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(54) **Remote engine stop/start system with backup motor control**

Vorrichtung zum Fernanlassen und Abschalten einer Brennkraftmaschine mit Steuerung eines Hilfsmotors

Dispositif de démarrage et d'arrêt à distance d'un moteur avec commande d'un moteur auxiliaire

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- **PATENT ABSTRACTS OF JAPAN vol. 007, no. 211 (M-243), 17 September 1983 (1983-09-17) -& JP 58 106148 A (KYOKUTO KAIHATSU KOGYO KK), 24 June 1983 (1983-06-24)**

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Description

REFERENCE TO RELATED APPLICATION

[0001] This application claims priority from provisional application serial number 60/477,908 filed June 12, 2003.

BACKGROUND OF THE INVENTION

1. Technical Field:

[0002] The invention relates to power take off systems for utility vehicles and more particularly to a system providing remote starting and stopping of the vehicle and for control of an emergency back up motor to the power take off system.

2. Description of the Problem:

[0003] Utility vehicles are often advantageously supplied with auxiliary equipment the operation of which is supported by the vehicle. Such auxiliary equipment can include hydraulically powered, aerial lift buckets that are often used for the repair of electrical power distribution lines. Typically, a hydraulic lift platform will be driven by a pump which is in turn driven by the vehicle's engine. In some applications, a back up prime mover, e.g. an electrical motor, is provided for the pump. A bucket at the end of the aerial lift system is electrically isolated to allow the worker to work on power lines which are still hot.

[0004] Trucks may come equipped with controls to allow a worker supported in the bucket to remotely shut off and turn on the vehicle's engine and to remotely raise and lower the lift. To avoid providing a conductive electrical path between the bucket and the truck, the controls located in and around the bucket for the operator's use are usually pneumatic. An air line is connected between the bucket, where a plunger-actuated piston is positioned, and a pneumatic, pressure actuated, electrical switch on the truck. To avoid expense a minimal number of pneumatic lines is provided. A problem addressed by the invention is providing a single, pneumatic, pressure actuated electrical switch which can be used to both start and stop a truck's engine, and in some applications, allow activation of a back up hydraulic pump in case of engine failure. Complicating the effort to construct such a device is the susceptibility of vehicle electronics to resetting during engine starting due to voltage fluctuations.

[0005] Industry standards specify that the bucket control for an aerial lift truck having an emergency or back up pump shall: (1) if the engine is running and the remote switch is closed (regardless of the duration for which it is held closed), shut down the engine; (2) if the remote switch is kept depressed for more than 3 seconds following a remote engine stop, cause the emergency or back up pump to operate and to continue to operate for as long as the switch is held closed; (3) if the remote switch is cycled following a remote stop or following the operation of the emergency pump, cause the engine to crank for the duration of the switch closure; and (4) if the engine does not start after cranking, respond to cycling the remote switch by causing the emergency pump to operate for as long as the remote switch is depressed.

[0006] Contemporary vehicles are commonly equipped with an electrical systems controller/body computer (ESC) and a controller area network allowing data transfer between the ESC and other controllers, including an engine controller and a transmission controller. These systems are built in conformance with the Society of Automotive Engineers' J1939 standard. Remote engine and bucket position control must be implemented in a way that cranking and shut down of the engine is effected only by closure of a hard-wired, ground side switch. This remote switch must be designed in the system hardware and be independent of the ESC's software. The hardware architecture cannot depend upon the ESC remaining active during engine cranking and must continue to function even if the ESC temporarily fails and reinitializes due to transient low voltage.

[0007] The status of the ESC cannot be allowed to interfere with normal starting and stopping of the engine using the standard four-position key ignition switch. It must remain possible to crank the engine even when the vehicle is latched in the remote start mode. This allows ground personnel to start the engine and engage PTO operation to lower a boom should the operator be disabled. It is permissible to allow momentary cycling of the key ignition switch to cancel remote stop mode. The system shall prevent engine cranking in response to closure of the remote switch if the hood is open. The hood disable feature must also be independently operable without reference to ESC status. However, the backup pump motor must be operable with the hood open.

[0008] The backup motor and solenoid should not be operated for any duration of time, or briefly cycled on and off, unless the conditions for emergency operation have been met. The backup motor brushes and solenoid contact life may be compromised by repeated, brief duration operation at high surge current levels. Remote switch operation should not result in application of any current to the backup motor and solenoid unless and until its operation is necessary.

[0009] The system shall permit the engine to crank only so long as the remote switch is closed. Once the remote switch opens, cranking should immediately stop, allowing only for some delay where the remote switch is pneumatically actuated. The system shall not allow the engine to crank unless the parking brake is set. This requirement can be met by modification of ESC software. The system shall not allow remote engine shut down unless a J1939 compliant engine RPM message is present on the vehicle databus from an engine controller. This requirement prevents stranding an operator in a boom since the engine will not crank remotely if an engine RPM message is not present.

[0010] US 3,788,294 discloses a vehicle engine igni-

tion system according to the preamble of claim 1 wherein a conventional system comprising an ignition key switch and a starter switch is provided in parallel with a remote system in which three relays are activated by a remote signal received by receiver. These three relays, two of which remain latched until energized again while the other one closes only when energized are connected to a starter relay such that the starter solenoid can be energized either by the starter switch or the remote switch, and the engine can be started and stopped by repeatedly actuating the remote switch.

[0011] JP 58-106148 A discloses to couple conventional and remote ignition systems in series in order to avoid an unintended remote start of the car. Due to the connection in series, the motor cannot be started by either the ignition or the remote switch, but only if both switches are closed simultaneously.

[0012] US 5,794,580 suggests to remove power from starter solenoid when a predetermined time has elapsed since a remote switch has been closed once. Then, a subsequent remote signal will be interpreted to stop the engine. The operating status of the engine is not taken into account.

SUMMARY OF THE INVENTION

[0013] According to the invention there is provided a motor vehicle having a remote switch by which the vehicle's engine may be shut down and restarted. In some applications the same switch may be used to engage a backup electric motor energized from the vehicle's battery as a substitute prime mover for a power take off apparatus installed on the vehicle. The invention provides a vehicle engine ignition control system having a starter solenoid and motor and engine control electronics. A multiple position ignition switch provides energization to the ignition control system in response to positioning of a key switch, as is conventional. The ignition switch has two output terminals which assume energized states in response to the positioning of the key switch. A first output is energized when the key switch in placed in a start position. A second output is energized when the key switch is in either the ignition position or the start position and may be energized when the key switch is in an accessory position. A remote switch is located on the vehicle away from the multiple position ignition switch, typically in a bucket suspended by an aerial boom. The remote switch provides a connection to ground when closed. An electrical systems controller communicates with the engine control electronics and is coupled to the remote switch to be responsive to closure of the remote switch in accordance with its programming. Responses include providing various enable signals and/or ground connections enabling operation of selected portions of the ignition control system. A remote start relay is coupled to respond to a remote start energization signal sourced by the electrical systems controller if it occurs concurrently with closure of the remote start switch. The remote start relay provides an activation signal on an output which is applied to a starter relay. The starter relay responds to the activation signal by providing activation energization to the starter solenoid and motor.

[0014] Remote stop of the engine is provided by control of a chassis ignition relay, which couples an ignition signal (Ign) from the ignition switch to an engine controller. A remote switch state detection relay is coupled to the remote switch and to the second output of the multiposition ignition switch and is responsive to the concurrent occurrence of an energization signal on the second output of the multiposition ignition switch and closure of the remote switch to generate a remote stop energization signal. The electrical systems controller is further responsive to closure of the remote switch and to indication that the engine is operating (by reading an engine RPM signal from the engine controller) for providing a ground connection through an input. A remote stop relay provides coupling of energization from the multiple position ignition switch to the chassis ignition relay. The chassis ignition relay is connected to the remote switch state detection relay to receive the remote stop relay energization signal and is further connected to the input of the controller, the remote stop relay being responsive to the remote stop energization signal and grounding of the ground side of its energization coil through the controller input for interrupting energization of the chassis ignition relay and thereby cutting the Ign signal to the engine controller, resulting in interruption of operation of the engine.

[0015] Where a vehicle is equipped with backup prime mover for a vehicle power take off (PTO) apparatus, the ignition system further includes a backup motor and solenoid connected to the vehicle electrical power source. A backup motor inhibit relay is connected across the power connection to the backup motor and solenoid to prevent any undesired operation of the motor, however brief. A backup motor relay is coupled to receive energization from the remote start relay and is further coupled to the remote switch to be responsive to concurrent closure of the remote switch and application of the energization signal from the remote start relay for coupling energization signal from the remote start relay to the backup motor inhibit relay as an input. Finally the electrical systems controller provides a connection to ground on an inhibit input in response to the key switch being in the ignition position and engine cranking having been attempted and failed.

[0016] Additional effects, features and advantages will be apparent in the written description that follows.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] The novel features believed characteristic of the invention are set forth in the appended claims. The invention itself however, as well as a preferred mode of use, further objects and advantages thereof, will best be understood by reference to the following detailed description of an illustrative embodiment when read in conjunc-

tion with the accompanying drawings, wherein:

Figure 1 is a simplified illustration of a truck mounted aerial lift assembly for locating an operator in various raised positions.

Figure 2 is a high level schematic of a vehicle electrical and hydraulic control system incorporating the invention for the truck of **Fig. 1.**

Figure 3-10 are a series of circuit schematics of a remote ignition control system in accordance with two embodiments of the invention.

Figures 11-12 are high-level flow charts of programs executed by a system electronics controller in implementing aspects of the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0018] Referring to the drawings, and particularly to **FIG.** 1, an example of a mobile aerial lift truck **1** is illustrated in simplified presentation for clarity of illustration. The mobile aerial lift truck **1** includes an aerial lift unit **2** mounted to a bed on the back portion of the truck. The aerial lift unit **2** includes a lower boom **3** and an upper boom **4** pivotally interconnected to each other and to the truck bed through support **6** and rotatable support bracket **7**. A bucket/basket **5** is shown secured to the outer end of the upper boom **4** within which the operating personnel are located during the lifting to and locating within a selected work area in accordance with known practice. Basket **5** is typically pivotally attached to the out end of the boom **4** to maintain a horizontal (level) orientation at all times. The aerial lift unit **2** is mounted to the truck bed through support **6**. A rotatable support bracket **7** is secured to the support **6** and projects upwardly. The lower boom **3** is pivotally connected as at pivot **8**, to the rotatable support bracket **7**. A lifting lower boom cylinder unit **9** is interconnected between bracket **7** and the lower boom **3**. In the illustrated embodiment, a pivot connection **10** connects the lower boom cylinder **11** of unit **9** to the bracket **7**. A cylinder rod **12** extends from the cylinder **11** and is pivotally connected to the boom **3** through a pivot **13**. Lower boom cylinder unit **9** is connected to either of two hydraulic supplies of a suitable hydraulic fluid, which allow the assembly to be lifted and lowered as desired.

[0019] The outer end of the lower boom **3** is interconnected to the lower and pivot end of the upper boom **4**. A pivot **116** interconnects the outer end of the lower boom **3** to the pivot end of upper boom. An upper boom/compensating cylinder unit or assembly **117** is connected between the lower boom **3** and the upper boom for pivoting the upper boom about pivot **116** for positioning of the upper boom relative to the lower boom. The upper boom/compensating cylinder unit **117** is constructed to permit independent movement of the upper boom **4** relative to boom **3** and to provide a compensating motion between the booms to maintain the upper boom raising with the lower boom and is similarly connected to the sources of pressurized hydraulic fluid as further developed below. Conventionally, aerial lift unit **2** requires positive hydraulic pressure both to be lifted or to be lowered. Bucket **5** includes a plunger moving a piston in an air line. The air line runs from bucket **5** to a point on truck **1** where a remote switch, as described below, is located.

[0020] **Fig. 2** is a block diagram schematic illustrating electronic control of a truck **1**, based on controller area network technology and an electrical systems controller/body computer (ESC) **24.** Collectively, bus/data link **18** and the various nodes (generally the various vocational controllers described below) to which it is attached form the controller area network (CAN), which conforms to the SAE J1939 standard. Controller area networks are networks which do not have destination addresses for nodes attached to the networks, but rather provide for transmission of data in packets, identified as to the source, message type and priority. The nodes are programmed as to whether to respond to a packet based on one or more of three identifiers. Many message types are predefined by the SAE J1939 standard. The SAE J1939 standard allows the definition of proprietary message types which in structure conform to the standard.

[0021] Active vehicle components are typically controlled by one of a group of autonomous, vocational controllers. These vocational controllers include ESC **24**, an engine controller **20**, a electrical gauge controller **14**, a transmission controller **16**, an anti-lock brake system controller **22**, and a remote power take off controller **57.** ESC **24** and engine controller **20** are of primary interest to the present invention. Transmission controller **16** is provided with vehicles equipped with automatic transmissions and generates a signal indicating whether the vehicle's drive line is engaged or not. It is preferred at the time this application is being written that application of the invention be limited to vehicles equipped with automatic transmissions due to the lack of a indicator on vehicles equipped with standard transmissions as to whether the vehicle drive line is disengaged. Should such an indicator be made available the invention can be used on vehicles equipped with standard transmissions. Engine controller **30** provides an engine RPM signal, which is required for implementing certain routines in ESC **24**. The engine controller **20** also receives certain signals implicated in engine operation. ESC **24**, through discrete input ports **50** and output ports **52**, provides selective enable signals and ground connections, and detects the state of a remote switch used for remotely starting and stopping the vehicle's engine.

[0022] The hydraulic lift unit **58** which supports operation of an aerial lift unit **2** is primarily powered by a conventional PTO hydraulic pump **60** which is usually driven by engine **30**. Backup to engine **30** for powering hydraulic pump **60** is provided by a backup solenoid and motor **54**, energized from vehicle battery **21**. Energization of backup solenoid and motor **54** is controlled in part by programming of ESC **24** and control signals issued by it through discrete outputs **52** coupled into the starter system **100** and a pump inhibit relay **46**. Energization for

backup solenoid and motor **54** is supplied by battery **21** as controlled by a pump relay **36** and the pump inhibit relay **46**. ESC **24** also controls remote starting and stopping of engine **30** by control signals provided to starter system **100** which in turn provides control signals to a starter solenoid and motor **59** and engine controller **20**. Battery **21** charge is maintained by an engine **30** driven charging system **47**. ESC **24** also monitors the position of a parking brake and a PTO on/off switch. PTO on/off switch is located in a multiplexed switch pack **43**, monitored on the J1708 switch data link **49**. The parking brake is a discrete switch input **50**.

[0023] Referring to **Figures 3-7**, a preferred embodiment of the starter system **100** as applied to a vehicle not having a backup hydraulic pump motor is illustrated. Starter system **100** provides for starting and stopping an internal combustion engine **30** from either inside a vehicle cab using an ignition switch **102** or from a remote point on the vehicle using a remote switch **110**. Remote switch **110** is a ground side, momentary contact switch with a default open state. Remote switch **110** is pneumatically actuated using a plunger **117** into an air line **111.** Ignition switch **102,** as is conventional, has four position: (1) accessory/Acc; (2) off; (3) ignition; and (4) start. Ignition switch **102** has first and second mechanically linked switches **106** and **108**. Switch **106** has an output connected to the start contact of the switch. For switch **108** the ignition and start position are tied together for output **115.** Ignition and Accessory/Acc positions are tied together when the key switch is either of these positions. Accessory/Acc is a discrete input to the ESC **24**. Acc has +12V anytime the key is in the accessory or ignition positions. Accessory drops out with the key switch in the crank position, which permits the invention to detect that the key switch is in the crank position during a remote stop period, such as the case where someone in the cab cranks the engine should the operator in the boom not be able to start the engine remotely (e.g. when the operator is unable to press the remote button. Switch **108**, as described below, allows for remote stopping and starting of an engine using remote switch **110**. Ignition switch **102** is key actuated and is energized through a 5 amp fuse **104** from battery **21.** For clarity of presentation, the off and ignition contacts for switch **106** are shown as floating, their operation not effecting the invention. The accessory contact of switch **106** provides power as an input to the ESC **24.**

[0024] Remote switch **110**, ignition switch **102** and the various relays used in implementing starter system **100** interact with programmable controllers which communicate with one another over the J1939 datalink **18**. ESC **24** and engine controller **20** monitor the state of various signals and provide enabling signals (including signals characterized by a ground connection through the controller) which implement aspects of the invention. Transmission controller **16** provides a driveline engagement indication signal used by engine controller **20** which inhibits cranking should the transmission engagement signal indicate the transmission (not shown) is in neutral or park. Some operations of starter system **100** can however be invoked notwithstanding temporary failure of the programmable controllers. ESC **24** is illustrated sectioned into two parts, one associated with electrical connections outside of a vehicle cab and a second section inside the vehicle cab. ESC **24** is usually one device and the division is simply for convenience of illustration. Adapting starter system **100** for remote operation must be done in a way that does not change normal operation of a vehicle. Accordingly, switch **106**, when moved to the start position, supplies power to a sense input (PIN 86) of starter relay **112**. This causes starter relay **144** to close thus supplying power from battery **21** through fuse **144** to the output associated with PIN 87 of the starter relay and from there to a starter solenoid and motor **59**. Engine controller **20** provides a ground to PIN **85** of starter relay **112** through a transistor switch **126** which is biased into conductivity in response to a gate signal provided by microprocessor **124**.

