DESIGN FOR FUEL THEFT PREVENTION IN AUTOMOBILES

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Abstract : Motorcycles are popular mode of transport. All motorcycles are petrol driven whose costs have been increasing steadily. The motorcycles come with a simple fuel delivery mechanism which is nothing but a simple tap with main/reserve option. This system is susceptible to pilferage and anyone can remove petrol from the fuel tank without much trouble. Each petrol tank has a capacity of at least 10 Ltrs. A mechanism has been developed to prevent this fuel theft in this project. The mechanism uses power supply from the vehicle and so for the fuel to come out of the fuel tank, vehicle must be in ON condition.

Keywords— Fuel tank , Solenoid , Pump , D.C Motor, Relay**.**

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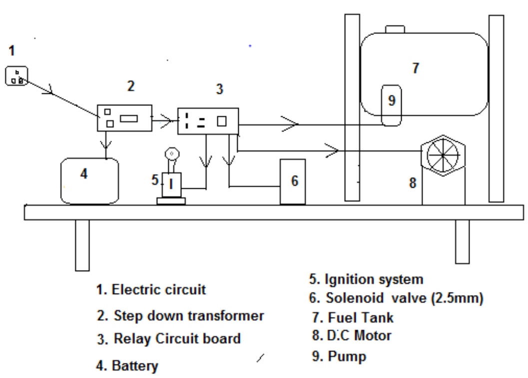
1. INTRODUCTION

Motorcycles are popular mode of transport. All motorcycles are petrol driven whose costs have been increasing steadily. The motorcycles come with a simple fuel delivery mechanism which is nothing but a simple tap with main or reserve option. This system is susceptible to pilferage and anyone can remove petrol from the fuel tank without much trouble. Each petrol tank has a capacity of at least 10 Liters. A mechanism has been developed to prevent this fuel theft in this project. The mechanism uses power supply from the vehicle and so for the fuel to come out of the fuel tank, vehicle must be in ON condition. Fuel cock determines the flow of fuel from the fuel tank to the Engine . Fuel cocks are a very important part in a vehicle via the carburetor MPFI.



1.1 Solenoid

Fig. 1.1 Assembly Diagram

A solenoid valve is used to protect fuel from the thief's by making a parameter that avoids the stolen of fuel from the vehicles. A fuel cock avoids the flooding of the carburetor of a vehicle. It also gives a sense of how much fuel is present in the tank courtesy the Reserve option. Though the exact amount of fuel cannot be accurately determined due to which a fuel gauge has become a regular feature in almost all the bike now-a-days. It consists of a dial which is driven by a sensor inside the tank. Over a period of time, this gauge fails due to a variety of reasons, including the failure of the sensor inside the tank. It gives us a control to flow of the fuel from the tank to the engine. When a vehicle stationary, there is no point in having the engine running. If the engine is not running, there is no point in fuel flowing from the tank to the engine. A knob is provided in the fuel cock which can be turned to OFF state so that the fuel does not flow to the engine. When the level of the fuel has dropped beyond a certain level wherein it becomes important to fill up the tank, the engine stalls. This is because While in ON state, No more fuel can pass into the engine. There is fuel existing in the tank, but as no fuel flows into the engine, the vehicle tends to stall. The knob of the fuel cock has to be turned to the Reserve state so that the remaining fuel can now pass.

In spite of using fuel cocks it is not a safe way for storing fuel in fuel tanks. Ideally, a person should have the tank filled up so that there may not be a dry fuel tank condition. A person needs to physically bring his hand below the fuel tank to change over the position of the knob. This may become a dangerous proposition when the vehicle is running and a switch over from ON to RESERVE has to be made while the vehicle is in running condition. These Fuel cocks cannot be operational in cars because of the remoteness of the fuel tank. Also, these process can operate not only where there is gravity flow of petrol. Another aspect is the ease with which fuel can be pilfered out. One just has to bring a bottle, remove the pipe from the carburetor, turn the knob to desired state and remove as much petrol as he desires. Fuel being a costly commodity surely needs protection. If fuel can be robbed so easily, these fuel system will need more security. A lot of companies have introduced a set of key operated fuel cocks where the knob is operable by means of a key which shall have to be positioned as the knob is positioned. More the number of keys more are the chances of a person forgetting. Since the fuel cock key has to be separate from the vehicle key because the fuel line is away from the front panel instrument cluster, it becomes a second is set of keys which a person shall need to carry and take care of it. So for providing more protection for the fuel supply system a design is implemented using a solenoid valve which provides the great protection to the fuel of the automobiles. This version of fuel prevention technique can be more commonly used in vehicles like Yamaha, Honda , Bajaj etc. exists which does have a kind of automation. The fuel cock Employed does have an advantage here as fuel pilferage is very difficult in these vehicles as the seat also acts as a locking mechanism. Moreover, there is no fuel line visible fuel line coming out of the vehicle. This fuel can be protectected using the design of fuel theft prevention.

