Office de la Propriété Intellectuelle du Canada
Un organisme d'Industrie Canada

Canadian Intellectual Property Office
An agency of Industry Canada

CA 2747916 A1 2012/04/01

(21) 2 747 916

(12) DEMANDE DE BREVET CANADIEN
CANADIAN PATENT APPLICATION

(13) A1

(22) Date de dépôt/Filing Date: 2011/08/03

(41) Mise à la disp. pub./Open to Public Insp.: 2012/04/01

(30) Priorité/Priority: 2010/10/01 (US12/896,691)

(51) Cl.Int./Int.Cl. *H02H 11/00* (2006.01), *H02J 13/00* (2006.01)

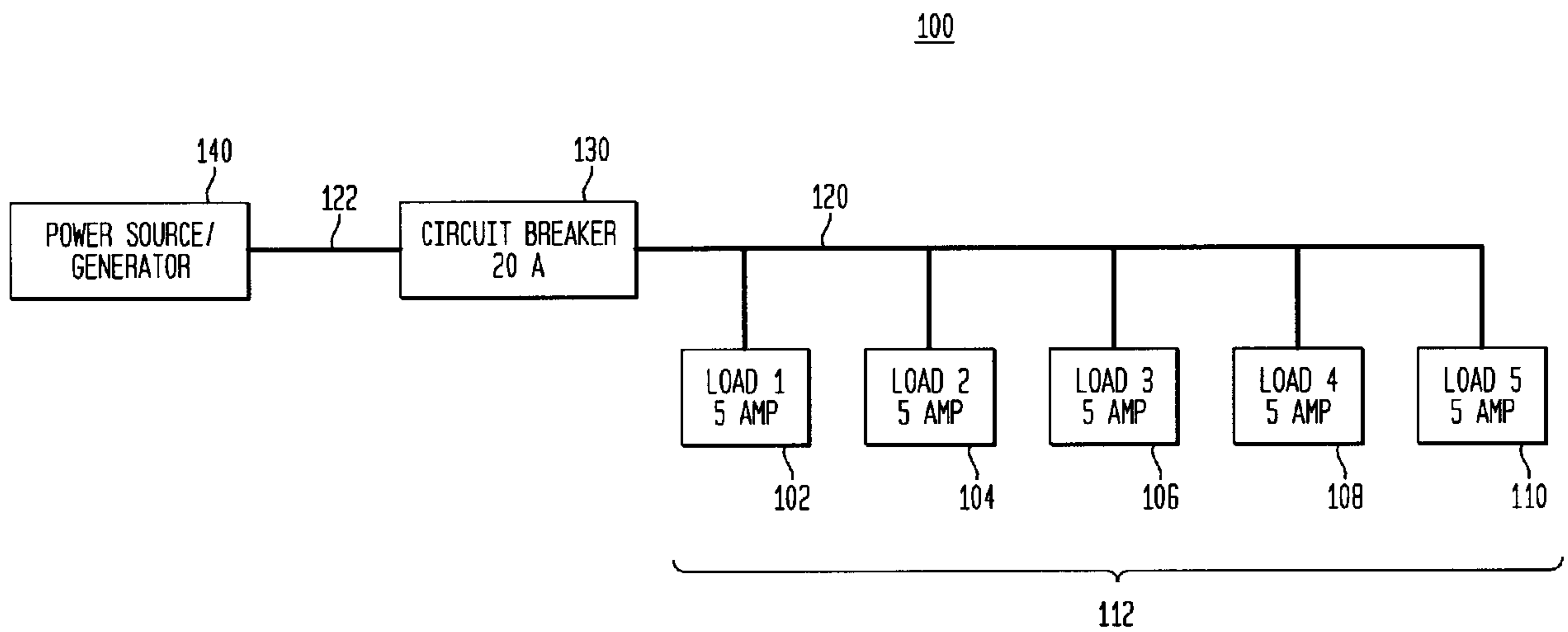
(71) Demandeur/Applicant:
THE BOEING COMPANY, US

(72) Inventeur/Inventor:
LARSEN, TY A., US

(74) Agent: SMART & BIGGAR

(54) Titre : PRELEVEMENT DE COURANT A COORDINATION DE CHARGE POUR CIRCUITS A COURANT ADMISSIBLE LIMITE

(54) Title: LOAD COORDINATING POWER DRAW FOR LIMITED AMPACITY CIRCUITS



(57) Abrégé/Abstract:
Presented is a system and method for coordinating power usage of electrical devices on a power bus. In an embodiment, the system includes a power bus, a first electrical device that is able to intermittently draw power from the power bus, a second electrical device that is able to intermittently draws power from the power bus, and a means for sensing when the second electrical device is intermittently drawing power. When the second electrical device is intermittently drawing power, the first electrical device is inhibited from drawing power from the power bus.

ABSTRACT

Presented is a system and method for coordinating power usage of electrical devices on a power bus. In an embodiment, the system includes a power bus, a first electrical device that is able to intermittently draw power from the power bus, a second electrical device that is able to intermittently draws power from the power bus, and a means for sensing when the second electrical device is intermittently drawing power. When the second electrical device is intermittently drawing power, the first electrical device is inhibited from drawing power from the power bus.

LOAD COORDINATING POWER DRAW FOR LIMITED AMPACITY CIRCUITS

BACKGROUND

Embodiments of the subject matter described herein relate generally to systems and methods for reducing electrical system loads drawn concurrently by devices requiring intermittent power.

When designing an electrical system for powering multiple devices, a conservative approach is to design the electrical system to handle the sum of the expected maximum loads to be drawn by each device. That sum of the loads is used to determine the size and electrical capacity of the wires used to connect the devices to the power source and also is used to determine the circuit protection necessary to protect the circuit and connected devices.

The assumption for the conservative approach is that there may be cases where all of the loads may be turned on and need power simultaneously. However, in some cases, there may be devices that only require power intermittently. An electrical system designed to provide continuous power will therefore use larger, heavier gauge wires and will generally be more expensive than necessary. In systems where space and weight are important factors, such as aviation power systems, the heavier gauge wires and larger power sources are unnecessary weight that must be carried by the vehicle, causing the vehicle to use additional fuel to carry the extra weight and reducing space in the airframe that could be utilized by other systems.

Standard practice in the art is to assume something called "demand factor." Demand factor is prevalent in residential applications. The demand factor is an estimate of how many devices might be simultaneously operating at any one time. All residential cabling and protective features are derated by this amount, thereby being somewhat cheaper. However, if the demand factor is not properly calculated or if too many devices simultaneously attempt to draw power, then the circuit breaker or fuse will trip. Circuit breaker tripping is considered an accepted risk, principally because devices can be unplugged and redistributed to different outlets in a home if necessary.

However, for some systems, such as vehicle electrical systems, it is desirable to avoid circuit breaker tripping. While excessive power draw can cause circuit breakers to trip, it also has the potential to overheat the electrical wiring. Excessive power cycling also increases stress on systems and components, increasing failure rates and reducing the useful lifespan of the equipment.

SUMMARY

Presented is a system and method for coordinating power among multiple devices on limited ampacity circuits. In an embodiment, a system includes a power bus, a first electrical device that is able to intermittently draw power from the power bus, a second electrical device that is able to intermittently draws power from the power bus, and a means for sensing when the second electrical device is intermittently drawing power. When the second electrical device is intermittently drawing power, the first electrical device is inhibited from drawing power from the power bus.

In an embodiment, a method includes the operations of connecting a number of intelligent loads to an electrical circuit, energizing the electrical circuit, and coordinating the drawing of power by the intelligent loads to prevent a circuit breaker from disconnecting the electrical circuit from the power source.