[0025] Remote operation is possible when ignition switch **102** is placed in the "ignition position". This places both of switches **106** and **108** in the ignition position, supplying power to node **115** which is tied to the second output of ignition switch **102**. Remote operation is invoked by closing momentary contact remote switch **110**, the effect of which is to connect to ground node **113**, which is normally biased high by ESC **24** from a sensor input **130**. The closure of remote switch **110** is detected by ESC **24** through sensor input **130**. The closure of remote switch **110** also grounds the ground side contact for the sense coil of a remote start relay **138** and the ground side contact for the sense coil of a remote switch state detect relay **132**. Assuming initially that engine **30** is running, the closure of remote switch **110** results in engine **30** being shut down. Since switch **108** is in the ignition position power flows from node **115** to the high side contact for the sense coil for remote switch state detect relay **132**, and the relay closes, supplying power from ignition switch **102** through remote switch state detect relay **132** to the high side sense input of remote stop relay **114**.

[0026] Upon detection of closure of remote switch **110** ESC **24** determines if the conditions for remote stop are present, e.g. (1) parking brake set, (2) Engine RPM signal non-zero, etc. If all the conditions are met, ESC **24** will provide a ground connection through transistor **132** (an RD15 low side driver) to the low side contact for the sense coil of remote stop relay **114**, resulting in the relay opening and the transfer of power through the remote stop relay being interrupted. When remote stop relay **114** opens, three ignition relays **116, 118** and **120** are all interrupted, with the result that power to all ignition powered features of the vehicle are interrupted. Chassis ignition relay **116** provides an ignition signal (Ign) via fuse **122** to engine controller **20** and microprocessor **124**. Engine controller **20** in turn carries out a shut down of engine **30**. Power is also interrupted to transmission controller **16**.

[0027] When the user releases remote switch **110**, DIN **19** on ESC **24** detects an increase in voltage at node **113** indicating to ESC **24** that the remote switch has opened. Remote switch state detect relay **132** is deenergized due to loss of a connection to ground on the low side of the switch state detect relay's sense coil. Remote stop relay **114** remains energized (i.e. latched) because the high side of the remote stop relay sense coil is tied to DIN 87 of the relay and ESC **24** continues to provide a ground connection to the low side of the remote stop relay's coil.

[0028] Remote start is explained with reference to **Fig. 4.** Again a user causes remote switch **110** to close and holds the remote switch down. Engine **30** cranks for as long as remote switch **110** is held closed. Upon closure of remote switch **110** node **113** drops to ground, an event which is detected by sensor **130** (DIN 19) of ESC **24**. The voltage drop causes remote switch state detect relay **132** to trip to a closed state, an operation which has no other effect on circuit operation. In response to the fall in voltage ESC **24** determines if the conditions for remote start are met. If the conditions are met, ESC **24** removes the gate voltage from transistor **134** cutting off conduction through the device. At this point the remote stop relay **114** deenergizes, reconnecting the high sides of the energization coils for the three ignition relays **116, 118** and **120**, to power from multiple position ignition switch **102**. The low side contacts for the sense coils for all three of the ignition relays **116, 118** and **120** are connected permanently to chassis ground so all three relays are automatically reenergized. The signal Ign to engine controller **20** is thus restored and transistor **126** is energized to connect the ground side of the energization coil of starter relay **112** to ground. Ign also indicates to the engine controller **20** that other ignition management functions are to be implemented.

[0029] ESC **24** must carry out certain actions to enable an engine restart in response to closure of remote switch **110**. The response to the detected voltage drop on node **113** includes ESC **24** driving output **136** high. With output **136** high and node **113** low, a voltage difference appears across the contacts of the sense coil for remote start relay **138** and the relay becomes energized. Provided the vehicle hood is closed (thus closing a hood safety switch **142**), power will be coupled through remote start relay **138** to the sense coil high side input (DIN 86) of starter relay **112** from node **115** with the key switch of the multiple position ignition switch **102** in the ignition (Ign) position. With starter relay **112** energized, energy is coupled through the starter relay from battery **21** to starter solenoid and motor **59** to initiate cranking.

[0030] High surge currents delivered to starter solenoid and motor **59** may cause a system voltage drop which may result in ESC **24** resetting. If this occurs transistor **134** remains in a non-conductive state which is desired. However, output **136** can fail. Accordingly, it is desirable to provide a means of latching remote start relay **138** in an energized state for cranking, since cranking will cease if remote start relay **138** deenergizes in response to loss of the signal from output **136**. See **Figure 6**. To effect latching of remote start relay **138** a diode **140** is provided oriented to conduct electricity from DIN 87 (the normally open contact) of remote start relay **138** to the high side contact of the energization coil for the relay. Once remote start relay **138** is energized, and for as long as remote switch **110** is closed, the relay will remain latched by way of a forward biased diode **140**. This of course requires the ignition switch **102** remain in the Ign or St position. If Ignition switch **102** is moved to the OFF position, it will of course deprive the output DIN 87 of power and remote start relay **138** will be deengergized. Release of remote switch **110** deprives the ground side contact of the energization coil of the remote start relay of a ground connection also resulting in deenergization of the relay. See **Figure 7**.

[0031] A diode **140** is used instead of a wire connection to provide a latch mechanism for remote start relay **138**. Were a wire used to connect the contacts of remote start relay **138**, anytime a high signal appeared on output **136** of ESC **24** the engine would crank. Since ESC **24** is subject to reprogramming and field maintenance the possibility that the device could be reprogrammed or rewired cannot be discounted. The engine crank inhibit low side driver (sensor input **130**) is a relatively low impedance path to ground from node **113** when the transmission is in neutral. It could function to pull down node **113** enough to be detected as closed remote switch.

[0032] Referring to **Figures 8-10** a second embodiment of the invention incorporating an emergency pump motor and solenoid **54** is described. The remote start/stop circuit **100** of **Figures 3-7** is unchanged except for the addition of the emergency motor and associated control relays. As with the remote start operation, operation of the emergency motor is to be invoked using remote switch **110**. An additional connection to ESC **24** is also provided to allow ESC **24** a certain degree of control over remote operation of emergency pump motor and solenoid **54** although the circuit provides for failsafe operation of the emergency pump motor should ESC **24** fail.

[0033] Normally the operation of emergency pump motor and solenoid **54** is inhibited by ESC **24**. This is effected by ESC **24** energizing transistor **146** to provide a pump inhibit signal (a ground contact) to the low side contact of the energization coil of pump inhibit relay **46**. The high side contact of the energization coil of pump inhibit relay **46** is connected to node **115**. As a result, pump inhibit relay is energized and no activation signal can flow from the relay to emergency pump and solenoid **54**. See **Figure 8**.

[0034] Emergency pump operation following a remote stop occurs when a user/operator keeps remote switch **110** depressed after a remote engine shut down. Remote start relay **138** is not energized, so ignition voltage is supplied from multiple position ignition switch **102** via node **115** to the high side sense coil contact of pump relay **36** energization coil and to the power input contact of the pump relay, the two contacts being in common.

See **Figure 9**. With the ground side contact of the energization coil of pump relay **36** at ground, the response of pump relay **36** is to energize supplying power to DIN 30 (common terminal) of pump inhibit relay **54**.

[0035] ESC **24** times the duration of closure of remote switch 110 and when three seconds have expired deenergizes transistor **146** depriving a connection to ground for the ground side contact of the energization coil of pump inhibit relay **46**. Pump inhibit relay **46** deenergizes connecting the common terminal of the relay to output DIN 87A and thereby supplying an activation signal to emergency pump motor and solenoid **54.** See **Figure 10.** The deenergized pump inhibit relay **46** supplies ignition voltage to the emergency pump motor solenoid resulting in energization of the emergency pump motor. Emergency pump motor and solenoid **54** operates as long as remote switch **110** is held closed. Opening remote switch **110** causes pump relay **36** to deenergize, interrupting the signal to the common terminal of pump inhibit relay **46** which in turn deenergizes depriving emergency pump motor and solenoid **54** of an activation signal. In addition, when remote switch **110** is released the voltage on node **113** increases, which is detected by ESC **24** which responds by energizing transistor **146** and thereby energizing pump inhibit relay **46** until ESC **24** again determines that the conditions for emergency pump motor operation are met. Were there no pump inhibit relay **46**, any closure of remote switch **110** would cause emergency pump motor and solenoid **54** to briefly operate, which has the potential of decreasing the life of the solenoid and motor.

[0036] Operation of emergency pump motor and solenoid **54** can also occur after an unsuccessful engine crank. ESC **24** maintains pump inhibit relay **46** in an energized state until the conditions for emergency pump motor and solenoid **54** operation are met. Following a crank attempt which fails, an operator releases remote switch **110** to discontinue cranking. The operator then depresses remote switch **110** and holds it closed to initiate operation of the emergency pump motor and solenoid **54**. See **Figure 9**. ESC **24** will detect the closed remote switch **110**. Even though the engine is not running, ESC **24** does not initiate a crank operation (by supplying the appropriate signals at output **136** and changing the state of transistor **134**) since the last command was to crank the engine. ESC **24** is programmed instead to engage emergency pump motor and solenoid **54** following a failed cranking attempt, even if ESC **24** suffered a reset due to low battery voltage during cranking. Three seconds after remote switch **110** is closed ESC **24** deenergizes transistor RD13 **146**. This in turn deenergizes pump inhibit relay **46**. Closure of remote switch **110** has already supplied a ground connection to the ground side contact of the energization coil of pump relay **36**, resulting in the pump relay becoming energized. Deenergized pump inhibit relay **46** supplies ignition voltage from pump relay **36** to emergency pump motor and solenoid **54** and the emergency pump motor begins to operate until remote switch **110** is released. Opening of remote switch **110** causes pump relay **36** to deenergize, interrupting ignition voltage to pump inhibit relay **46** and cutting off power to emergency pump motor and solenoid **54**. Pump inhibit relay **46** remains energized by a reenergized RD 13 transistor **146** until the conditions for emergency pump motor operation are again met.

[0037] Emergency pump motor and solenoid **54** operation are also available in case of a complete failure of ESC **24**. If ESC **24** fails, the pump inhibit signal from RD 13 transistor **146** also fails and the pump inhibit relay **46** deenergizes. If battery voltage is still available, ignition voltage is still present on the high side contact and common contact for the energization coil of pump relay **36**. When remote switch **110** is depressed pump relay **36** energizes and couples ignition voltage through to the common contact of now deenergized pump inhibit relay **46**. Pump inhibit relay couples the ignition voltage through to emergency pump motor and solenoid **54** which is energized whenever, and for as long as, remote switch **110** is closed. No three-second delay occurs for pump operation under conditions of failure of ESC **24**.

[0038] **Figures 11** and **12** are flow charts for programming of ESC **24** to implement certain features of the present invention for the embodiment not incorporating and the alternative embodiment incorporating an emergency pump motor, respectively. The programs implement logical testing for the conditions under which the vehicle's engine is stopped or started and the emergency pump motor is run. When the conditions for an engine stop are met ESC **24** provides the required signals for invoking particular operations. For example, for a remote engine stop, a 1 amp FET low side driver associated with ESC output **136** is deactivated and remote stop relay **114** is activated and remains activated until either multiple position ignition switch **102** is moved to OFF or an engine crank sequence has begun. For a vehicle equipped with an emergency pump motor the remote stop relay **114** remains activated until the ignition switch is turned to off, or the remote switch **110** is held closed for a period exceeding a delay period, or an engine crank is requested. Programming helps determine if the conditions for an engine stop are met, which are: (1) the engine is running; (2) the multiple position ignition switch is NOT in the OFF position; (3) remote switch **110** is depressed; (4) the remote switch **110** has just been depressed; (5) the park brake is set; (6) the status of the engine speed message signal is good; and (7) if a PTO interlock variable is set, the PTO switch is on and has good status. Where the vehicle is equipped with an emergency pump motor then the last condition (no. 7) is simply that the status of the engine speed signal is good. When the engine controller determines that the engine has started it discontinues cranking.

[0039] The engine can be remotely started under the following conditions: (1) The engine is not running; (2) the key is not in the OFF position; (3) the plunger switch is depressed; (4) the plunger switch has just been de-

pressed; (5) the park brake is set; and (6) if the PTO interlock is set, then the PTO switch is on and has good status. For a vehicle with an emergency pump motor condition 6 is replaced with the condition that: the previous sequence with the engine not running was an emergency pump motor operation sequence or the previous sequence was an engine stop sequence using remote switch **110**.

[0040] Emergency pump motor inhibit relay **46** is activated when ignition switch **102** is not in the off position and any one of the three following conditions is met: (1) the accessory signal is ON and NEW, or (2) the engine state is ON and NEW, or (3) the remote switch **110** has just been released. Pump inhibit relay **46** is deactivated when the ignition switch **102** is OFF or all of the following conditions are met: (1) ignition switch **102** is not OFF; (2) remote switch **110** is closed; (3) remote switch **110** has been closed for longer that the programmed delay period after stopping the engine to run the emergency pump motor **59**. Finally, if an emergency pump motor is present it will also run if the multiple position ignition switch **102** is not in the OFF position, the remote switch **110** is depressed, no other functions are currently running (engine stop, cranking, etc.) and the conditions are such that no other function will run.

[0041] Referring particularly to **Figure 11**, execution of the program for a vehicle not having an emergency pump motor begins with determination at step **200** of the position of the ignition switch. If the ignition switch is not in the OFF position the Key_State is true and execution continues to step **202.** If NO the variables Engine_Stop_Relay_Cmd and Engine_Crank_Cmd are reset at step **222** and processing stops. At step **202** ESC **24** determines if remote switch **110** is depressed. If no, the Engine_Crank_Cmd variable is reset at step **224** and processing stops. If a yes resulted at step **202,** execution continues to step **204** where the value of the variable "Tem_Rem_Start_Stop_Plunger" is checked. If the value is "NEW", i.e. the remote switch is newly depressed a value of 1 is stored on a stack in memory, otherwise a value of 0 is entered. A logical AND operation is then implemented on the stack. Next, at step **206** it is determined in the remote stop start PTO interlock is set. If the PTO interlock is set, step **208** is executed to determine if the PTO engagement switch is on and a logical AND operation is performed with 1 and the stack. Otherwise the stack is "ANDed" with 0. At step **210**, following step **208** or along the NO branch from step **206**, it is determined if the Parking brake is engaged. If yes the stack is ANDed with 1, otherwise with zero. Next, at step **212**, if the ignition signal (Ign) to engine controller is on an "AND" operation is preformed on the stack with 1 if the Engine_State has a good status. Otherwise the AND operation on the stack uses a 0. Next, at step **214** the stack is interrogated to see if it has the value 1. If NO the conditions for remote start or stop have not been met and processing is exited. If YES, the conditions for a remote stop or start have been met and step **216** is executed to determine if the engine is running. If YES, the Engine_Stop_Relay_Cmd is set and transistor RD15 **134** is energized. If NO, the engine stop relay command is reset and engine crank command is issued on output **136**.

