e., a setup time in the second timer means (timer S). When the determination is of yes, the power circuit 9 is turned off at a step 114. If the determination is of no, on the other hand,
15 the process is returned to the step 103. Such a waiting time for 3 seconds is provided before turning off the power circuit 9 so that the power circuit 9 is not erroneously turned off if application software intentionally displays a homogeneous black image or the
20 like for a prescribed period of time.

Then, a determination is made at a step 115 as to whether or not the state with presence of no video signal is continuous in excess of the setup time in the timer F. If the determination is of yes, the heater 14 is turned
25 off at a step 116. Such a prescribed period of time is



provided before turnoff of the heater 14 after the power circuit 9 is turned off so that image display can be quickly restored without waiting for a heating time for the heater 14 when the video signal is again detected (step 112) during this time.

At the aforementioned step 117, the first and second timer means (timers F and S) are restarted. This step is carried out when a forced ON request is detected at the step 103, no power save mode is detected at the step 106, or the video signal is detected at the step 112.

After the timers F and S are restarted at the step 117, a determination is made at a step 118 as to whether or not the power circuit 9 or the heater 14 has been turned off. If this CRT display unit has been already used and the power circuit 9 and the heater 14 have been turned on, the process is returned to the step 103. If employment of the CRT display unit is started, the power circuit 9 is turned off at the step 114 or the heater 14 is turned off at the step 116 following the power circuit 9, on the other hand, the process is led to a step 119 so that the power circuit 9 and the heater 14 are turned on. Thus, image display is started in the CRT 10.

When the image display is started at the step 119, a picture blanking signal is supplied to the video circuit 8 for 2 seconds at a step 120. This picture blanking signal



is supplied to prevent display of an irregular image,
which appears on the CRT 10 upon turnon of the power
circuit 9 at the step 119 after the video signal is
detected at the step 112 when the power circuit 9 is in an
5 OFF state but the heater 14 is in an ON state. When the
high voltage circuit 6, the deflection circuit 7 and the
video circuit 8 are simultaneously turned on, the high
voltage circuit 6 and the deflection circuit 7 cause
instable states in rising, such that an irregular image is
10 displayed on the CRT 10 if a video signal is applied to
the video circuit 8 in this stage. When a picture
blanking signal is supplied for 2 seconds, for example,
until the high voltage circuit 6 and the deflection
circuit 7 are stabilized, therefore, the CRT 10 displays a
15 homogeneous black picture image, to be prevented from
display of the irregular image. The video signal is
applied to the video circuit 8 after a lapse of such 2
seconds, so that the CRT 10 displays an ordinary image.

The aforementioned power supply control procedure is
20 now described in relation to transition of typical states
in a power save mode shown in Fig. 4.

In a state A shown in Fig. 4, the CRT 10 displays an
ordinary image. If the device is in a power save mode in
this state, the procedure shown in Fig. 3 is executed
25 along a loop of returning the process to the step 103

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through the steps 103, 104, 105, 106, 109, 110, 112, 117
and 118. When no power save mode is employed, on the
other hand, the procedure shown in Fig. 3 is executed
along a loop of returning the process to the step 103
5 through the steps 103, 104, 105, 106, 117 and 118.

When absence of the video signal from the host
computer occurs in the aforementioned state A in
employment of the power save mode, transition to a state B
in Fig. 4 takes place. When the CRT 10 continuously
10 displays the same image for a constant period of time in
an operating state of the "screen saver", the video signal
from the host computer is interrupted so that the CRT 10
displays a homogeneous black picture image in order to
prevent burning of a fluorescent material provided
15 therein, as hereinabove described. In response to such
interruption of the video signal, transition from the
state A to the state B takes place. In the state B, the
procedure shown in Fig. 3 is executed along a loop of
returning the process to the step 103 through the steps
20 103, 104, 105, 106, 109, 110, 112 (or 111, 112) and 113.

When a period of time for 3 minutes elapses in the
aforementioned state B, the power circuit 9 is turned off,
whereby transition to a state C shown in Fig. 4 takes
place. In the state C, the procedure shown in Fig. 3 is
25 executed along a loop of returning the process to the step

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103 through the steps 103, 104, 105, 106, 109, 110, 112, 113, 114 and 115.

When the prescribed period of time which is set in the first timer means (timer F), i.e., 8 to 63 minutes from interruption of the video signal (5 to 60 minutes from transition from the state B to the state C) elapses in the state C, the heater 14 is turned off, whereby transition to a state D takes place. In the state D, the procedure shown in Fig. 3 is executed along a loop of returning the process to the step 103 through the steps 103, 104, 105, 106, 109, 110, 112, 113, 114, 115 and 116.

The process passes through the step 112 in every one of the states B, C and D, while the process is led from the step 112 to the step 117 when a video signal is again supplied from the host computer in each state. Thereafter a determination of no is made at the step 118 following the step 117 in the state B since both of the power circuit 9 and the heater 14 are in ON states, so that the process is returned to the step 103 for restoration to a state of making ordinary image display in the CRT 10, i.e., the state A. In the state C or D, on the other hand, a determination of yes is made at the step 118 following the step 117, so that the process is returned to the step 103 through the steps 119 and 120. Consequently, the device is restored to a state of making ordinary image



display in the CRT 10, i.e., the state A.

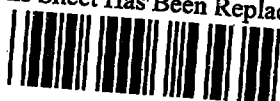
From the state B, the device is instantaneously restored to the state A. From the state C, on the other hand, the device is restored to the state A after a lapse of 2 seconds due to the picture blanking signal which is supplied for 2 seconds at the step 120. When the device is restored from the state D to the state A, further, a recovery time of 10 to 15 seconds is experimentally required since it is necessary to raise up the temperature of the heater 14.

Fig. 4 shows exemplary levels of power consumed by the CRT display device in the states A, B, C and D respectively. Assuming that power of 100 % is consumed in the state A, power of 86 %, power of 11 % and power of 5.7 % are consumed in the states B, C and D respectively. However, such concrete percentages are mere examples. Power which is consumed in the state A is varied with the content of the image displayed on the CRT 10, as well as with the dimensions of the CRT 10.

While the present invention has been described with reference to a preferred embodiment, the following modifications are also available in the power control method according to the present invention:

As to the state transition shown in Fig. 4, the state B may be omitted so that the power supply is controlled to

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cause transition from the state A to the states C and D.
In this case, the step 113 shown in Fig. 3 is omitted.

Referring to Fig. 4, further, the state C may be
omitted so that the power supply is controlled to cause
5 transition to the state D through the states A and B. In
this case, the steps 110, 111 and 115 are omitted from
Fig. 3.

In the power supply control procedure shown in Fig.
3, the first timer means (timer F) is adapted to start
10 clocking from a point of time when no video signal is
present at the step 115, in order to obtain timing for
off-controlling the heater 14 at the step 116. However,
this timer means may be replaced by that which is adapted
to start clocking from a point of time when the power
15 circuit 9 is turned off, in order to obtain timing for
off-controlling the heater 15. Such a control procedure
is now described with reference to Fig. 5.

Fig. 5 is a flow chart showing a power control
procedure executed in another embodiment of the present
20 invention. Referring to Fig. 5, steps corresponding to
those shown in Fig. 3 are denoted by similar reference
numerals, to omit redundant description.

In the control procedure shown in Fig. 5, a single
timer is so employed as to provide timing for off-
25 controlling the power circuit 9 and that for off-



controlling the heater 14. Namely, a setup time for 3 minutes for off-controlling the power circuit 9 is first set in this timer, which in turn starts clocking. After completion of such clocking for 3 minutes, a setup time
5 for 5 to 60 minutes is set in this timer, which in turn starts clocking. At a step 102a shown in Fig. 5, the setup time for 3 minutes is set in this timer, which simultaneously starts clocking. Further, the CPU 15 stores a setup time for 60 minutes to be subsequently set
10 in the timer.

When a determination is made at a step 110 shown in Fig. 5 that it is necessary to change a period of time from turnoff of the power circuit 9 to that of the heater 14, this period of time is changed at a step 111a within a
15 range of 5 to 60 minutes, so that the as-changed period of time is stored in the CPU 15.

When no video signal is detected at a step 112, the process is led to a step 200. At the step 200, a determination is made as to whether or not the power
20 circuit 9 is turned off. If the determination is of no, a determination is made at a step 113 as to whether or not a state with presence of no video signal is continuous in excess of 3 minutes. If the determination is of yes, the power circuit 9 is turned off at a step 114.

25 Then, data related to the period of time within the

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range of 5 to 60, which is stored in the CPU 15, is set at a step 210, so that the timer starts clocking. Then, a determination is made at a step 115a as to whether or not the setup time of 5 to 60 minutes elapses from turnoff of the power circuit 9. If the power circuit 9 is continuously in an OFF state in excess of the setup time, the heater 14 is turned off at a step 116, similarly to the aforementioned embodiment.

If the determination is of yes at the step 200, on the other hand, the process is directly led to the step 115a. If the determinations are of no at the steps 113 and 115a respectively, the process is returned to a step 103.

When a video signal is detected at the step 112, on the other hand, the process is led to a step 117a. At this step 117a, the timer is set at 3 minutes, to restart clocking along the setup time of 3 minutes.

The remaining part of the control procedure shown in Fig. 5 is substantially similar to that shown in Fig. 3.

As hereinabove described, the operation for off-controlling the power supply for the CRT display unit is started by display of a homogeneous black picture image on the CRT 10 according to the present invention. When the computer employs an operating system or application software in which no homogeneous black picture image is



displayed but proper animation display is carried out on the CRT upon operation of the "screen saver", therefore, it is impossible to apply the inventive power supply control.

5 According to the following embodiment, however, it is possible to drive the "screen saver" regardless of the operating system or application software employed in the computer as well as to display a homogeneous black picture image on the CRT at this time, whereby the inventive power
10 supply control method can be regularly applied. Thus, it is possible to widen the available range of the power supply control method.

 Fig. 6 is a block diagram showing a graphics board 51 according to still another embodiment of the present
15 invention and electrical elements which are included in a computer related thereto. Fig. 7 schematically illustrates a mother board 52 provided in the body of the computer holding the graphics board 51 shown in Fig. 6 and some external input/output units.

20 Referring to Fig. 7, the mother board 52 which is provided with some option slots 53, 54, 55, ... is arranged in the body of a computer of an open architecture type. The graphics board 51 is inserted in an arbitrary one, such as the option slot 53, for example, selected
25 from the option slots 53, 54, 55, ... The mother board 52



further carries a CPU 56 thereon.

The mother board 52 is connected with a keyboard 57 serving as external input means. The mother board 52 is further connected with a mouse 58 and a network 59, serving as other external input means, respectively at need. The graphics board 51 is connected with a CRT display unit 60.

Some buses (not shown in Fig. 7) extend in relation to the option slots 53, 54, 55, ..., so that an option board such as the graphics board 51 is connected to these buses in common whichever option slot receives this option board.

Fig. 6 shows elements corresponding to some of those shown in Fig. 7 with similar reference numerals. Referring to Fig. 6, the graphics board 51 comprises a graphic control part 61. This graphic control part 61 supplies an image signal to a frame memory 62, so that pixel data for one screen which is stored in the frame memory 62 is inputted in a pixel data terminal of a D-A converter (RAMDAC) 63. On the other hand, a blank signal from the graphic control part 61 is applied to a blank terminal of the D-A converter 63 through a gate 64. Thus, the D-A converter 63 generates a video signal which is supplied to the CRT display unit 60 (Fig. 7). Further, a synchronizing signal which is supplied as an output from

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the graphic control part 61 is supplied to the CRT display unit 60 through a buffer 65. The graphic control part 61 is connected with an address bus 66 and a data bus 67 extending from the CPU 56.

5 The aforementioned structure which is related to the graphics board 51 is substantially similar to that provided in a conventional graphics board.

 According to this embodiment, the graphics board 51 further comprises an input detection part 68 and a timer
10 69. The input detection part 68 is adapted to monitor presence/absence of an interruption request which is generated upon receiving of an input signal from external input means such as the keyboard 57 or the mouse 58, thereby detecting presence of the input signal from the
15 external input means. This input detection part 68 is now described in detail.

 Data from the keyboard 57 is received by a keyboard controller 70, which in turn write the data in an output buffer (not shown) and presents an interruption request to
20 the CPU 56 through an interruption signal line 71. The keyboard controller 70 is also connected with the address bus 66 and the data bus 67 respectively.

 Further, data from the mouse 58 is received by a mouse controller 72, which in turn presents an
25 interruption request to the CPU 56 through an interruption



signal line 73. The mouse controller 72 is also connected with the address bus 66 and the data bus 67 respectively.

Similarly, an external input controller 74 is provided for receiving data, i.e., an input signal from
5 external input means such as a network, a facsimile, a digitizer or a track ball, to present an interruption request to the CPU 56 through an interruption signal line 75 upon receiving of the input signal. The external input controller 74 is also connected to the address bus 66 and
10 the data bus 67 respectively. External input controllers corresponding to such an external input controller 74 are provided in correspondence to the number of external input means as employed, so that interruption requests from the external input controllers as added are supplied to the
15 CPU 56 through other interruption signal lines 76, ...

In order to monitor presence/absence of the aforementioned interruption request, the input detection part 68 of the graphics board 51 comprises an interruption request detection part 77 and a keyboard access detection
20 part 78. The interruption request detection part 77 is connected to the interruption signal lines 73, 75, 76, ..., to monitor presence/absence of an interruption request which is presented from the mouse controller 72, the external input controller 74 or the like to the CPU
25 56.

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The aforementioned interruption signal lines 73, 75, 76, ... extend along the address bus 66 and the data bus 67, whereby the graphics board 51 can be easily connected with the interruption signal lines 73, 75, 76, ... when
5 the same is inserted in the option slot 53, for example. However, the interruption signal line 71 from the keyboard controller 70 is generally directly introduced into the CPU 56, without extending along the address bus 66 and the data bus 67. Therefore, it is impossible to directly
10 monitor an interruption request on the interruption signal line 71, in order to detect manipulation of the keyboard 57. To this end, the keyboard access detection part 78 is provided independently of the interruption request
detection part 77 in order to detect manipulation of the
15 keyboard 57, thereby detecting an address signal which is supplied as an output to the address bus 66 in response to manipulation of the keyboard 57. When the keyboard 57 is manipulated and an interruption request is supplied from
the keyboard controller 70 to the CPU 56 through the
20 interruption signal line 71, the CPU 56 determines such manipulation of the keyboard 57 to output an address signal onto the address bus 66.

Each of signals from the interruption request detection part 77 and the keyboard access detection part
25 78 is supplied to a gate 80 through switching means 79, so

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that an output signal from the gate 80 is applied to a reset terminal of the timer 69. The aforementioned switching means 79 is driven to select the external input means generating the signal whose presence is to be
5 detected, so that it is possible to monitor only manipulation of the keyboard 57, only manipulation of the keyboard 57 or the mouse 58, or supply of an input signal from any one of the external input means to the CPU 56, for example, by driving the switching means 79. The
10 switching means 79 is generally driven previously by a manufacturer of the graphics board 51, or in an initial stage of employment of the graphics board 51.

The timer 69 starts a clocking operation upon input of a signal from the gate 80, i.e., upon detection of
15 presence of an input signal from any one of the external input means including the keyboard 57 and the mouse 58. More specifically, the timer 69 is adapted to set a prescribed timer value which is subtract therein with a lapse of time, and is reset when the same receives a
20 signal in the aforementioned reset terminal. When the input detection part 68 detects no presence of an input signal from the external input means again before a lapse of a period of time previously set in the timer 69, an output signal is derived. This output signal is supplied
25 to the aforementioned gate 64 to supply a blank signal



from the D-A converter 63 to the CRT display unit 60 (Fig. 7). Thus, a CRT provided in the CRT display unit 60 displays a homogeneous black picture image, to attain a state of operation of a "screen saver".

5 If the input detection part 68 detects presence of an input signal from the external input means before a lapse of the period of time previously set in the timer 69 or in an operating state of the "screen saver", the timer 69 is reset to restart a clocking operation. At the same time,
10 the CRT display unit 60 is restored to an ordinary image display state.

 The period of time previously set in the timer 69 is preferably rendered variable in response to a request by the operator. When a nonvolatile memory storing the
15 period of time set in the timer 69 is provided on the graphics board 51, further, it is possible to drive a desired "screen saver" without setting the timer 69 when the power supply for the computer is turned off and thereafter again turned on to start the computer.

20 Although the present invention has been described and illustrated in detail, it is clearly understood that the same is by way of illustration and example only and is not to be taken by way of limitation, the scope of the present invention being limited only by the terms of the appended
25 claims.

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CLAIMS:

1. A CRT display unit being connected to a central unit generating a synchronizing signal and a video signal for displaying an image of said video signal, said CRT display unit comprising:

5 a power supply circuit (3) including a main power supply (4) and an auxiliary power supply (5);

a power circuit (9), being driven by said main power supply (4), including a high voltage circuit (6), a deflection circuit (7) and a video circuit (8);

10 a synchronous processing circuit (16) for processing said synchronizing signal from said central unit and supplying processed said synchronizing signal to said high voltage circuit (6) and said deflection circuit (7);

15 a video input processing circuit (17), including video signal detection means (20) for detecting presence/absence of said video signal from said central unit, for processing said video signal and supplying processed said video signal to said video circuit (8);

20 a CRT (10) comprising an anode (11) being supplied with a high dc voltage from said high voltage circuit (6), a deflection yoke (12) being supplied with a deflecting current from said deflection circuit (7), a cathode (13) being supplied with a cathode drive signal from said video





25 circuit (8), and a heater (14) being supplied with a
current from said auxiliary power supply (5);

main power supply control means (15) for controlling
said main power supply (4) to turn on/off said power
circuit (9) upon detection of presence/absence of said
video signal by said video signal detection means (20);

30 first timer means for clocking at least a turnoff
period of time of said power circuit (9); and

auxiliary power supply means (45) for controlling
said auxiliary power supply (5) to turn off said heater
(14) after a lapse of a period of time being previously
35 set in said first timer means.

2. A CRT display unit in accordance with claim 1,
wherein said main power supply control means (15)
comprises second timer means for clocking a state with
absence of said video signal, and power circuit turnoff
5 means for turning off said power circuit (9) after a lapse
of a period of time being previously set in said second
timer means.

3. A CRT display unit in accordance with claim 1,
wherein said period of time being previously set in said
first timer means is variable.

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4. A CRT display unit in accordance with claim 1,
wherein said main power supply control means (15)
comprises blanking signal generation means for supplying a
picture blanking signal to said video circuit (8) for a
5 prescribed period of time when said video signal detection
means (20) detects presence of said video signal.

5. A CRT display unit in accordance with claim 1,
further comprising means for controlling said power supply
circuit (3) to turn off said power circuit (9) and said
heater (14) after a lapse of a prescribed period of time
5 upon detection of absence of said synchronizing signal
from said central unit.

6. A CRT display unit in accordance with claim 1,
wherein said video signal includes video signals of
respective colors of red, green and blue, said video
signal detection means detecting presence/absence of said
5 red or blue color signal.

