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Jordan

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[54] **VEHICLE OPERATOR IDENTIFICATION SYSTEM**

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[52] **U.S. Cl.** ..... **340/64,** 180/114, 340/149 A

[51] **Int. Cl.** **B60r 25/04,** B60r 25/10

[58] **Field of Search** ..... 340/63, 64, 149 A; 180/114

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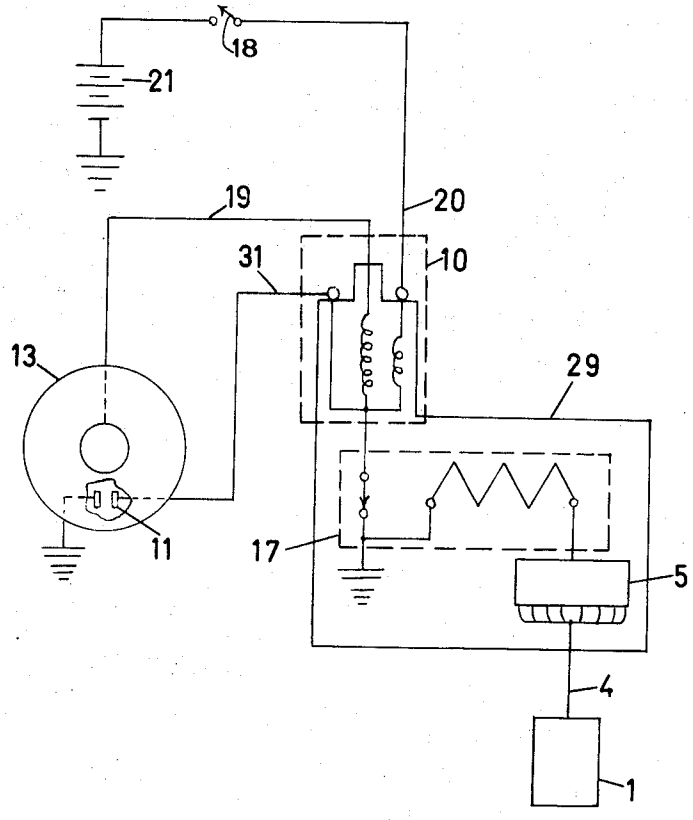
[57] **ABSTRACT**

A vehicle operator identification system consists of a card reader into which the vehicle operator inserts his coded identification card. The coded card contains an array of logically coded information which is compared against a preferred code and operation of the vehicle is enabled only when the two codes are identical. This operator identification system eliminates the necessity for ignition keys and renders theft of the vehicle by tampering with the wiring virtually impossible.