[0042] The required logic is more complex if an emergency pump motor is provided. Referring to **Figure 12** a flow chart for a vehicle equipped with an emergency pump motor is illustrated. Again processing begins with a determination of the key state at step **230** (i.e. the key is not in the OFF position). If the key is in the OFF position (the NO branch), step **268** is executed to reset each of four variables: (1) Engine_Crank_Cmd; (2) Engine_Stop_Relay_Cmd; (3) EmergencyPump_Inhibit_Relay; and (4) Start_Stop_Timer and the process is terminated. Otherwise processing continues to step **232** which tests to see if one of three conditions is met: (1) if the Accessory_Signal is on or new (in this version the invention also works for ACC being on in the ignition switch **102**); (2) the Engine state is on or new; or (3) the remote switch is newly open. If yes, step **234** is executed to set the emergency pump motor relay and to stop the remote switch closed timer. Following the NO branch from step **232** or after step **234** it is determined if the remote switch is closed. If NO, the routine is exited via step **270** with reset of the engine crank command and the remote switch closure timer. Otherwise step **238** is executed to determine if the remote switch timer has expired. If yes, the process is exited via step **272** with a reset of the emergency pump motor inhibit relay and turning off the timer. Otherwise, along the NO branch from step **238,** step **240** is executed to put a 1 on the stack if the remote switch is newly closed. Next, at step **242**, if the parameter remote stop/start PTO interlock is set, an AND operation is performed between the stack and 1, but only if the PTO engagement switch is on and has a good status. Otherwise an AND operation is performed between the stack and 0. Next, at step **244**, an AND operation between the stack and 1 is done if the parking brake is set, but otherwise with 0.

[0043] Next, at step **246** it is determined if the signal Ign is high (as reported by the Engine Controller). If YES, step **248** is executed to determine if the engine status is bad and the remote switch is newly depressed. If YES, step **250** provides that a remote shut down flag be set and remote switch depression timer be started along with a stop timer. Following either the NO branch from step **248** or after step **250**, if engine status is bad an AND operation between the stack and 0 is done, but otherwise the AND operation is done against 1. Next, along the NO branch rom step **246** or after step **252**, the value of stack is compared to 1. If it is not 1, processing ceases. Otherwise, along the YES branch it is determined if the engine state is true. If YES, the engine stop relay command and remote shut down flags are set. The remote switch closure timer is started and the engine stop timer is started and processing stops. Following the NO branch from step **256**, the remote switch timer is stopped and the engine stop relay command is reset. Next, at step **262** it

is determined if the remote shut down flag is set. If YES, the engine crank command is reset and the remote shut down flag is reset. If NO, the remote shut down flag is set, the remote switch timer is started and the remote switch time. Processing then discontinues.

[0044] The present invention provides a simple, multifunction remote start/stop control system for a utility vehicle that exhibits robustness. A single control may be used to invoke not only starting and stopping, but also to actuate an electric motor-driven pump in case of engine failure.

Claims

1. A vehicle engine ignition control system, comprising:

a starter solenoid and motor (59);
engine control electronics (20);
an engine (30) coupled to the motor for starting and to the engine control electronics for control of its operation;
an ignition switch (102);
a remote switch (110) providing an electric connection to ground when closed;
a remote start relay (138) for providing an activation signal on an output (87); and
a starter relay (112) coupled to respond to the activation signal from the remote start relay for providing activation energization to the starter solenoid and motor;
characterized in that
the ignition switch (102) is a multiple position ignition switch (102) having first and second outputs which assume energized states in response to positioning of a key switch, the second output being energized in response to positioning of the key switch in an ignition position (IGN) or in a start position (ST);
the system further comprising a controller (24) communicating with the engine control electronics and coupled to the remote switch to be responsive to closure of the remote switch and indication that the engine is not currently operating for providing a remote start energization signal;
wherein the remote start relay (138) is coupled to respond to the remote start energization signal occurring concurrently with closure of the remote start switch for providing an activation signal on an output (87); and
the starter relay (112) is coupled to respond to energization of the first output of the multiple position ignition switch or to the activation signal from the remote start relay for providing activation energization to the starter solenoid and motor.

2. A vehicle engine ignition control system as set forth in claim 1, further comprising:

a vehicle electrical power source (21);
a chassis ignition relay (116) for coupling power from the vehicle electrical power source to the engine control electronics for maintaining operation of the engine;
a remote switch state detection relay (132) coupled to the remote switch and to the second output of the multiposition ignition switch and responsive to the concurrent occurrence of an energization signal on the second output of the multiposition ignition switch and closure of the remote switch to generate a remote stop energization signal;
the controller (24) being further responsive to closure of the remote switch and
indication that the engine is operating for providing a ground connection through an input; and
a remote stop relay (114) for coupling energization from the multiple position ignition switch to the chassis ignition relay connected to the remote switch state detection relay to receive the remote stop energization signal and further connected to the input of the controller, the remote stop relay being responsive to the remote stop energization signal and grounding through the controller input for interrupting energization of the chassis ignition relay and thereby operation of the engine.

3. A vehicle engine ignition control system as set forth in claim 2, further comprising:

a diode (140) coupled to conduct the activation signal from the output of remote start relay back to a sense input of the remote start relay in backup to possible loss of the energization signal from the controller.

4. A vehicle engine ignition control system as set forth in claim 3, further comprising:

a safety switch (142) connected between the remote start relay and a sense input of the starter relay.

5. A vehicle engine ignition control system as set forth in claim 3, further comprising:

a backup drive motor and solenoid (54) connected to the vehicle electrical power source;
a backup drive motor operation inhibit relay (46);
a backup drive motor relay (36) coupled to receive energization from a second output of the remote start relay and coupled to the remote

switch to be responsive to concurrent closure of the remote switch and application of the energization signal from the remote start relay for coupling energization signal from the remote start relay to the backup drive motor operation inhibit relay as an input; and
the controller further providing a connection to ground on an inhibit input in response to the key switch being in the ignition position and engine cranking having been attempted and failed.

6. A vehicle engine ignition control system as claimed in claim 5, further comprising:

the controller being programmed to provide a delay in connecting the inhibit input to ground following stop in engine operation.

7. A utility truck (1) with remote engine shut down and start up, comprising:

a vehicle engine ignition control system according to claim 1;
an electrical power source (21);
wherein the starter motor is mechanically coupled to the engine and starter solenoid for connecting the starter motor to the electrical power source;
the multiple position ignition switch (102) further comprises an off position (OFF);
the remote switch (110) has a default open position and a closed position;
the electrical system controller is connected to detect the movement of the remote switch to the closed position, the electrical system controller being responsive to detection of movement of the remote switch concurrent with the engine running for supplying a first ground connection on a remote stop relay enable port and for detection of movement of the remote switch concurrent with the engine not running for supplying a remote start relay energization signal on a start signal port;
and
the remote start relay (138) is connected by an input to respond to the remote start relay energization signal on the start signal port of the electrical system controller for connecting the output of the multiple position ignition switch by an output to an input of the starter relay, the starter relay being responsive energization of the output of the multiple position ignition switch for providing an activation signal to the starter solenoid.

8. A utility truck with remote engine shut down and start up as set forth in claim 7, further comprising:

a diode (140) for coupling the energization supplied to the starter relay by the remote start relay back to a sense input of the remote start relay for latching the remote start relay; and
the starter relay being connected to the remote switch to remain active after latched for as long as the remote switch is closed.

9. A utility truck with remote engine shut down and start up as set forth in claim 7, further comprising:

an engine controller having an ignition input and responsive to an enable signal on the ignition input for allowing the engine to run;
an ignition relay (116) for supplying an activation signal on the ignition input;
a remote stop relay (114) having an energization input and an enable input for supplying the activation signal to the ignition relay; and
the electrical system controller being connected to the enable input of the remote stop relay and further responsive to closure of the remote switch when the engine is running for supplying an enabling signal to the enable input of the remote stop relay.

10. A utility truck with remote engine shut down and start up as set forth in claim 9, further comprising:

a remote switch state detection relay (132) coupled to the remote switch and to the output of the multiposition ignition switch and responsive to the concurrent occurrence of an energization signal on the output of the multiposition ignition switch and closure of the remote switch to generate a remote stop energization signal for application to a energization input of the remote stop relay.

11. A utility truck with remote engine shut down and start up as set forth in claim 10, further comprising:

a backup motor and solenoid (54) for energization from the electrical power source;
the electrical system controller being responsive to conditions indicating a failure of the engine to resume operation after cranking initiated by the remote switch for providing an inhibit disable signal;
a backup motor inhibit relay (46) connected to the electrical system controller to receive the inhibit disable signal;
a backup motor energization relay (36) coupled to the output from multiple position ignition switch and to the remote switch to respond to concurrent closure of the remote switch and an energization signal on the output to apply a backup motor activation signal to the backup motor inhibit relay; and

the backup motor inhibit relay being connected between the backup motor energization relay and the backup motor for coupling the backup motor activation signal to the backup motor in response to the inhibit disable signal.

12. A utility truck with remote engine shut down and start up as set forth in claim 11, further comprising:

the inhibit disable signal being the absence of a ground connection through port on the controller.

13. A utility truck with remote engine shut down and start up as set forth in claim 12, further comprising:

a hydraulic pump (60) coupled to be powered by the engine and the back up motor; and
a hydraulic lift unit coupled to the hydraulic pump.

14. A utility truck with remote engine shut down and start up as set forth in claim 13, further comprising:

an aerial lift unit including a bucket (5) for an occupant coupled to the hydraulic lift unit to be raised and lowered.

15. A utility truck with remote engine shut down and start up as set forth in claim 14, further comprising:

a pneumatic actuation system accessible from the bucket for the remote switch.

Patentansprüche

1. Zündsteuersystem für einen Fahrzeug-Verbrennungsmotor, aufweisend:

einen Startermagneten und -motor (59);
eine Verbrennungsmotor-Steuerelektronik (20);
einen Verbrennungsmotor (30), der mit dem Startermotor und mit der Verbrennungsmotor-Steuerelektronik verbunden ist, um seinen Betrieb zu steuern;
einen Zündschalter (102);
einen Funkschalter (110), der eine elektrische Erdung bereitstellt, wenn er geschlossen ist;
ein Start-Funkrelais (138), das an einem Ausgang (87) ein Aktivierungssignal liefert; und
ein Starterrelais (112), das so geschaltet ist, dass es auf das Aktivierungssignal vom Funkstartrelais anspricht, um den Startermagneten und motor mit Aktivierungsenergie zu versorgen;
dadurch gekennzeichnet, dass
der Zündschalter (102) ein mehrfach verstellbarer Zündschalter (102) mit ersten und zweiten Ausgängen ist, die ansprechend auf eine Positionierung eines Schlüsselschalters Erregungszustände annehmen, wobei der zweite Ausgang ansprechend auf die Positionierung des Schlüsselschalters in einer Zündstellung (IGN) oder einer Startstellung (ST) erregt wird;
wobei das System ferner eine Steuereinrichtung (24) aufweist, die mit der Verbrennungsmotor-Steuerelektronik kommuniziert und mit dem Funkschalter so verschaltet ist, dass sie auf eine geschlossene Stellung des Funkschalters und eine Anzeige eines aktuellen Nichtbetriebs des Verbrennungsmotors anspricht, um ein Start-Erregungsfunksignal auszugeben;
wobei das Start-Funkrelais (138) so geschaltet ist, dass es auf eine Gleichzeitigkeit des Start-Erregungsfunksignals und einer geschlossenen Stellung des Start-Funkschalters anspricht, um an einem Ausgang (87) ein Aktivierungssignal auszugeben; und
wobei das Starterrelais (138) so geschaltet ist, dass es auf eine Erregung des ersten Ausgangs des mehrfach verstellbaren Zündschalters oder auf das Aktivierungssignal vom Start-Funkrelais anspricht, um dem Startermagneten und motor Aktivierungsenergie zuzuführen.

2. Zündsteuersystem für einen Fahrzeug-Verbrennungsmotor nach Anspruch 1, ferner aufweisend:

eine Quelle (21) für elektrische Fahrzeugleistung;
ein Rahmen-Zündrelais (116), um Leistung von der Quelle für elektrische Fahrzeugleistung auf die Verbrennungsmotor-Steuerelektronik zu übertragen, um einen Betrieb des Verbrennungsmotors aufrechtzuerhalten;
ein Funkschalterzustands-Erfassungsrelais (132), das mit dem Funkschalter und
dem zweiten Ausgang des mehrfach verstellbaren Zündschalters verschaltet ist und auf die Gleichzeitigkeit eines Erregungssignals am zweiten Ausgang des mehrfach verstellbaren Zündschalters und einer geschlossenen Stellung des Funkschalters mit der Erzeugung eines Stopp-Erregungsfunksignals anspricht;
wobei die Steuereinrichtung (24) ferner auf eine geschlossene Stellung des Funkschalters und auf eine Anzeige, dass der Verbrennungsmotor läuft, mit einer Erdung über einen Eingang anspricht; und
ein Stopp-Funkrelais (114) zum Übertragen der Erregung vom mehrfach verstellbaren Zündschalter auf das Rahmen-Zündrelais, das mit dem Funkschalterzustands-Erfassungsrelais verbunden ist, um das Stopp-Erregungsfunksignal zu empfangen, und das außerdem mit dem

Eingang der Steuereinrichtung verbunden ist, wobei das Stopp-Funkrelais auf das Stopp-Erregungsfunksignal und eine Erdung über den Eingang der Steuereinrichtung anspricht, um eine Erregung des Rahmenzündrelais und damit einen Betrieb des Verbrennungsmotors zu unterbrechen.

3. Zündsteuersystem für einen Verbrennungsmotor nach Anspruch 2, ferner aufweisend:

eine Diode (140), die so geschaltet ist, dass sie das Aktivierungssignal vom Ausgang des Start-Funkrelais zu einem Sense-Eingang des Start-Funkrelais zurückleitet, um eine Sicherung gegen einen möglichen Verlust des Erregungssignals von der Steuereinrichtung zu erhalten.

4. Zündsteuersystem für einen Verbrennungsmotor nach Anspruch 3, ferner aufweisend:

einen Sicherheitsschalter (142), der zwischen das Start-Funkrelais und einen Sense-Eingang des Starterrelais geschaltet ist.

5. Zündsteuersystem für einen Verbrennungsmotor nach Anspruch 3, ferner aufweisend:

einen Sicherungsantriebsmotor und -magneten (54), der mit der Quelle für elektrische Fahrzeugleistung verbunden ist;
ein Relais (46) zum Hemmen des Betriebs des Sicherungsantriebsmotors;
ein Sicherungsantriebsmotor-Relais (36), das so geschaltet ist, dass es eine Erregung von einem zweiten Ausgang des Start-Funkrelais empfängt, und das mit dem Funkschalter verschaltet ist, um auf die Gleichzeitigkeit einer geschlossenen Stellung des Funkschalters und einer Anlegung des Erregungssignals vom Start-Funkrelais **dadurch** anspricht, dass es ein Erregungssignal vom Start-Funkrelais auf das Relais (46) zum Hemmen des Betriebs des Sicherungsantriebsmotors als Eingang überträgt; und
wobei die Steuereinrichtung ferner ansprechend darauf, dass der Schlüsselschalter die Zündstellung einnimmt und eine Andrehung des Verbrennungsmotors versucht, aber nicht geschafft wurde, an einem Hemmungseingang eine Erdung bereitstellt.

6. Zündsteuersystem für einen Verbrennungsmotor nach Anspruch 5, ferner aufweisend,
dass die Steuereinrichtung so programmiert ist, dass sie für eine Verzögerung bei der Erdung des Hemmungseingangs im Anschluss an eine Unterbrechung eines Verbrennungsmotorbetriebs sorgt.