7. An extension graphics board (51), to be inserted
in an option slot being provided in a computer (56) of an
open architecture type, comprising a circuit for supplying
a video signal to a CRT display unit (60) in accordance
5 with claim 1 for displaying an image based on an input

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signal from external input means (57, 58), said extension graphics board (51) comprising:

an input detection part (68) for monitoring presence/absence of an interruption request being
10 generated upon receiving of said input signal and detecting presence/absence of said input signal from said external input means (57, 58);

timer means (69) starting a clocking operation upon detection of presence of said input signal by said input
15 detection part (68); and

means (61, 63, 64) for supplying a blank signal to said CRT display unit (60) as said video signal upon no re-detection of presence of said input signal by said input detection part (68) before a lapse of a period of
20 time being previously set in said timer means (69).

8. An extension graphics board in accordance with claim 7, wherein said input means includes a keyboard (57), said input detection part (68) including means (78) for detecting an address signal being supplied to an
5 address bus (66) in response to manipulation of said keyboard (57).

9. An extension graphics board in accordance with claim 7, wherein said external input means includes a

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mouse (58), said input detection part (68) including means
(77) for detecting an interruption signal being supplied
5 as an output in response to manipulation of said mouse
(58).

10. An extension graphics board in accordance with
claim 7, wherein a plurality of said external input means
(57, 58) are provided, said timer means (69) starting a
clocking operation when said input detection part (68)
5 detects presence of an input signal from any one of said
external input means (57, 58).

11. An extension graphics board in accordance with
claim 10, wherein said input detection part (68) comprises
means (79) for selecting said external input means (57,
58) generating a signal whose presence is to be detected.

12. A CRT display unit being connected to a central
unit generating a synchronizing signal and a video signal
for displaying an image of said video signal, said CRT
display unit comprising:

5 a power supply circuit (3) including a main power
supply (4) and an auxiliary power supply (5);

a power circuit (9), being driven by said main power
supply (4), including a high voltage circuit (6), a

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deflection circuit (7) and a video circuit (8);

10 a synchronous processing circuit (16) for processing
said synchronizing signal from said central unit and
supplying processed said synchronizing signal to said high
voltage circuit (6) and said deflection circuit (7);

15 a video input processing circuit (17), including
video signal detection means (20) for detecting
presence/absence of said video signal from said central
unit, for processing said video signal and supplying
processed said video signal to said video circuit (8);

20 a CRT (10) comprising an anode (11) being supplied
with a high dc voltage from said high voltage circuit (6),
a deflection yoke (12) being supplied with a deflecting
current from said deflection circuit (7), a cathode (13)
being supplied with a cathode drive signal from said video
circuit (8), and a heater (14) being supplied with a
25 current from said auxiliary power supply (5);

timer means (15) starting clocking upon detection of
absence of said video signal by said video signal
detection means (20) for clocking a state with absence of
said video signal; and

30 power supply circuit control means (15) for
controlling said power supply circuit (3) to turn off said
power circuit (9) and said heater (14) after a lapse of a
period of time being previously set in said timer means

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(15).

13. A CRT display unit in accordance with claim 12, further comprising means for controlling said power supply circuit (3) to turn off said power circuit (9) and said heater (14) after a lapse of a prescribed period of time
5 upon detection of absence of said synchronizing signal from said central unit.

14. A CRT display unit in accordance with claim 12, wherein said video signal includes video signals of respective colors of red, green and blue, said video signal detection means detecting presence/absence of said
5 red or blue color signal.

15. An extension graphics board (51), to be inserted in an option slot being provided in a computer (56) of an open architecture type, comprising a circuit for supplying a video signal to a CRT display unit (60) in accordance
5 with claim 12 for displaying an image based on an input signal from external input means (57, 58), said extension graphics board (51) comprising:

an input detection part (68) for monitoring presence/absence of an interruption request being
10 generated upon receiving of said input signal and

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detecting presence/absence of said input signal from said external input means (57, 58);

timer means (69) starting a clocking operation upon detection of presence of said input signal by said input
15 detection part (68); and

means (61, 63, 64) for supplying a blank signal to said CRT display unit (60) as said video signal upon no re-detection of presence of said input signal by said input detection part (68) before a lapse of a period of
20 time being previously set in said timer means (69).

16. An extension graphics board in accordance with claim 15, wherein said input means includes a keyboard (57), said input detection part (68) including means (78) for detecting an address signal being supplied to an
5 address bus (66) in response to manipulation of said keyboard (57).

17. An extension graphics board in accordance with claim 15, wherein said external input means includes a mouse (58), said input detection part (68) including means (77) for detecting an interruption signal being supplied
5 as an output in response to manipulation of said mouse (58).

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18. An extension graphics board in accordance with claim 15, wherein a plurality of said external input means (57, 58) are provided, said timer means (69) starting a clocking operation when said input detection part (68) detects presence of an input signal from any one of said external input means (57, 58).

19. An extension graphics board in accordance with claim 18, wherein said input detection part (68) comprises means (79) for selecting said external input means (57, 58) generating a signal whose presence is to be detected.

20. A power supply control method for a CRT display unit being connected to a central unit generating a video signal for displaying an image of said video signal, said CRT display unit comprising a CRT (10) including an anode (11), a deflection yoke (12), a cathode (13) and a heater (14), a power circuit (9) including a high voltage circuit (6) for applying a high dc voltage to said anode (11), a deflection circuit (7) for supplying a deflecting current to said deflection yoke (12) and a video circuit (8) for supplying a cathode drive signal to said cathode (13), and a power supply circuit (3) including a main power supply (4) providing a power supply for driving said power circuit (9) and an auxiliary power supply (5) for

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supplying a current to said heater (14), said power supply
15 control method comprising the steps of:

controlling said main power supply (4) to turn off
said power circuit (9) in response to absence of said
video signal; and

controlling said auxiliary power supply (15) to turn
20 off said heater (14) after a lapse of a prescribed period
of time in an OFF state of said power circuit (9).

21. A power supply control method in accordance with
claim 20, wherein said step of controlling said main power
supply (4) to turn off said power circuit (9) comprises a
step of maintaining said power circuit (9) in an ON state
5 until a prescribed period of time elapses in a state with
absence of said video signal, and a step of turning off
said power circuit (9) after a lapse of said prescribed
period of time.

22. A power supply control method in accordance with
claim 20, wherein a period of time from turnoff of said
power circuit (9) to turnoff of said heater (14) is
rendered variable.

23. A power supply control method for a CRT display
unit being connected to a central unit generating a video

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5 signal for displaying an image of said video signal, said
CRT display unit comprising a CRT (10) including an anode
(11), a deflection yoke (12), a cathode (13) and a heater
(14), a power circuit (9) including a high voltage circuit
(6) for applying a high dc voltage to said anode (11), a
deflection circuit (7) for supplying a deflecting current
to said deflection yoke (12) and a video circuit (8) for
10 supplying a cathode drive signal to said cathode (13), and
a power supply circuit (3) including a main power supply
(4) providing a power supply for driving said power
circuit (9) and an auxiliary power supply (5) for
supplying a current to said heater (14), said power supply
15 control method comprising the step of:

controlling said main power supply (4) and said
auxiliary power supply (15) to turn off said power circuit
(9) and said heater (14) respectively after a lapse of a
prescribed period of time from starting of a state with
20 absence of said video signal.

24. An extension graphics board (51), to be inserted
in an option slot being provided in a computer (56) of an
open architecture type, comprising a circuit for supplying
a video signal to a CRT display unit (60) for displaying
5 an image based on an input signal from external input
means (57, 58), said extension graphics board (51)

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comprising:

an input detection part (68) for monitoring
presence/absence of an interruption request being
10 generated upon receiving of said input signal and
detecting presence/absence of said input signal from said
external input means (57, 58);

timer means (69) starting a clocking operation upon
detection of presence of said input signal by said input
15 detection part (68); and

means (61, 63, 64) for supplying a blank signal to
said CRT display unit (60) as said video signal upon no
re-detection of presence of said input signal by said
input detection part (68) before a lapse of a period of
20 time being previously set in said timer means (69).

25. An extension graphics board in accordance with
claim 24, wherein said input means includes a keyboard
(57), said input detection part (68) including means (78)
for detecting an address signal being supplied to an
5 address bus (66) in response to manipulation of said
keyboard (57).

26. An extension graphics board in accordance with
claim 24, wherein said external input means includes a
mouse (58), said input detection part (68) including means

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(77) for detecting an interruption signal being supplied as an output in response to manipulation of said mouse (58).

5 27. An extension graphics board in accordance with claim 24, wherein a plurality of said external input means (57, 58) are provided, said timer means (69) starting a clocking operation when said input detection part (68) detects presence of an input signal from any one of said external input means (57,
10 58).

 28. An extension graphics board in accordance with claim 27, wherein said input detection part (68) comprises means (79) for selecting said external input means (57, 58) generating a signal whose presence is
15 to be detected.

 29. A control circuit for controlling the power supply of a CRT monitor coupled to a computer, the control circuit including means for monitoring the video signals supplied to the computer to determine
20 the existence of a blank display, and means operable to switch off the heater of the CRT at a predetermined delay time following said determination.

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30. A control circuit as claimed in claim 29,
wherein the power supply includes a first supply
circuit for supplying power to the heater, and a
second supply circuit for supplying power to at least
5 some other parts of the CRT monitor, the control
circuit being operable to disable the second power
circuit at a predetermined period prior to disabling
the first power circuit.

31. A monitoring circuit for monitoring the video
10 signal supplied by a computer to a CRT monitor, the
monitoring circuit being operable to detect the
absence of a video signal in response to the red
and/or blue components, but not the green component,
of the video signal.

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ABSTRACT OF THE DISCLOSURE

When a "screen saver" operates to display a homogeneous black picture image after the same image is continuously displayed on a CRT (10) for a constant period of time, a power supply (3) for a CRT display unit is controlled to be turned off, thereby preventing the CRT display unit from being left for a long time in a power-on state. Namely, a waiting time for 3 minutes, for example, is provided when the "screen saver" so operates that the CRT displays a homogeneous black picture image to turn off a power circuit (9) for the CRT, and then a heater (14) for the CRT is turned off after a lapse of a prescribed period of time within 5 to 60 minutes, for example. A function for enabling such an operation of the "screen saver" may be provided in an extension graphics board (51) which is inserted in an open slot (53) provided in a computer of an open architecture type. In this case, the graphics board (51) is provided with an input detection part (68) including a keyboard access detection part (78) for detecting an address signal which is supplied to an address bus (66) in response to manipulation of a keyboard (57), and an interruption request detection part (77) for detecting an interruption signal which is outputted in response to manipulation of a mouse (58) respectively. A timer (69) is reset when the input detection part (68)

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detects presence of an input signal from the keyboard (57) or the mouse (58). When no reset signal is supplied from the input detection part (78) again before a lapse of a period of time which is previously set in the timer (69),
5 a blank signal is supplied to the CRT display unit.

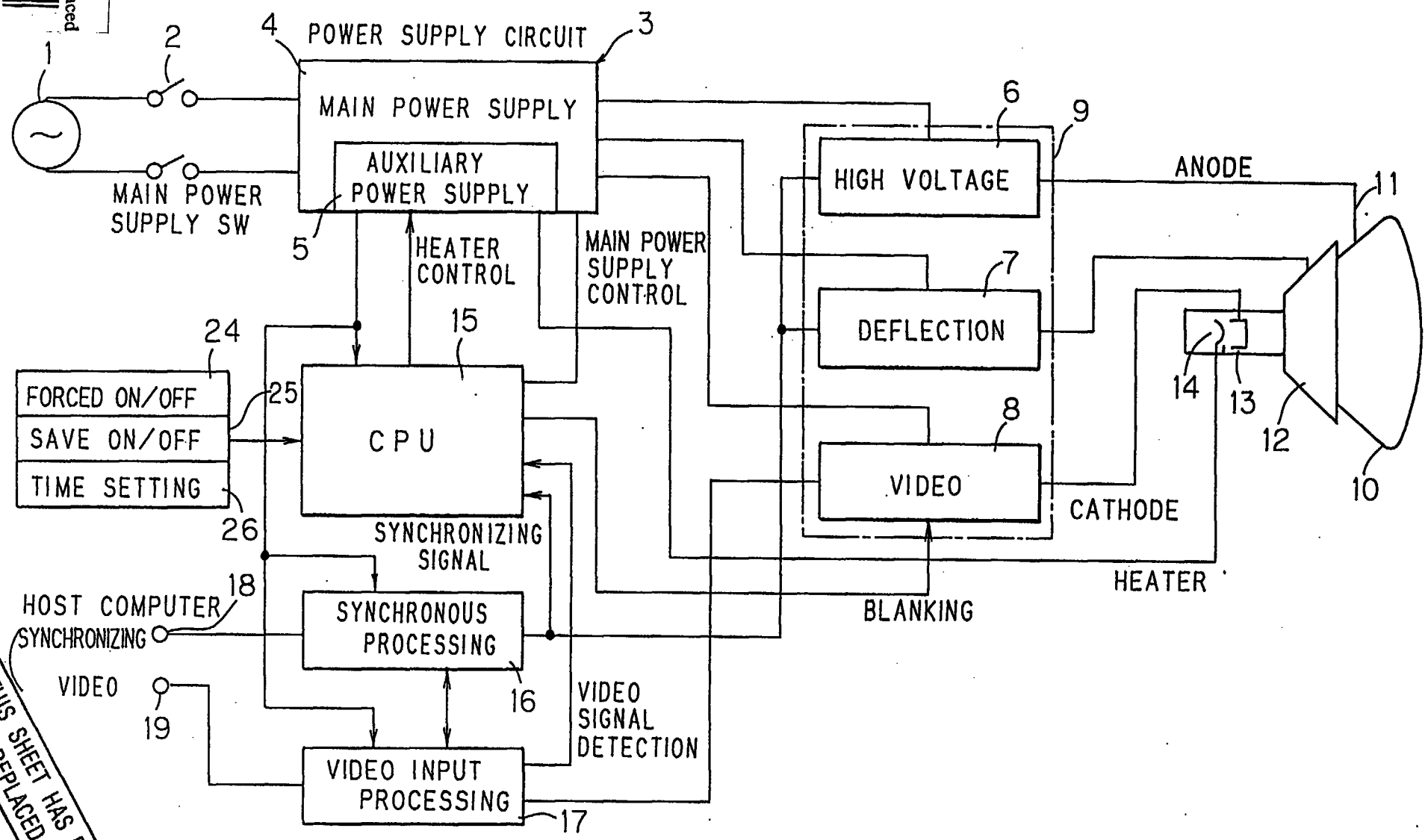
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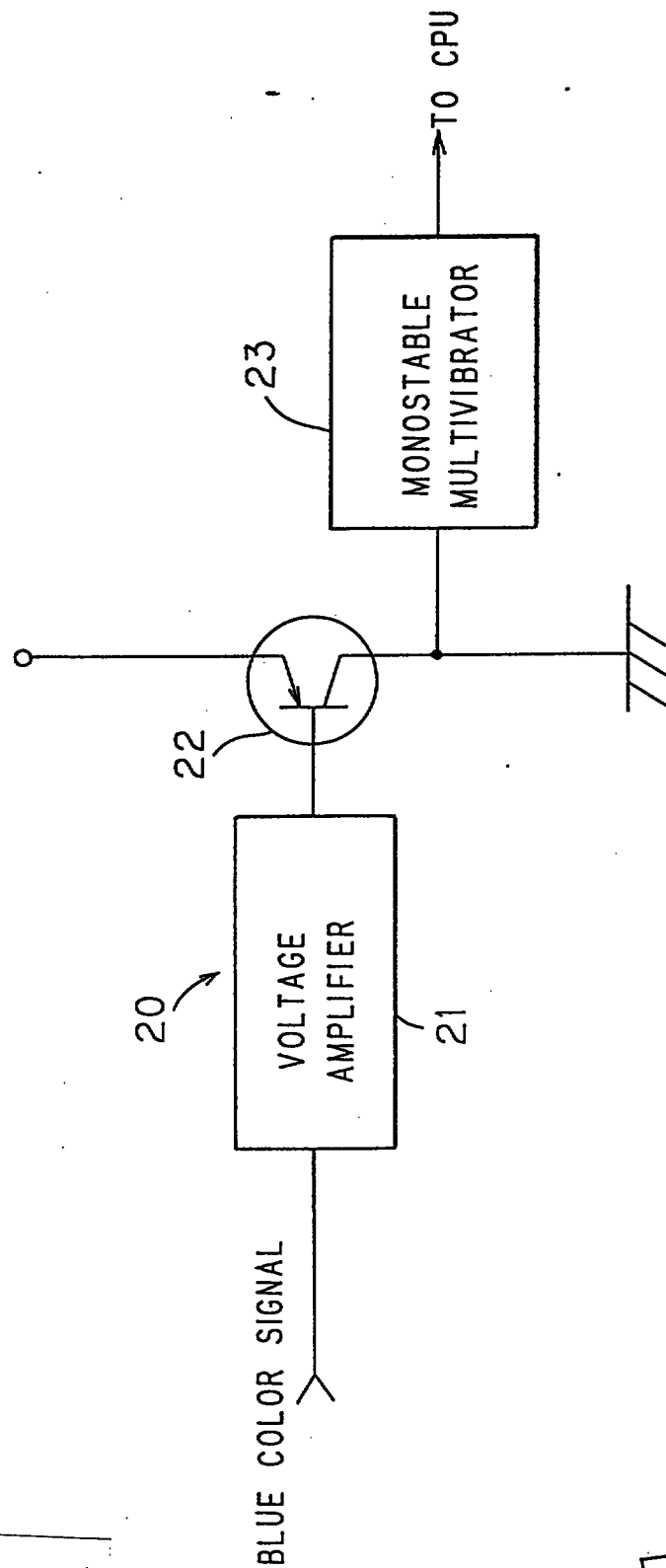
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FIG. 1