6 Claims, 6 Drawing Figures



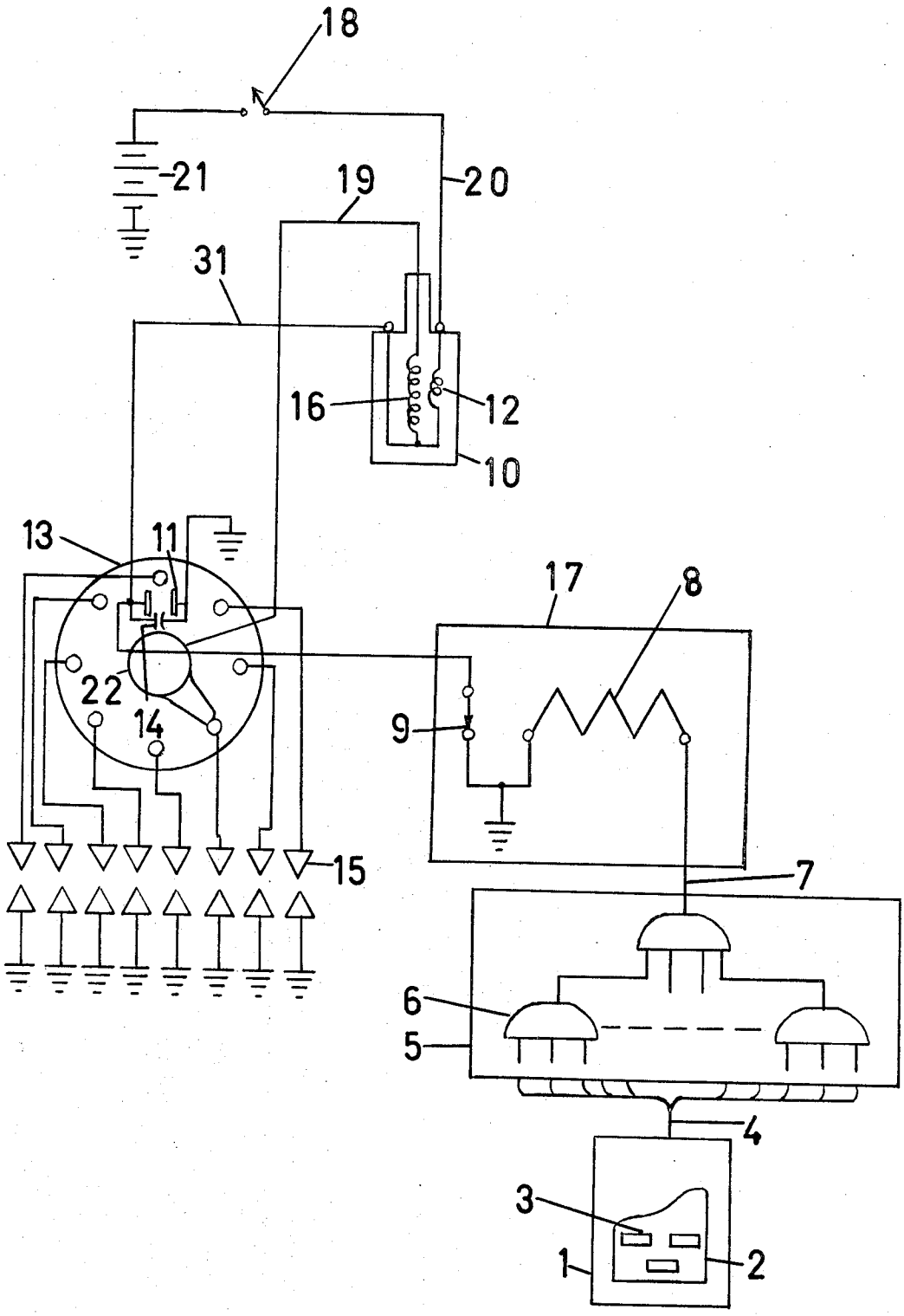


FIG. 1

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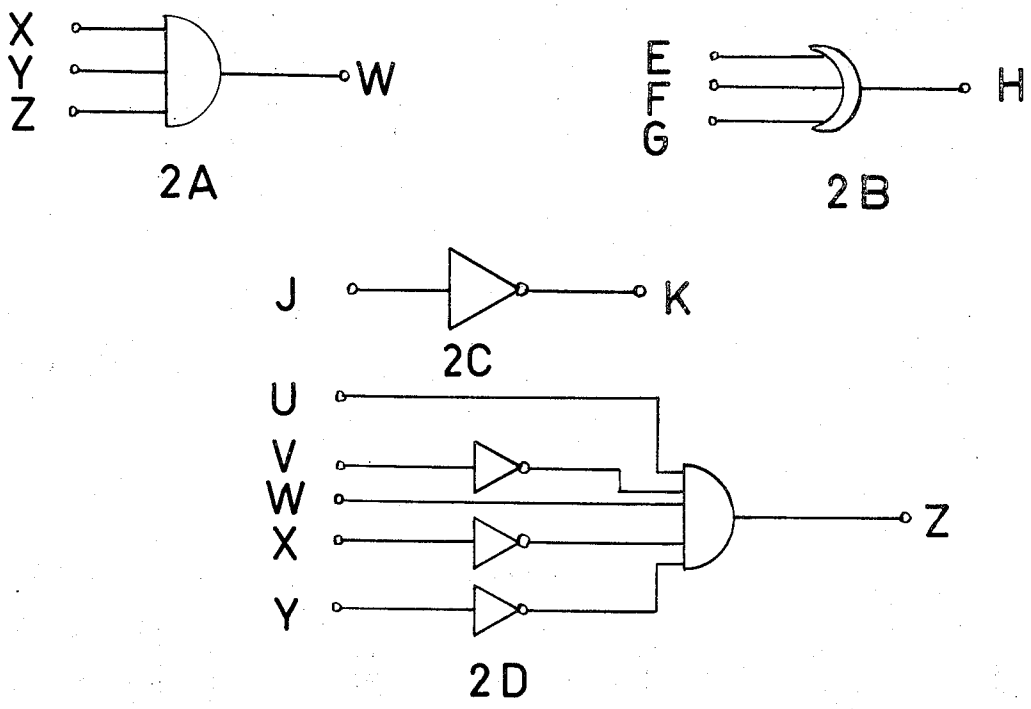