7. Nutzfahrzeug (1), in dem ein Verbrennungsmotor per Funk ausgeschaltet und gestartet wird, aufweisend:

ein Zündsteuersystem für ein Fahrzeug nach Anspruch 1;
eine Quelle für elektrische Leistung (21);
wobei der Startermotor mechanisch mit dem Verbrennungsmotor und einem Startermagneten verbunden ist, um den Startermotor mit der Quelle für elektrische Leistung zu verbinden;
wobei der mehrfach verstellbare Zündschalter (102) ferner eine Ausschaltstellung (AUS) aufweist;
wobei der Funkschalter (110) eine voreingestellte offene Stellung und eine geschlossene Stellung aufweist;
wobei die Steuereinrichtung für das elektrische System so angeschlossen ist, dass sie die Bewegung des Funkschalters in die geschlossene Stellung erfasst, wobei die Steuereinrichtung für das elektrische System auf die Gleichzeitigkeit einer Erfassung der Bewegung des Funkschalters und eines Laufens des Verbrennungsmotors mit einer Erdung an einem Stopp-Funkrelaisaktivierungsport anspricht, und auf die Gleichzeitigkeit einer Erfassung der Bewegung des Funkschalters und eines Stehens des Verbrennungsmotors mit der Lieferung eines Start-Funkrelaiserregungssignals an einem Startsignalport anspricht; und
wobei das Startfunkrelais (138) durch einen Eingang so angeschlossen ist, dass es auf das Start-Funkrelaiserregungssignal am Startsignalport der Steuereinrichtung für das elektrische Systems **dadurch** anspricht, dass es den Ausgang des mehrfach verstellbaren Zündschalters durch einen Ausgang mit einem Eingang des Starterrelais verbindet, wobei das Starterrelais auf eine Erregung des Ausgangs des mehrfach verstellbaren Zündschalters mit der Lieferung eines Aktivierungssignals am Startermagneten anspricht.

8. Nutzfahrzeug, in dem ein Verbrennungsmotor per Funk ausgeschaltet und gestartet wird, nach Anspruch 7, ferner aufweisend
eine Diode (140) zur Rückübertragung der Erregung, die dem Starterrelais von dem Start-Funkrelais geliefert wird, zu einem Sense-Eingang des Start-Fernrelais, um das Start-Fernrelais zu sperren; und
wobei das Starterrelais mit dem Funkschalter verbunden ist, so dass es aktiv bleibt, nachdem es gesperrt wurde, solange der Funkschalter geschlossen ist.

9. Nutzfahrzeug, in dem ein Verbrennungsmotor per

Funk ausgeschaltet und gestartet wird, nach Anspruch 7, ferner aufweisend
eine Verbrennungsmotor-Steuereinrichtung mit einem Zündeingang, die auf ein Freigabesignal am Zündeingang anspricht, um ein Laufen des Motors zuzulassen;
ein Zündrelais (116), um ein Aktivierungssignal am Zündeingang zu liefern;
ein Stopp-Funkrelais (114) mit einem Erregungseingang und einem Freigabeeingang, um das Aktivierungssignal an das Zündrelais zu liefern; und wobei die Steuereinrichtung für das elektrische System mit dem Freigabeeingang des Stopp-Funkrelais verbunden ist und ferner auf eine geschlossene Stellung des Funkschalters bei laufendem Motor mit der Lieferung eines Freigabesignals an den Freigabeeingang des Stopp-Funkrelais anspricht.

10. Nutzfahrzeug, in dem ein Verbrennungsmotor per Funk ausgeschaltet und gestartet wird, nach Anspruch 9, ferner aufweisend:

ein Funkschalterzustands-Erfassungsrelais (132), das mit dem Funkschalter und mit dem Ausgang des mehrfach verstellbaren Zündschalters verschaltet ist, und das auf die Gleichzeitigkeit eines Erregungssignals am Ausgang des mehrfach verstellbaren Zündschalters und eine geschlossene Stellung des Funkschalters mit der Erzeugung eines Stopp-Funkerregungssignals zum Anlegen an einen Erregungseingang des Stopp-Funkrelais anspricht.

11. Nutzfahrzeug, in dem ein Verbrennungsmotor per Funk ausgeschaltet und gestartet wird, nach Anspruch 10, ferner aufweisend:

einen Sicherungsmotor und magneten (54), der von der Quelle für elektrische Leistung erregt wird;
wobei die Steuereinrichtung für das elektrische System auf Bedingungen, die ein Misslingen einer Wiederaufnahme des Verbrennungsmotorbetriebs nach einem vom Funkschalter initiierten Andrehen anzeigen, mit der Ausgabe eines Hemmungssperrsignals anspricht;
ein Sicherungsmotor-Hemmungsrelais (46), das mit der Steuereinrichtung für das elektrische System verbunden ist, um das Hemmungssperrsignal zu empfangen;
ein Sicherungsmotor-Erregungsrelais (36), das mit dem Ausgang vom mehrfach verstellbaren Zündschalter und mit dem Fernschalter verschaltet ist, um auf die Gleichzeitigkeit einer geschlossenen Stellung des Funkschalters und eines Erregungssignals am Ausgang durch Beaufschlagen des Sicherungsmotor-Hemmungsrelais mit einem Sicherungsmotor-Aktivierungssignal anzusprechen; und
wobei das Sicherungsmotor-Hemmungsrelais zwischen das Sicherungsmotor-Erregungsrelais und den Sicherungsmotor geschaltet ist, um das Sicherungsmotor-Aktivierungssignal ansprechend auf das Hemmungssperrsignal auf den Sicherungsmotor zu übertragen.

12. Nutzfahrzeug, in dem ein Verbrennungsmotor per Funk ausgeschaltet und gestartet wird, nach Anspruch 11, ferner aufweisend,
dass es sich bei einem Hemmungssperrsignal um das Fehlen einer Erdung über einen Port an der Steuereinrichtung handelt.

13. Nutzfahrzeug, in dem ein Verbrennungsmotor per Funk ausgeschaltet und gestartet wird, nach Anspruch 12, ferner aufweisend:

eine hydraulische Pumpe (60), die so angeschlossen ist, dass sie vom Verbrennungsmotor und vom Sicherungsmotor angetrieben wird; und
eine hydraulische Hebeeinheit, die mit der Hydraulikpumpe verbunden ist.

14. Nutzfahrzeug, in dem ein Verbrennungsmotor per Funk ausgeschaltet und gestartet wird, nach Anspruch 13, ferner aufweisend:

eine Hubeinheit, die einen Korb (5) für einen Insassen aufweist, der mit der hydraulischen Hubeinheit derart verbunden ist, dass er angehoben und abgesenkt werden kann.

15. Nutzfahrzeug, in dem ein Verbrennungsmotor per Funk ausgeschaltet und gestartet wird, nach Anspruch 14, ferner aufweisend:

ein pneumatisches Stellsystem für den Funkschalter, das vom Korb aus zugänglich ist.

Revendications

1. Système de commande de l'allumage d'un moteur de véhicule comprenant :

un solénoïde et moteur (59) de démarreur ;
une électronique (20) de commande de moteur ;
un moteur (30) couplé au moteur de démarreur, pour le démarrage, et à l'électronique de commande du moteur,
pour la commande de son fonctionnement ;
un interrupteur (102) d'allumage ;
un téléinterrupteur (110) ménageant une connexion électrique à la terre lorsqu'il est fermé ;
un relais (138) de télédémarrage, pour fournir

un signal d'activation sur une sortie (87) ; et
un relais (112) de démarreur couplé, de manière à réagir au signal d'activation provenant du relais de télédémarrage, pour fournir une excitation d'activation au solénoïde et moteur de démarreur ;
caractérisé en ce que
l'interrupteur (102) d'allumage est un interrupteur (102) d'allumage à position multiple ayant des première et
seconde sorties, qui prennent des états excités en réaction à un positionnement d'un interrupteur clé, la deuxième sortie étant excitée en réaction à la mise de l'interrupteur clé dans une position (IGN) d'allumage ou
dans une position (ST) de démarrage ;
le système comprenant, en outre, une unité (24) de commande communiquant avec l'électronique de commande du moteur et couplée au téléinterrupteur, pour être sensible à une fermeture du téléinterrupteur et à l'indication que le moteur ne fonctionne pas actuellement, pour fournir un signal d'excitation de télédémarrage ;
dans lequel le relais (138) de télédémarrage est couplé,
pour réagir au signal d'excitation de télédémarrage se produisant concurremment avec la fermeture du téléinterrupteur de démarrage, pour fournir un signal d'activation sur une sortie (87) ;
le relais (112) de démarreur est couplé, pour réagir à l'excitation de la première sortie de l'interrupteur d'allumage à position multiple ou au signal d'activation provenant du relais de télédémarrage, pour fournir une excitation d'activation au solénoïde et moteur de démarreur.

2. Système de commande de l'allumage d'un moteur de véhicule suivant la revendication 1, comprenant, en outre :

une source (21) de courant électrique du véhicule ;
un relais (116) d'allumage de châssis, pour appliquer du courant de la source de courant électrique du véhicule à l'électronique de commande du moteur, afin de maintenir le moteur en fonctionnement ;
un relais (132) de télédétection de l'état d'un interrupteur couplé au téléinterrupteur et à la deuxième sortie de l'interrupteur d'allumage à position multiple et sensible à l'apparition simultanée d'un signal d'excitation sur la deuxième sortie de l'interrupteur d'allumage à position multiple et à la fermeture du téléinterrupteur, pour produire un signal d'excitation du téléarrêt ;
l'unité (24) de commande étant, en outre, sensible à une fermeture du téléinterrupteur et à l'indication que le moteur fonctionne, pour fournir une connexion à la terre par l'intermédiaire d'une entrée ; et
un relais (114) de téléarrêt, pour appliquer de l'excitation provenant de l'interrupteur d'allumage à position multiple au relais d'allumage de châssis relié au relais de télédétection de l'état d'un interrupteur,
pour recevoir le signal d'excitation de téléarrêt et connecté, en outre, à l'entrée de l'unité de commande, le relais de téléarrêt étant sensible au signal d'excitation de téléarrêt et à la mise à la terre par l'entrée de l'unité de commande, pour interrompre l'excitation du relais d'allumage de châssis et ainsi le fonctionnement du moteur.

3. Système de commande de l'allumage d'un moteur de véhicule suivant la revendication 2, comprenant en outre :

une diode (140) montée pour conduire le signal d'activation de la sortie du relais de télédémarrage en sens inverse vers une entrée de détection du relais de télédémarrage en réserve d'une perte possible du signal d'excitation provenant de l'unité de commande.

4. Système de commande de l'allumage d'un moteur de véhicule suivant la revendication 3, comprenant en outre :

un interrupteur (142) de sécurité monté entre le relais de télédémarrage et une entrée de détection du relais de démarreur.

5. Système de commande de l'allumage d'un moteur de véhicule suivant la revendication 3, comprenant, en outre :

un moteur et solénoïde (54) d'attaque de réserve reliés à la source de courant électrique du véhicule ;
un relais (46) d'inhibition du fonctionnement du moteur d'attaque de réserve ;
un relais (36) de moteur d'attaque de réserve monté pour recevoir de l'excitation d'une deuxième sortie du relais de télédémarrage et couplé au téléinterrupteur, pour être sensible à la fermeture concomitante du téléinterrupteur et à l'application du signal d'excitation en provenance du relais de télédémarrage, pour fournir le signal d'excitation provenant du relais de télédémarrage au relais d'inhibition du fonctionnement du moteur d'entraînement de réserve en tant qu'entrée ; et
l'unité de commande fournissant, en outre, une liaison à la terre sur une entrée d'inhibition, en réaction au fait que l'interrupteur clé est dans la position d'allumage et

que l'on a essayé sans succès de lancer le moteur.

6. Système de commande de l'allumage d'un moteur de véhicule suivant la revendication 5, comprenant, en outre :

le fait que l'unité de commande est programmée pour donner un retard à la connexion de l'entrée d'inhibition à la terre à la suite de l'arrêt du fonctionnement du moteur.

7. Camion (1) utilitaire ayant un téléarrêt et un télédémarrage du moteur, comprenant :

un système de commande de l'allumage du moteur d'un véhicule suivant la revendication 1 ;
une source (21) de courant électrique ;
dans lequel le moteur de démarreur est couplé mécaniquement au moteur et solénoïde de démarreur, pour relier le moteur de démarreur à la source de courant électrique ;
l'interrupteur (102) d'allumage à position multiple comprenant en outre une position ouverte (OFF) ;
le téléinterrupteur (112) a une position ouverte de défaut et une position fermée ;
l'unité électrique de commande du système est montée pour détecter le mouvement du téléinterrupteur allant vers la position fermée, l'unité électrique de commande du système étant sensible à la détection du mouvement du téléinterrupteur concurremment avec le fait que le moteur tourne, pour fournir une première connexion à la terre sur un accès validant un relais de téléarrêt et pour la détection du mouvement du téléinterrupteur concurremment avec le fait que le moteur ne tourne pas pour fournir un signal d'excitation du relais de télédémarrage sur un accès de signal de démarrage ; et
le relais (138) de télédémarrage est relié par une entrée pour réagir au signal d'excitation du relais de télédémarrage sur l'accès de signal de démarrage de l'unité électrique de commande du système, pour relier la sortie de l'interrupteur d'allumage à position multiple par une sortie à une entrée du relais de démarreur, le relais de démarreur étant sensible à l'excitation de la sortie du relais d'allumage à position multiple, pour fournir un signal d'excitation au solénoïde de démarreur.

8. Camion utilitaire ayant un téléarrêt et un télédémarrage du moteur suivant la revendication 7, comprenant, en outre :

une diode (140) pour renvoyer l'excitation fournie au relais de démarreur par le relais de télédémarrage à une entrée de détection du relais de télédémarrage pour verrouiller le relais de télédémarrage ; et
le relais de démarreur étant relié au téléinterrupteur,
pour rester actif après avoir été verrouillé aussi longtemps que le téléinterrupteur est fermé.

9. Camion utilitaire ayant un téléarrêt et un télédémarrage du moteur suivant la revendication 7, comprenant, en outre :

une unité de commande du moteur, ayant une entrée d'allumage et sensible à un signal de validation sur l'entrée d'allumage, pour permettre au moteur de tourner ;
un relais (116) d'allumage, pour fournir un signal d'activation sur l'entrée d'allumage ;
un relais (114) de téléarrêt, ayant une entrée d'excitation et une entrée de validation, pour fournir le signal d'activation au relais d'allumage ; et
le dispositif électrique de commande du système étant relié à l'entrée de validation du relais de téléarrêt et
étant sensible, en outre, à une fermeture du téléinterrupteur, lorsque le moteur tourne pour fournir un signal de validation à l'entrée de validation du relais de téléarrêt.

10. Camion utilitaire ayant un téléarrêt et un télédémarrage du moteur suivant la revendication 9, comprenant, en outre :

un relais (132) de télédétection de l'état d'un interrupteur couplé au téléinterrupteur et à la sortie de l'interrupteur d'allumage à position multiple et sensible à l'apparition simultanée d'un signal d'excitation sur la sortie de l'interrupteur d'allumage à position multiple et à la fermeture du téléinterrupteur, pour produire un signal d'excitation du relais de téléarrêt à appliquer à l'entrée d'excitation du relais de téléarrêt.

11. Camion utilitaire ayant un téléarrêt et un télédémarrage du moteur suivant la revendication 10, comprenant, en outre :

un moteur et solénoïde (54) de réserve à exciter par la source de courant électrique ;
l'unité électrique de commande du système étant sensible à des états indiquant une défaillance du moteur à reprendre un fonctionnement après avoir fait un lancement initié par le téléinterrupteur afin de fournir un signal d'invalidation d'inhibition ;
un relais (46) d'inhibition du moteur de réserve, relié à l'unité électrique de commande du sys-

tème, pour recevoir le signal d'invalidation d'inhibition ;
un relais (36) d'excitation du moteur de réserve, couplé à la sortie de l'interrupteur d'allumage à position multiple et au téléinterrupteur, pour réagir à la fermeture concomitante du téléinterrupteur et à un signal d'excitation sur la sortie, pour appliquer un signal d'activation du moteur de réserve au relais d'inhibition du moteur de réserve ; et
le relais d'inhibition du moteur de réserve étant monté entre le relais d'excitation du moteur de réserve et le moteur de réserve, pour appliquer le signal d'activation du moteur de réserve au moteur de réserve en réaction au signal d'invalidation d'inhibition.