In an embodiment, an apparatus includes a switch for intermittently drawing power from a power bus, a load in communication with the switch, a sensor that detects the electrical state of the power bus, and a controller that is in communication with the switch and sensor, and controls the intermittent drawing of power from the power bus for powering the load based in part on the electrical state of the power bus.

The features, functions, and advantages discussed can be achieved independently in various embodiments of the present invention or may be combined in yet other embodiments further details of which can be seen with reference to the following description and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying figures depict various embodiments of the system and method for coordinating power drawing among multiple devices on limited ampacity circuits. A brief description of each figure is provided below. Elements with the same reference number in each figure indicated identical or functionally similar elements. Additionally, the left-most digit(s) of a reference number indicate the drawing in which the reference number first appears.

Fig. **1** is a diagram of a single line circuit for a simplified example system;

Fig. **2** is a diagram of a single line circuit for a self-coordinating power system in one embodiment of the system and method for coordinating power drawing among multiple devices on limited ampacity circuits;

Fig. **3** is a diagram of a self-coordinating power unit in one embodiment of the system and method for coordinating power drawing among multiple devices on limited ampacity circuits;

Figs. **4**a and **4**b are diagrams illustrating current and voltage for six solenoids operating concurrently in a simplified example system;

Figs. **5**a and **5**b are diagrams illustrating current and voltage for the six solenoids of Figures **4**a and **4**b using self-coordinating power units in one embodiment of the system and method for coordinating power drawing among multiple devices on limited ampacity circuits; and

Fig. **6** is a flowchart of a method of operation for circuitry associated with a device that requires power intermittently in one embodiment of the system and method for coordinating power drawing among multiple devices on limited ampacity circuits.

DETAILED DESCRIPTION

The following detailed description is merely illustrative in nature and is not intended to limit the embodiments of the invention or the application and uses of such embodiments. Furthermore, there is no intention to be bound by any expressed or implied theory presented in the preceding technical field, background, brief summary or the following detailed description.

A conservative approach when designing an electrical system for powering multiple devices is to design the electrical system to handle the sum of the expected maximum loads drawn by each device. That sum determines the electrical capacity of the wires used to connect the devices to the power source and also determines the circuit protection necessary to protect the circuit and the other connected devices.

In Figure **1**, an example diagram of a simplified system **100** is presented. In the simplified system **100**, a series of loads **102**, **104**, **106**, **108**, **110** (collectively loads **112**) each draw up to **5** Amps of current each when turned on. Each of the loads **112** is connected to a circuit breaker **130** through a common wire, or bus **120**. The circuit breaker **130** is connected to the power source **140** through a power wire, alternatively known as a power feed **122**. For the simplified system **100**, a demand factor is estimated at **80%**. A demand factor of **80%** indicates that the simplified system **100** is designed so that no more than **80%** of the maximum current draw for all of the loads **112** together is anticipated at any one time. The maximum possible current draw for the loads **112** together is **25** Amps (**5** total loads, **102 104**, **106**, **108**, **110**, each drawing **5** Amps when turned on), assuming that all of the loads **112** draw current at the same time. The circuit breaker **130** will therefore trip if there is any load on the bus **120** that is greater than **20** Amps (**25** Amps * **80%** demand factor = **20** Amps). The bus **120** and protective features therefore only have to support a maximum of **20** Amps, however the bus **120** may be larger to reduce voltage drops along the length of the bus **120** due to the loads **112**. The wire of the bus **120** is sized appropriately to handle **20** Amps.

The simplified system **100** has drawbacks however. If too many of the loads **112** draw power at the same time, the circuit breaker **130** will trip. If one of the loads **112** malfunctions but draws less than **20** Amps, then the circuit breaker **130** will not trip despite the fault condition. Also, when more than one load **112** is drawing power from the bus **120**, different loads **112** may see different voltages based on voltage drops across the bus **120**. For example, if loads **102**, **104**, and **106** are drawing current from the bus **120**, then the voltage present at loads **108** and **110** may be reduced somewhat from the voltage provided by the power source **140**.

Referring now to Figure **2**, a load coordinating system **200** is presented to address these and other issues. Similar to the simplified system **100** of Figure **1**, the load coordinating system **200** has a power source **140** that provides power to a circuit breaker **130** through a power feed **122**. The load coordinating system **200** advantageously uses a low power bus **220** that connects the circuit breaker **130** to the intelligent loads **202**, **204**, **206**, **208**, **210** (collectively intelligent loads **212**.) The intelligent loads **212** coordinate with other intelligent loads **212** when drawing power from the low power bus **220**.

Referring now to Figures **2** and **3**, in an embodiment, the intelligent load **212** comprises a load **112**, and a sense/control **300**. In an embodiment, the sense/control **300** has a switch **318** for interconnecting the load **112**, the energy storage means **302**, and the low power bus **220**. In an embodiment, the sense/control **300** has an energy storage means **302**. In an embodiment, one or more intelligent loads **212** share an energy storage means **302**. In embodiments, the energy storage means **302** is a battery, such as a rechargeable Nickel-Cadmium (NiCad), Lithium-Ion (Li-Ion), or lithium polymer battery. In embodiments, the energy storage means **302** is a capacitive device. In embodiments, the energy storage means **302** stores sufficient energy to power an intelligent load **212** for one or more full activations. By providing power for one or more uses, the energy storage means **302** allows the intelligent load **212** to wait for extended periods of time to schedule power drawing from the low power bus **220** for recharging the energy storage means.

In embodiments, the energy storage means **302** provides power for operation of the sensing electronics **304** associated with an intelligent load **212**. In these embodiments, the energy storage means **302** provides an initial source of power for the intelligent load **212** to enable sensing of the current state of the low power bus **220**. This allows the intelligent load **212** to slow start when power is first presented on the low power bus **220**. This prevents a common cause of nuisance trips, which occur when power is first presented on a bus **120**. This condition occurs when multiple loads **112** immediately begin to draw power as soon as the bus **120** is energized after having been powered off for a period of time. By preventing the intelligent load **212** from immediately drawing power simultaneously when the low power bus **220** is first energized, one cause of nuisance trips is eliminated.

In an embodiment, the sense/control **300** has sensing electronics **304** that enables sensing of the current state of the low power bus **220**. In an embodiment, one or more intelligent loads **212** share sensing electronics **304**. In embodiments, the sensing electronics **304** comprises means for sensing the voltage, current, or power particulars of the low power pus. Non-limiting examples of means for sensing include a voltage sensor, an amperage sensor, a magnetic field sensor for example an inductive coil **306** for placement in proximity to, or around, the low power bus **220**, an electric field sensor **308** such as a Hall effect device, a solid-state sensor, or any other electrical, magnetic, or electromagnetic sensor as would be understood in the art. In embodiments, the sensing electronics **304** directly senses the electrical condition of the low power bus **220**, for example by monitoring the voltage on the low power bus **220** or the current passing through a portion of the low power bus **220**. In embodiments, the sensing electronics **304** passively monitors the low power bus **220** using sensors **306**, **308** that monitor capacitive or magnetic changes due to changes in electric or magnetic fields proximate to the low power bus **220**. In an embodiment, the sensing electronics **304** includes associated circuitry to produce a signal indicating the current state of the low power bus **220**.