FIG. 2

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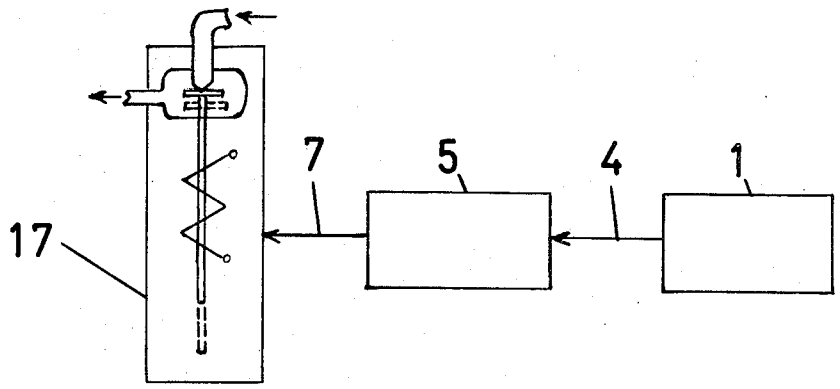

FIG. 3

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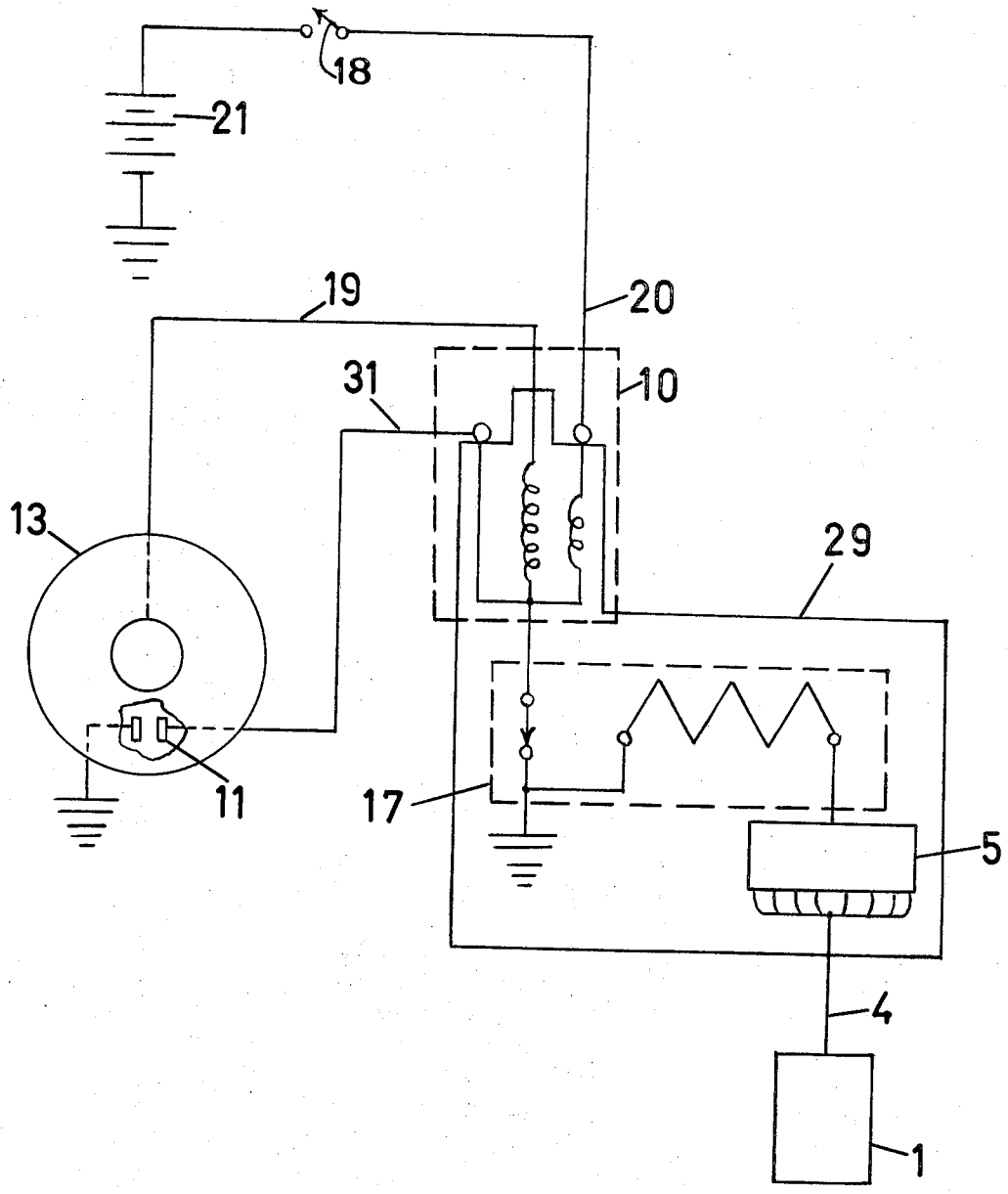