12. Camion utilitaire ayant un téléarrêt et un télédémarrage du moteur suivant la revendication 11, comprenant, en outre :

le signal d'invalidation d'inhibition étant l'absence d'une connexion à la terre par l'accès sur l'unité de commande.

13. Camion utilitaire ayant un téléarrêt et un télédémarrage du moteur suivant la revendication 12, comprenant, en outre :

une pompe (60) hydraulique montée pour être alimentée par le moteur et par le moteur de réserve ; et
une unité hydraulique de levage couplée à la pompe hydraulique.

14. Camion utilitaire ayant un téléarrêt et un télédémarrage du moteur suivant la revendication 13, comprenant, en outre :

une unité aérienne de levage comprenant une benne (5) pour un occupant couplé à l'unité hydraulique de levage pour la soulever et l'abaisser.

15. Camion utilitaire ayant un téléarrêt et un télédémarrage du moteur suivant la revendication 14, comprenant, en outre :

un système pneumatique d'actionnement du téléinterrupteur accessible de la.benne.

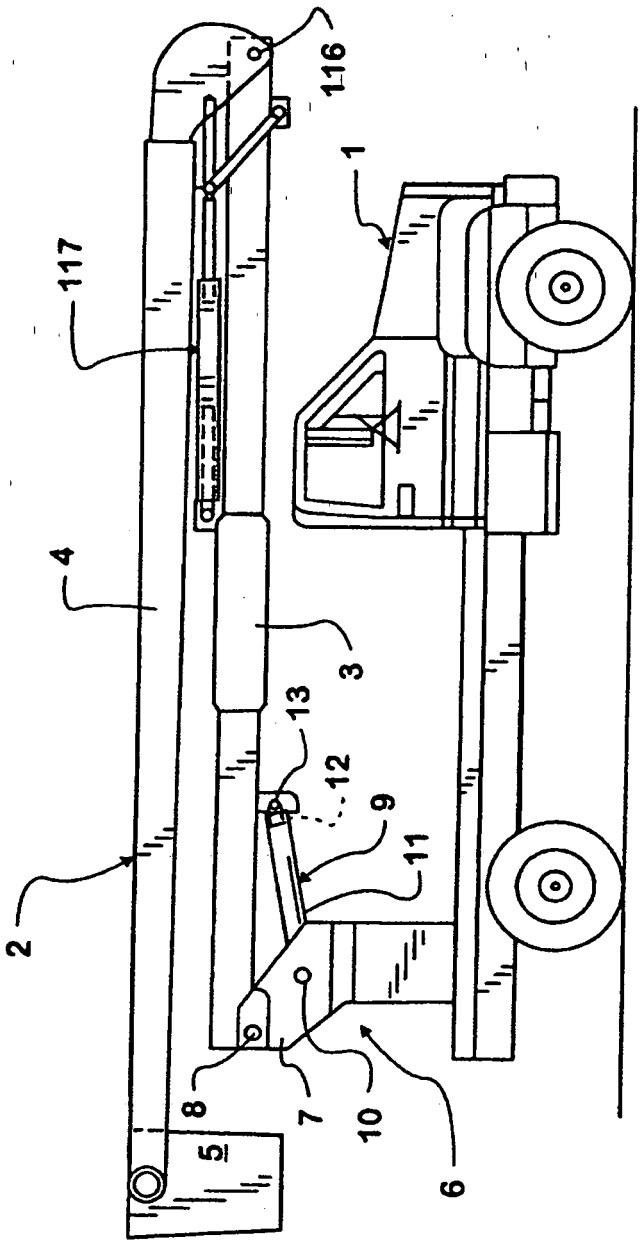

FIG. 1

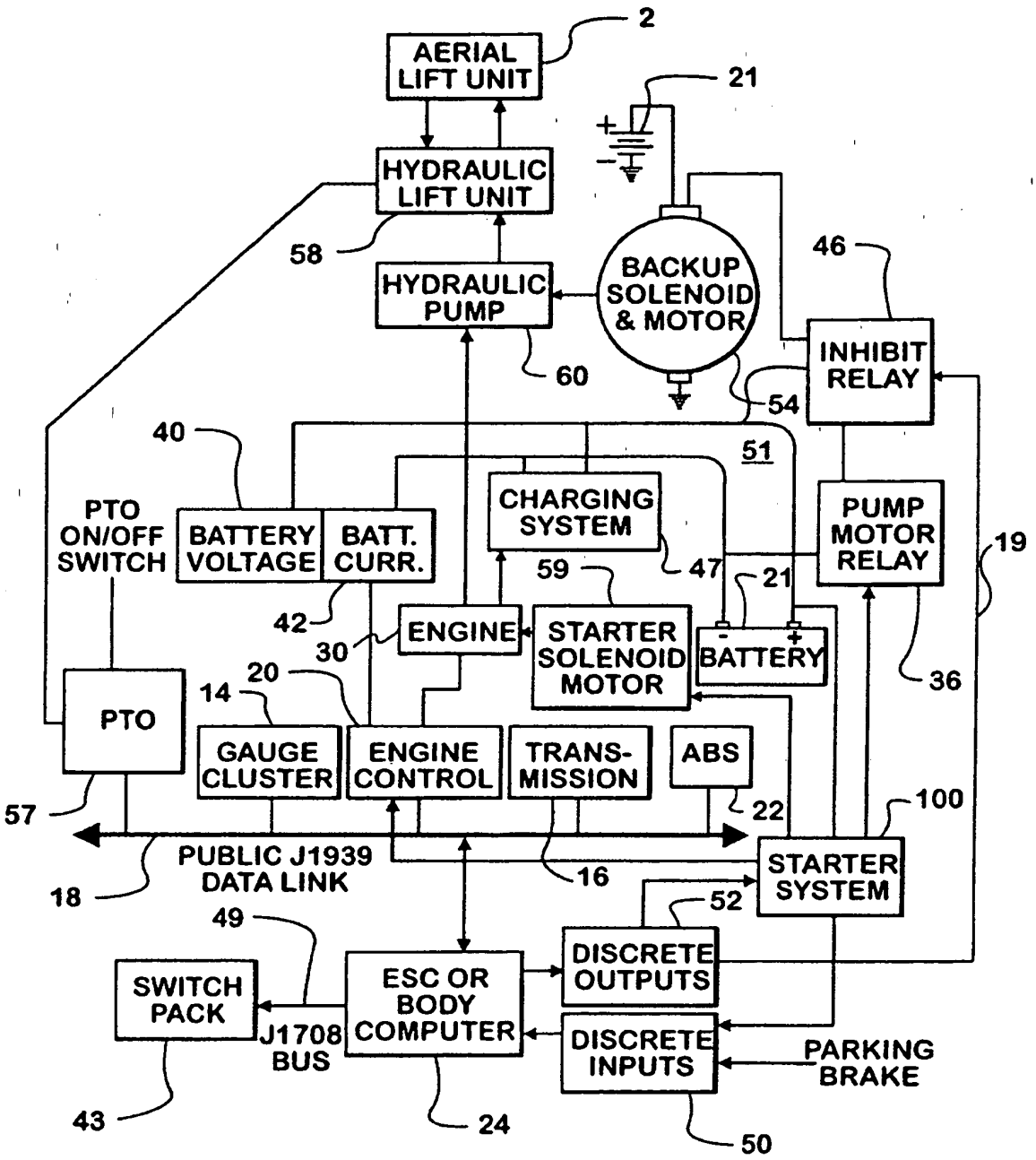
AERIAL LIFT UNIT
2
21
HYDRAULIC LIFT UNIT
58
HYDRAULIC PUMP
60
BACKUP SOLENOID & MOTOR
46
INHIBIT RELAY
54
40
51
PTO ON/OFF SWITCH
BATTERY VOLTAGE
BATT. CURR.
CHARGING SYSTEM
47
59
PUMP MOTOR RELAY
19
42
30
ENGINE
STARTER SOLENOID MOTOR
BATTERY
36
PTO
20
14
GAUGE CLUSTER
ENGINE CONTROL
TRANS-MISSION
ABS
22
100
57
18
PUBLIC J1939 DATA LINK
16
STARTER SYSTEM
52
49
SWITCH PACK
ESC OR BODY COMPUTER
DISCRETE OUTPUTS
J1708 BUS
DISCRETE INPUTS
PARKING BRAKE
43
24
50

FIG. 2

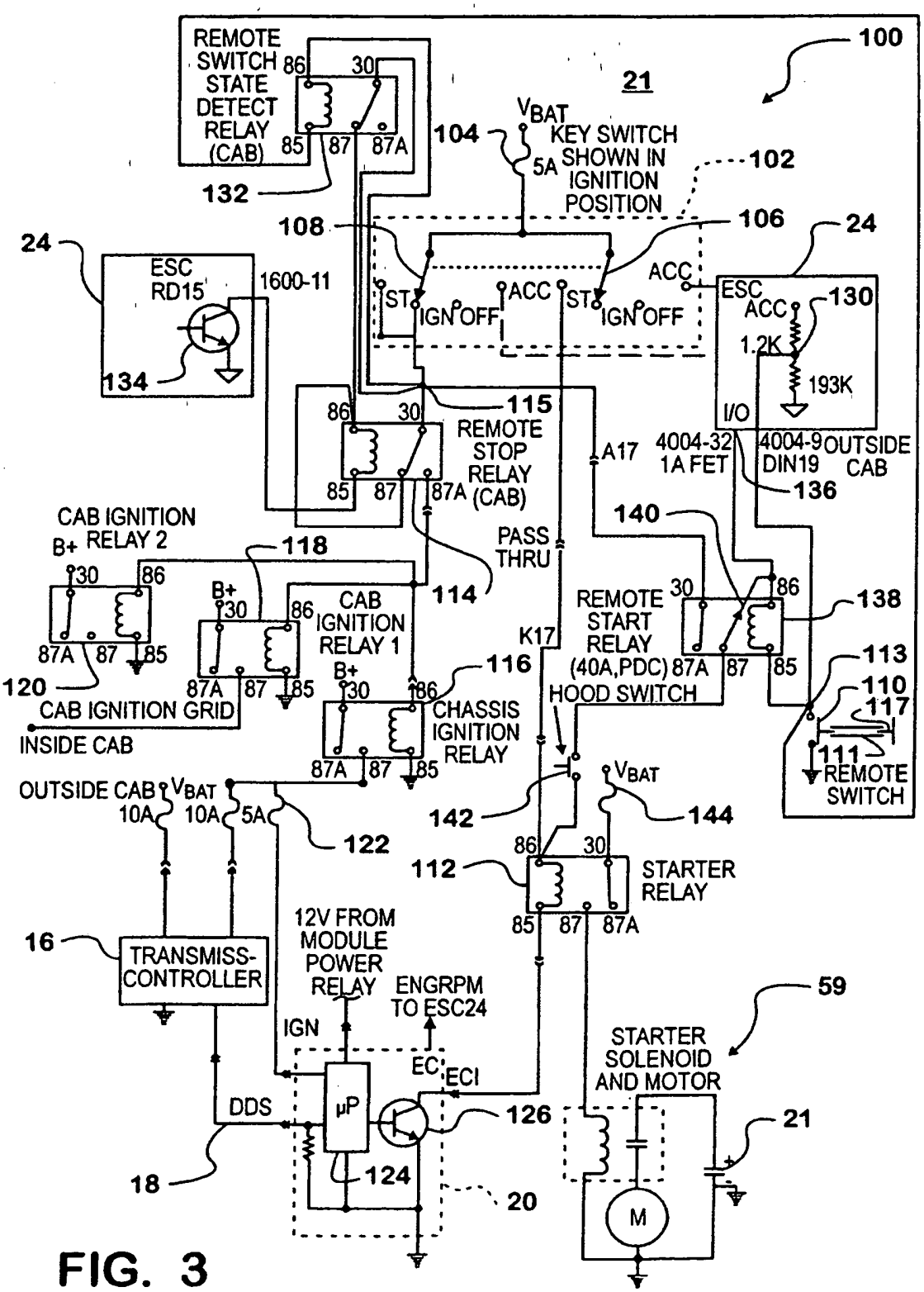
REMOTE SWITCH STATE DETECT RELAY (CAB)
86
30
85
87
87A
132
100
21
104
V_{BAT}
5A
KEY SWITCH SHOWN IN IGNITION POSITION
102
108
106
24
ESC RD15
1600-11
134
ST
IGN
OFF
ACC
ESC
ACC
130
1.2K
193K
I/O
115
REMOTE STOP RELAY (CAB)
A17
4004-32 1A FET
4004-9 DIN19
OUTSIDE CAB
136
CAB IGNITION B+ RELAY 2
118
PASS THRU
114
140
REMOTE START RELAY (40A,PDC)
K17
138
CAB IGNITION RELAY 1
116
HOOD SWITCH
113
110
117
111
REMOTE SWITCH
120
CAB IGNITION GRID
INSIDE CAB
CHASSIS IGNITION RELAY
OUTSIDE CAB
10A
10A
5A
122
142
144
112
STARTER RELAY
16
TRANSMISS-CONTROLLER
12V FROM MODULE POWER RELAY
ENGRPM TO ESC24
IGN
EC
ECI
59
STARTER SOLENOID AND MOTOR
DDS
µP
126
21
18
124
20
M

FIG. 3

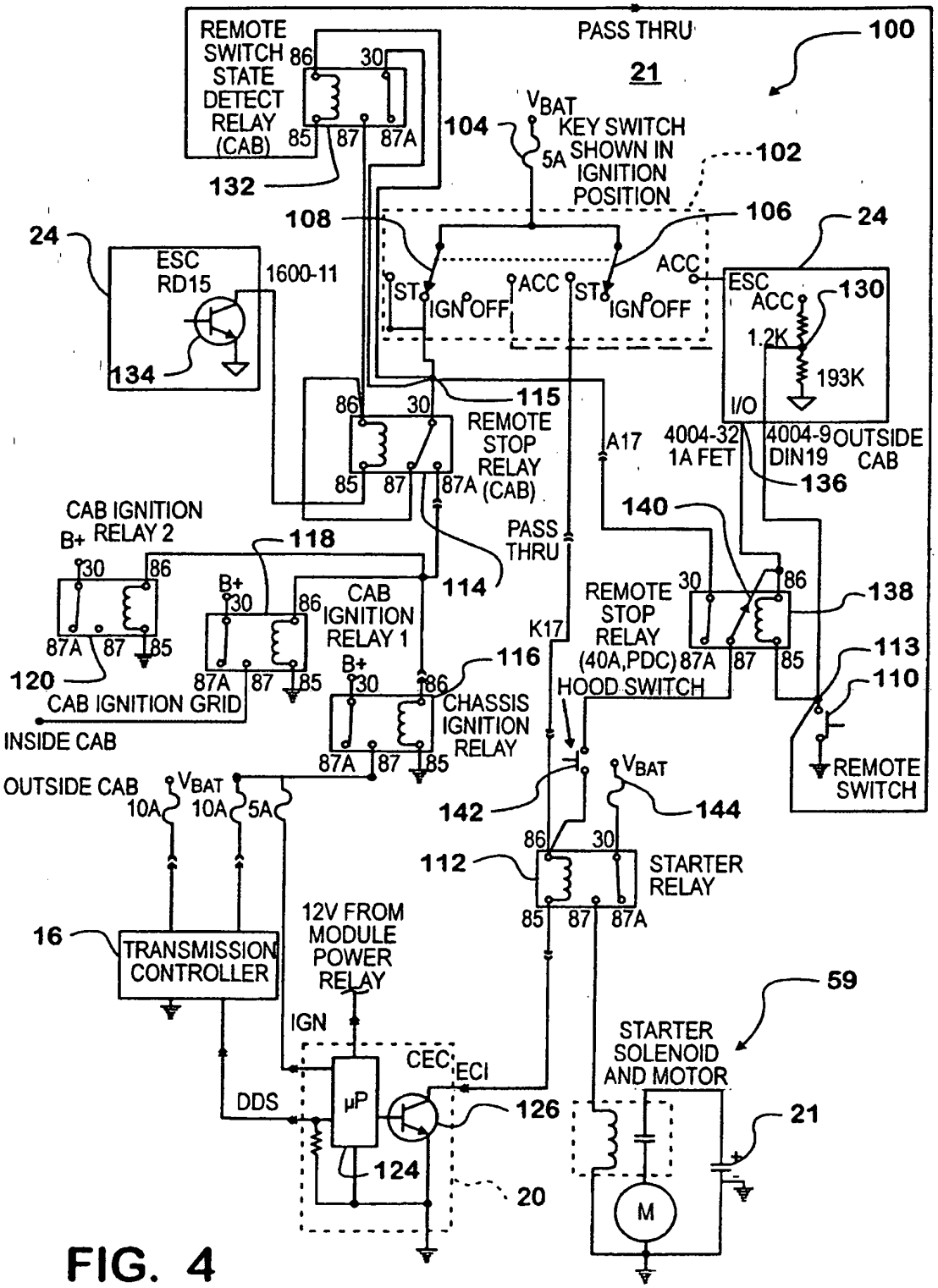
REMOTE SWITCH STATE DETECT RELAY (CAB)
86
30
85
87
87A
132
PASS THRU
21
100
V_{BAT}
104
KEY SWITCH
5A
SHOWN IN IGNITION POSITION
102
108
106
24
ESC RD15
1600-11
134
ST
IGN
OFF
ACC
ESC
130
1.2K
193K
I/O
115
REMOTE STOP RELAY (CAB)
A17
4004-32 1A FET
4004-9 DIN19
OUTSIDE CAB
136
CAB IGNITION B+ RELAY 2
118
PASS THRU
114
140
CAB IGNITION RELAY 1
REMOTE STOP RELAY (40A,PDC)
138
K17
116
113
110
120
CAB IGNITION GRID
INSIDE CAB
CHASSIS IGNITION RELAY
HOOD SWITCH
REMOTE SWITCH
OUTSIDE CAB
10A
5A
142
144
112
STARTER RELAY
16
TRANSMISSION CONTROLLER
12V FROM MODULE POWER RELAY
IGN
59
STARTER SOLENOID AND MOTOR
CEC
ECI
DDS
µP
126
124
20
21
M