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FIG. 2

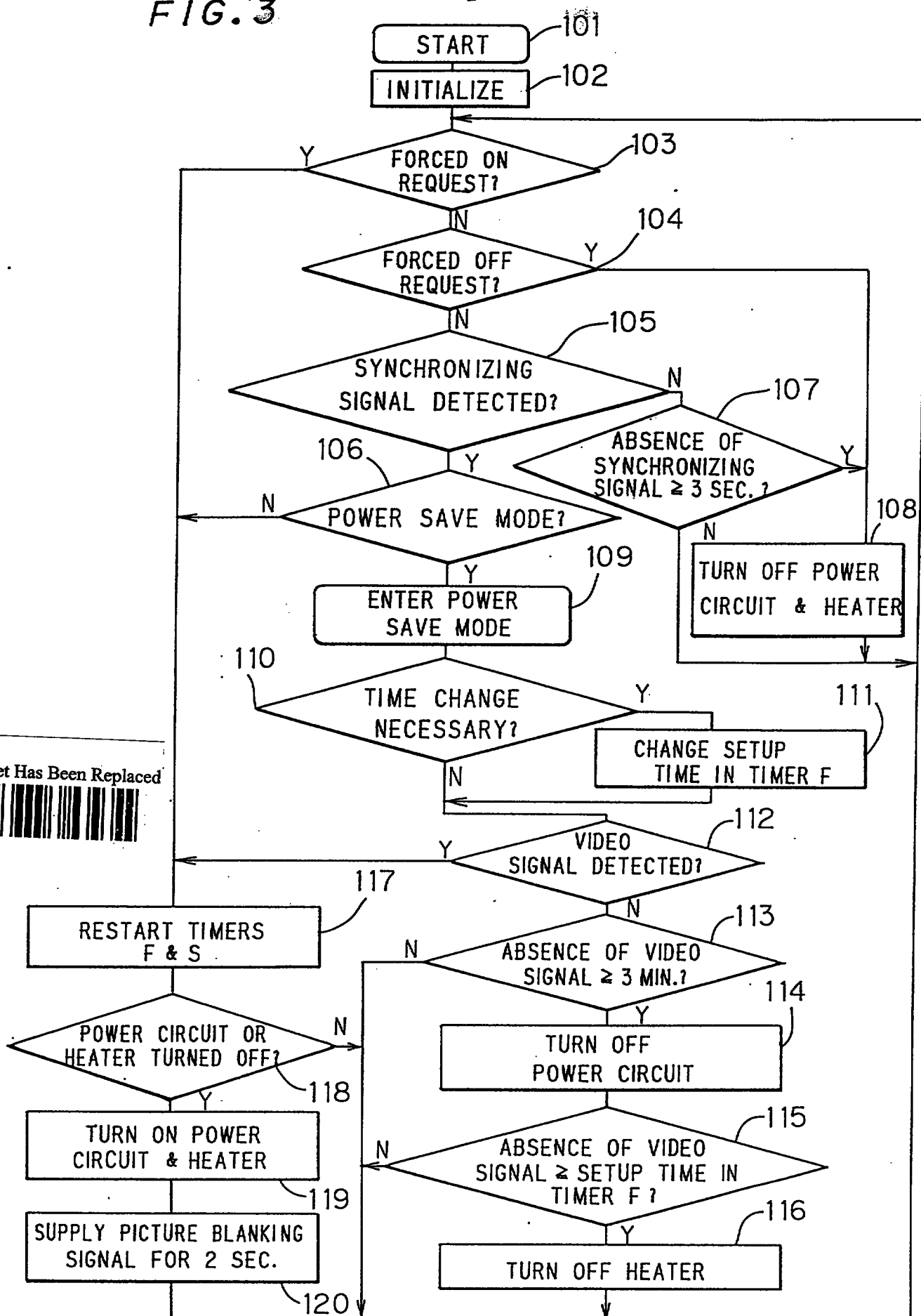


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FIG. 3

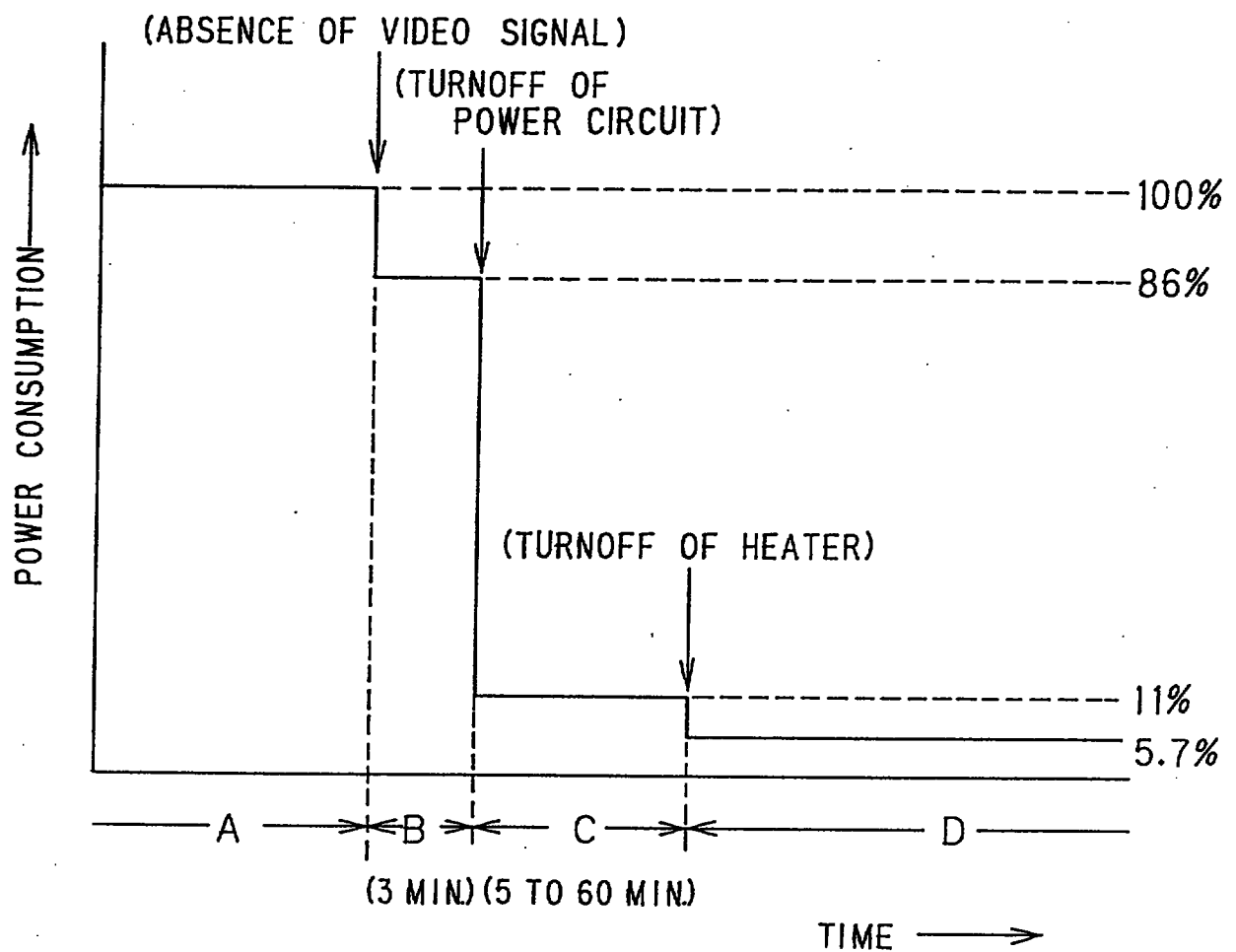


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FIG. 4



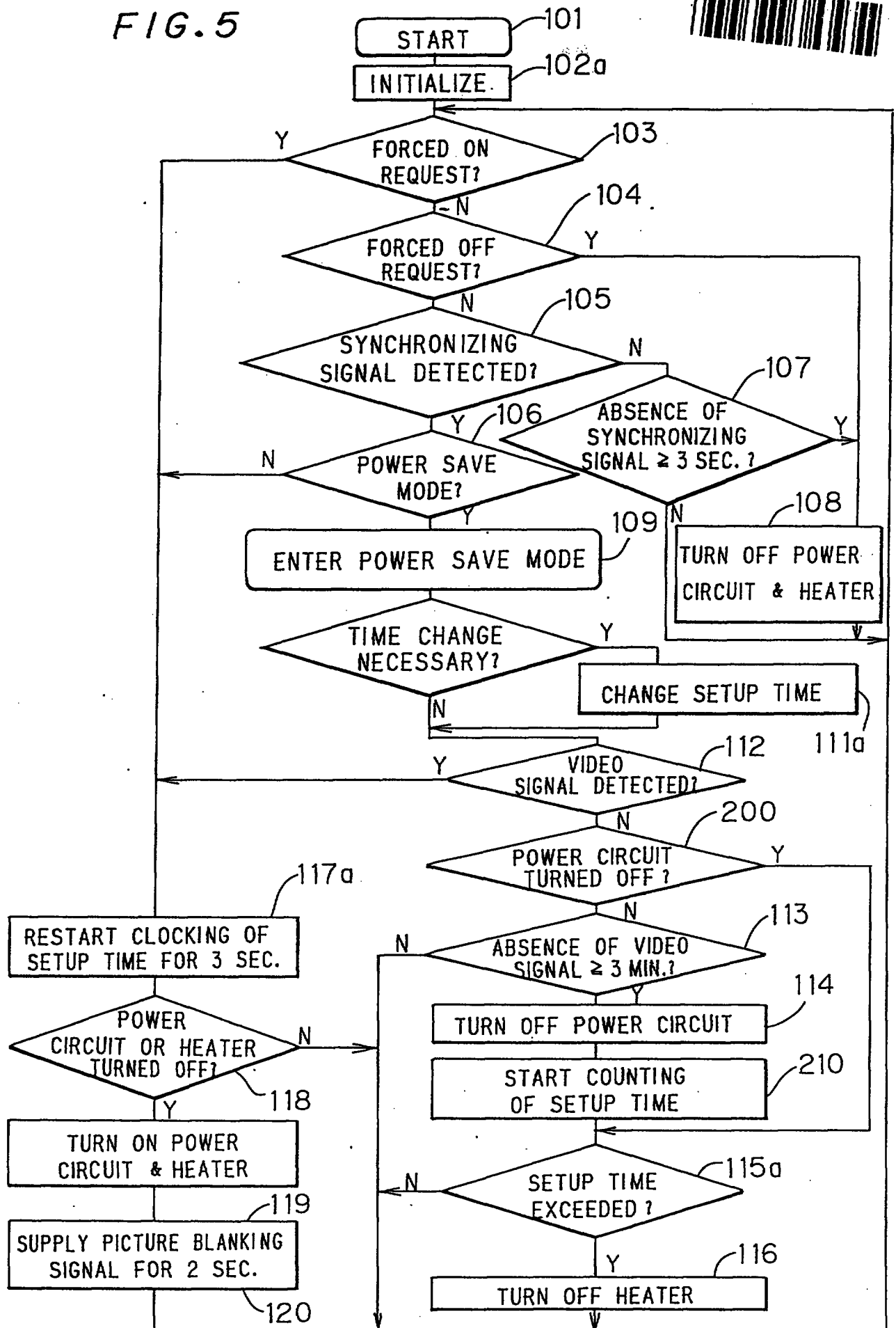
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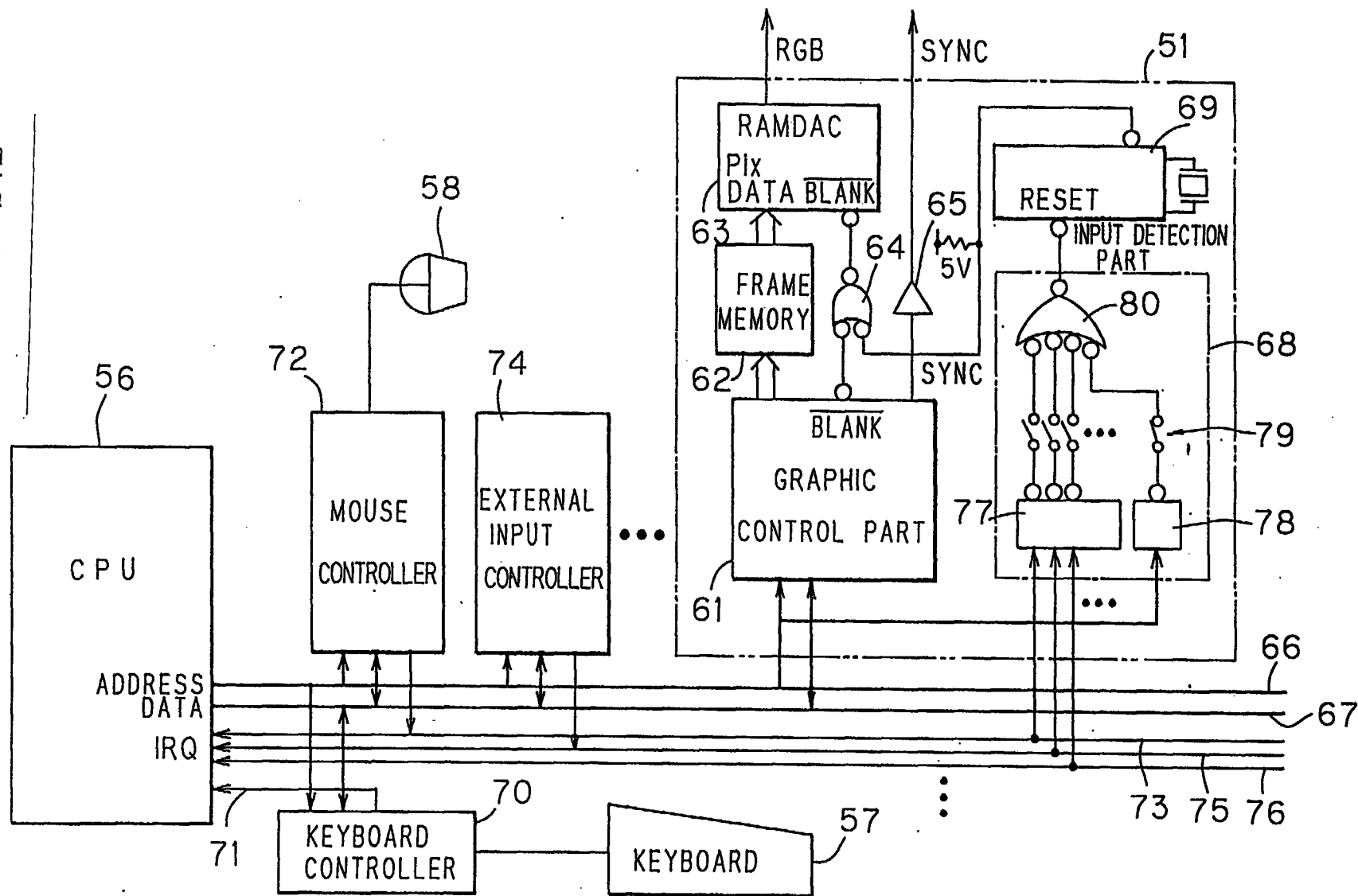
FIG. 5

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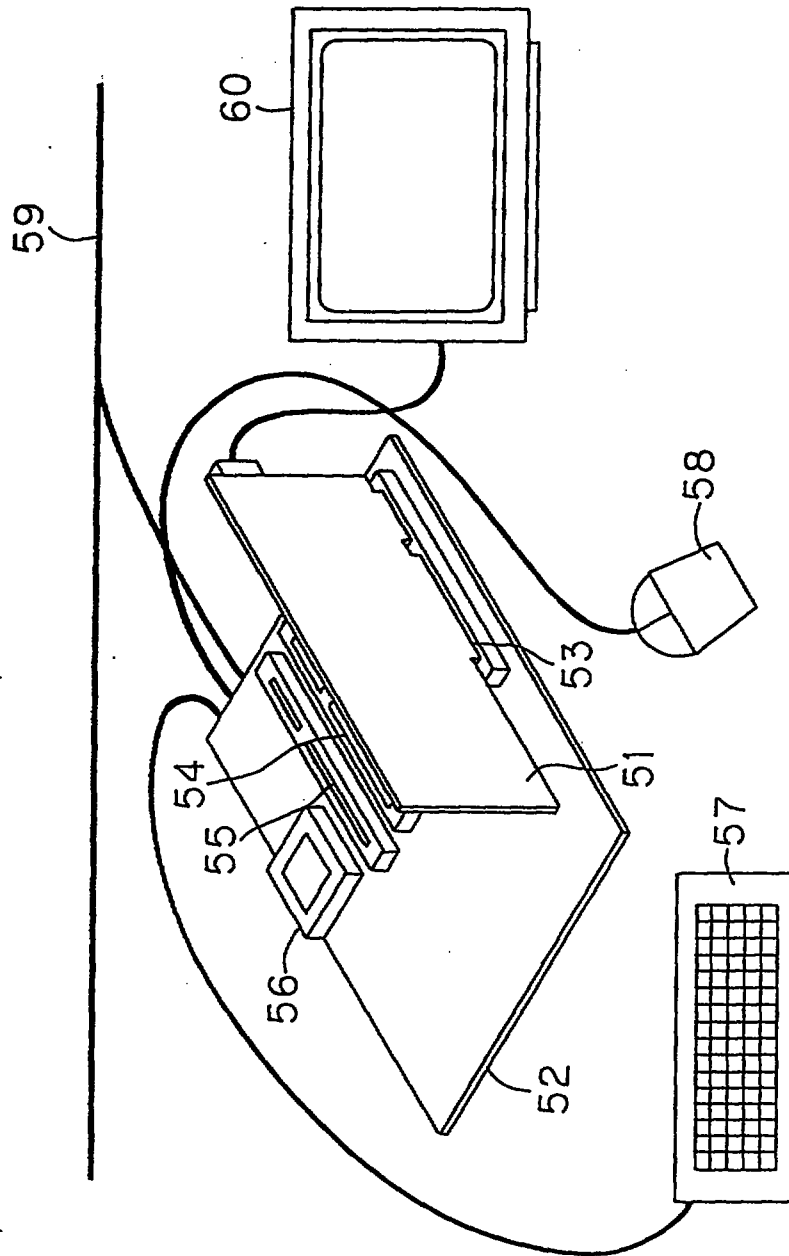
FIG. 6



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FIG. 7



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TITLE OF THE INVENTION

CRT Display Unit and Power Supply Control Method
Therefor

BACKGROUND OF THE INVENTION

Field of the Invention

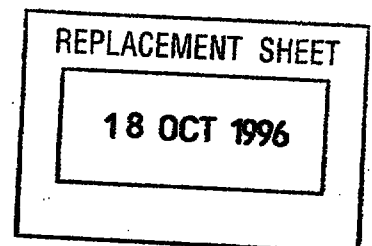
The present invention relates to a CRT display unit and a power supply control method therefor, and more particularly, it relates to power supply control for increasing the life of a CRT.

Description of the Background Art

A CRT display unit is connected to a central unit, such as a host computer, which generates a synchronizing signal and a video signal, to display an image of the video signal. In this case, it is recommended that power is applied to the CRT display unit independently of a power supply for the computer. If the power supply for the computer is also employed for applying power to the CRT display unit, this may lead to excessive capacity of a power supply switch for the computer. Further, the CRT display unit is often installed in a position separated from the computer.

Under such circumstances, there have been proposed some CRT display units, whose power supplies are on-off controlled on the basis of signals from computers.

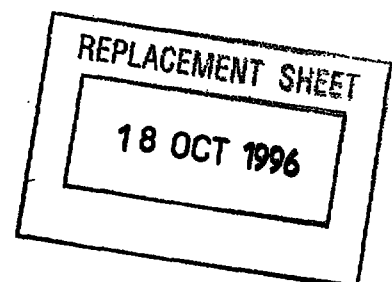
Japanese Patent Application Laying-Open No. 64-33586



(1989) describes a technique of detecting presence/absence of a video signal from a computer for on-off controlling a power supply for a CRT display unit on the basis of the result of the detection. In such a power supply control method, however, no video signal is present when a CRT intentionally displays a homogeneous black picture image, and hence the power supply for the CRT display unit is disadvantageously erroneously turned off in this case.

On the other hand, each of Japanese Patent Application Laying-Open Nos. 60-1982 (1985) and 1-257893 (1989) describes a technique of detecting presence/absence of a synchronizing signal from a computer for on-off controlling a power supply for a CRT display unit on the basis of the result of the detection. In this power supply control method, however, the computer regularly transmits a synchronizing signal and hence the power supply for the CRT display unit cannot be turned off unless a power supply for the computer is turned off or the CRT display unit is disconnected from the computer.