FIG. 4

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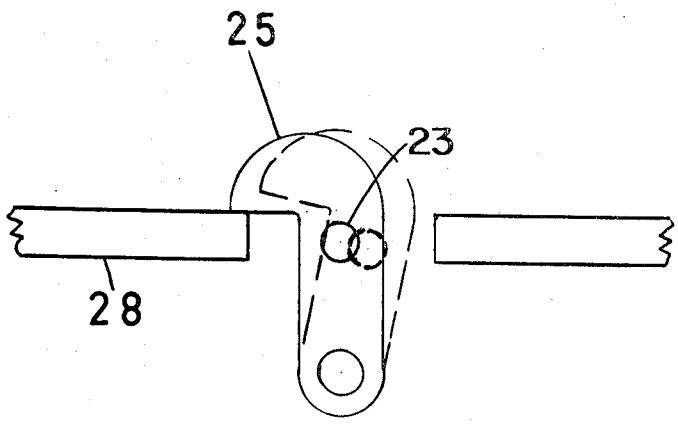

FIG. 6

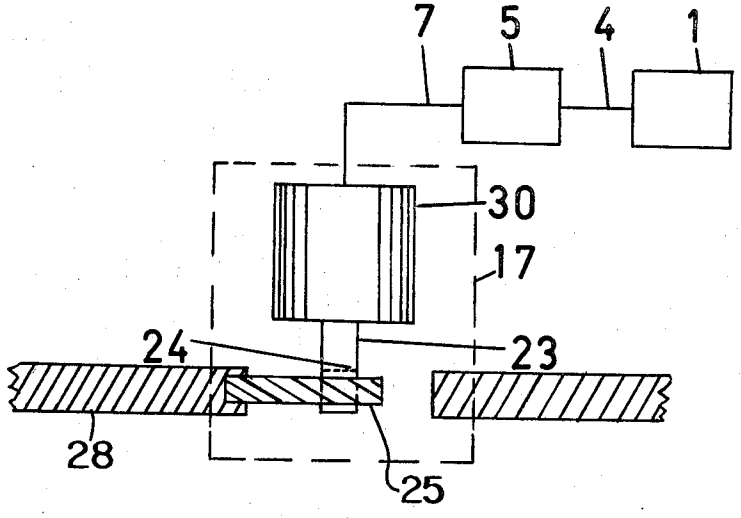

FIG. 5

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VEHICLE OPERATOR IDENTIFICATION SYSTEM