FIG. 4

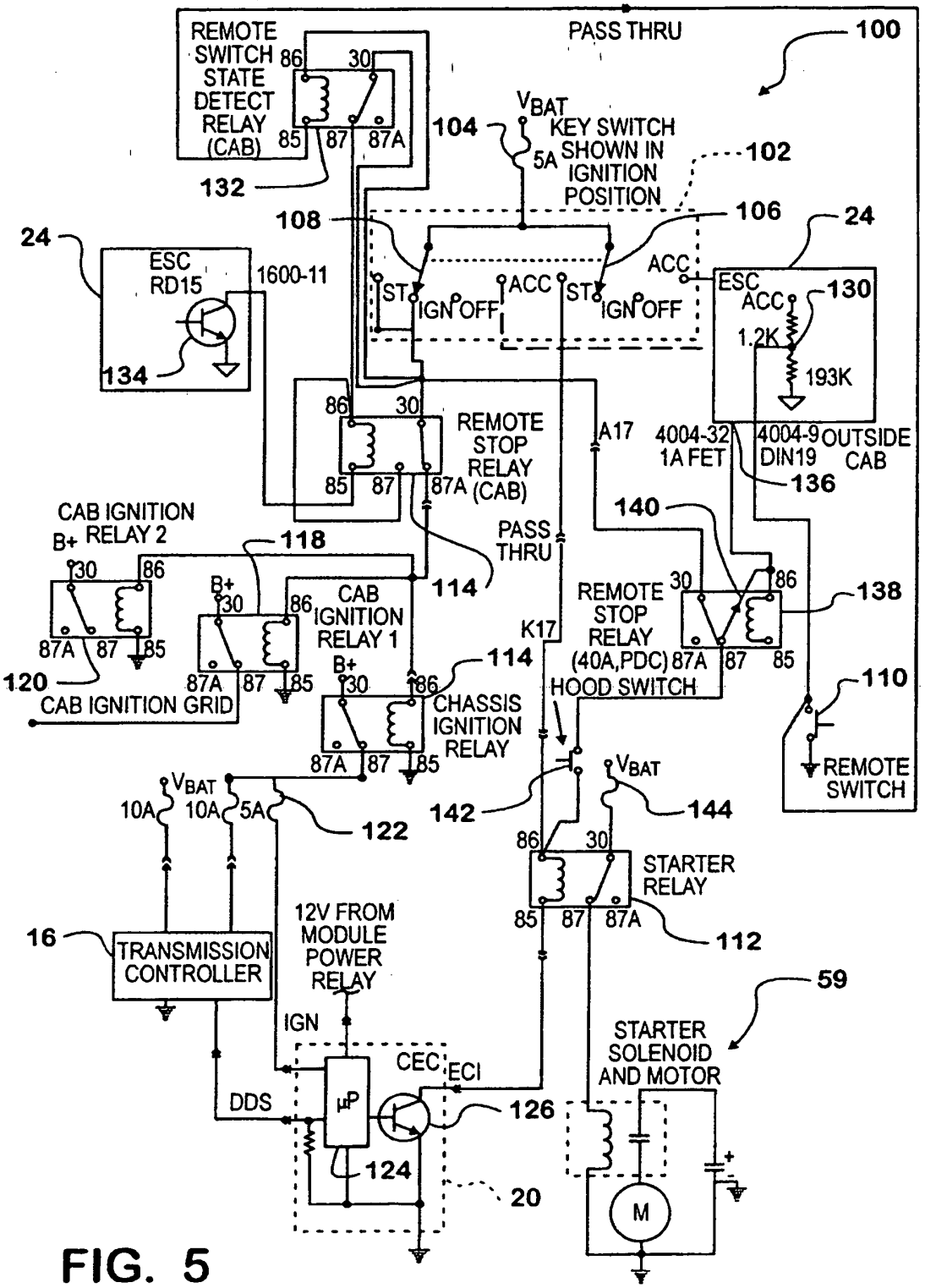
REMOTE SWITCH STATE DETECT RELAY (CAB)
PASS THRU
100
V_{BAT}
104
KEY SWITCH SHOWN IN IGNITION POSITION
102
5A
132
108
106
24
ESC RD15
1600-11
134
ST
IGN
OFF
ACC
ESC
130
1.2K
193K
REMOTE STOP RELAY (CAB)
A17
4004-32 1A FET
4004-9 DIN19
OUTSIDE CAB
136
140
CAB IGNITION B+ RELAY 2
118
PASS THRU
114
CAB IGNITION RELAY 1
REMOTE STOP RELAY (40A,PDC)
138
K17
120
CAB IGNITION GRID
CHASSIS IGNITION RELAY
HOOD SWITCH
110
REMOTE SWITCH
142
144
V_{BAT}
10A
10A
5A
122
STARTER RELAY
112
16
TRANSMISSION CONTROLLER
12V FROM MODULE POWER RELAY
59
IGN
CEC
ECI
STARTER SOLENOID AND MOTOR
DDS
μP
126
124
20
M

FIG. 5

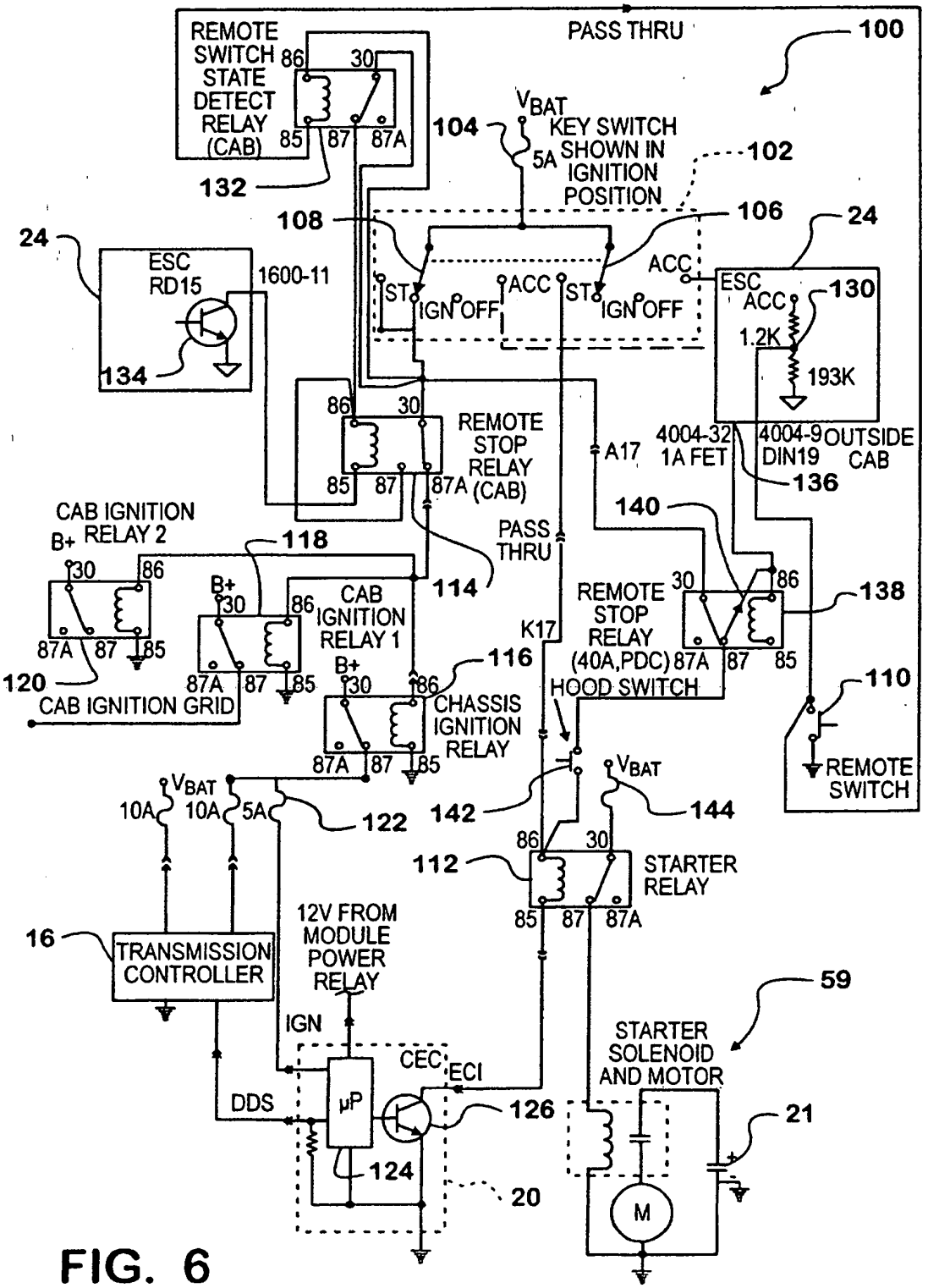
REMOTE SWITCH STATE DETECT RELAY (CAB)
86
30
85
87
87A
132
PASS THRU
100
V_{BAT}
104
KEY SWITCH SHOWN IN IGNITION POSITION
5A
102
108
106
24
ESC RD15
1600-11
134
ST
IGN
OFF
ACC
ESC ACC
130
1.2K
193K
REMOTE STOP RELAY (CAB)
A17
4004-32 1A FET
4004-9 DIN19
OUTSIDE CAB
136
CAB IGNITION B+ RELAY 2
118
PASS THRU
114
140
CAB IGNITION RELAY 1
B+
REMOTE STOP RELAY (40A,PDC)
138
K17
116
CHASSIS IGNITION RELAY
HOOD SWITCH
110
120
CAB IGNITION GRID
REMOTE SWITCH
V_{BAT}
10A
5A
122
142
144
112
STARTER RELAY
16
TRANSMISSION CONTROLLER
12V FROM MODULE POWER RELAY
IGN
59
STARTER SOLENOID AND MOTOR
CEC
ECI
DDS
µP
126
21
124
20
M

FIG. 6

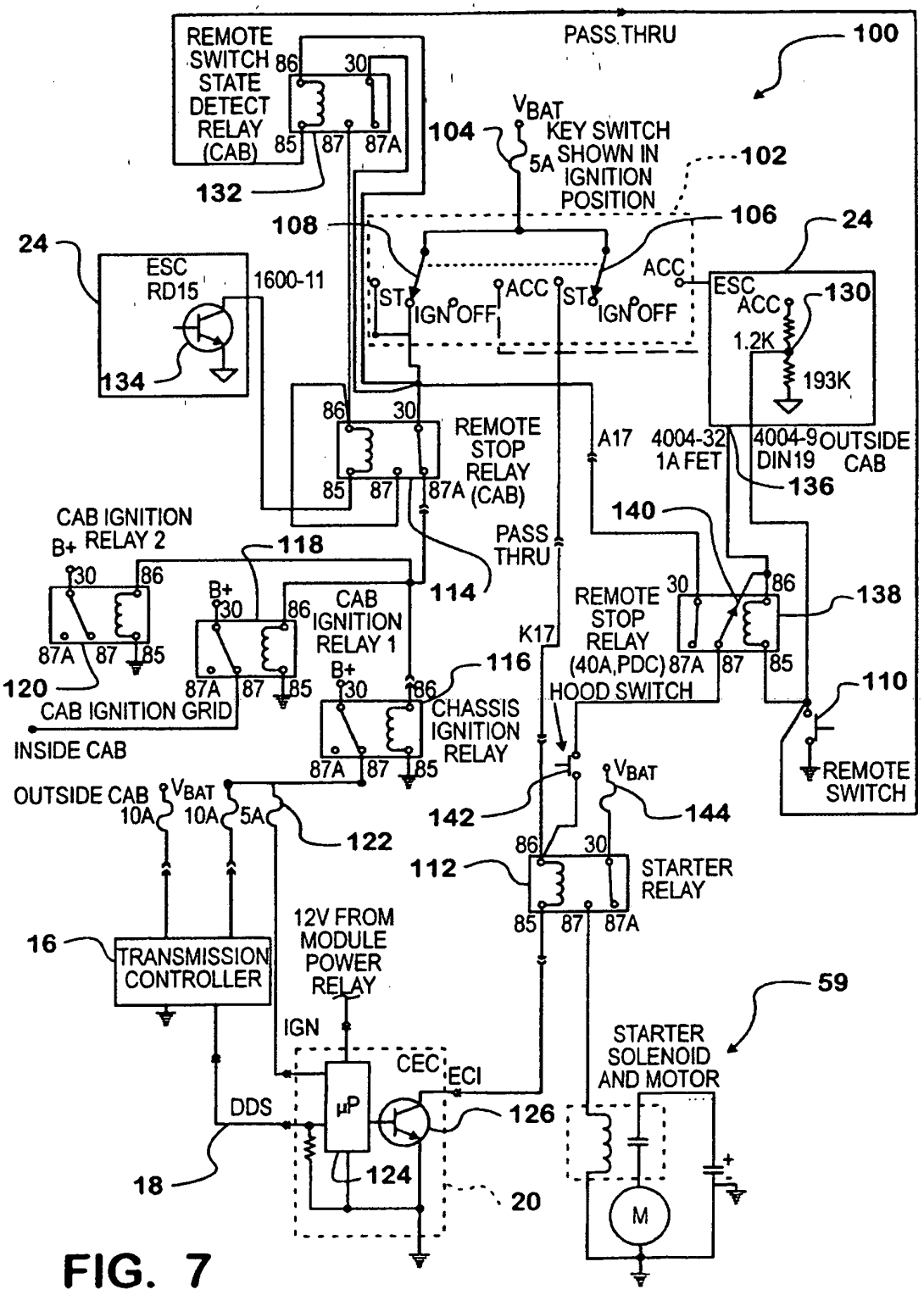
REMOTE SWITCH STATE DETECT RELAY (CAB)
86
30
85
87
87A
132
PASS THRU
100
104
VBAT
5A
KEY SWITCH SHOWN IN IGNITION POSITION
102
106
108
24
ESC RD15
1600-11
134
ST
IGN
OFF
ACC
ESC
130
1.2K
193K
REMOTE STOP RELAY (CAB)
A17
4004-32 1A FET
4004-9 DIN19
OUTSIDE CAB
136
140
CAB IGNITION RELAY 2
B+
118
114
PASS THRU
CAB IGNITION RELAY 1
116
K17
REMOTE STOP RELAY (40A,PDC)
138
120
CAB IGNITION GRID
INSIDE CAB
CHASSIS IGNITION RELAY
HOOD SWITCH
110
REMOTE SWITCH
OUTSIDE CAB
10A
5A
122
142
144
112
STARTER RELAY
16
TRANSMISSION CONTROLLER
12V FROM MODULE POWER RELAY
IGN
CEC
ECI
DDS
μP
126
124
18
20
59
STARTER SOLENOID AND MOTOR
M