Further, there has been developed a technique of switching the screen of a CRT to display of a homogeneous black image when the same display image continuously appears on the CRT for a constant period, in order to prevent burning of a fluorescent material which is applied to the screen of the CRT. Such switching of the display

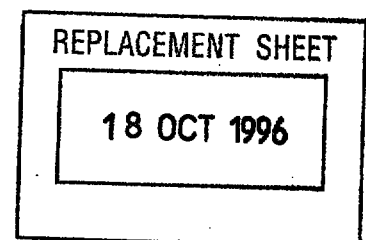


to a black picture image is often carried out by application software called "screen saver", for example. When the "screen saver" operates in such a manner, however, it is difficult to distinguish the screen of the CRT from that in a cutoff state of the CRT display unit. On the other hand, the power supply for the CRT display unit is not turned off upon such operation of the "screen saver". Consequently, the CRT display unit may be left intact in an ON state of the power supply therefor. This leads to wasteful power consumption, as well as to reduction in life of the CRT due to a continuous ON state of a heater provided therein.

Accordingly, a first object of the present invention is to eliminate the aforementioned disadvantage in a CRT display unit provided with a "screen saver".

According to the present invention, as hereinafter described in detail, provided is a power supply control method for a CRT display unit which is adapted to turn off a power circuit after a lapse of a prescribed period of time as well as to turn off a heater after a further lapse of a prescribed period of time when a "screen saver" so operates that a CRT displays a homogeneous black picture image, in order to eliminate the aforementioned disadvantage.

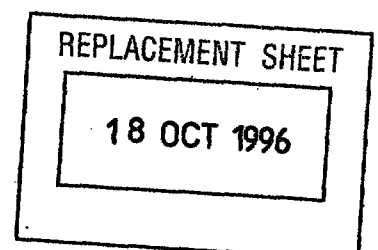
However, the aforementioned "screen saver", which has



been developed in order to prevent a CRT screen from burning, may be adapted to display various patterns of animations for the purpose of amusement, in addition to display of a homogeneous black picture image. A typical system of such a "screen saver" is provided with tens of types of patterns, for example, while the user can produce such patterns himself in response to his liking.

In such circumstances, an applicable range of such a power supply control method is inevitably narrowed if the factor for starting the control for turning off the power supply for the CRT display is restricted to only the display of a homogeneous black picture image. Further, the software of the "screen saver", which has dependence on an operating system, requires dedicated programs for various systems such as DOS, Windows, OS/2, UNIX and the like, for example.

When the same image is displayed on the CRT for a constant period of time and it is necessary to drive the "screen saver", on the other hand, all input operations for the computer which are made by an operator are interrupted in general. There have been proposed some means for detecting such an interrupted state of the input operations in a hardware manner and displaying a homogeneous black picture image, for example, in order to prevent the CRT screen from burning. According to



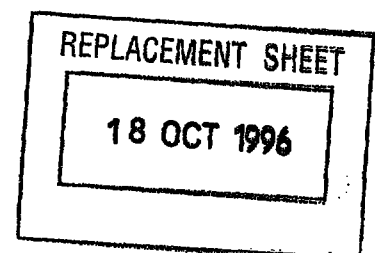
Japanese Utility Model Publication No. 2-6467 (1990), for example, a CRT display unit comprises a timer so that a video signal is converted to a blank signal if no input operation is carried out for a period of time which is previously set in the timer.

In order to implement the "screen saver" in the aforementioned hardware manner, however, it is necessary to remarkably modify the interior of the computer in general. Thus, a relatively high cost is required for such a modification. Further, such a modification is not easy for dealers other than a computer manufacturer.

Accordingly, a second object of the present invention is to implement a "screen saver" in a hardware manner, with no introduction of a remarkable modification to a computer body.

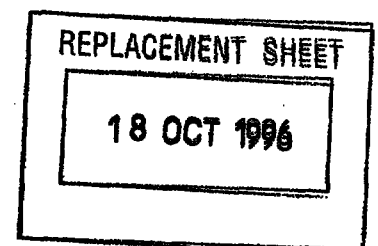
SUMMARY OF THE INVENTION

The present invention is first directed to a CRT display unit which is connected to a central unit generating a synchronizing signal and a video signal, for displaying an image of the video signal. This CRT display unit comprises a power supply circuit which includes a main power supply and an auxiliary power supply, a power circuit, which is driven by the main power supply, including a high voltage circuit, a deflection circuit and a video circuit, a synchronous processing circuit for



processing a synchronizing signal received from the central unit and supplying the processed synchronizing signal to the high voltage circuit and the deflection circuit, a video input processing circuit, which includes video signal detection means for detecting presence/absence of a video signal from the central unit, for processing the video signal and supplying the processed video signal to the video circuit, and a CRT having an anode which is supplied with a high dc voltage from the high voltage circuit, a deflecting yoke which is supplied with a deflecting current from the deflection circuit, a cathode which is supplied with a cathode drive signal from the video circuit, and a heater which is supplied with a current from the auxiliary power supply. According to each of first and second aspects as described below, the CRT display unit according to the present invention comprises the aforementioned elements in common.

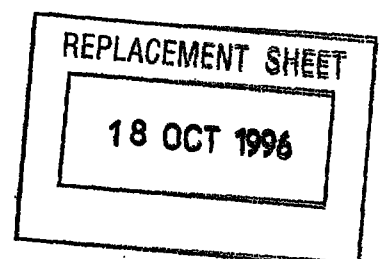
According to the first aspect of the present invention, the CRT display unit further comprises main power supply control means for controlling the main power supply to turn on/off the power circuit when the video signal detection means detects presence/absence of the video signal, first timer means for clocking at least a period of time when the power circuit is turned off, and auxiliary power supply control means for controlling the



auxiliary power supply to turn off the heater after a lapse of a period of time previously set in the first timer means.

According to the aforementioned first aspect of the present invention, the power circuit is first turned off when the "screen saver" so operates that the CRT displays a homogeneous black picture image, i.e., when no video signal is present. When the period of time which is previously set in the first timer means elapses upon continuation of such a state, the heater is then turned off. According to the present invention, therefore, it is possible to reduce wasteful power consumption as well as to increase the life of the CRT. When a video signal is detected before the heater is turned off after turnoff of the power circuit, it is possible to quickly restore the CRT to an ordinary image display state.

In the aforementioned first aspect of the present invention, the main power supply control means preferably comprises second timer means for clocking the state with presence of no video signal, and power circuit turnoff means for turning off the power circuit after a lapse of a period of time which is previously set in the second timer means. In this case, the power circuit is not immediately turned off even if the "screen saver" so operates that no video signal is present, whereby it is possible to prevent

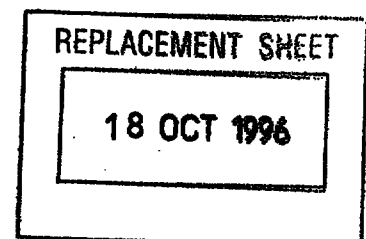


the power circuit from erroneous turnoff when application software intentionally displays a homogeneous black picture image, for example. Consequently, it is possible to carry out delicate power supply control.

The period of time which is previously set in the first timer means is preferably rendered variable, so that it is possible to carry out power supply control in response to requirement by an operator.

Further, the main power supply control means preferably comprises blanking signal generation means which supplies a picture blanking signal to the video circuit for a prescribed period of time when the video signal detection means detects presence of the video signal. As hereinabove described, the CRT is restored to an ordinary image display state when a video signal is detected before the heater is turned off after turnoff of the power circuit, while the image is irregularized at the moment of such restoration. When a picture blanking signal is supplied for a prescribed period of time of 2 seconds, for example, at the moment of restoration as hereinabove described, it is possible to show the operator no irregular image.

The CRT display unit according to the second aspect of the present invention comprises timer means which starts counting when the video signal detection means

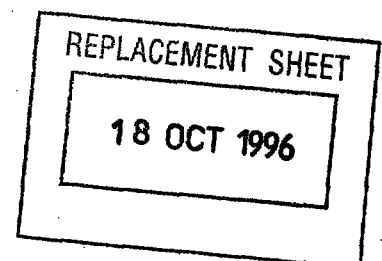


detects absence of the video signal for clocking a state with presence of no video signal, and the power supply circuit control means for controlling the power supply circuit to turn off the power circuit and the heater after a lapse of a period of time which is previously set in the timer means, in addition to the aforementioned common elements.

According to the second aspect of the present invention, it is possible to reduce wasteful power consumption while preventing the power circuit and the heater from erroneous turnoff operations even if the application software intentionally displays a black picture image for a relatively short period of time, as well as to increase the life of the CRT.

In each of the first and second aspects of the present invention, the CRT display unit preferably further comprises means for controlling the power supply circuit to turn off the power circuit and the heater after a lapse of a prescribed period of time from detection of presence of no synchronizing signal from the central unit. In this case, it is possible to turn off the power circuit and the heater also when a power supply for the central unit such as a host computer is turned off.

According to each of the aforementioned first and second aspects of the present invention, further, the



video signal detection means may not detect all color signals of red, green and blue but may detect only a red or blue color signal. Such a red or blue color signal is selected as the object of detection since a green color signal may be transmitted from the central unit to the CRT display unit as a composite video signal on which a synchronizing signal is superposed, and the circuit is complicated in this case since it is necessary to eliminate the synchronizing signal from the composite video signal if the green color signal is processed as the object of detection. When only a red or blue color signal is processed as the object of detection, on the other hand, the video signal detection means can be simplified in structure. Nevertheless, the video signal detection means may sufficiently detect only a color signal of red or blue in order to detect presence of no video signal. Alternatively, the video signal detection means may detect both of the red and blue color signals.

The present invention is also directed to a power supply control method for the aforementioned CRT display unit.

This power supply control method comprises a step of controlling the main power supply to turn off the power circuit in response to absence of the video signal, and a step of controlling the auxiliary power supply to turn off

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the heater after a lapse of a prescribed period of time in such an OFF state of the power circuit.

In the power supply control method according to the present invention, the main power supply and the auxiliary power supply may be so controlled as to turn off the power circuit and the heater after a lapse of a prescribed period of time from starting of a state with absence of the video signal.

According to the present invention, further, attention is drawn to a computer of an open architecture type which is manufactured by IBM Corporation, for example, in order to attain the aforementioned second object. Such a computer of an open architecture type, whose interfaces are laid open to public, comprises some option slots so that the user can insert option boards for varying the computer functions at need. The option boards can be manufactured by a manufacturer of such boards. According to the present invention, a graphics board is noted as one of such option boards. While a graphic board originally comprises a circuit for supplying a video signal to a CRT display unit in order to display a picture which is based on an input signal from external input means such as a keyboard, for example, hardware for implementing the "screen saver" is added to such a graphics board according to the present invention.

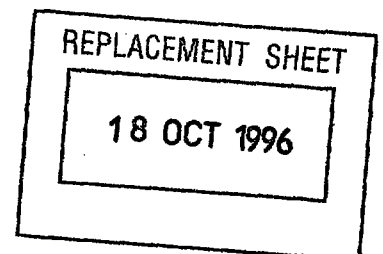
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In more concrete terms, the graphics board according to the present invention comprises an input detection part for monitoring presence/absence of an interruption request which is generated upon receiving of an input signal from external input means for detecting presence of the input signal from the external input means, timer means starting a clocking operation when the input detection part detects presence of the input signal, and means for supplying a blank signal to the CRT display unit as a video signal when the input detection part detects no presence of an input signal again before a lapse of a period of time previously set in the timer means.

The external input means typically includes input operation means such as a keyboard and a mouse which are driven by the operator, as well as those based on an external communication system such as a network, a facsimile, a digitizer and a track ball.

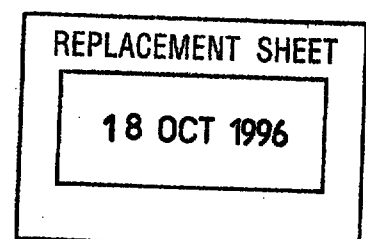
When the external input means is formed by a keyboard, the input detection means detects an address signal which is supplied as an output to an address bus in response to manipulation of the keyboard. When the external input means is formed by a mouse, on the other hand, the input detection part detects an interruption signal which is supplied as an output in response to manipulation of the mouse.



When such external input means is formed by a plurality of elements such as a keyboard, a mouse and another external unit, the timer means preferably starts its clocking operation when the input detection part detects presence of an input signal from any one of the external input means. Further, the input detection part is preferably adapted to select the external input means generating an input signal whose presence is to be detected.

Thus, the present invention is further provided with a function of the "screen saver", which supplies a blank signal to the CRT display unit as a video signal when no input signal is received from the external input means for a prescribed period of time, with respect to an extension graphics board which is inserted in an option slot provided in a computer of an open architecture type.

Thus, according to the inventive graphics board, it is possible to provide a computer of an open architecture type with a "screen saver" function simply by inserting the graphics board in its option slot. The input detection part which is provided in the graphics board simply monitors presence/absence of an interruption request generated upon receiving of an input signal from the external input means, whereby no modification is required on the body of the computer. In other words, the

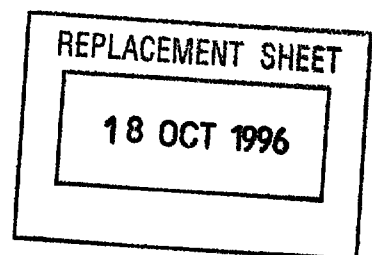


"screen saver" function can be provided by merely modifying the graphics board, whereby it is possible to provide the "screen saver" function on the side of the manufacturer of such a graphics board.

According to the present invention, the graphics board is selected as an option board for providing a "screen saver" function. The graphics board, which necessarily supplies a video signal to the CRT display unit and is connected to a line of an interface signal between a CPU and an input/output unit provided in the computer, is most suitable for detecting absence of an input signal from the external input means for a prescribed period of time and driving the "screen saver".

When the graphics board according to the present invention is employed, it is possible to drive a "screen saver" with no regard to an operating system or application software employed in the computer to display a homogeneous black picture image on the CRT, thereby enabling regular application of the aforementioned power supply control method for a CRT display unit according to the present invention. Thus, it is possible to widen the applicable range of this power supply control method.

The foregoing and other objects, features, aspects and advantages of the present invention will become more apparent from the following detailed description of the



present invention when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block diagram showing an electrical structure provided in a CRT display unit according to an embodiment of the present invention;

Fig. 2 is a block diagram showing a video signal detection circuit 20 included in a video input processing circuit 17 shown in Fig. 1;

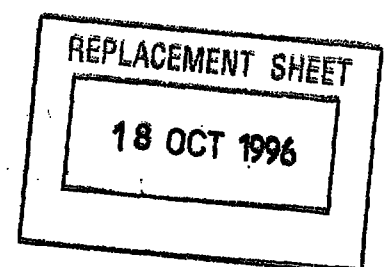
Fig. 3 is a flow chart showing a power supply control procedure executed by a CPU 15 shown in Fig. 1;

Fig. 4 illustrates some typical state transitions implemented in a power save mode which is obtained along the power supply control procedure shown in Fig. 3 in relation to power consumption;

Fig. 5 is a flow chart corresponding to Fig. 3, showing a power supply control procedure executed in another embodiment of the present invention;

Fig. 6 is a block diagram showing a graphics board 51 included in still another embodiment of the present invention and electrical elements on a computer side related thereto; and

Fig. 7 schematically illustrates a mother board 52 provided in a computer body holding the graphics board 51 shown in Fig. 6 and some external input/output units.



DESCRIPTION OF THE PREFERRED EMBODIMENTS

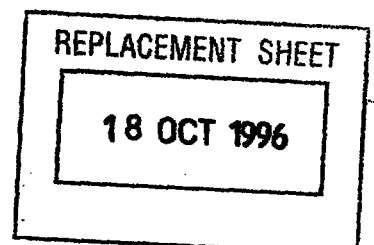
Fig. 1 is a block diagram showing an electrical structure provided in a CRT display unit according to an embodiment of the present invention. This CRT display unit is connected to a central unit such as a host computer, for example, generating a synchronizing signal and a video signal, to display an image of the video signal.

The CRT display unit comprises a power supply circuit 3 which is connected to a commercial ac power supply 1 through a main power supply switch 2. This power supply circuit 3 includes a main power supply 4 and an auxiliary power supply 5.

The CRT display unit further comprises a power circuit 9 including a high voltage circuit 6, a deflection circuit 7 and a video circuit 8, which are driven by the main power supply 4.

A CRT 10 comprises an anode 11 which is supplied with a high dc voltage from the high voltage circuit 6, a deflection yoke 12 which is supplied with a deflecting current from the deflection circuit 7, a cathode 13 which is supplied with a cathode drive signal from the video circuit 8, and a heater 14 which is supplied with a current from the auxiliary power supply 5.

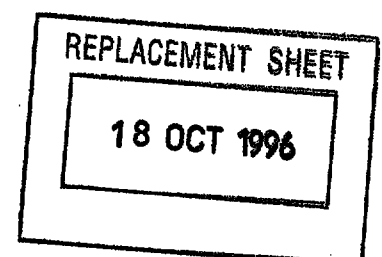
The CRT display unit further comprises a CPU 15, a



synchronous processing circuit 16 and a video input processing circuit 17, which are driven by the auxiliary power supply 5.

A synchronizing signal from the host computer (not shown) is supplied to the synchronous processing circuit 16 through a synchronizing signal input terminal 18, while a composite video signal superposed with such a synchronizing signal is supplied to the synchronous processing circuit 16 through a video signal input terminal 19. The synchronous processing circuit 16 performs processing such as waveform shaping, polarity decision and/or synchronization separation of the synchronizing signal or automatic switching of the composite video signal, so that the as-processed desired synchronizing signal is supplied to the high voltage circuit 6 and the deflection circuit 7 as well as to the CPU 15.

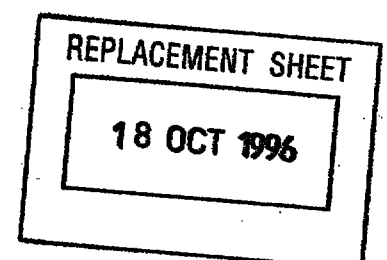
A video signal from the host computer is supplied to the video input processing circuit 17 through the video signal input terminal 19. The video input processing circuit 17 performs processing such as amplification of the video signal, so that the as-processed video signal is supplied to the video circuit 8. The video input processing circuit 17 includes video signal detection means for detecting presence/absence of the video signal



from the host computer. This video signal detection means is illustrated in Fig. 2 in detail.

As shown in Fig. 2, a video signal detection circuit 20 is adapted to detect presence/absence of a blue color signal, so that an analog signal serving as such a blue color signal is applied as an input to a voltage amplifier 21 to be amplified therein. An output of the voltage amplifier 21 is supplied to a base of a transistor 22. When the voltage supplied to the base is reduced below a prescribed value, the transistor 22 is so switched that a prescribed voltage is applied as an input to a monostable multivibrator 23. The monostable multivibrator 23 generates a signal having a pulse width of 38 msec. exceeding a vertical scanning period as a video signal detection signal, which in turn is supplied to the CPU 15.