BACKGROUND OF INVENTION

There are numerous schemes in the prior art to prevent theft of vehicles. Most of these schemes disable the ignition circuit and alarm when an unauthorized person attempts to operate the vehicle. However, since some means must be provided for the rightful owner of the vehicle to operate it, a second key operated switch is usually provided which switches the protection system on or off. Professional car thieves have learned to identify these systems and disable the alarm prior to attempting to start the vehicle. They then start the vehicle by jumpering around the ignition switch. The prior art still relies on the owner having to carry keys as both a means of starting the vehicle and a means of preventing operation by unauthorized users. Tampering with ignition switch wiring to start and operate the vehicle without inserting the proper key is a well developed technique among vehicle thieves. This invention overcomes the shortcomings of prior vehicle protective systems by incorporating a coded identification card reader in the vehicle in such a manner as to enable operation of the vehicle only when a card with the preferred code is inserted into the card reader.

SUMMARY OF INVENTION

A vehicle operator identification system eliminates the use of an ignition key and replaces it with a coded identification card. Since a logical code consisting of a large number of true or false states can be compactly arranged on a small card, the possibility of an unauthorized person starting and operating the vehicle by tampering with the wiring and selecting the preferred code on a trial and error basis is virtually nil.

An object of this invention is to provide a vehicle operator identification system comprised of a card reader, a decoding unit and an enabling unit. The enabling unit will permit operation of the vehicle only when a properly coded card is inserted into the card reader.

A further object of this invention is to provide a vehicle operator identification system in which the enabling unit disables the breaker points in the vehicle ignition system and enables the breaker points only when the properly coded card is inserted into the card reader.

A further object of this invention is to provide a vehicle operator identification system in which the enabling unit disables the vehicle's fuel system until a properly coded card in inserted into the card reader.

A further object of this invention is to provide a vehicle operator identification system in which the enabling unit, decoding unit and the vehicle's ignition coil are in a single sealed unit to inhibit a thief from circumventing the protective system.

A further object of this invention is to provide a vehicle operator identification system in which the enabling unit inhibits opening the vehicle's hood.

A still further object of this invention is to provide a burglar alarm system installed in the vehicle which is disabled by the operator identification system to permit the authorized user of the vehicle to operate the vehicle without sounding the alarm.

These and other objects and advantages of this invention will become more apparent as the vehicle operator identification system is more fully discribed herein.

BRIEF DESCRIPTION OF THE DRAWINGS

Reference is made to the accompanying drawings.

FIG. 1 is a schematic diagram of the vehicle operator identification system.

FIG. 2 illustrates the three principal logic elements used in constructing a decoding unit.

FIG. 3 shows in block diagram form an operator identification system in which the enabling unit operates on the vehicle's fuel system.

FIG. 4 illustrates the enabling unit, decoding unit, and ignition coil contained in a single enclosure.

FIG. 5 displays a locking device for the vehicle's hood that can be unlocked only by means of the operator identification system.

FIG. 6 displays a side view of the locking device.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to FIG. 1 of the drawings, the numeral 1 generally refers to the operator identification unit which is a card reader into which a coded identification card can be inserted. Card readers of this type are commonly used with computers and are commercially available in many forms. One design utilizes a series of electrical contacts which are closed until a punched data card is inserted into the card reader. The card then separates the two sides of each pair of electrical contacts that are not located at a card position with a punched slot. The contacts are closed when they are opposite a punched slot in the card. The number and positions of punched slots in the card thus determine the code contained on the card. This card code is converted into electrical signals when the electrical contacts are energized. Those contacts opposite a punched card slot form a closed electrical circuit and those opposite a portion of the card which is not punched form an open circuit. This is called an electrical contact card reader.

Photoelectric card readers operate on a similar principle except that the slots in the card permit passage of light from one side of the card through to a photoelectric receiver on the opposite side of the card. Thus an electric signal is generated at the photoelectric receivers opposite slots in the card and not at those receivers opposite unpunched portions of the card.