In a non-limiting example, the sensing electronics **304** comprises an analog to digital converter (A/D convertor **310**), a processor or CPU **312** for controlling interactions between elements of the sense/control **300**, and/or a communications port **316** for receiving a sense signal from an external device. In non-limiting embodiments, the CPU **312** is any kind of processor including, but not limited to, a DSP, an ARM processor, a programmable logic device, an ASIC, or any other processor as would be understood by one familiar in the art. In embodiments, the CPU **312** is electronics adapted to perform decisions based on inputs from the other components of the sense/control. The CPU **312** therefore is a controller that determines when the switch **318** interconnects the load **112**, the energy storage means **302**, and the low power bus **220**. As inputs, the CPU can use programming, inputs from sensors **306**, **308**, inputs from other devices such as other intelligent loads **212**, inputs from other components of the sense/control **300**, or inputs received as communications signals from the communications port **316**.

In an embodiment, the sense/control **300** and/or sensing electronics **304** are completely integrated into the intelligent load **212**. In an embodiment, the sensing electronics **304** or sense/control **300** is an ASIC, hybrid chip, or other customizable chip, circuit or combination of chips and/or circuits for performing the sensing or sense/control functions. In an embodiment, the sensing electronics **304** is separate from the rest of the intelligent load **212**. In this embodiment, and embodiments where the intelligent load **212** shares sensing electronics **304** with another intelligent load **212**, the sensing electronics **304** includes a sense input **314** for connecting the sensing electronics **304** with the sensors **306**, **308** or a sense output (not shown) of another intelligent load **212**. In an embodiment, the intelligent load **212** further comprises a communications port or communication means **316** for exchanging signals with other intelligent loads **212**. In non-limiting embodiments, the communications means **316** includes one or more data lines, a serial data communications port, a wireless data communications package, and a power line communications device for communicating over the low power bus **220**.

In embodiments, before drawing power from the low power bus **220** each intelligent load **212** of the load coordinating system **200** uses the sensing electronics **304** to sense the current state of the low power bus **220**. In embodiments, an intelligent load **212** coordinates with other intelligent loads **212** to schedule power draws from the low power bus **220**. In embodiments, the intelligent loads **212** schedule power draws with the circuit breaker **130** or a computer system (not shown) that perform intelligent queuing or scheduling of power draws. In embodiments, both loads **112** and intelligent loads **212** are present on the same bus **120**, **220**. In embodiments, the intelligent loads **212** wait until power is not being drawn on the low power bus **220** before attempting to draw power. In embodiments, the intelligent loads **212** determine whether there is available capacity left on the low power bus **220** before drawing power, thereby allowing two or more intelligent loads **212** to simultaneously draw power without tripping the circuit breaker **130**.

In an embodiment, if users try to activate a number of intelligent loads **212** simultaneously, the intelligent loads **212** detect whether or not to activate and draw current. In one embodiment, the intelligent loads **212** are prioritized, for example using dip switches, or any other means of establishing priority. The highest priority intelligent load **212** activates first. In another embodiment, the intelligent load **212** that is activated first draws power first. In either embodiment, the other intelligent loads **212** go into standby mode for a chosen length of time. The length of time can be static, for example **1** second before trying again, or can use a back-off method, such as increasing the amount of time between attempts in **500** msec increments. The length of time can also be adaptive or have a random variable, such a **500** msec +/- **200** msec before retesting the low power bus **220**. In these embodiments, instead of the circuit breaker tripping as could occur in the simplified system **100** of Figure **1**, some intelligent loads **122** will see a delay before activating. The faster each intelligent load **212** activates to draw current and then deactivates, the larger the number of intelligent loads **212** that can be installed together on a common low power bus **220** if the latency between activating is low. In an embodiment where the intelligent loads **212** communicate, an intelligent load **212** can signal another intelligent load **212** to deactivate allowing an override function. For example, if a load coordinating system **200** is first turned on, some intelligent loads **212** that have energy storage means **302** may start activating to charge the energy storage means **302**. If a user attempts to activate another intelligent load **212** manually, that intelligent load **212** sends a signal to the other intelligent loads **212** to deactivate.

In embodiments, the intelligent loads **212** communicate with other intelligent loads **212**, with a circuit breaker **130**, with a power source **140**, or with a computing system (not shown) to coordinate power draws. For example, an intelligent load **212** may communicate with a power source **140**, such as a generator of an aircraft engine, to signal an anticipated use power, thereby allowing the generator to idle when power is not needed. An intelligent load **212** may communicate with a circuit breaker **130**, thereby alerting the circuit breaker **130** to anticipated power use. The power draw from a device or intelligent load **212** is characterized, enabling intelligent circuit breaking for power drawing activity outside of the expected range for normal power drawing activities. If the power draw is out of the expected range of acceptable power use for that intelligent load **212**, the circuit breaker **130** intelligently trips. In an embodiment, the circuit breaker **130** compares profiles of anticipated power use to actual power use by the intelligent load **212**. For example, activation of a door lock may have a particular signature profile that can be used as a template to identify proper power draw by the intelligent load **212** associated with the door lock activation. For example, referring to Figures **4**a and **4**b, a current chart **400** and voltage chart **410** for **28** V solenoids is illustrated. The current chart **400** and voltage chart **410** illustrate that the current draw **402** and voltage drop **404** for solenoids have an identifiable characteristic, a spike that occurs shortly after energizing, that can be used to develop a signature profile.

Continuing to refer to the current chart **400** and voltage chart **410** of Figures **4**a and **4**b, a current draw **402** and voltage drop **404** are illustrated for a **28** V circuit, powering six **0.4** Amp solenoids as loads **112**. The configuration for the current chart **400** and voltage chart **410** of Figures **4**a and **4**b is similar to the simplified system **100** in that no intelligent loads **212** are utilized. The initial current draw **402** is **0** Amps and the voltage drop **404** is **0** V. The bus **120** is a nominal **28** V circuit. At time **0.5**s, one solenoid load **112** is activated, causing **0.4** Amps of current to be drawn. This also causes an approximate **0.75** V drop on the **28** V circuit. Between times **1**s and **3**s, other solenoid loads **112** are activated and deactivated. At time **1.5**s, multiple solenoids are activated causing up to **1.8** Amps to be drawn, and causing a **3.5** V drop in the **28** V circuit. In the example illustrated in Figures **4**a and **4**b, the circuit breaker **130**, power source **140**, and wiring **122**, **120** must be capable of handling **1.8** Amps to prevent overheating or a circuit breaker **130** from tripping. Moreover, the solenoid loads **112** or other loads **112**, must be capable of operating using the lower **24.5** voltage provided on the **28** V circuit during periods of heavy utilization.

Referring now to the current charge of for intelligent loads **500** and voltage chart for intelligent loads **510** of Figures **5**a and **5**b, a reduced current draw **502** and reduced voltage drop **504** are illustrated for a **28** V circuit, powering six **0.4** Amp solenoids configured as intelligent loads **212**. The initial reduced current draw **502** is **0** Amps and the reduced voltage drop **504** is **0** V. The lower bus **220** is a nominal **28** V circuit. At time **1.0**s, one solenoid configured as an intelligent load **212** is activated, causing **0.4** Amps of current to be drawn. This also causes an approximate **0.75** V drop on the **28** V circuit. However, no other solenoids configured as intelligent loads **212** activate until the first solenoid deactivates. It takes somewhat longer for all of the solenoids to activate than in Figures **4**a and **4**b, however the intelligent loads **212** offer savings that offset the additional time for low duty-cycle loads. One benefit is that the reduced current draw **502** never rises above **0.4** Amps, and the reduced voltage drop **504** is never above about **0.75** Volts, so that the **28** V circuit never drops below about **27.25** Volts. This advantageously allows the use of circuit breakers **130**, power sources **140**, and wiring **122**, **120** that only have to be capable of handling **0.4** Amps, and solenoids that work for voltages above **27.25** Volts.