FIG. 7

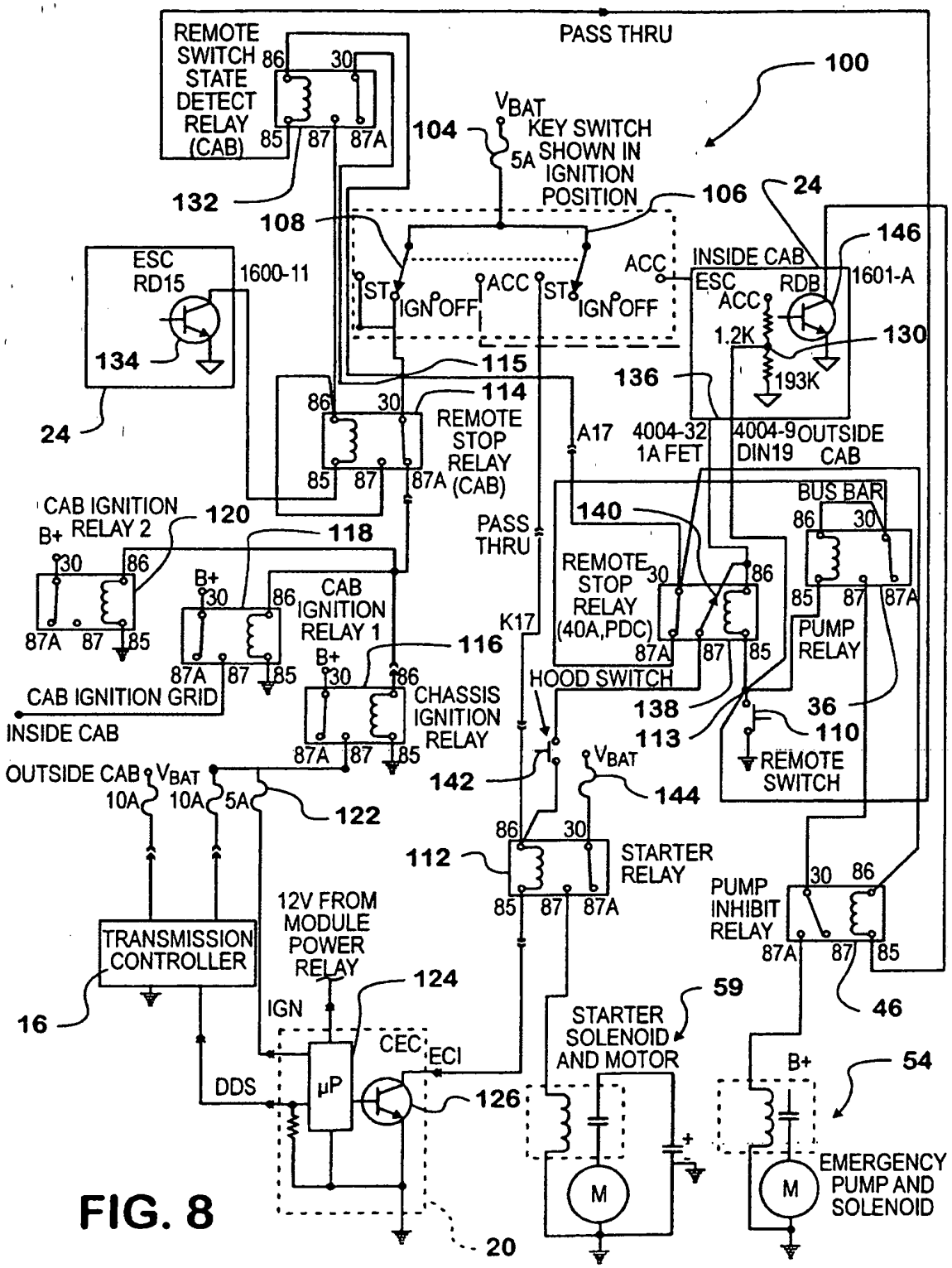
REMOTE SWITCH STATE DETECT RELAY (CAB)
86
30
85
87
87A
132
PASS THRU
100
V_{BAT}
104
5A
KEY SWITCH SHOWN IN IGNITION POSITION
106
24
108
ESC RD15
1600-11
134
ST
IGN
OFF
ACC
ST
IGN
OFF
ACC
INSIDE CAB
ESC
RDB
1601-A
ACC
1.2K
130
193K
136
115
114
REMOTE STOP RELAY (CAB)
24
A17
4004-32 1A FET
4004-9 DIN19
OUTSIDE CAB
146
CAB IGNITION RELAY 2
120
118
B+
CAB IGNITION RELAY 1
116
CAB IGNITION GRID
INSIDE CAB
CHASSIS IGNITION RELAY
PASS THRU
140
BUS BAR
REMOTE STOP RELAY (40A,PDC)
K17
HOOD SWITCH
138
113
PUMP RELAY
36
110
REMOTE SWITCH
OUTSIDE CAB
V_{BAT}
10A
10A
5A
122
142
V_{BAT}
144
112
STARTER RELAY
TRANSMISSION CONTROLLER
16
12V FROM MODULE POWER RELAY
IGN
124
CEC
ECI
DDS
μP
126
20
59
STARTER SOLENOID AND MOTOR
PUMP INHIBIT RELAY
46
B+
54
EMERGENCY PUMP AND SOLENOID
M

FIG. 8

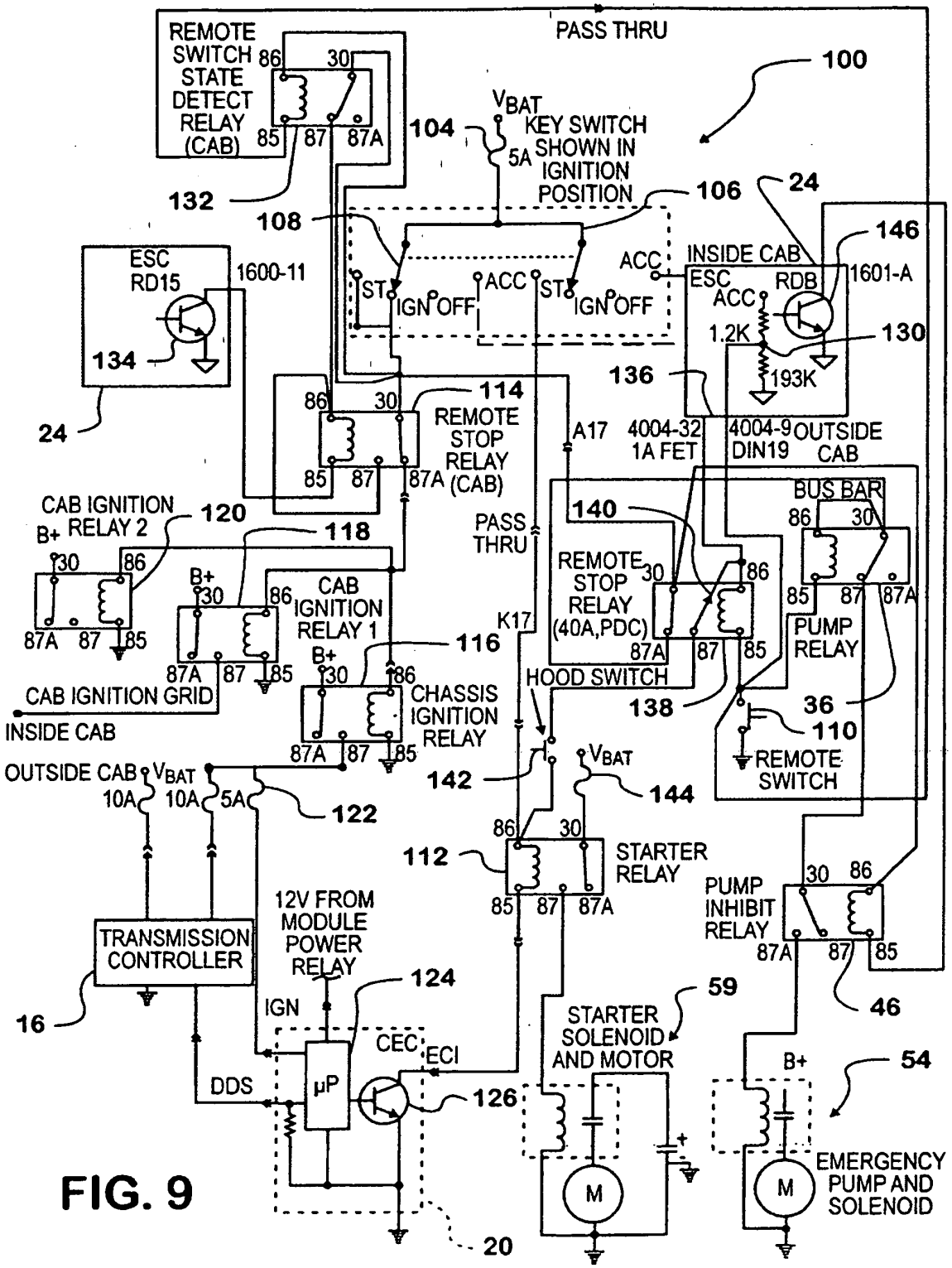
REMOTE SWITCH STATE DETECT RELAY (CAB)
86
30
85
87
87A
132
PASS THRU
100
V_{BAT}
104
5A
KEY SWITCH SHOWN IN IGNITION POSITION
106
24
108
146
ESC RD15
1600-11
134
ST
IGN
OFF
ACC
INSIDE CAB
ESC
RDB
1601-A
1.2K
130
193K
136
114
REMOTE STOP RELAY (CAB)
A17
4004-32 1A FET
4004-9 DIN19
OUTSIDE CAB
CAB IGNITION B+ RELAY 2
120
118
BUS BAR
140
PASS THRU
REMOTE STOP RELAY (40A,PDC)
PUMP RELAY
CAB IGNITION RELAY 1
116
K17
HOOD SWITCH
138
36
110
REMOTE SWITCH
CAB IGNITION GRID
INSIDE CAB
CHASSIS IGNITION RELAY
OUTSIDE CAB
10A
5A
122
142
144
112
STARTER RELAY
PUMP INHIBIT RELAY
12V FROM MODULE POWER RELAY
TRANSMISSION CONTROLLER
16
124
IGN
CEC
ECI
DDS
µP
126
59
STARTER SOLENOID AND MOTOR
B+
54
46
EMERGENCY PUMP AND SOLENOID
M
20

FIG. 9

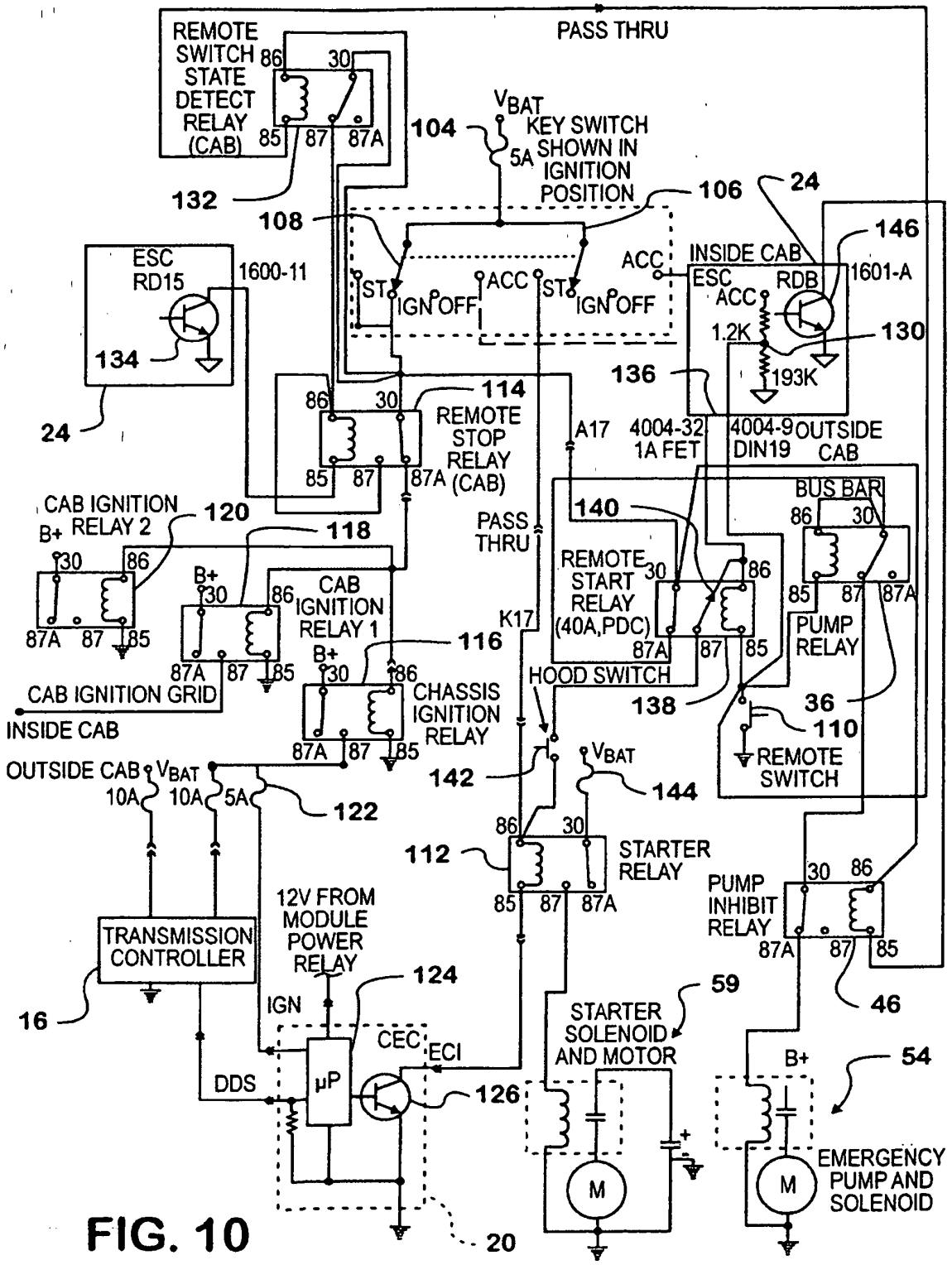
REMOTE SWITCH STATE DETECT RELAY (CAB)
PASS THRU
VBAT
KEY SWITCH SHOWN IN IGNITION POSITION
5A
104
106
24
132
108
146
ESC RD15
1600-11
ACC
INSIDE CAB
ESC RDB
1601-A
ST
IGN OFF
ACC
ST
IGN OFF
1.2K
130
134
193K
136
114
REMOTE STOP RELAY (CAB)
A17
4004-32 1A FET
4004-9 DIN19
OUTSIDE CAB
24
CAB IGNITION B+ RELAY 2
120
118
BUS BAR
140
PASS THRU
REMOTE START RELAY (40A,PDC)
PUMP RELAY
K17
CAB IGNITION RELAY 1
116
HOOD SWITCH
138
36
110
REMOTE SWITCH
CAB IGNITION GRID
INSIDE CAB
CHASSIS IGNITION RELAY
OUTSIDE CAB
VBAT
10A
10A
5A
122
142
VBAT
144
112
STARTER RELAY
PUMP INHIBIT RELAY
TRANSMISSION CONTROLLER
16
12V FROM MODULE POWER RELAY
124
IGN
59
STARTER SOLENOID AND MOTOR
46
CEC
ECI
DDS
μP
126
B+
54
EMERGENCY PUMP AND SOLENOID
M
M
20