Numeral 2 designates an operator's identification card inserted in the reader showing slots 3.

The explanation of operation will be continued using a card reader with electrical contacts as an example although it is recognized that other types of readers may be substituted without violating the spirit of the invention. The state of each contact in the card reader is transmitted by the electrical multiconductor cable 4 to the decoding unit 5 which is comprised of a plurality of logic gates 6. Each pair of contacts is connected by means of a wire in the multiconductor cable to one input of a logic gate. A common wire, often called a ground wire, is also contained in cable 4. These gates compare the punched code in the operator's identification card with a preferred code in a manner to be described in more detail below. The results of this comparison are transmitted to the enabling unit 17 by a second electrical cable 7. This cable may be comprised of only two wires since it transmits only one electrical signal. If the code on the operator's identification card agrees with the preferred code a signal representative

of the true state is transmitted to the enabling unit. Otherwise a signal representative of the false state is transmitted.

The enabling unit **17** enables operation of the vehicle only when a true signal is present on **7**. The relay coil **8** in the enabling unit is energized when a true signal is present on **7** and opens the relay contacts **9**. This action removes the ground connection from the ignition coil **10**. The removal of the ground connection enables the breaker points **11** to perform the normal function in the vehicle's ignition system, that of alternately making and breaking the ground connection to the primary **12** of the ignition coil. The other elements in FIG. **1** are parts in a conventional vehicle ignition system. The alternate making and breaking of the breaker points **14** causes a high voltage to be induced in the ignition coil secondary **16**. This high voltage is transmitted to the spark plugs **15** to produce an electrical arc that ignites the engine fuel. When the enabling unit **17** is not receiving a true signal on cable **7**, relay contacts **9** are closed and the breaker points **14** are disabled from performing their normal function. Even though the breaker points may alternately open and close, the primary coil **12** of the ignition coil **10** remains continuously energized by current from the battery **21** passing through the ignition switch **18**, the primary **12** and the relay contacts **9** to the vehicle electrical ground. When the primary coil **12** is continuously energized with a dc current from the battery **21**, no high voltage is induced in the ignition coil secondary **16**. Other conventional vehicle ignition system parts are the distributor which is generally designated by numeral **13** and the capacitor paralleling the breaker points which is designated by numeral **14**. The spark plugs **15** are connected to the high voltage secondary **16** of the ignition coil by the rotor **22**. An ignition switch **18** switches the battery **21** onto the primary **12** of the ignition coil **10**. It should be emphasized that with this invention the vehicle will not start even though the ignition switch is closed until the operator's identification card with the preferred code is inserted into the card reader. The ignition switch therefore need not be a key switch.

The card reader **1** is located in the passenger section of the vehicle convenient to the driver. The vehicle operator identification card can be a billfold size card approximately 2 inch/3½ inches made of plastic or cardboard. The card reader will be slightly larger than the operator identification card so the card reader can completely contain the card and the reader can also contain low current electrical contacts for sensing the presence or absence of punched holes in the card.

The decoding unit **5** can be located any place in the vehicle since all signals are transmitted to and from it via electrical cables **4** and **7**. It most probably would be located in the engine compartment. Integrated circuit logic gates are used to construct the decoding unit.

The enabling unit is comprised of a relay coil **8** and a set of contacts **9**. The enabling unit would normally be located in the engine compartment close to the ignition coil **10**.

The combined operation of the operator identification unit **1** and the decoding unit **5** is best explained by reference to FIG. **2**. In FIG. **2** the three types of logic elements or gates that are used in the decoding unit are displayed. FIG. 2A shows an "AND" gate which implements the Boolean algebraic equation:

$$W = X \cdot Y \cdot Z \tag{1}$$

where the variables X, Y, Z, and W are Boolean logic variables that have one or the other of two possible states, true or false. Equation (1) states that if inputs X and Y and Z are all true, then the output W will be true. Otherwise W will be false if one or more of the inputs is false. FIG. 2B shows an "OR" gate which implements the Boolean equation:

$$H = E + F + G \tag{2}$$

Equation (2) states that if one or more of the inputs E, F, or G are true, the output H will be true, otherwise it will be false. FIG. 2C shows a "NOT" gate which implements the Boolean equation:

$$K = \overline{J} \tag{3}$$

Equation (3) states that the output K is the complement of the input J. If J is true, K is false and if J is false, K is true.