The disclosed system and method provides substantial improvements when used for powering intelligent loads **500** that are used intermittently, for example electronic lock, cargo door motors, and single use maintenance displays. These and other low-usage loads can be installed with a minimum amount of power infrastructure necessary to support them, thereby allowing the electrical system designer to use lower power components, generators and wiring. Low power generators and wiring are generally smaller, have a lower cost, and have a lower weight, resulting in savings in space utilization, lower costs during manufacturing, and lower recurring fuel costs for the customer because of the decreased weight of the aircraft. Therefore the disclosed system and method advantageously permits the design and implementation of economical power systems and power infrastructures that are smaller and lighter than systems designed using conventional approaches.

Referring now to Figure **6**, an exemplary flowchart of the method of operation **600** for an intelligent load **212** is presented. In a first step, power is turned on **602** to the low power bus **220**. The intelligent load **212** enters a state of waiting for activation **604**, for example a user activating the intelligent load **212**, such as a user opening a cargo door. Once the intelligent load **212** is activated **606**, for example by a signal or button press, the intelligent load **212** monitors the low power bus **220** for other intelligent loads **212** that might be actively drawing current from the low power bus **220**. If another load is actively drawing current, then the intelligent load **212** delays **610** activating and then monitors **608** the low power bus **220** again.

If no other load **212** is drawing current, the intelligent load **212** activates or operates **612** after which the intelligent load **212** returns to the operation of waiting for activation **604**.

Additional embodiments may be claimed as shown in the following paragraphs.

A**18**. An apparatus, comprising: a switch for intermittently drawing power from a power bus; a load in electrical communication with said switch; a sensor for sensing an electrical state of said power bus; and a controller in communications with said switch and said sensing means; and wherein said controller controls said switch to intermittently draw power from said power bus for powering said load, based at least in part on said electrical state of said power bus.

A**19**. The apparatus of claim A**18**, further comprising: a battery in electrical communication with said power bus through said switch; and wherein said battery is charged with a stored power using an intermittent power draw through said switch; and wherein said load is in electrical communication with said battery; and wherein said battery provides said stored power to said load when said switch is not drawing power from said power bus.

A**20**. The apparatus of claim A**18**, wherein said controller prevents said switch from drawing power from said power bus based upon a condition selected from the group consisting of a voltage drop on said power bus due to a second load drawing power from said power bus; a current increase on said power bus due to said second load drawing power from said power bus; and a received signal indicating said power bus is in use.

The embodiments of the invention shown in the drawings and described above are exemplary of numerous embodiments that may be made within the scope of the appended claims. It is contemplated that numerous other configurations of the load coordinating system **100** may be created taking advantage of the disclosed approach. It is the applicant's intention that the scope of the patent issuing herefrom will be limited only by the scope of the appended claims.

What is claimed is:

1. A system, comprising:

a power bus;

a first electrically powered device adapted to intermittently draw power from said power bus;

a second electrically powered device adapted to intermittently draw power from said power bus; and,

a means for sensing that said second electronically powered device is drawing power from said power bus, and

wherein said first electrically powered device is inhibited from drawing power from said power bus when said second electronically powered device is drawing power from said power bus.

2. The system of claim **1**, wherein said power bus comprises a wire that connects said first electrically powered device and said second electrically powered device to a circuit breaker, said wire having a limited current carrying capacity that is less than the sum of a current draw of said first electrically powered device and said second electrically powered device.

3. The system of claim **1**, wherein said means for sensing is selected from the group consisting of a voltage sensor, an amperage sensor, a magnetic field sensor, a coil for sensing a current in said power bus, a Hall effect device, a solid-state sensor, an electrical sensor, a magnetic sensor, and an electromagnetic sensor.

4. The system of claim **1**, further comprising an energy storage means for providing energy to said first electrically powered device for a full activation of said first electrically powered device.

5. The system of claim **4**, wherein said energy storage means is selected from the group consisting of a battery, rechargeable battery, a NiCad battery, a Li-Ion battery, a lithium polymer battery, and a capacitor.

6. The system of claim **1**, wherein said first electrically powered device coordinates an intermittent power draw from said power bus with said second electrically powered device.

7. The system of claim **6**, further comprising a means for prioritizing an intermittent power draw from said power bus of said first electrically powered device in relation to an intermittent power draw of said second electrically powered device.

8. The system of claim **6**, further comprising a communications means for communicating an intermittent power draw by said first electrically powered device to said second electrically powered device, and wherein said communications means is selected from the group consisting of a data line, a serial data communications module, a wireless data communication module, and a power bus communications module.

9. A method, comprising the operations of:

connecting a plurality of intelligent loads to an electrical circuit;

energizing said electrical circuit; and

coordinating a plurality of intermittent power draws, from said electrical circuit, by said plurality of intelligent loads to prevent a circuit breaker from disconnecting said electrical circuit from a power source.

10. The method of claim **9**, further comprising the operation of:

inhibiting an intermittent power draw from a first intelligent load during an intermittent power draw of a second intelligent load.

11. The method of claim **10**, further comprising the operations of:

sensing said intermittent power draw of said second intelligent load; and

inhibiting an intermittent power draw by said first intelligent load during said operation of sensing said intermittent power draw of said second intelligent load.

12. The method of claim **11**, wherein said operation of sensing is performed by a sensor selected from the group consisting of a voltage sensor, an amperage sensor, a magnetic field sensor, a coil for sensing a current, a Hall effect device, a solid-state sensor, an electrical sensor, a magnetic sensor, and an electromagnetic sensor.

13. The method of claim **9**, wherein said operation of coordinating further comprises:

communicating an intermittent power draw by said first intelligent load to inhibit an intermittent power draw by said second intelligent load using a communications medium selected from the group consisting of a data line, a serial data communications module, a wireless data communication module, and a power bus communications module.

14. The method of claim **9**, further comprising the operation of:

prioritizing a plurality of intermittent power draws, from said electrical circuit, of said plurality of intelligent loads.

15. The method of claim **9**, further comprising the operations of:

powering an activation of a first intelligent load from energy stored in an energy storage means; and,

charging said energy storage means using an intermittent power draw.

16. The method of claim **15**, wherein said energy storage means is selected from the group consisting of a battery, rechargeable battery, a NiCad battery, a Li-Ion battery, a lithium polymer battery, and a capacitor.

17. The method of claim **9**, wherein said electrical circuit is a limited current carrying electrical circuit such that simultaneous activation of more than one intelligent load triggers said circuit breaker to disconnect said electrical circuit from a power source.