Referring again to Fig. 1, the CPU 15 comprises main power supply control means which controls the main power supply 4 to turn on/off the power circuit 9 when the video signal detection circuit 20 detects presence/absence of a blue color signal, first timer means which clocks an OFF state of the power circuit 9, and auxiliary power supply control means which controls the auxiliary power supply 5 to turn off the heater 14 after a lapse of a period of time previously set in the first timer means, as clearly described later with reference to a power supply control



procedure. The main power supply control means comprises second timer means for clocking a state with presence of no video signal, power circuit turnoff means for turning off the power circuit 9 after a lapse of a period of time previously set in the second timer means, and blanking signal generation means which supplies a picture blanking signal to the video circuit 8 for a prescribed period of time when the video signal detection circuit 20 detects presence of a video signal. The CPU 15 further comprises means for controlling the power supply circuit 3 to turn off the power circuit 9 and the heater 14 after a lapse of a prescribed period of time upon detection of presence of no synchronizing signal from the host computer.

In relation to the CPU 15, further provided are a forced on/off switch 24, a power save on/off switch 25 and a time setting switch 26. The forced on/off switch 24 supplies the CPU 15 with a signal for controlling the power supply circuit 3, in order to forcibly turn on/off the power circuit 9 and the heater 14 with no regard to a power supply control state by the CPU 15. The power save on/off switch 25 supplies the CPU 15 with a signal for switching the device between the so-called "power save mode" for turning off the power circuit 9 and the heater 14 along a prescribed procedure upon operation of the aforementioned "screen saver" and another mode. The time

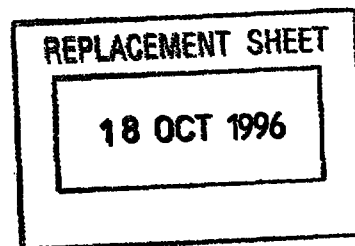
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setting switch 26 is so driven as to change the time which is set in the first timer means. According to this embodiment, the first timer means is adapted to restart clocking when the video signal detection circuit 20 detects presence of no video signal. A period of time for 63 minutes is previously set in the first timer means, and this period of time can be varied in a range of 8 to 63 minutes through the time setting switch 26. On the other hand, a period of time for 3 minutes is previously set in the second timer means, and this period of time is fixed. However, the period of time which set in the second timer means may also be rendered variable, as a matter of course.

Fig. 3 is a flow chart showing a power supply control procedure which is executed by the CPU 15. Fig. 4 illustrates transition of some typical states implemented in a power save mode obtained along the power supply control procedure shown in Fig. 3 in relation to power consumption.

Mainly with reference to Fig. 3, the main power supply switch 2 (Fig. 1) is turned on at a step 101, to start the procedure shown in Fig. 3. Upon such operation of the main power supply switch 2, the auxiliary power supply 5 first rises as shown in Fig. 1, thereby driving the CPU 15, the synchronous processing circuit 16 and the



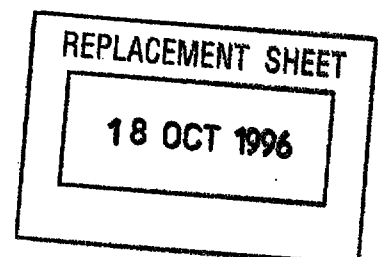
video input processing circuit 17.

Then, initialization is carried out at a step 102 to set a period of time for 63 minutes in the first timer means (shown as "timer F" in Fig. 3) and a period of time for 3 minutes in the second timer means (shown as "timer S" in Fig. 3). The first and second timer means start clocking simultaneously with such setting.

Then, a determination is made at a step 103 as to whether or not the forced on/off switch 24 (Fig. 1) generates an ON request. If the determination is of yes, the process is led to steps 117, 118, 119 and 120, so that the CPU 15 generates a main power supply control signal and a heater control signal at the step 119 for controlling the main power supply 4 and the auxiliary power supply 5 to turn on the power circuit 9 and the heater 14 respectively. Thus, the CRT 10 makes display.

If the determination at the step 103 is of no, on the other hand, the process is led to a step 104, so that a determination is made as to whether or not the forced on/off switch 24 generates an OFF request. If the determination is of yes, the process is led to a step 108, so that the main power supply 4 and the auxiliary power supply 5 are controlled to turn off the power circuit 9 and the heater 14.

If the determination at the step 104 is of no, on the



other hand, the process is led to a step 105, so that a determination is made as to whether or not a synchronizing signal is received from the host computer through the synchronizing signal input terminal 18. If the determination is of no, a determination is made at a step 107 as to whether or not such a state with presence of no synchronizing signal is continuous in excess of 3 seconds. If the determination is of yes, the power circuit 9 and the heater 14 are turned off at a step 108. Such a state with presence of no synchronizing signal in excess of 3 seconds corresponds to an OFF state of a power supply for the host computer or a state of disconnection between the host computer and the CRT display unit. When the determination at the step 107 is of no, on the other hand, the power circuit 9 and the heater 14 are not turned off and the process is returned to the step 103. Such a waiting time for 3 seconds is provided before turning off the power circuit 9 and the heater 14 in consideration of a possibility of mode switching in the host computer, so that the power circuit 9 and the heater 14 are not erroneously turned off by absence of the synchronizing signal caused by such mode switching.

If a synchronizing signal is detected at the aforementioned step 105, on the other hand, the process is led to a step 106. At the step 106, a determination is

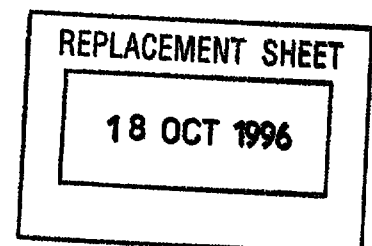
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made as to whether or not the device is switched to a power save mode by the power save on/off switch 25 shown in Fig. 1. If the determination is of yes, the device enters a power save mode at a step 109.

When the device thus enters a power save mode, a determination is made at a step 110 as to whether or not it is necessary to change the setup time in the first timer means (timer F), i.e., a period of time from turnoff of the power circuit 9 to turnoff of the heater 14. While the setup time of the timer F is variable within the range of 8 to 63 minutes from a state with presence of no video signal (5 to 60 minutes from turnoff of the power circuit 9), this time is previously set at 63 minutes at the step 102. In order to set a shorter period of time, the operator keys data therefor, for example. Therefore, the determination at the step 110 is made as to whether or not such data is keyed. When it is necessary to change the setup time in the timer F, the time setting switch 26 shown in Fig. 1 is manipulated to change the same at a step 111. Simultaneously with such change of the setup time, the timer F restarts clocking.

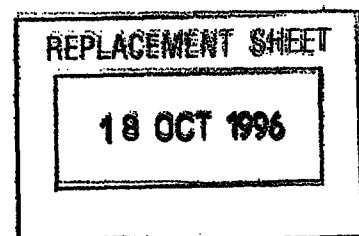
When the determination at the step 110 is of no or the change of the setup time is finished at the step 111, on the other hand, the process is led to a step 112. At the step 112, a determination is made as to whether or not



a video signal is transmitted from the host computer to the video signal input terminal 19 shown in Fig. 1 and a blue color signal, for example, is detected by the video signal detection circuit 20 (Fig. 2) included in the video input processing circuit 17. If the determination is of yes, the process is led to the aforementioned step 117. If the determination is of no, on the other hand, the process is led to a step 113.

At the step 113, a determination is made as to whether or not a state with presence of no video signal is continuous in excess of 3 minutes, i.e., a setup time in the second timer means (timer S). When the determination is of yes, the power circuit 9 is turned off at a step 114. If the determination is of no, on the other hand, the process is returned to the step 103. Such a waiting time for 3 seconds is provided before turning off the power circuit 9 so that the power circuit 9 is not erroneously turned off if application software intentionally displays a homogeneous black image or the like for a prescribed period of time.

Then, a determination is made at a step 115 as to whether or not the state with presence of no video signal is continuous in excess of the setup time in the timer F. If the determination is of yes, the heater 14 is turned off at a step 116. Such a prescribed period of time is

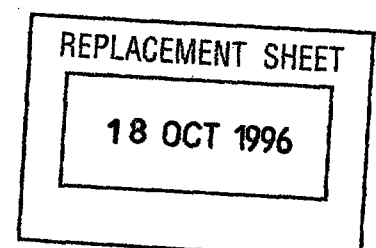


provided before turnoff of the heater 14 after the power circuit 9 is turned off so that image display can be quickly restored without waiting for a heating time for the heater 14 when the video signal is again detected (step 112) during this time.

At the aforementioned step 117, the first and second timer means (timers F and S) are restarted. This step is carried out when a forced ON request is detected at the step 103, no power save mode is detected at the step 106, or the video signal is detected at the step 112.

After the timers F and S are restarted at the step 117, a determination is made at a step 118 as to whether or not the power circuit 9 or the heater 14 has been turned off. If this CRT display unit has been already used and the power circuit 9 and the heater 14 have been turned on, the process is returned to the step 103. If employment of the CRT display unit is started, the power circuit 9 is turned off at the step 114 or the heater 14 is turned off at the step 116 following the power circuit 9, on the other hand, the process is led to a step 119 so that the power circuit 9 and the heater 14 are turned on. Thus, image display is started in the CRT 10.

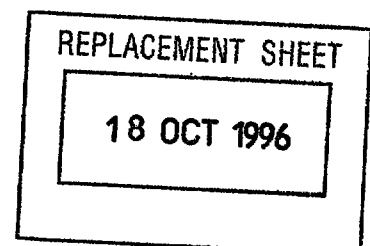
When the image display is started at the step 119, a picture blanking signal is supplied to the video circuit 8 for 2 seconds at a step 120. This picture blanking signal



is supplied to prevent display of an irregular image, which appears on the CRT 10 upon turnon of the power circuit 9 at the step 119 after the video signal is detected at the step 112 when the power circuit 9 is in an OFF state but the heater 14 is in an ON state. When the high voltage circuit 6, the deflection circuit 7 and the video circuit 8 are simultaneously turned on, the high voltage circuit 6 and the deflection circuit 7 cause instable states in rising, such that an irregular image is displayed on the CRT 10 if a video signal is applied to the video circuit 8 in this stage. When a picture blanking signal is supplied for 2 seconds, for example, until the high voltage circuit 6 and the deflection circuit 7 are stabilized, therefore, the CRT 10 displays a homogeneous black picture image, to be prevented from display of the irregular image. The video signal is applied to the video circuit 8 after a lapse of such 2 seconds, so that the CRT 10 displays an ordinary image.

The aforementioned power supply control procedure is now described in relation to transition of typical states in a power save mode shown in Fig. 4.

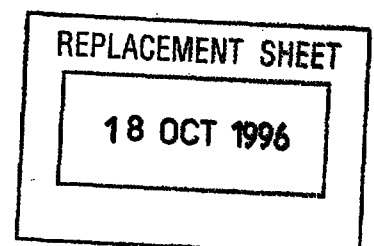
In a state A shown in Fig. 4, the CRT 10 displays an ordinary image. If the device is in a power save mode in this state, the procedure shown in Fig. 3 is executed along a loop of returning the process to the step 103



through the steps 103, 104, 105, 106, 109, 110, 112, 117 and 118. When no power save mode is employed, on the other hand, the procedure shown in Fig. 3 is executed along a loop of returning the process to the step 103 through the steps 103, 104, 105, 106, 117 and 118.

When absence of the video signal from the host computer occurs in the aforementioned state A in employment of the power save mode, transition to a state B in Fig. 4 takes place. When the CRT 10 continuously displays the same image for a constant period of time in an operating state of the "screen saver", the video signal from the host computer is interrupted so that the CRT 10 displays a homogeneous black picture image in order to prevent burning of a fluorescent material provided therein, as hereinabove described. In response to such interruption of the video signal, transition from the state A to the state B takes place. In the state B, the procedure shown in Fig. 3 is executed along a loop of returning the process to the step 103 through the steps 103, 104, 105, 106, 109, 110, 112 (or 111, 112) and 113.

When a period of time for 3 minutes elapses in the aforementioned state B, the power circuit 9 is turned off, whereby transition to a state C shown in Fig. 4 takes place. In the state C, the procedure shown in Fig. 3 is executed along a loop of returning the process to the step



103 through the steps 103, 104, 105, 106, 109, 110, 112, 113, 114 and 115.

When the prescribed period of time which is set in the first timer means (timer F), i.e., 8 to 63 minutes from interruption of the video signal (5 to 60 minutes from transition from the state B to the state C) elapses in the state C, the heater 14 is turned off, whereby transition to a state D takes place. In the state D, the procedure shown in Fig. 3 is executed along a loop of returning the process to the step 103 through the steps 103, 104, 105, 106, 109, 110, 112, 113, 114, 115 and 116.

The process passes through the step 112 in every one of the states B, C and D, while the process is led from the step 112 to the step 117 when a video signal is again supplied from the host computer in each state. Thereafter a determination of no is made at the step 118 following the step 117 in the state B since both of the power circuit 9 and the heater 14 are in ON states, so that the process is returned to the step 103 for restoration to a state of making ordinary image display in the CRT 10, i.e., the state A. In the state C or D, on the other hand, a determination of yes is made at the step 118 following the step 117, so that the process is returned to the step 103 through the steps 119 and 120. Consequently, the device is restored to a state of making ordinary image

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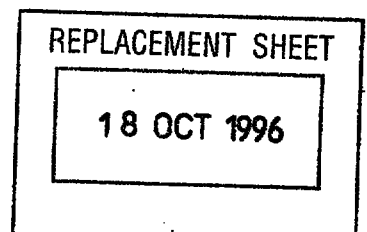
display in the CRT 10, i.e., the state A.

From the state B, the device is instantaneously restored to the state A. From the state C, on the other hand, the device is restored to the state A after a lapse of 2 seconds due to the picture blanking signal which is supplied for 2 seconds at the step 120. When the device is restored from the state D to the state A, further, a recovery time of 10 to 15 seconds is experimentally required since it is necessary to raise up the temperature of the heater 14.

Fig. 4 shows exemplary levels of power consumed by the CRT display device in the states A, B, C and D respectively. Assuming that power of 100 % is consumed in the state A, power of 86 %, power of 11 % and power of 5.7 % are consumed in the states B, C and D respectively. However, such concrete percentages are mere examples. Power which is consumed in the state A is varied with the content of the image displayed on the CRT 10, as well as with the dimensions of the CRT 10.

While the present invention has been described with reference to a preferred embodiment, the following modifications are also available in the power control method according to the present invention:

As to the state transition shown in Fig. 4, the state B may be omitted so that the power supply is controlled to



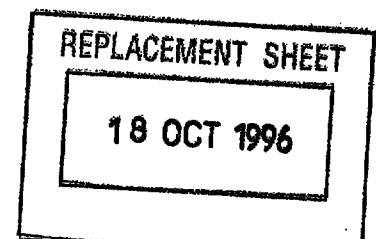
cause transition from the state A to the states C and D. In this case, the step 113 shown in Fig. 3 is omitted.

Referring to Fig. 4, further, the state C may be omitted so that the power supply is controlled to cause transition to the state D through the states A and B. In this case, the steps 110, 111 and 115 are omitted from Fig. 3.

In the power supply control procedure shown in Fig. 3, the first timer means (timer F) is adapted to start clocking from a point of time when no video signal is present at the step 115, in order to obtain timing for off-controlling the heater 14 at the step 116. However, this timer means may be replaced by that which is adapted to start clocking from a point of time when the power circuit 9 is turned off, in order to obtain timing for off-controlling the heater 15. Such a control procedure is now described with reference to Fig. 5.

Fig. 5 is a flow chart showing a power control procedure executed in another embodiment of the present invention. Referring to Fig. 5, steps corresponding to those shown in Fig. 3 are denoted by similar reference numerals, to omit redundant description.

In the control procedure shown in Fig. 5, a single timer is so employed as to provide timing for off-controlling the power circuit 9 and that for off-



controlling the heater 14. Namely, a setup time for 3 minutes for off-controlling the power circuit 9 is first set in this timer, which in turn starts clocking. After completion of such clocking for 3 minutes, a setup time for 5 to 60 minutes is set in this timer, which in turn starts clocking. At a step 102a shown in Fig. 5, the setup time for 3 minutes is set in this timer, which simultaneously starts clocking. Further, the CPU 15 stores a setup time for 60 minutes to be subsequently set in the timer.

When a determination is made at a step 110 shown in Fig. 5 that it is necessary to change a period of time from turnoff of the power circuit 9 to that of the heater 14, this period of time is changed at a step 111a within a range of 5 to 60 minutes, so that the as-changed period of time is stored in the CPU 15.

When no video signal is detected at a step 112, the process is led to a step 200. At the step 200, a determination is made as to whether or not the power circuit 9 is turned off. If the determination is of no, a determination is made at a step 113 as to whether or not a state with presence of no video signal is continuous in excess of 3 minutes. If the determination is of yes, the power circuit 9 is turned off at a step 114.

Then, data related to the period of time within the

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range of 5 to 60, which is stored in the CPU 15, is set at a step 210, so that the timer starts clocking. Then, a determination is made at a step 115a as to whether or not the setup time of 5 to 60 minutes elapses from turnoff of the power circuit 9. If the power circuit 9 is continuously in an OFF state in excess of the setup time, the heater 14 is turned off at a step 116, similarly to the aforementioned embodiment.

If the determination is of yes at the step 200, on the other hand, the process is directly led to the step 115a. If the determinations are of no at the steps 113 and 115a respectively, the process is returned to a step 103.

When a video signal is detected at the step 112, on the other hand, the process is led to a step 117a. At this step 117a, the timer is set at 3 minutes, to restart clocking along the setup time of 3 minutes.

The remaining part of the control procedure shown in Fig. 5 is substantially similar to that shown in Fig. 3.

As hereinabove described, the operation for off-controlling the power supply for the CRT display unit is started by display of a homogeneous black picture image on the CRT 10 according to the present invention. When the computer employs an operating system or application software in which no homogeneous black picture image is

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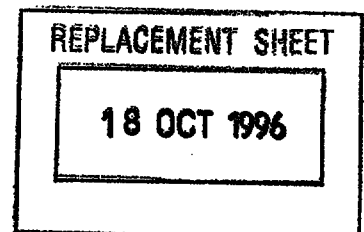
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displayed but proper animation display is carried out on the CRT upon operation of the "screen saver", therefore, it is impossible to apply the inventive power supply control.

According to the following embodiment, however, it is possible to drive the "screen saver" regardless of the operating system or application software employed in the computer as well as to display a homogeneous black picture image on the CRT at this time, whereby the inventive power supply control method can be regularly applied. Thus, it is possible to widen the available range of the power supply control method.

Fig. 6 is a block diagram showing a graphics board 51 according to still another embodiment of the present invention and electrical elements which are included in a computer related thereto. Fig. 7 schematically illustrates a mother board 52 provided in the body of the computer holding the graphics board 51 shown in Fig. 6 and some external input/output units.

Referring to Fig. 7, the mother board 52 which is provided with some option slots 53, 54, 55, ... is arranged in the body of a computer of an open architecture type. The graphics board 51 is inserted in an arbitrary one, such as the option slot 53, for example, selected from the option slots 53, 54, 55, ... The mother board 52



further carries a CPU 56 thereon.