Combinations of the above three gates can be devised to uniquely select one and only one code on the operator's identification card as the preferred code. One gate is not restricted to three inputs. For example, consider one row of an operator's identification card represented by:

Column	U	V	W	X	Y
Code	1	0	1	0	0

The 1's represent a punch in the designated column and the 0's represent the absence of a punch in that column. Then a Boolean equation for decoding this row is:

$$Z = U \cdot \overline{V} \cdot W \cdot \overline{X} \cdot \overline{Y} \tag{4}$$

where Z is a Boolean variable which has a logically true state only if columns U and W have punches and columns V, X, and Y have no punches. FIG. 2D shows a combination of AND and NOT gates combined to decode this row of five code positions and present a true signal at the output Z if and only if the card contains the preferred punch code which is:

1 0 1 0 0

Each code position on the card has the potential of existing in one of two logical states, namely, true or false. The true state is represented by a punch and the false state is represented by the absence of a punch. The number of possible codes which an N position card can have is 2^N. For example, if there were 10 possible code positions on the card there would be $2^{10} = 1{,}024$ possible codes with such a card. It is clearly impractical for anyone to expect to select the preferred code by guesswork or trial and error from such a large number of possible codes. Even a small billfold size card can easily be coded with more than 10 code positions.

Commercially available integrated circuit logic gates can be used to construct the decoding unit. For example, Digital Equipment Corporation's integrated circuits numbers M113 and M119 could be used to assemble a decoding unit which would perform the logical decoding function displayed in FIG. 2D. The M113 gates would be used to perform the NOT functions in

FIG. 2D and the M119 would be used to perform the AND function. In this case a voltage of 3.6 volts would represent a true state and a voltage of 0 volts would represent a false state.

FIG. 3 illustrates a block diagram for a vehicle operator identification system in which the enabling unit **17** is an electrically operated valve in the fuel line. The valve is moved to a position which permits passage of fuel into the vehicle's engine only when a true signal is present at cable **7** at the output of the decoding unit **5.** The operator identification unit **1** receives the operator's identification card as described in connection with FIG. **1.**

The dotted lines in the enabling unit **17** show the position of the plunger in the enabling unit when a true signal is present on **7.** In this condition the solenoid coil is energized, the plunger is retracted and fuel is allowed to pass through the enabling unit as shown by the arrows. When a false signal is present on **7,** the plunger is in the position shown by the solid lines in FIG. **3** and fuel is inhibited from passing through the enabling unit.

FIG. **4** shows a vehicle operator identification system similar to the one displayed in FIG. **1** except that the decoding unit **5,** the enabling unit **17** and the ignition coil **10** are all contained in a single enclosed and sealed enclosure **29.** The electrical leads entering the sealed enclosure **29** are the cable **4** from the operator identification unit **1,** the battery lead **20,** the primary lead **31** from the ignition coil **10** to the breaker points **11** and the ignition coil high voltage lead **19.** No combination of opening or shorting the leads external to the sealed unit **29** will get the vehicle started. The only way the ignition system can be enabled is by means of a card with the preferred code inserted into the operator identification unit. As already explained it is virtually impossible for a person to guess the preferred code from the many possible code combinations.

A burglar alarm system can be added to further protect the vehicle from theft. The alarm system is comprised of an electrically operated horn which is sounded upon the simultaneous occurrence of two events. One event is the closing of a switch which is held in an open position when-ever the vehicle's hood is closed and the second event is the presence of a false signal at the output of the decoding unit. This set of conditions can be implemented in an electrical circuit as described below.