FIG. 1

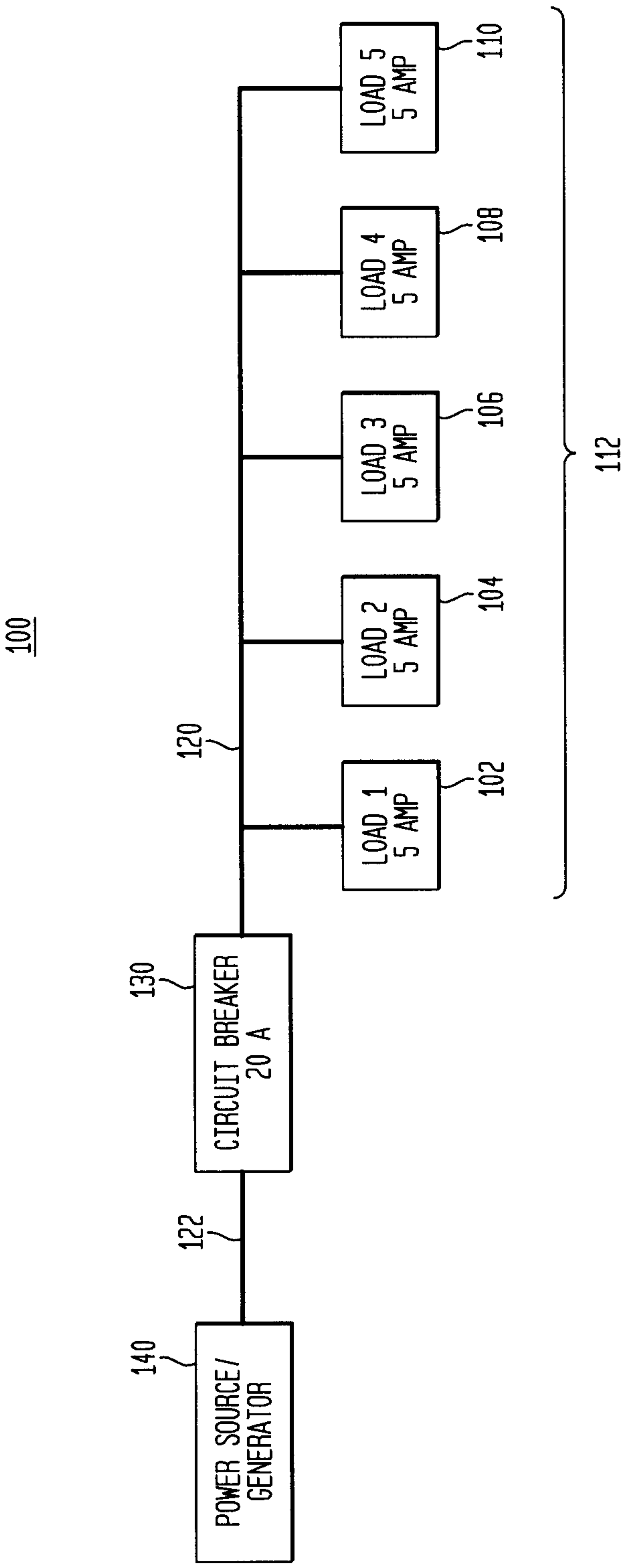

100
POWER SOURCE/
GENERATOR
140
122
CIRCUIT BREAKER
20 A
130
120
LOAD 1
5 AMP
102
LOAD 2
5 AMP
104
LOAD 3
5 AMP
106
LOAD 4
5 AMP
108
LOAD 5
5 AMP
110
112

FIG. 2

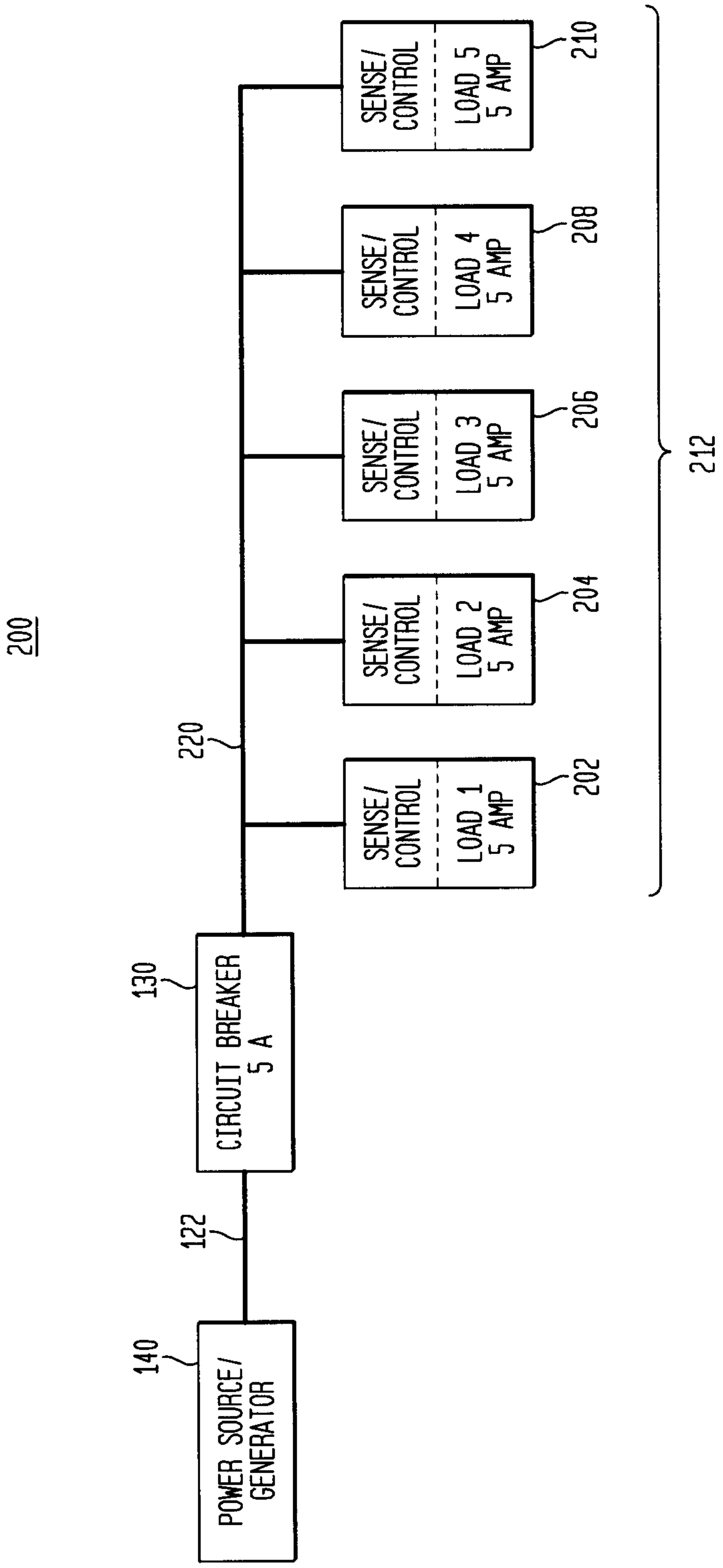

200
POWER SOURCE/
GENERATOR
140
122
CIRCUIT BREAKER
5 A
130
220
SENSE/
CONTROL
LOAD 1
5 AMP
202
SENSE/
CONTROL
LOAD 2
5 AMP
204
SENSE/
CONTROL
LOAD 3
5 AMP
206
SENSE/
CONTROL
LOAD 4
5 AMP
208
SENSE/
CONTROL
LOAD 5
5 AMP
210
212