The mother board 52 is connected with a keyboard 57 serving as external input means. The mother board 52 is further connected with a mouse 58 and a network 59, serving as other external input means, respectively at need. The graphics board 51 is connected with a CRT display unit 60.

Some buses (not shown in Fig. 7) extend in relation to the option slots 53, 54, 55, ..., so that an option board such as the graphics board 51 is connected to these buses in common whichever option slot receives this option board.

Fig. 6 shows elements corresponding to some of those shown in Fig. 7 with similar reference numerals. Referring to Fig. 6, the graphics board 51 comprises a graphic control part 61. This graphic control part 61 supplies an image signal to a frame memory 62, so that pixel data for one screen which is stored in the frame memory 62 is inputted in a pixel data terminal of a D-A converter (RAMDAC) 63. On the other hand, a blank signal from the graphic control part 61 is applied to a blank terminal of the D-A converter 63 through a gate 64. Thus, the D-A converter 63 generates a video signal which is supplied to the CRT display unit 60 (Fig. 7). Further, a synchronizing signal which is supplied as an output from

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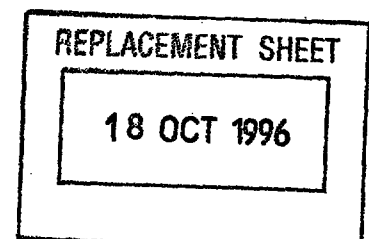
the graphic control part 61 is supplied to the CRT display unit 60 through a buffer 65. The graphic control part 61 is connected with an address bus 66 and a data bus 67 extending from the CPU 56.

The aforementioned structure which is related to the graphics board 51 is substantially similar to that provided in a conventional graphics board.

According to this embodiment, the graphics board 51 further comprises an input detection part 68 and a timer 69. The input detection part 68 is adapted to monitor presence/absence of an interruption request which is generated upon receiving of an input signal from external input means such as the keyboard 57 or the mouse 58, thereby detecting presence of the input signal from the external input means. This input detection part 68 is now described in detail.

Data from the keyboard 57 is received by a keyboard controller 70, which in turn write the data in an output buffer (not shown) and presents an interruption request to the CPU 56 through an interruption signal line 71. The keyboard controller 70 is also connected with the address bus 66 and the data bus 67 respectively.

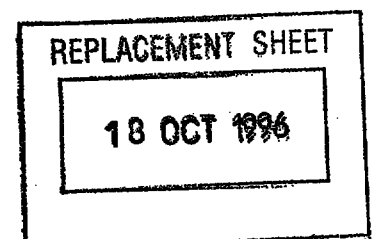
Further, data from the mouse 58 is received by a mouse controller 72, which in turn presents an interruption request to the CPU 56 through an interruption



signal line 73. The mouse controller 72 is also connected with the address bus 66 and the data bus 67 respectively.

Similarly, an external input controller 74 is provided for receiving data, i.e., an input signal from external input means such as a network, a facsimile, a digitizer or a track ball, to present an interruption request to the CPU 56 through an interruption signal line 75 upon receiving of the input signal. The external input controller 74 is also connected to the address bus 66 and the data bus 67 respectively. External input controllers corresponding to such an external input controller 74 are provided in correspondence to the number of external input means as employed, so that interruption requests from the external input controllers as added are supplied to the CPU 56 through other interruption signal lines 76, ...

In order to monitor presence/absence of the aforementioned interruption request, the input detection part 68 of the graphics board 51 comprises an interruption request detection part 77 and a keyboard access detection part 78. The interruption request detection part 77 is connected to the interruption signal lines 73, 75, 76, ..., to monitor presence/absence of an interruption request which is presented from the mouse controller 72, the external input controller 74 or the like to the CPU 56.



The aforementioned interruption signal lines 73, 75, 76, ... extend along the address bus 66 and the data bus 67, whereby the graphics board 51 can be easily connected with the interruption signal lines 73, 75, 76, ... when the same is inserted in the option slot 53, for example. However, the interruption signal line 71 from the keyboard controller 70 is generally directly introduced into the CPU 56, without extending along the address bus 66 and the data bus 67. Therefore, it is impossible to directly monitor an interruption request on the interruption signal line 71, in order to detect manipulation of the keyboard 57. To this end, the keyboard access detection part 78 is provided independently of the interruption request detection part 77 in order to detect manipulation of the keyboard 57, thereby detecting an address signal which is supplied as an output to the address bus 66 in response to manipulation of the keyboard 57. When the keyboard 57 is manipulated and an interruption request is supplied from the keyboard controller 70 to the CPU 56 through the interruption signal line 71, the CPU 56 determines such manipulation of the keyboard 57 to output an address signal onto the address bus 66.

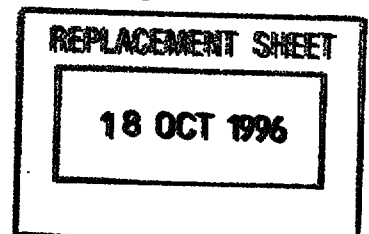
Each of signals from the interruption request detection part 77 and the keyboard access detection part 78 is supplied to a gate 80 through switching means 79, so

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that an output signal from the gate 80 is applied to a reset terminal of the timer 69. The aforementioned switching means 79 is driven to select the external input means generating the signal whose presence is to be detected, so that it is possible to monitor only manipulation of the keyboard 57, only manipulation of the keyboard 57 or the mouse 58, or supply of an input signal from any one of the external input means to the CPU 56, for example, by driving the switching means 79. The switching means 79 is generally driven previously by a manufacturer of the graphics board 51, or in an initial stage of employment of the graphics board 51.

The timer 69 starts a clocking operation upon input of a signal from the gate 80, i.e., upon detection of presence of an input signal from any one of the external input means including the keyboard 57 and the mouse 58. More specifically, the timer 69 is adapted to set a prescribed timer value which is subtract therein with a lapse of time, and is reset when the same receives a signal in the aforementioned reset terminal. When the input detection part 68 detects no presence of an input signal from the external input means again before a lapse of a period of time previously set in the timer 69, an output signal is derived. This output signal is supplied to the aforementioned gate 64 to supply a blank signal

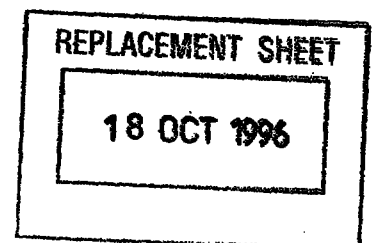


from the D-A converter 63 to the CRT display unit 60 (Fig. 7). Thus, a CRT provided in the CRT display unit 60 displays a homogeneous black picture image, to attain a state of operation of a "screen saver".

If the input detection part 68 detects presence of an input signal from the external input means before a lapse of the period of time previously set in the timer 69 or in an operating state of the "screen saver", the timer 69 is reset to restart a clocking operation. At the same time, the CRT display unit 60 is restored to an ordinary image display state.

The period of time previously set in the timer 69 is preferably rendered variable in response to a request by the operator. When a nonvolatile memory storing the period of time set in the timer 69 is provided on the graphics board 51, further, it is possible to drive a desired "screen saver" without setting the timer 69 when the power supply for the computer is turned off and thereafter again turned on to start the computer.

Although the present invention has been described and illustrated in detail, it is clearly understood that the same is by way of illustration and example only and is not to be taken by way of limitation, the scope of the present invention being limited only by the terms of the appended claims.





CLAIMS:

1. A CRT display unit being connected to a central unit generating a synchronizing signal and a video signal for displaying an image of said video signal, said CRT display unit comprising:

a power supply circuit (3) including a main power supply (4) and an auxiliary power supply (5);

a power circuit (9), being driven by said main power supply (4), including a high voltage circuit (6), a deflection circuit (7) and a video circuit (8);

a synchronous processing circuit (16) for processing said synchronizing signal from said central unit and supplying processed said synchronizing signal to said high voltage circuit (6) and said deflection circuit (7);

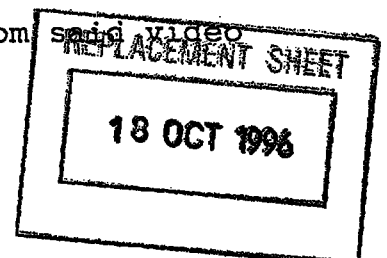
a video input processing circuit (17), including video signal detection means (20) for detecting presence/absence of said video signal from said central unit, for processing said video signal and supplying processed said video signal to said video circuit (8);

a CRT (10) comprising an anode (11) being supplied with a high dc voltage from said high voltage circuit (6), a deflection yoke (12) being supplied with a deflecting current from said deflection circuit (7), a cathode (13) being supplied with a cathode drive signal from said video

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circuit (8), and a heater (14) being supplied with a current from said auxiliary power supply (5);

main power supply control means (15) for controlling said main power supply (4) to turn on/off said power circuit (9) upon detection of presence/absence of said video signal by said video signal detection means (20);

first timer means for clocking at least a turnoff period of time of said power circuit (9); and

auxiliary power supply means (45) for controlling said auxiliary power supply (5) to turn off said heater (14) after a lapse of a period of time being previously set in said first timer means.

2. A CRT display unit in accordance with claim 1, wherein said main power supply control means (15) comprises second timer means for clocking a state with absence of said video signal, and power circuit turnoff means for turning off said power circuit (9) after a lapse of a period of time being previously set in said second timer means.

3. A CRT display unit in accordance with claim 1, wherein said period of time being previously set in said first timer means is variable.

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4. A CRT display unit in accordance with claim 1, wherein said main power supply control means (15) comprises blanking signal generation means for supplying a picture blanking signal to said video circuit (8) for a prescribed period of time when said video signal detection means (20) detects presence of said video signal.

5. A CRT display unit in accordance with claim 1, further comprising means for controlling said power supply circuit (3) to turn off said power circuit (9) and said heater (14) after a lapse of a prescribed period of time upon detection of absence of said synchronizing signal from said central unit.

6. A CRT display unit in accordance with claim 1, wherein said video signal includes video signals of respective colors of red, green and blue, said video signal detection means detecting presence/absence of said red or blue color signal.

7. An extension graphics board (51), to be inserted in an option slot being provided in a computer (56) of an open architecture type, comprising a circuit for supplying a video signal to a CRT display unit (60) in accordance with claim 1 for displaying an image based on an input

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signal from external input means (57, 58), said extension graphics board (51) comprising:

an input detection part (68) for monitoring presence/absence of an interruption request being generated upon receiving of said input signal and detecting presence/absence of said input signal from said external input means (57, 58);

timer means (69) starting a clocking operation upon detection of presence of said input signal by said input detection part (68); and

means (61, 63, 64) for supplying a blank signal to said CRT display unit (60) as said video signal upon no re-detection of presence of said input signal by said input detection part (68) before a lapse of a period of time being previously set in said timer means (69).

8. An extension graphics board in accordance with claim 7, wherein said input means includes a keyboard (57), said input detection part (68) including means (78) for detecting an address signal being supplied to an address bus (66) in response to manipulation of said keyboard (57).

9. An extension graphics board in accordance with claim 7, wherein said external input means includes a

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mouse (58), said input detection part (68) including means (77) for detecting an interruption signal being supplied as an output in response to manipulation of said mouse (58).

10. An extension graphics board in accordance with claim 7, wherein a plurality of said external input means (57, 58) are provided, said timer means (69) starting a clocking operation when said input detection part (68) detects presence of an input signal from any one of said external input means (57, 58).

11. An extension graphics board in accordance with claim 10, wherein said input detection part (68) comprises means (79) for selecting said external input means (57, 58) generating a signal whose presence is to be detected.

12. A CRT display unit being connected to a central unit generating a synchronizing signal and a video signal for displaying an image of said video signal, said CRT display unit comprising:

a power supply circuit (3) including a main power supply (4) and an auxiliary power supply (5);

a power circuit (9), being driven by said main power supply (4), including a high voltage circuit (6), a

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deflection circuit (7) and a video circuit (8);

a synchronous processing circuit (16) for processing said synchronizing signal from said central unit and supplying processed said synchronizing signal to said high voltage circuit (6) and said deflection circuit (7);

a video input processing circuit (17), including video signal detection means (20) for detecting presence/absence of said video signal from said central unit, for processing said video signal and supplying processed said video signal to said video circuit (8);

a CRT (10) comprising an anode (11) being supplied with a high dc voltage from said high voltage circuit (6), a deflection yoke (12) being supplied with a deflecting current from said deflection circuit (7), a cathode (13) being supplied with a cathode drive signal from said video circuit (8), and a heater (14) being supplied with a current from said auxiliary power supply (5);

timer means (15) starting clocking upon detection of absence of said video signal by said video signal detection means (20) for clocking a state with absence of said video signal; and

power supply circuit control means (15) for controlling said power supply circuit (3) to turn off said power circuit (9) and said heater (14) after a lapse of a period of time being previously set in said timer means

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(15).

13. A CRT display unit in accordance with claim 12, further comprising means for controlling said power supply circuit (3) to turn off said power circuit (9) and said heater (14) after a lapse of a prescribed period of time upon detection of absence of said synchronizing signal from said central unit.

14. A CRT display unit in accordance with claim 12, wherein said video signal includes video signals of respective colors of red, green and blue, said video signal detection means detecting presence/absence of said red or blue color signal.

15. An extension graphics board (51), to be inserted in an option slot being provided in a computer (56) of an open architecture type, comprising a circuit for supplying a video signal to a CRT display unit (60) in accordance with claim 12 for displaying an image based on an input signal from external input means (57, 58), said extension graphics board (51) comprising:

an input detection part (68) for monitoring presence/absence of an interruption request being generated upon receiving of said input signal and

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detecting presence/absence of said input signal from said external input means (57, 58);

timer means (69) starting a clocking operation upon detection of presence of said input signal by said input detection part (68); and

means (61, 63, 64) for supplying a blank signal to said CRT display unit (60) as said video signal upon no re-detection of presence of said input signal by said input detection part (68) before a lapse of a period of time being previously set in said timer means (69).

16. An extension graphics board in accordance with claim 15, wherein said input means includes a keyboard (57), said input detection part (68) including means (78) for detecting an address signal being supplied to an address bus (66) in response to manipulation of said keyboard (57).

17. An extension graphics board in accordance with claim 15, wherein said external input means includes a mouse (58), said input detection part (68) including means (77) for detecting an interruption signal being supplied as an output in response to manipulation of said mouse (58).

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18. An extension graphics board in accordance with claim 15, wherein a plurality of said external input means (57, 58) are provided, said timer means (69) starting a clocking operation when said input detection part (68) detects presence of an input signal from any one of said external input means (57, 58).

19. An extension graphics board in accordance with claim 18, wherein said input detection part (68) comprises means (79) for selecting said external input means (57, 58) generating a signal whose presence is to be detected.

20. A power supply control method for a CRT display unit being connected to a central unit generating a video signal for displaying an image of said video signal, said CRT display unit comprising a CRT (10) including an anode (11), a deflection yoke (12), a cathode (13) and a heater (14), a power circuit (9) including a high voltage circuit (6) for applying a high dc voltage to said anode (11), a deflection circuit (7) for supplying a deflecting current to said deflection yoke (12) and a video circuit (8) for supplying a cathode drive signal to said cathode (13), and a power supply circuit (3) including a main power supply (4) providing a power supply for driving said power circuit (9) and an auxiliary power supply (5) for

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supplying a current to said heater (14), said power supply control method comprising the steps of:

controlling said main power supply (4) to turn off said power circuit (9) in response to absence of said video signal; and

controlling said auxiliary power supply (15) to turn off said heater (14) after a lapse of a prescribed period of time in an OFF state of said power circuit (9).

21. A power supply control method in accordance with claim 20, wherein said step of controlling said main power supply (4) to turn off said power circuit (9) comprises a step of maintaining said power circuit (9) in an ON state until a prescribed period of time elapses in a state with absence of said video signal, and a step of turning off said power circuit (9) after a lapse of said prescribed period of time.

22. A power supply control method in accordance with claim 20, wherein a period of time from turnoff of said power circuit (9) to turnoff of said heater (14) is rendered variable.

23. A power supply control method for a CRT display unit being connected to a central unit generating a video

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signal for displaying an image of said video signal, said CRT display unit comprising a CRT (10) including an anode (11), a deflection yoke (12), a cathode (13) and a heater (14), a power circuit (9) including a high voltage circuit (6) for applying a high dc voltage to said anode (11), a deflection circuit (7) for supplying a deflecting current to said deflection yoke (12) and a video circuit (8) for supplying a cathode drive signal to said cathode (13), and a power supply circuit (3) including a main power supply (4) providing a power supply for driving said power circuit (9) and an auxiliary power supply (5) for supplying a current to said heater (14), said power supply control method comprising the step of:

controlling said main power supply (4) and said auxiliary power supply (15) to turn off said power circuit (9) and said heater (14) respectively after a lapse of a prescribed period of time from starting of a state with absence of said video signal.

24. An extension graphics board (51), to be inserted in an option slot being provided in a computer (56) of an open architecture type, comprising a circuit for supplying a video signal to a CRT display unit (60) for displaying an image based on an input signal from external input means (57, 58), said extension graphics board (51)

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comprising:

an input detection part (68) for monitoring presence/absence of an interruption request being generated upon receiving of said input signal and detecting presence/absence of said input signal from said external input means (57, 58);

timer means (69) starting a clocking operation upon detection of presence of said input signal by said input detection part (68); and

means (61, 63, 64) for supplying a blank signal to said CRT display unit (60) as said video signal upon no re-detection of presence of said input signal by said input detection part (68) before a lapse of a period of time being previously set in said timer means (69).

25. An extension graphics board in accordance with claim 24, wherein said input means includes a keyboard (57), said input detection part (68) including means (78) for detecting an address signal being supplied to an address bus (66) in response to manipulation of said keyboard (57).

26. An extension graphics board in accordance with claim 24, wherein said external input means includes a mouse (58), said input detection part (68) including means

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(77) for detecting an interruption signal being supplied as an output in response to manipulation of said mouse (58).

27. An extension graphics board in accordance with claim 24, wherein a plurality of said external input means (57, 58) are provided, said timer means (69) starting a clocking operation when said input detection part (68) detects presence of an input signal from any one of said external input means (57, 58).

28. An extension graphics board in accordance with claim 27, wherein said input detection part (68) comprises means (79) for selecting said external input means (57, 58) generating a signal whose presence is to be detected.

29. A control circuit for controlling the power supply of a CRT monitor coupled to a computer, the control circuit including means for monitoring the video signals supplied to the computer to determine the existence of a blank display, and means operable to switch off the heater of the CRT at a predetermined delay time following said determination.

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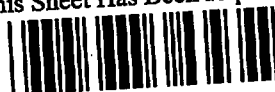


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30. A control circuit as claimed in claim 29, wherein the power supply includes a first supply circuit for supplying power to the heater, and a second supply circuit for supplying power to at least some other parts of the CRT monitor, the control circuit being operable to disable the second power circuit at a predetermined period prior to disabling the first power circuit.

31. A monitoring circuit for monitoring the video signal supplied by a computer to a CRT monitor, the monitoring circuit being operable to detect the absence of a video signal in response to the red and/or blue components, but not the green component, of the video signal.