The enabling unit is constructed in two parts. The first part serves to inhibit the operation of the vehicle as shown in FIG. **1.** The second part enables the alarm system and consists of two switches which are in series with the electrically operated horn. One switch is held open whenever the vehicle's hood is closed and the second switch is the normally closed contacts of a relay operating from the output of the decoding unit. Thus when the decoding unit output is false the relay is deenergized and the alarm system is enabled. If the hood of the vehicle is opened the alarm will sound. Whenever the authorized operator of the vehicle desires to open the hood he places his identification card containing the preferred code in the card reader thereby establishing a true state at the output of the decoding unit and disabling the alarm system. The vehicle hood encloses the enabling system including the ignition circuit as well as the vehicle's engine. An unauthorized person desiring to tamper with the enabling system must open the hood thereby sounding the alarm.

An alternative means for implementing an alarm system is to replace the switch held open by the hood with a second set of contacts mechanically linked to the ignition switch, numeral **18** in FIG. **1.** This set of contacts interlocks with the contacts shown at **18** in FIG. **1** and closes whenever the ignition switch is closed. If the enabling unit's output is false at that time, the alarm will sound. An unauthorized person trying to start the vehicle without the proper operator identification card would naturally close the ignition switch thereby sounding the alarm.

The vehicle operator identification system can also be used as a means for locking the hood of a vehicle shut to all but authorized persons. FIG. **5** displays such a system. The latch **25,** which is shown in the locking position, engages a molding **28** attached to the inside of the hood. The latch keeps the molding and the hood from being raised to an open position. When the latch is moved to the open position which is shown in dotted lines in FIG. **5,** the hood is free to be raised. A plunger **23** fitted into a solonoid **30** inhibits the latch **25** from moving to the open position when the solonoid **30** is deenergized. When the solonoid is energized, the plunger **23** retracts permitting the latch **25** to be moved to the open position. Numeral **24,** FIG. **5,** designates the end of the plunger in the retracted position. The solenoid-plunger assembly **17** comprises the enabling unit of the vehicle operator identification system when it is used to lock the vehicle's hood. The other elements of the system, namely, the operator identification unit **1,** the decoding unit **5,** the electrical cable **4** interconnecting elements **1** and **5,** the electrical cable **7** interconnecting elements **5** and **17** all serve the same functions as explained in the discussion of FIG. **1.**

The foregoing description is illustrative of the principles of this invention. Numerous modifications and changes will occur to those skilled in the art and accordingly such modifications and changes fall within the spirit of this invention as defined in the following claims.

What is claimed is:

1. A vehicle operator identification system comprised of a card reading means, capable of receiving a coded operator identification card; a decoding means, said decoding means and said card reading means capable of functioning in combination to compare the operator identification card code with a preferred code, said combination of decoding means and card reading means capable of communicating a logical state to an enabling means, said logical state to assume one state when operator identification code coincides with preferred code and complement state otherwise, said decoding means, said enabling means and vehicle's ignition coil being housed in a single enclosure, said ignition coil primary is electrically connected to vehicle's battery and breaker points, said enabling means comprised of a switching means opening a ground connection to said primary when said logical state is in said one state and closing said ground connection when said logical state is in the complement state.

2. Apparatus set forth in claim **1** wherein said decoding means is comprised of logic gates.

3. Apparatus set forth in claim **1** wherein said card reading means is an electrical contact card reader.

4. Apparatus set forth in claim 1 wherein said card reading means is a photoelectric card reader.

5. Apparatus set forth in claim 1 wherein said enabling means is comprised of a first part and a second part, said first part of said enabling means comprised of a switching means opening a ground connection to said primary when said logical state is in said one state and closing said ground connection when said logical state is in the complement state, said second part of said enabling means comprised of at least two switching means, first of said switching means being closed when the vehicle's hood is open, otherwise said first switching means being open, second of said switching means being open when said logical state is in said one state and closed when said logical state is in the complement state, and further comprising an alarm which is activated when said first and second switching means are simultaneously closed.

6. Apparatus set forth in claim 1 wherein said enabling means also inhibits or enables the opening of the vehicle's hood depending upon the logical state communicated to the enabling means.

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