FIG. 3

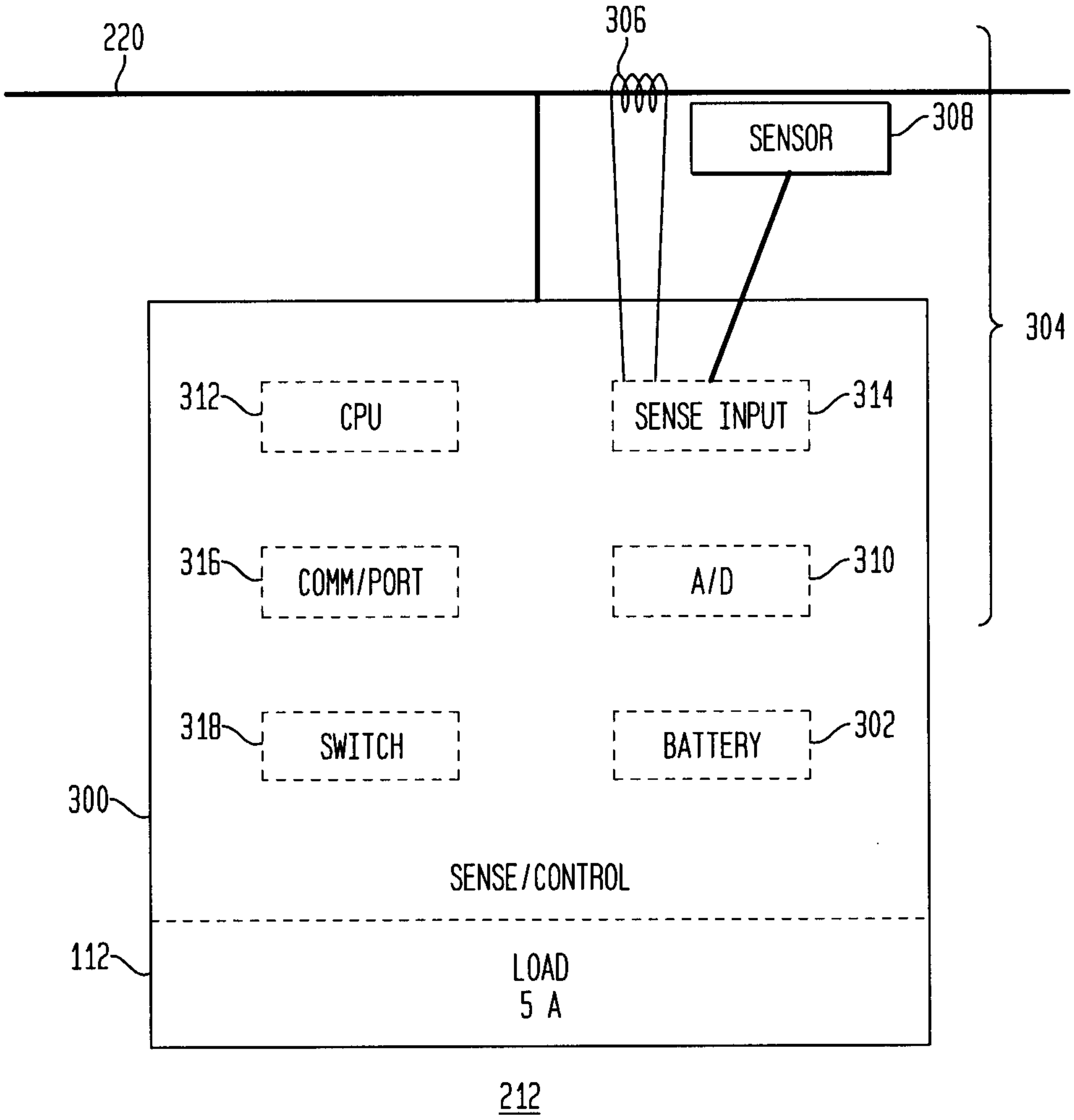

220
306
SENSOR
308
304
312
CPU
SENSE INPUT
314
316
COMM/PORT
A/D
310
318
SWITCH
BATTERY
302
300
SENSE/CONTROL
112
LOAD
5 A
212