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**CRT DISPLAY UNIT AND POWER SUPPLY CONTROL
METHOD THEREFOR**

ABSTRACT OF THE DISCLOSURE

When a "screen saver" operates to display a homogeneous black picture image after the same image is continuously displayed on a CRT for a constant period of time, a power supply for a CRT display unit is controlled to be turned off, thereby preventing the CRT display unit from being left for a long time in a power-on state. Namely, a waiting time for 3 minutes, for example, is provided when the "screen saver" so operates that the CRT displays a homogeneous black picture image to turn off a power circuit for the CRT, and then a heater for the CRT is turned off after a lapse of a prescribed period of time within 5 to 60 minutes, for example.

FIGURE 1.

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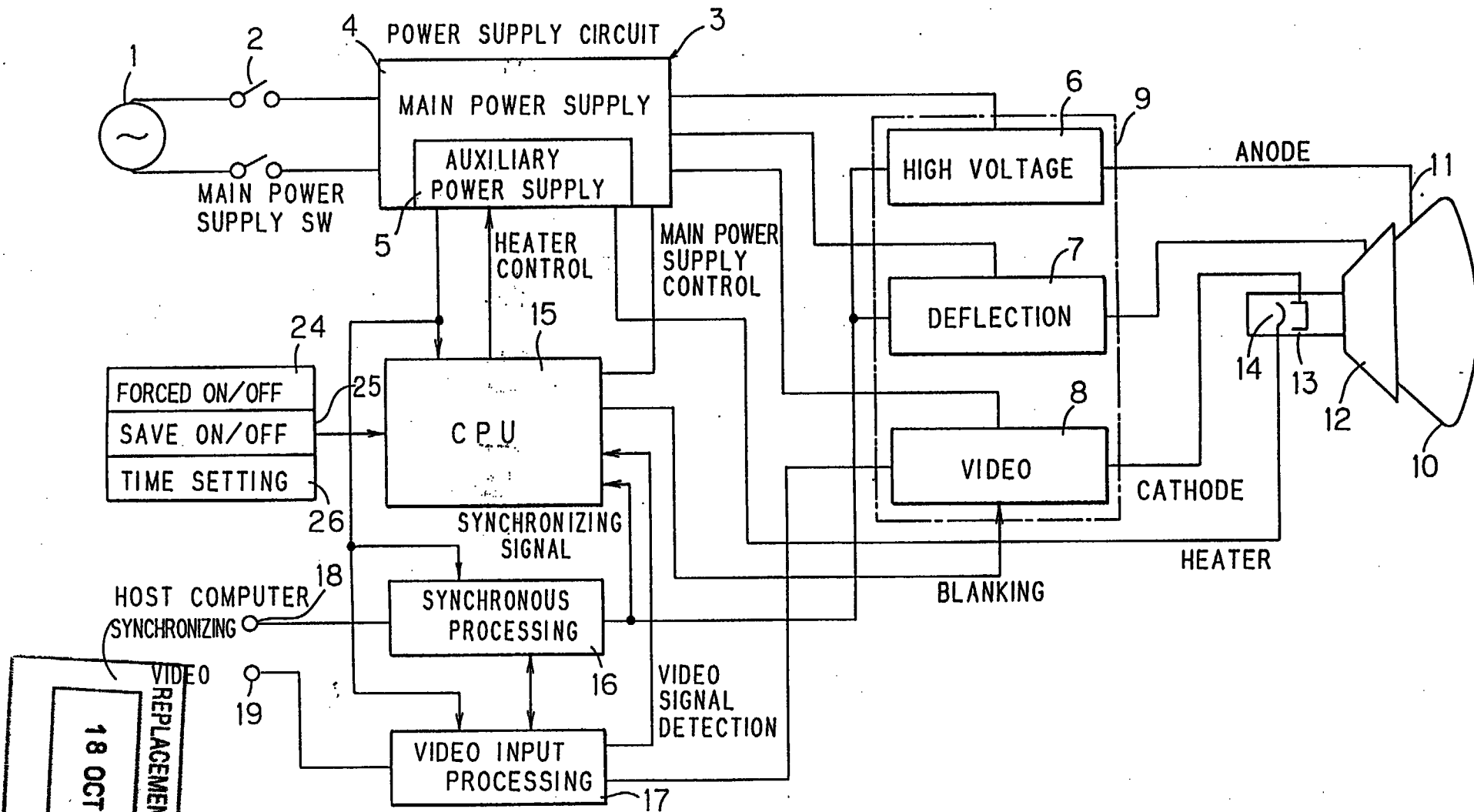