FIG. 10

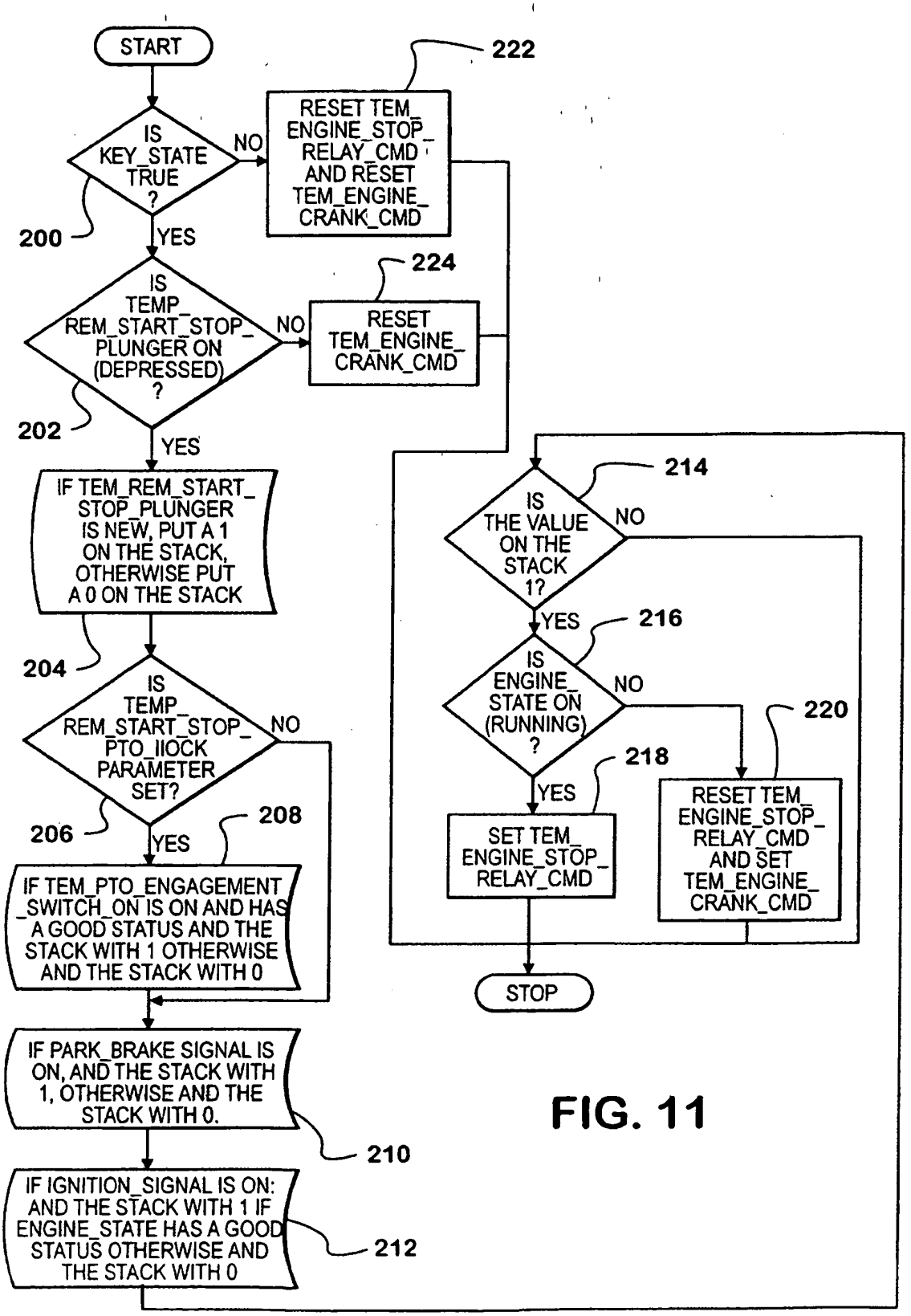
START
IS KEY_STATE TRUE ?
NO
YES
200
RESET TEM_ ENGINE_STOP_ RELAY_CMD AND RESET TEM_ENGINE_ CRANK_CMD
222
IS TEMP_ REM_START_STOP_ PLUNGER ON (DEPRESSED) ?
NO
YES
202
RESET TEM_ENGINE_ CRANK_CMD
224
IF TEM_REM_START_ STOP_PLUNGER IS NEW, PUT A 1 ON THE STACK, OTHERWISE PUT A 0 ON THE STACK
204
IS TEMP_ REM_START_STOP_ PTO_IIOCK PARAMETER SET?
NO
YES
206
208
IF TEM_PTO_ENGAGEMENT _SWITCH_ON IS ON AND HAS A GOOD STATUS AND THE STACK WITH 1 OTHERWISE AND THE STACK WITH 0
IF PARK_BRAKE SIGNAL IS ON, AND THE STACK WITH 1, OTHERWISE AND THE STACK WITH 0.
210
IF IGNITION_SIGNAL IS ON: AND THE STACK WITH 1 IF ENGINE_STATE HAS A GOOD STATUS OTHERWISE AND THE STACK WITH 0
212
IS THE VALUE ON THE STACK 1?
NO
YES
214
IS ENGINE_ STATE ON (RUNNING) ?
NO
YES
216
218
220
SET TEM_ ENGINE_STOP_ RELAY_CMD
RESET TEM_ ENGINE_STOP_ RELAY_CMD AND SET TEM_ENGINE_ CRANK_CMD
STOP

FIG. 11

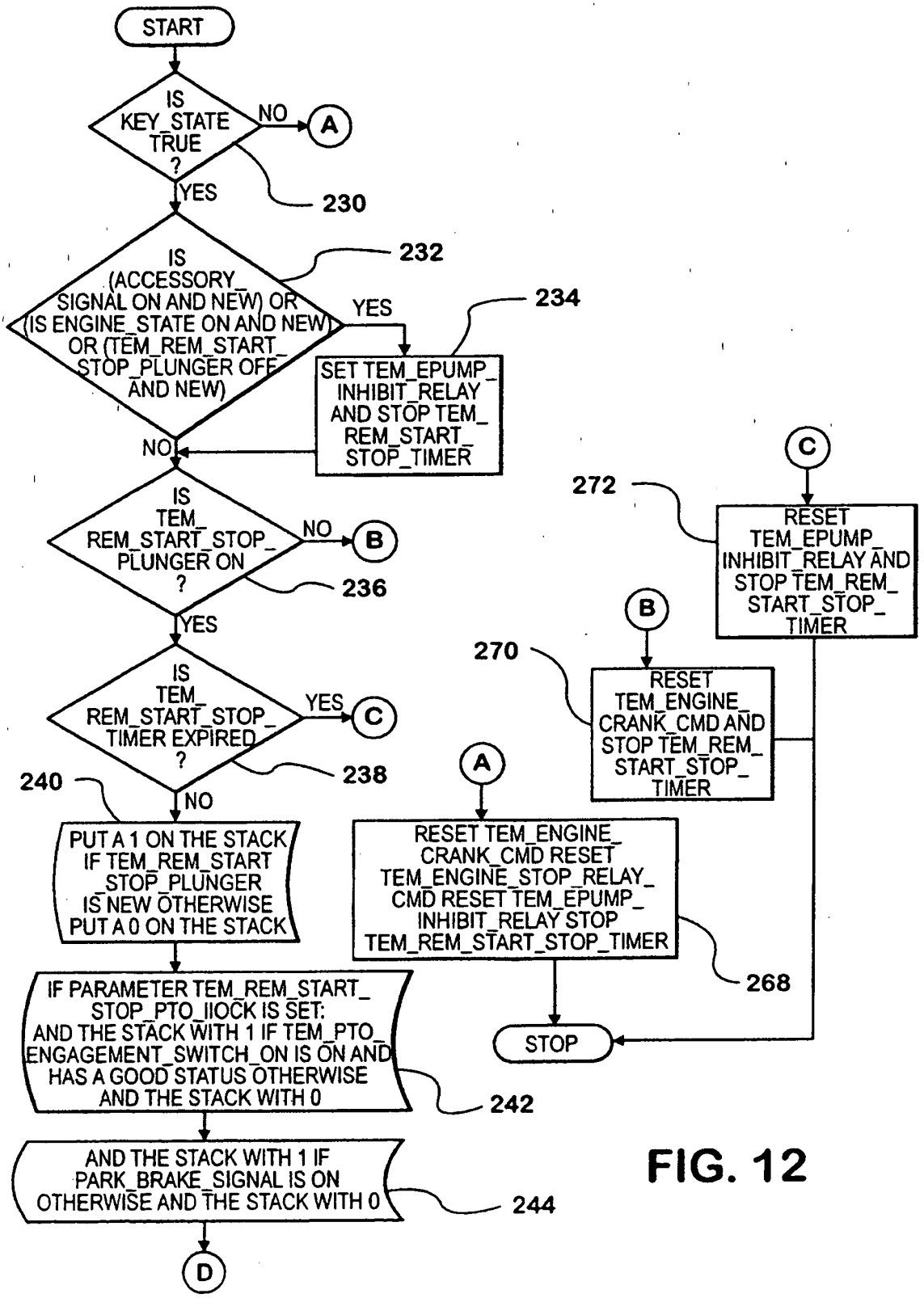
START
IS KEY_STATE TRUE ?
NO
A
YES
230
IS (ACCESSORY_SIGNAL ON AND NEW) OR (IS ENGINE_STATE ON AND NEW) OR (TEM_REM_START_STOP_PLUNGER OFF AND NEW)
232
YES
234
SET TEM_EPUMP_INHIBIT_RELAY AND STOP TEM_REM_START_STOP_TIMER
NO
IS TEM_REM_START_STOP_PLUNGER ON ?
NO
B
236
YES
IS TEM_REM_START_STOP_TIMER EXPIRED ?
YES
C
238
240
NO
PUT A 1 ON THE STACK IF TEM_REM_START_STOP_PLUNGER IS NEW OTHERWISE PUT A 0 ON THE STACK
IF PARAMETER TEM_REM_START_STOP_PTO_IIOCK IS SET: AND THE STACK WITH 1 IF TEM_PTO_ENGAGEMENT_SWITCH_ON IS ON AND HAS A GOOD STATUS OTHERWISE AND THE STACK WITH 0
242
AND THE STACK WITH 1 IF PARK_BRAKE_SIGNAL IS ON OTHERWISE AND THE STACK WITH 0
244
D
C
272
RESET TEM_EPUMP_INHIBIT_RELAY AND STOP TEM_REM_START_STOP_TIMER
B
270
RESET TEM_ENGINE_CRANK_CMD AND STOP TEM_REM_START_STOP_TIMER
A
RESET TEM_ENGINE_CRANK_CMD RESET TEM_ENGINE_STOP_RELAY_CMD RESET TEM_EPUMP_INHIBIT_RELAY STOP TEM_REM_START_STOP_TIMER
268
STOP

FIG. 12

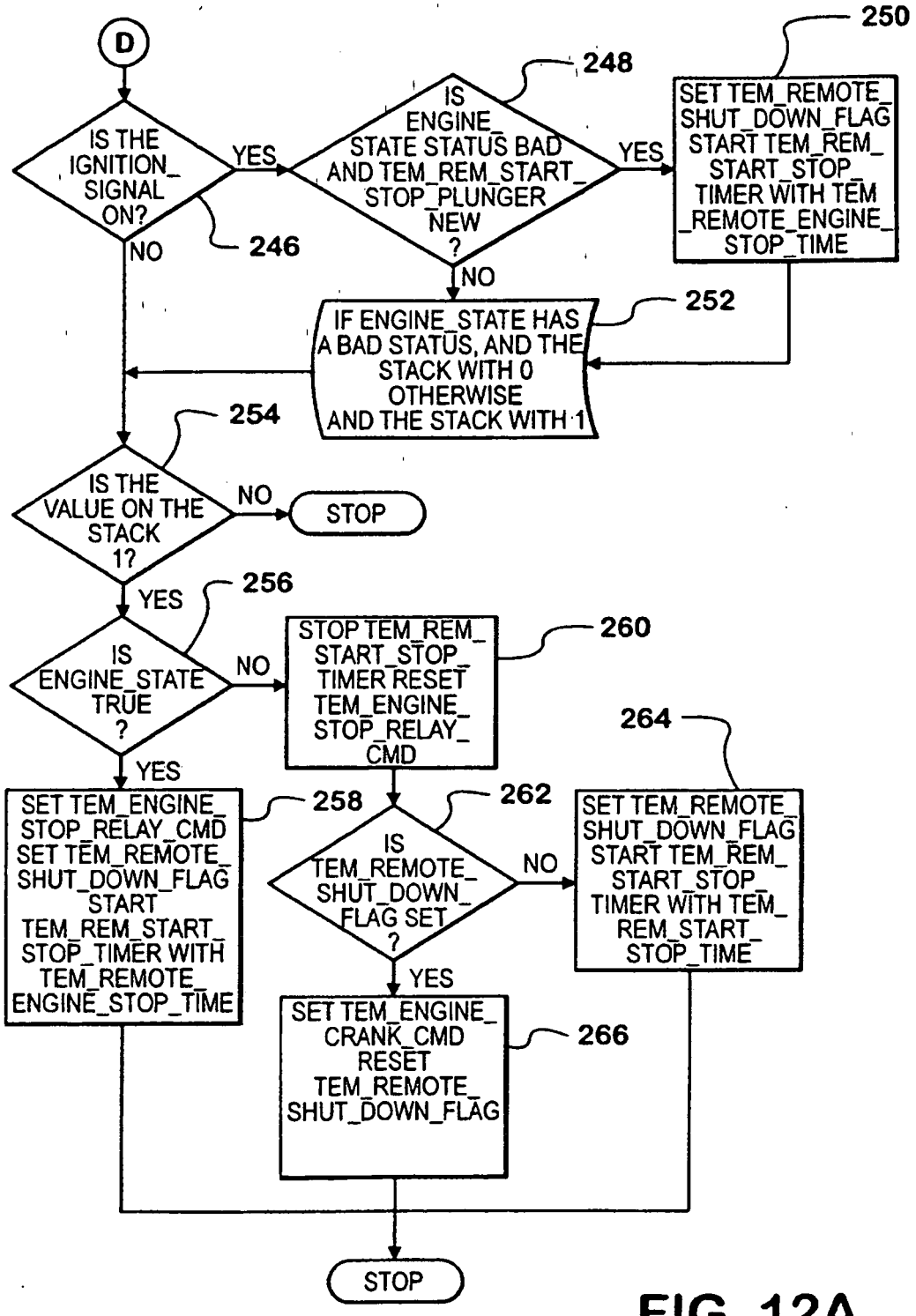
D
IS THE IGNITION_ SIGNAL ON?
YES
NO
246
IS ENGINE_ STATE STATUS BAD AND TEM_REM_START_ STOP_PLUNGER NEW ?
248
YES
NO
SET TEM_REMOTE_ SHUT_DOWN_FLAG START TEM_REM_ START_STOP_ TIMER WITH TEM _REMOTE_ENGINE_ STOP_TIME
250
IF ENGINE_STATE HAS A BAD STATUS, AND THE STACK WITH 0 OTHERWISE AND THE STACK WITH 1
252
IS THE VALUE ON THE STACK 1?
254
NO
STOP
YES
IS ENGINE_STATE TRUE ?
256
NO
YES
STOP TEM_REM_ START_STOP_ TIMER RESET TEM_ENGINE_ STOP_RELAY_ CMD
260
SET TEM_ENGINE_ STOP_RELAY_CMD SET TEM_REMOTE_ SHUT_DOWN_FLAG START TEM_REM_START_ STOP_TIMER WITH TEM_REMOTE_ ENGINE_STOP_TIME
258
IS TEM_REMOTE_ SHUT_DOWN_ FLAG SET ?
262
NO
YES
SET TEM_REMOTE_ SHUT_DOWN_FLAG START TEM_REM_ START_STOP_ TIMER WITH TEM_ REM_START_ STOP_TIME
264
SET TEM_ENGINE_ CRANK_CMD RESET TEM_REMOTE_ SHUT_DOWN_FLAG
266
STOP

FIG. 12A

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 3788294 A **[0010]**
- JP 58106148 A **[0011]**
- US 5794580 A **[0012]**