FIG. 4A

402

400

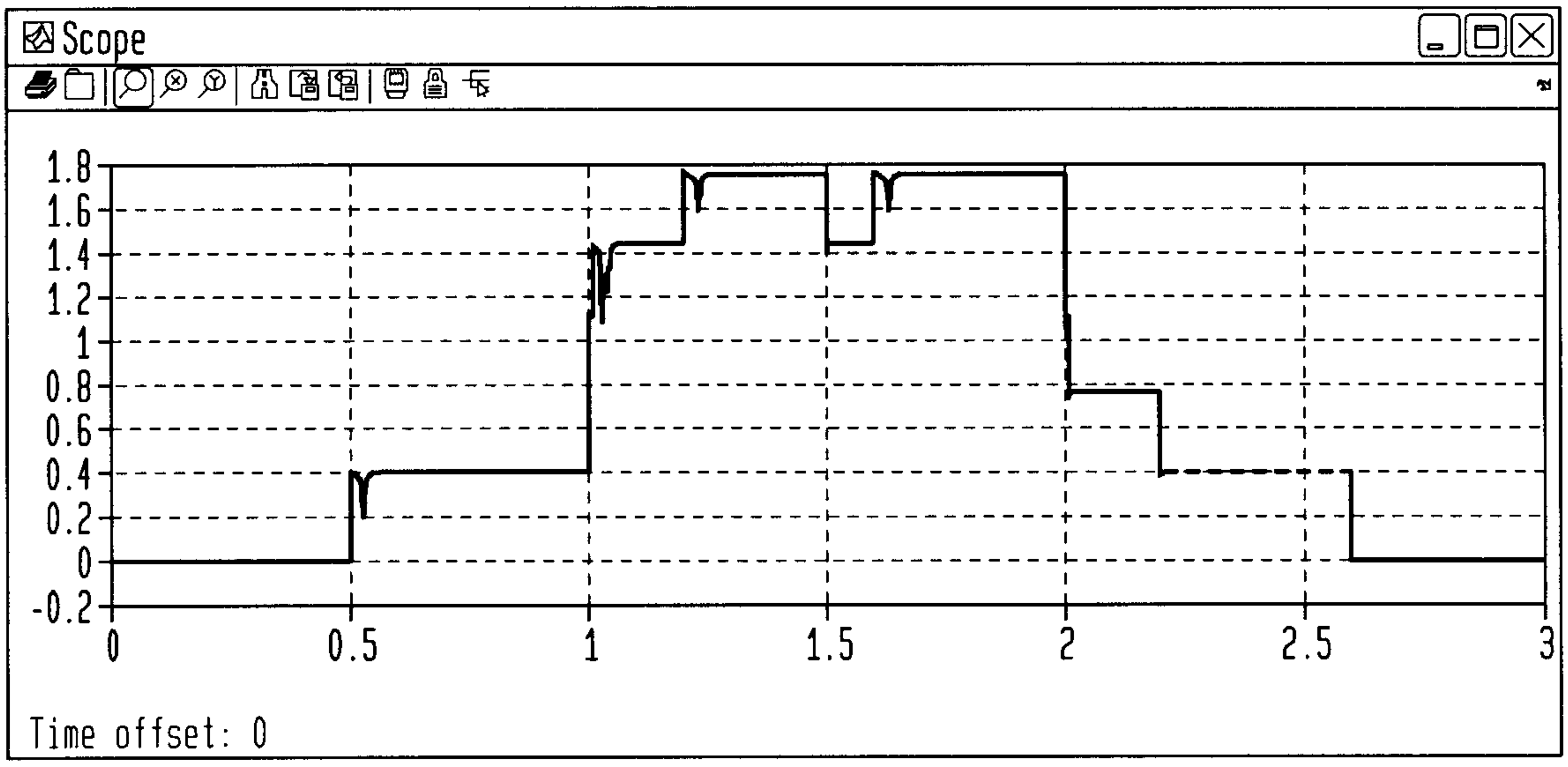


FIG. 4B

404

410

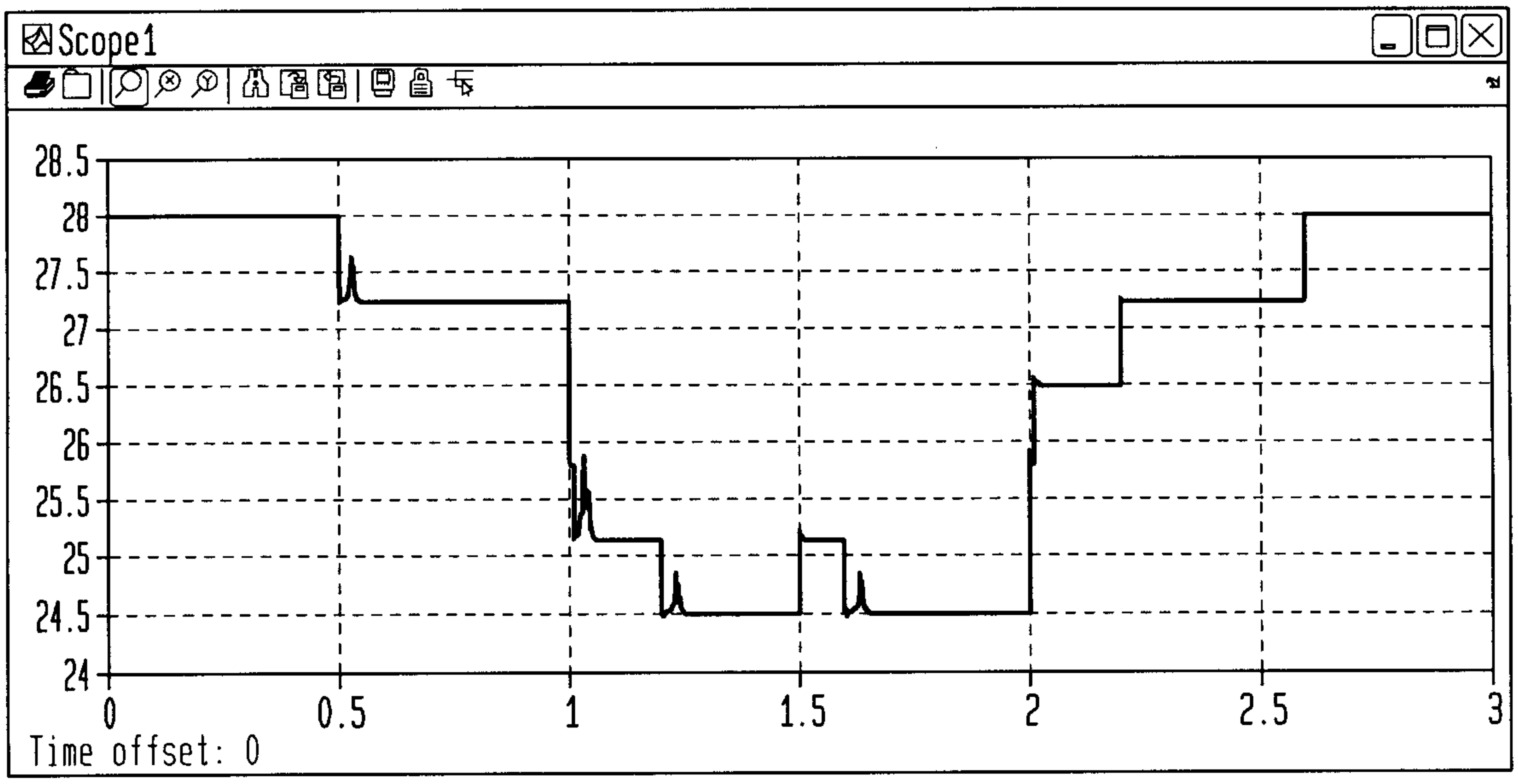


FIG. 5A

502

500

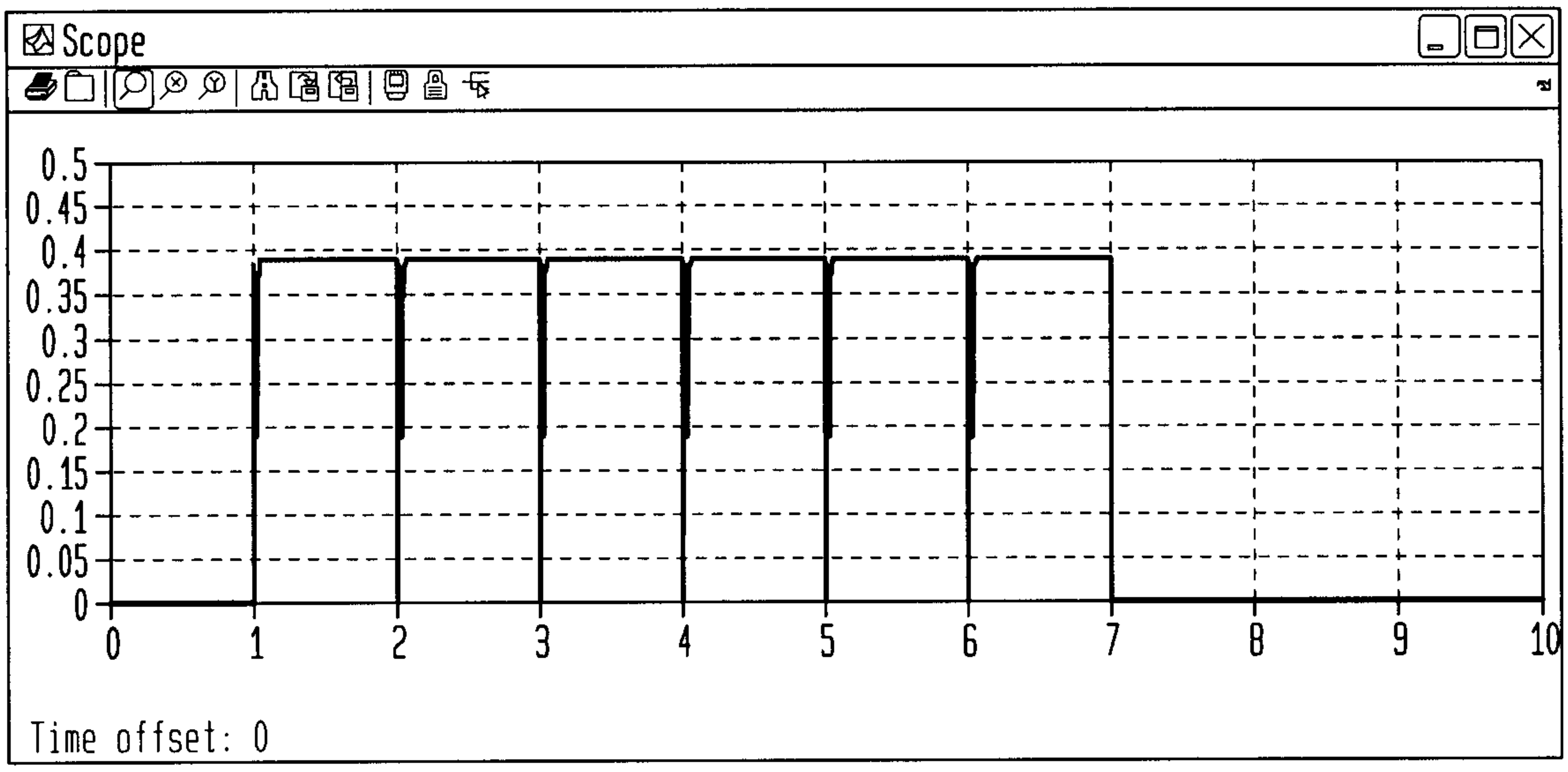


FIG. 5B

504

510

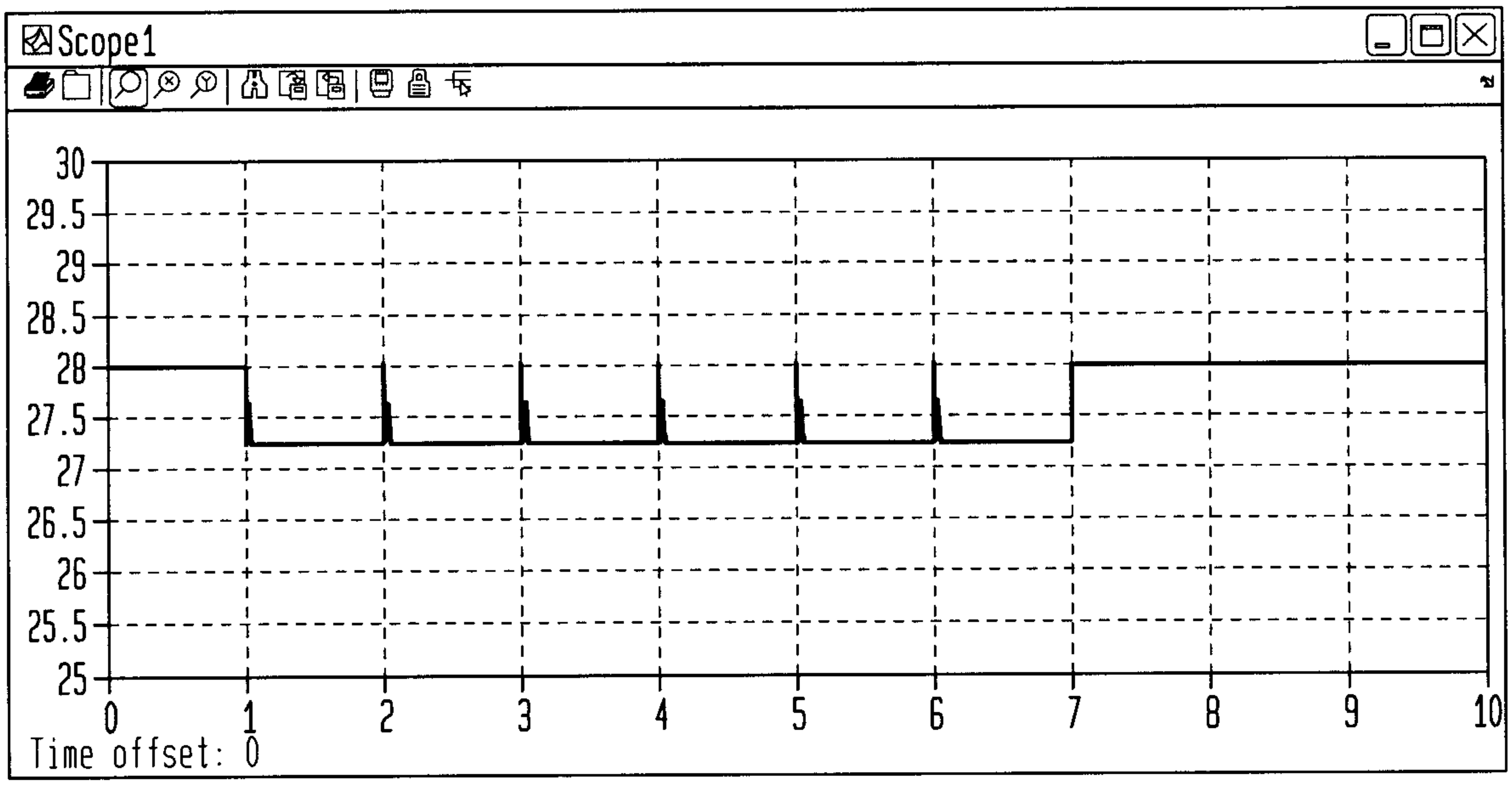
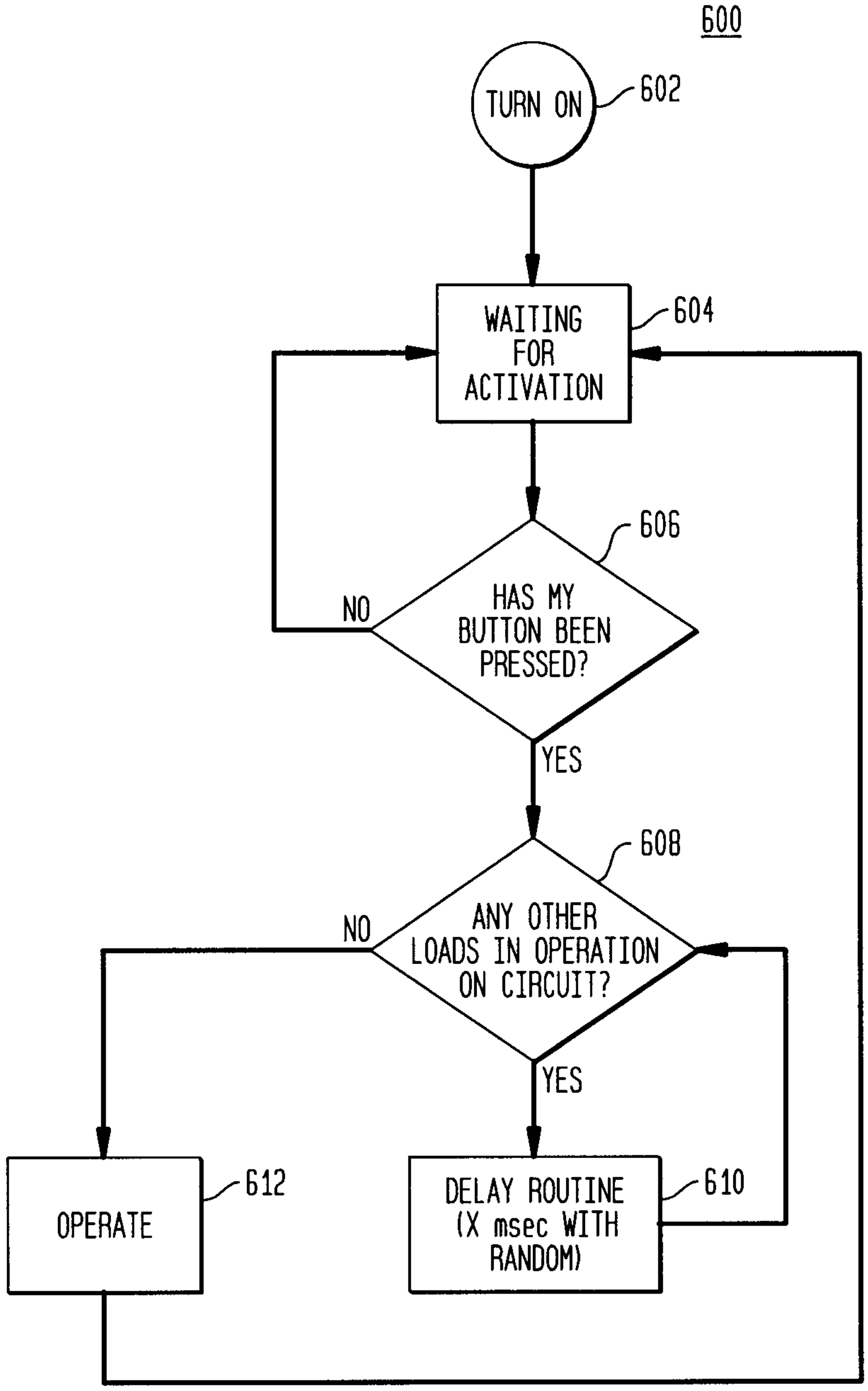


FIG. 6


600
TURN ON
602
WAITING FOR ACTIVATION
604
HAS MY BUTTON BEEN PRESSED?
606
NO
YES
ANY OTHER LOADS IN OPERATION ON CIRCUIT?
608
NO
YES
OPERATE
612
DELAY ROUTINE (X msec WITH RANDOM)
610


100
140
130
122
120
POWER SOURCE/
GENERATOR
CIRCUIT BREAKER
20 A
LOAD 1
5 AMP
LOAD 2
5 AMP
LOAD 3
5 AMP
LOAD 4
5 AMP
LOAD 5
5 AMP
102
104
106
108
110
112