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FIG. 1



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FIG. 2

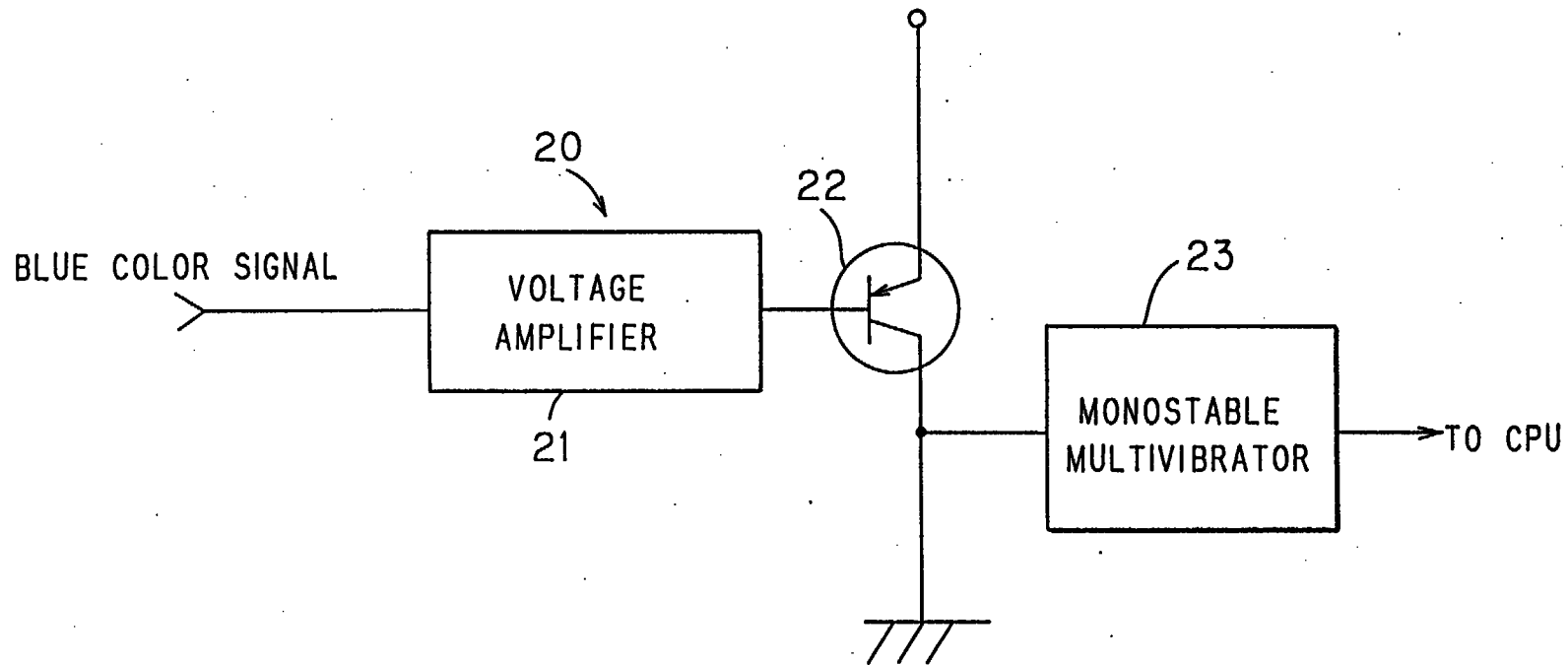


FIG. 3

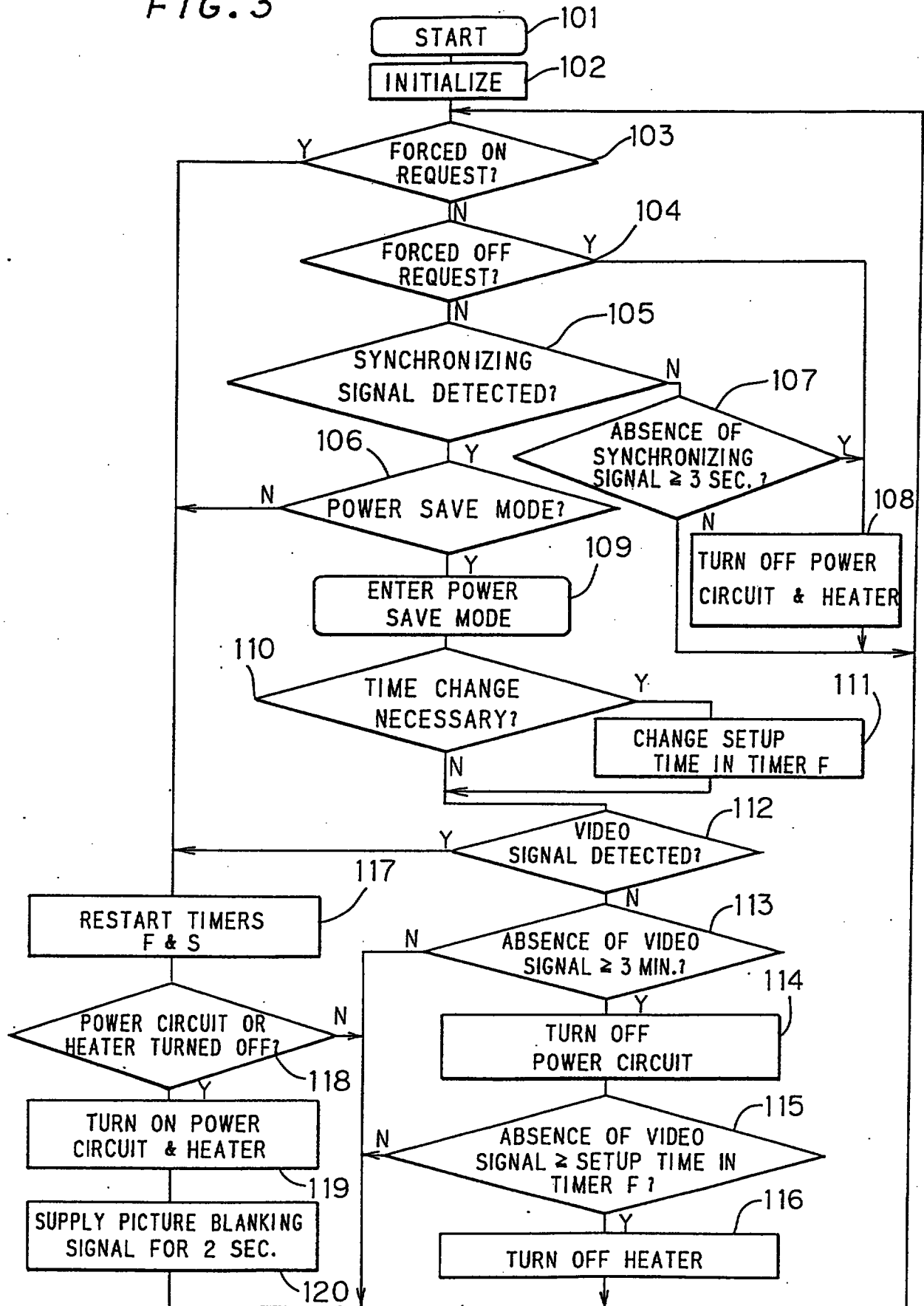


FIG. 4

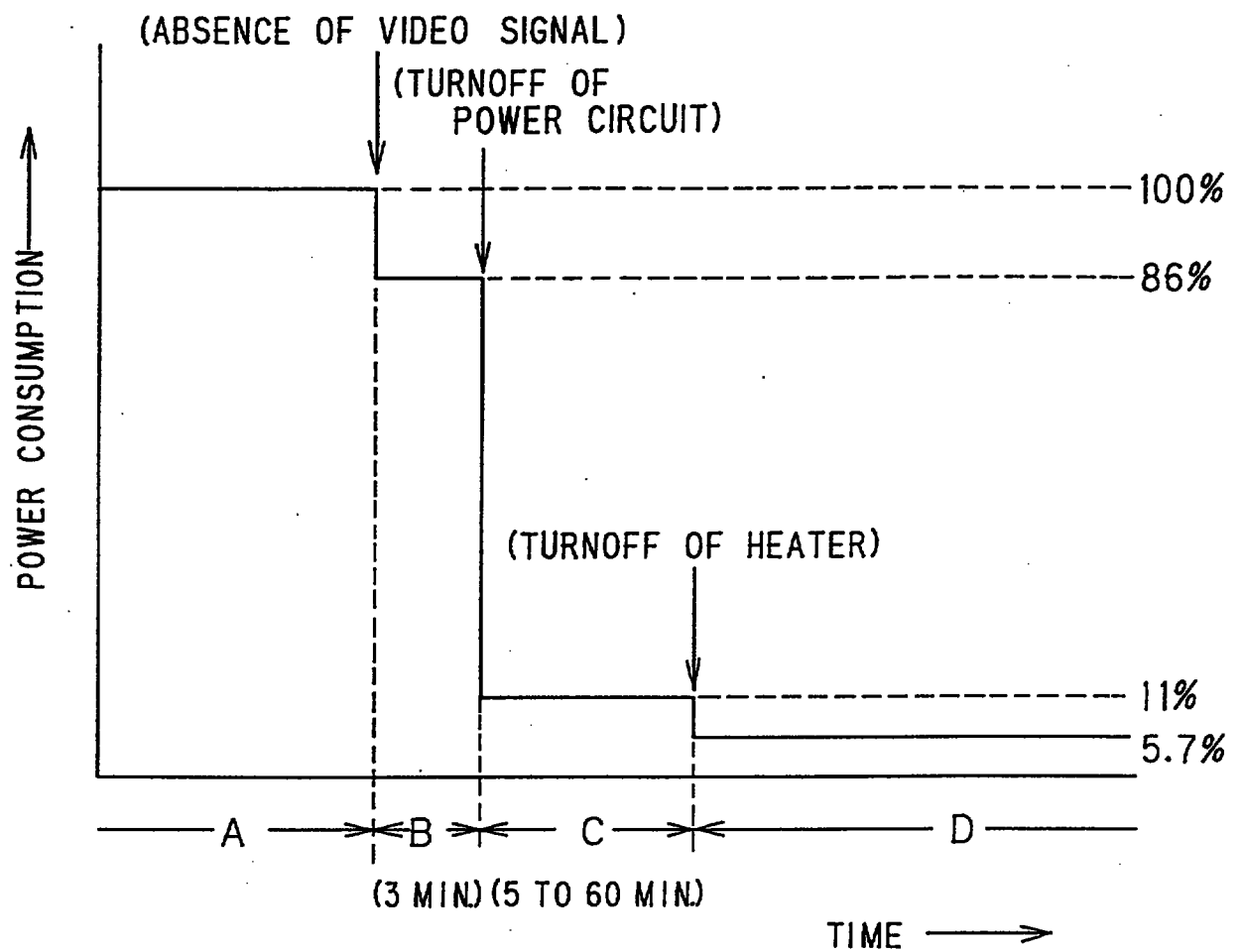


FIG. 5

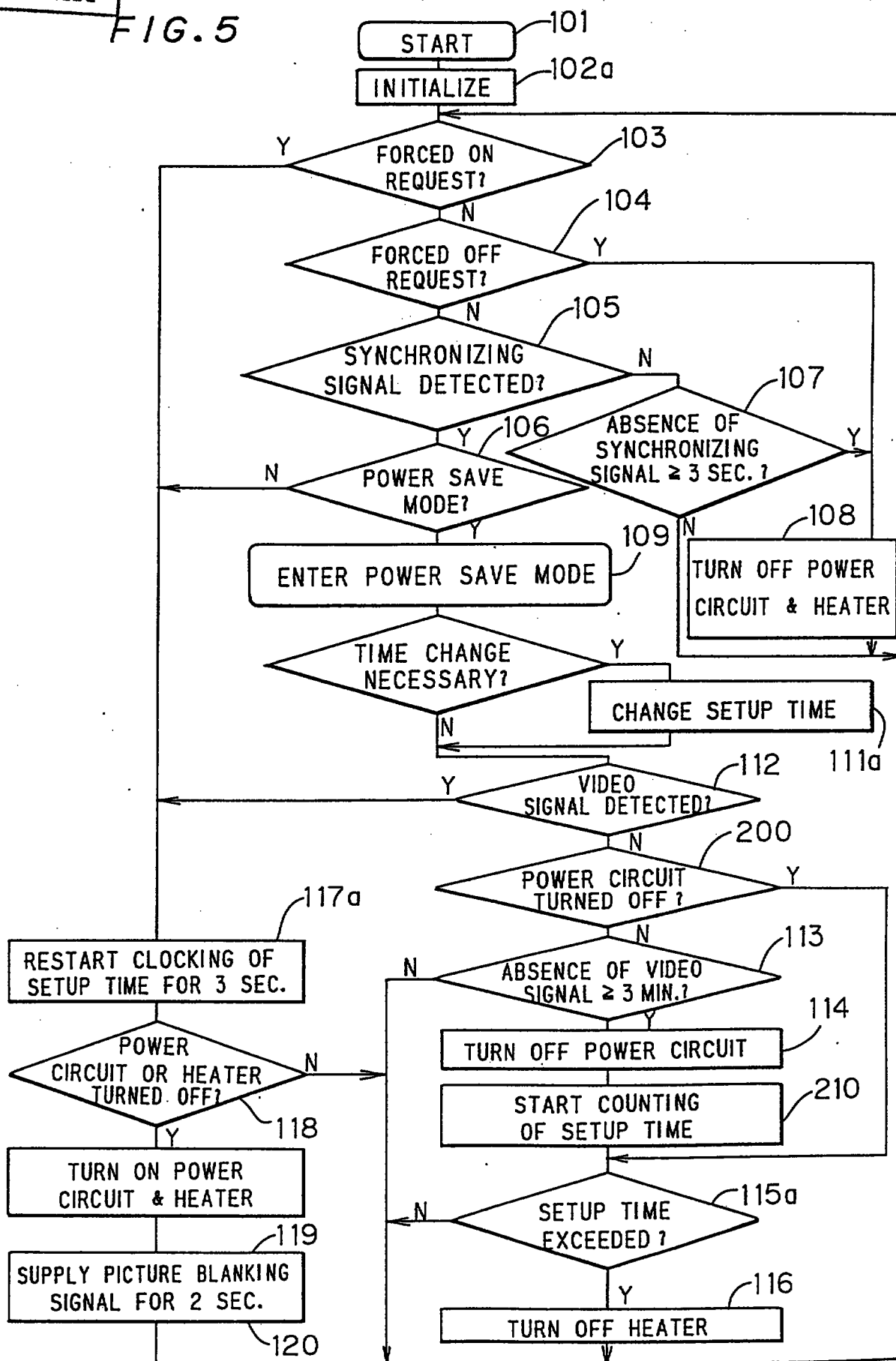


FIG. 6

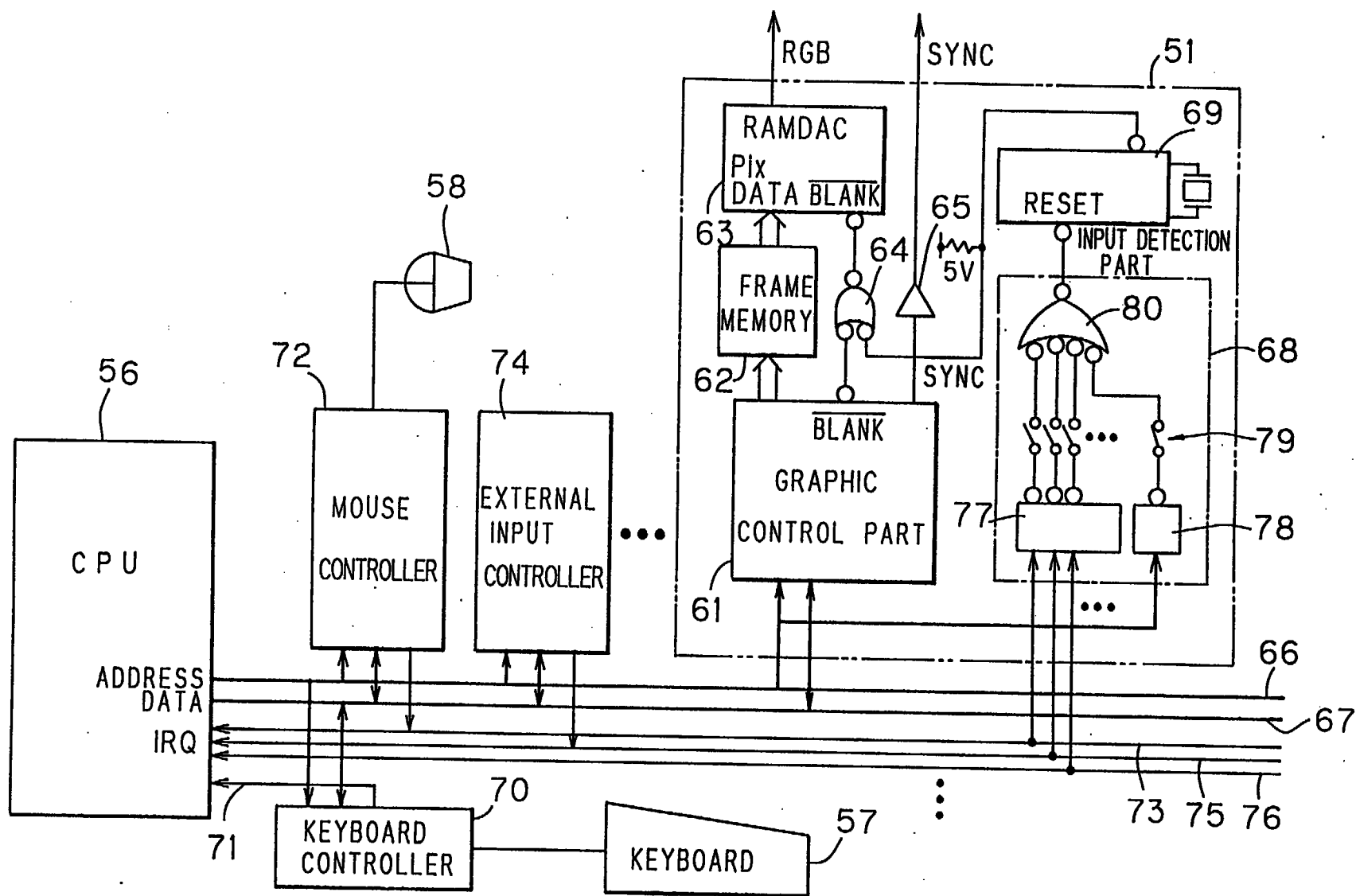
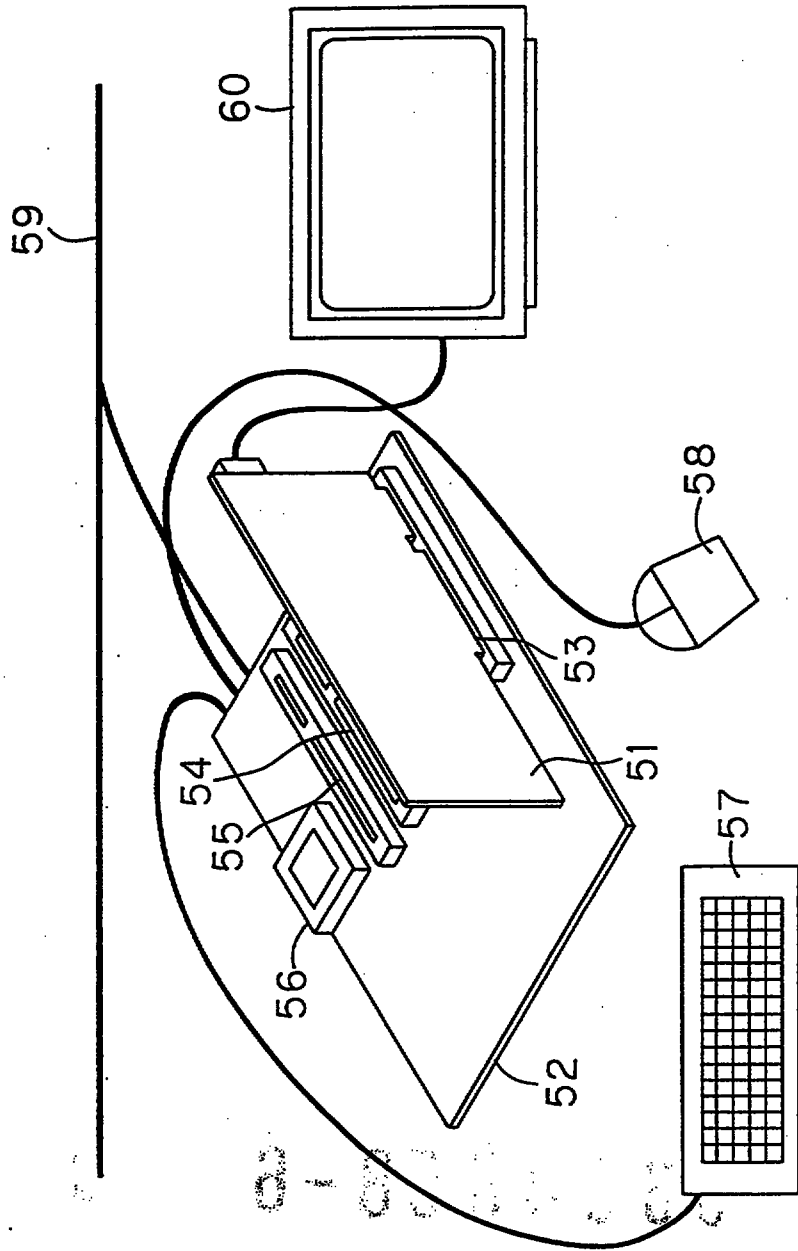


FIG. 7





CLAIMS:

1. A control circuit for controlling the power supply of a CRT display unit coupled to a computer, the CRT display unit comprising a heater (14) and a power circuit (9) including a high voltage circuit (6), a deflection circuit (7) and a video circuit (8), wherein the control circuit includes means (15) for monitoring the video signals supplied by the computer to determine the existence of a blank display, and means (15) operable to switch off the power circuit (9) after said determination,

characterised in that said switching means (15) is further operable to switch off the heater (14) at a predetermined delay time following said determination.

2. A CRT display unit comprising a control circuit according to claim 1, said CRT display unit being connectable to a central unit generating a synchronizing signal and a video signal for displaying an image of said video signal, said CRT display unit comprising:

a power supply circuit (3) including a main power supply (4) and an auxiliary power supply (5);

a power circuit (9), driven by said main power

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supply (4), including a high voltage circuit (6), a deflection circuit (7) and a video circuit (8);

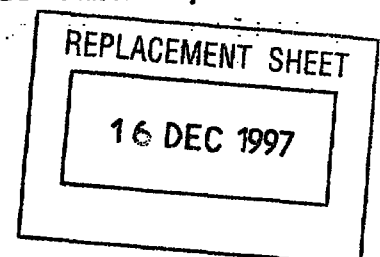
a synchronous processing circuit (16) for processing said synchronizing signal from said central unit and supplying said processed synchronizing signal to said high voltage circuit (6) and said deflection circuit (7);

a video input processing circuit (17), including video signal detection means (20) for detecting presence/absence of said video signal from said central unit, for processing said video signal and supplying said processed video signal to said video circuit (8);

a CRT (10) comprising an anode (11) being supplied with a high dc voltage from said high voltage circuit (6), a deflection yoke (12) supplied with a deflecting current from said deflection circuit (7), a cathode (13) supplied with a cathode drive signal from said video circuit (8), and a heater (14) supplied with a current from said auxiliary power supply (5).

3. A CRT display unit according to claim 2, said control circuit comprising:

main power supply control means (15) for controlling said main power supply (4) to turn on/off





said power circuit (9) in response to detection of the presence/absence of said video signal by said video signal detection means (20);

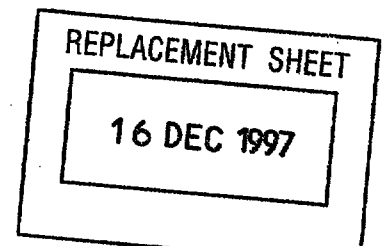
first timer means for clocking period of time in which said power circuit (9) is switched off; and

auxiliary power supply control means (15) for controlling said auxiliary power supply (5) to turn off said heater (14) after a lapse of a previously set period of time in said first timer means.

4. A CRT display unit in accordance with claim 3, wherein said main power supply control means (15) comprises a second timer means for clocking a state in which said video signal is absent, and power circuit turnoff means for turning off said power circuit (9) after a lapse of a previously set period of time in said second timer means.

5. A CRT display unit in accordance with claim 3 or 4, wherein said previously set period of time in said first timer means is variable.

6. A CRT display unit in accordance with any of claims 3 to 5, wherein said main power supply control means (15) comprises blanking signal generation means for supplying a picture blanking signal to said video





circuit (8) for a prescribed period of time when said video signal detection means (20) detects presence of said video signal.

7. A CRT display unit according to claim 2, wherein said control circuit comprises:

timer means (15) starting clocking upon detection of absence of said video signal by said video signal detection means (20) for clocking a state in which said video signal is absent; and

power supply circuit control means (15) for controlling said power supply circuit (3) to turn off said power circuit (9) and said heater (14) after a lapse of a period of time previously set in said timer means (15).

8. A CRT display unit in accordance with any of claims 3 to 7, further comprising means (15) for controlling said power supply circuit (3) to turn off said power circuit (9) and said heater (14) after a lapse of a prescribed period of time upon detection of absence of said synchronizing signal from said central unit.

9. A CRT display unit in accordance with any of claims 3 to 8, wherein said video signal includes

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video signals of respective colors of red, green and blue, said video signal detection means (20) detecting the presence/absence of said red or blue color signal.

10. A CRT display unit in accordance with any of claims 2 to 9 and an extension graphics board (51), to be inserted in an option slot provided in a computer (56) of an open architecture type, comprising a circuit for supplying a video signal to said CRT display unit (60) to display an image based on an input signal from external input means (57, 58), said extension graphics board (51) comprising:

an input detection part (68) for monitoring presence/absence of an interruption request generated in response to receipt of said input signal and detecting presence/absence of said input signal from said external input means (57, 58);

third timer means (69) starting a clocking operation in response to detection of the presence of said input signal by said input detection part (68); and

means (61, 63, 64) for supplying a blank signal to said CRT display unit (60) as said video signal when the presence of said input signal by said input detection part (68) is not re-detected before a lapse of a previously set period of time in said third timer

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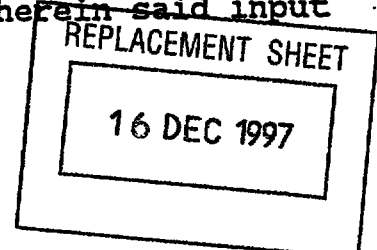
means (69).

11. A CRT display unit and an extension graphics board in accordance with claim 10, wherein said input means includes a keyboard (57), said input detection part (68) including means (78) for detecting an address signal supplied to an address bus (66) in response to manipulation of said keyboard (57).

12. A CRT display unit and an extension graphics board in accordance with claim 10 or 11, wherein said external input means includes a mouse (58), said input detection part (68) including means (77) for detecting an interruption signal supplied as an output in response to manipulation of said mouse (58).

13. A CRT display unit and an extension graphics board in accordance with any of claims 10 to 12, wherein a plurality of said external input means (57, 58) are provided, said third timer means (69) starting a clocking operation when said input detection part (68) detects presence of an input signal from any one of said external input means (57, 58).

14. A CRT display unit and an extension graphics board in accordance with claim 13, wherein said input





detection part (62) comprises means (79) for selecting said external input means (57, 58) generating a signal whose presence is to be detected.

15. A power supply control method for a CRT display unit being connected to a central unit generating a video signal for displaying an image of said video signal, said CRT display unit comprising a CRT (10) including an anode (11), a deflection yoke (12), a cathode (13) and a heater (14), a power circuit (9) including a high voltage circuit (6) for applying a high dc voltage to said anode (11), a deflection circuit (7) for supplying a deflecting current to said deflection yoke (12) and a video circuit (8) for supplying a cathode drive signal to said cathode (13), and a power supply circuit (3) including a main power supply (4) providing a power supply for driving said power circuit (9) and an auxiliary power supply (5) for supplying a current to said heater (14), said power supply control method comprising the steps of:

controlling said main power supply (4) to turn off said power circuit (9) in response to absence of said video signal; and

controlling said auxiliary power supply (5) to turn off said heater (14) after a lapse of a

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prescribed period of time in an OFF state of said power circuit (9).

16. A power supply control method in accordance with claim 15, wherein said step of controlling said main power supply (4) to turn off said power circuit (9) comprises a step of maintaining said power circuit (9) in an ON state until a prescribed period of time elapses in a state with absence of said video signal, and a step of turning off said power circuit (9) after a lapse of said prescribed period of time.

17. A power supply control method in accordance with claim 15 or 16, wherein a period of time from turnoff of said power circuit (9) to turnoff of said heater (14) is rendered variable.

18. A power supply control method for a CRT display unit being connected to a central unit generating a video signal for displaying an image of said video signal, said CRT display unit comprising a CRT (10) including an anode (11), a deflection yoke (12), a cathode (13) and a heater (14), a power circuit (9) including a high voltage circuit (6) for applying a high dc voltage to said anode (11), a deflection circuit (7) for supplying a deflecting

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current to said deflection yoke (12) and a video circuit (8) for supplying a cathode drive signal to said cathode (13), and a power supply circuit (3) including a main power supply (4) providing a power supply for driving said power circuit (9) and an auxiliary power supply (5) for supplying a current to said heater (14), said power supply control method comprising the step of:

controlling said main power supply (4) and said auxiliary power supply (5) to turn off said power circuit (9) and said heater (14) respectively after a lapse of a prescribed period of time from starting of a state with absence of said video signal.

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CRT DISPLAY UNIT AND POWER SUPPLY CONTROL
METHOD THEREFOR

ABSTRACT OF THE DISCLOSURE

When a "screen saver" operates to display a homogeneous black picture image after the same image is continuously displayed on a CRT for a constant period of time, a power supply for a CRT display unit is controlled to be turned off, thereby preventing the CRT display unit from being left for a long time in a power-on state. Namely, a waiting time for 3 minutes, for example, is provided when the "screen saver" so operates that the CRT displays a homogeneous black picture image to turn off a power circuit for the CRT, and then a heater for the CRT is turned off after a lapse of a prescribed period of time within 5 to 60 minutes, for example.

FIGURE 1.

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current to said deflection yoke (12) and a video circuit (8) for supplying a cathode drive signal to said cathode (13), and a power supply circuit (3) including a main power supply (4) providing a power supply for driving said power circuit (9) and an auxiliary power supply (5) for supplying a current to said heater (14), said power supply control method comprising the step of:

controlling said main power supply (4) and said auxiliary power supply (15) to turn off said power circuit (9) and said heater (14) respectively after a lapse of a prescribed period of time from starting of a state with absence of said video signal.

19. A power supply control method according to claim 18, comprising controlling said main power supply and said auxiliary power supply to provide a first stage of power saving and a second stage of power saving in which the saving is increased in relation to the first stage.

20. A power supply method according to claim 19, comprising entering said first stage of power saving in response to detection of the absence of the video signal from said control unit.

21. A power supply method according to claim 19 or 20, comprising entering said second stage of power saving in response to detection of the absence of the video signal from said control unit.

22. A power supply method according to claim 19, 20 or 21, comprising entering said second stage of power saving in response to detection of the absence of a synchronising

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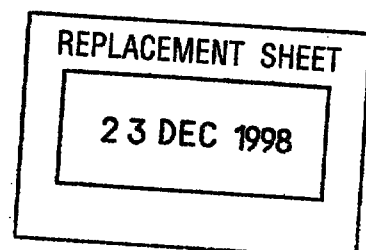


signal from said control unit.

23. A power supply method according to any of claims 19 to 22, wherein said main power supply is switched off in said first stage of power saving.

24. A power supply method according to any of claims 19 to 23, wherein said main power supply and said auxiliary power supply are switched off in said second stage of power saving.

25. A power supply method according to any of claims 15 to 24, wherein said control unit is a host computer.



**CRT DISPLAY UNIT AND POWER SUPPLY CONTROL
METHOD THEREFOR**

ABSTRACT OF THE DISCLOSURE

When a "screen saver" operates to display a homogeneous black picture image after the same image is continuously displayed on a CRT for a constant period of time, a power supply for a CRT display unit is controlled to be turned off, thereby preventing the CRT display unit from being left for a long time in a power-on state. Namely, a waiting time for 3 minutes, for example, is provided when the "screen saver" so operates that the CRT displays a homogeneous black picture image to turn off a power circuit for the CRT, and then a heater for the CRT is turned off after a lapse of a prescribed period of time within 5 to 60 minutes, for example.

FIGURE 1.

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current to said deflection yoke (12) and a video circuit (8) for supplying a cathode drive signal to said cathode (13), and a power supply circuit (3) including a main power supply (4) providing a power supply for driving said power circuit (9) and an auxiliary power supply (5) for supplying a current to said heater (14), said power supply control method comprising the step of:

controlling said main power supply (4) and said auxiliary power supply (5) to turn off said power circuit (9) and said heater (14) respectively after a lapse of a prescribed period of time from starting of a state with absence of said video signal.

19. A power supply control method according to claim 18, comprising controlling said main power supply and said auxiliary power supply to provide a first stage of power saving and a second stage of power saving in which the saving is increased in relation to the first stage.

20. A power supply method according to claim 19, comprising entering said first stage of power saving in response to detection of the absence of the video signal from said control unit.

21. A power supply method according to claim 19 or 20, comprising entering said second stage of power saving in response to detection of the absence of the video signal from said control unit.

22. A power supply method according to claim 19, 20 or 21, comprising entering said second stage of power saving in response to detection of the absence of a synchronising

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