2. Block Diagram of design for fuel theft prevention

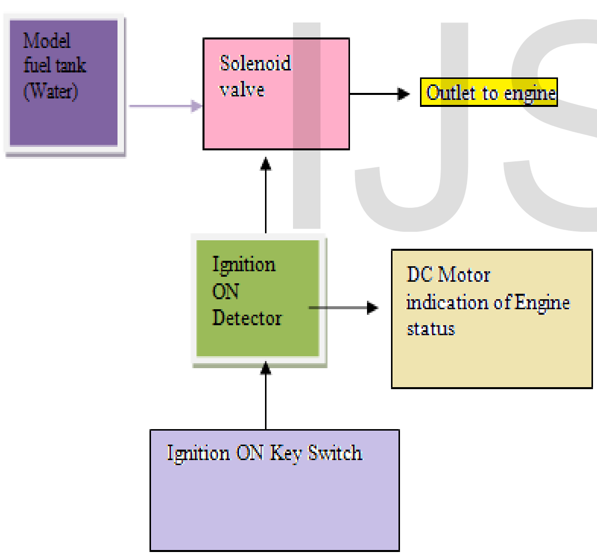


Fig. 1. Block Diagram

3. PROCEDURE

- The Fuel tank is taken where the fuel is filled in it.
- Then the fuel tank is attached to the solenoid valve to protect the fuel from releasing out into the pipe.
- The solenoid valve is attached to the ignition detector ,when the ignition is ON it helps in flowing the fuel to the DC motor which indicates of engine status and when the ignition is OFF the flow of fuel gets stopped and remains in the the fuel tank.
- A relay is used so as to control the operation of solenoid by providing the supply when specific amount of current is supplied.
- The relay allows the isolation of two separate sections of a system with two different voltage sources.
- A Ignition system for a relative connectivity to the solenoid so as to whenever the ignition system is switched ON using the ignition key the solenoid valve gets operated so the plunger of the solenoid valve gets lifted up and the passage fuel supply gets open .

4. DIFFERENT DEVICES USED IN THE DESIGN OF FUEL THEFT PREVENTION IN AUTOMOBILES

4.1 Fuel tank

Fuel tank is a safe container for flammable fluids. Though any storage tank for fuel may be so called, the term is typically applied to part of an engine system in which the fuel is stored and propelled fuel pump or released pressurized gas into an engine. Fuel tanks range in size and complexity from the small plastic tank of a butane lighter to the multi-chambered cryogenic Space Shuttle external tank.

Fig. 2

4.1.1 Uses

Typically, a fuel tank must allow or provide the following:

- Storage of fuel: the system must contain a given quantity of fuel and must avoid leakage and limit evaporative emissions.
- Filling the fuel tank must be filled in a secure way, without sparks.

- Provide a method for determining level of fuel in tank, gauging the remaining quantity of fuel in the tank must be measured or evaluated.
- Venting if over-pressure is not allowed, the fuel vapors must be managed through valves.
- Feeding of the engine through a pump.
- Anticipate potentials for damage and provide safe survival potential.

4.2 Solenoid valve

The solenoid valve is controlled by an electric current through a solenoid in the case of a two-port valve the flow is switched on or off in the case of a three-port valve, the outflow is switched between the two outlet ports. Multiple solenoid valves can be placed together on a manifold.

Solenoid valves are the most frequently used control elements in fluidics. Their tasks are to shut off, release, dose, distribute or mix fluids. They are found in many application areas. Solenoids offer fast and safe switching, high reliability, long service life, good medium compatibility of the materials used, low control power and compact design.

Besides the plunger-type actuator which is used most frequently, pivoted-armature actuators and rocker actuators are also used.

Fig. 3

Solenoid valves are also characterized by how they operate. A small solenoid can generate a limited force. If that force is sufficient to open and close the valve, then a direct acting solenoid valve is possible. An approximate relationship between the required solenoid force F_s the fluid pressure P, and the orifice area A for a direct acting solenoid value is:

$$F_s = PA = P\pi d^2/4$$

Where d is the orifice diameter.

When high pressures and large orifices are encountered, then high forces are required. To generate those forces, an internally piloted solenoid valve design may be possible. In such a design, the line pressure is used to generate the high valve forces a small solenoid controls how the line pressure is used. Internally piloted valves are used in dishwashers and irrigation systems where the fluid is water, the pressure might be 80 pounds per square inch 550 kPa and the orifice diameter might be 19 mm.

In some solenoid valves the solenoid acts directly on the main valve. Others use a small, complete solenoid valve, known as a pilot, to actuate a larger valve. While the second type is actually a solenoid valve combined with a pneumatically actuated valve, they are sold and packaged as a single unit referred to as a solenoid valve. Piloted valves require much less power to control, but they are noticeably slower. Piloted solenoids usually need full power at all times to open and stay open, where a direct acting solenoid may only need full power for a short period of time to open it, and only low power to hold it.

A direct acting solenoid valve typically operates in 5 to 10 milliseconds. The operation time of a piloted valve depends on its size; typical values are 15 to 150 milliseconds.

4.3 DC Motors

Fig. 4

An electric motor is a machine which converts electrical energy to mechanical energy. This motor is used as a indication of engine status

4.3.1 Principles of operation

In any electric motor, operation is based on simple electromagnetism. A current-carrying conductor generates a magnetic field; when this is then placed in an external magnetic field, it will experience a force proportional to the current in the conductor, and to the strength of the external magnetic field. As you are well aware of from playing with magnets as a kid, opposite North and South polarities attract, while like polarities North and North, South and South repel. The internal configuration of a DC motor is designed to harness the magnetic interaction between a current-carrying conductor and an external magnetic field to generate rotational motion.

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Every DC motor has six basic parts -- axle, rotor a.k.a., armature, stator, commutator, field magnet, and brushes. In most common DC motors the external magnetic field is produced by high-strength permanent magnets. The stator is the stationary part of the motor -- this includes the motor casing, as well as two or more permanent magnet pole pieces. The rotor together with the axle and attached commutator rotate with respect to the stator. The rotor consists of windings generally on a core, the windings being electrically connected to the commutator. The above diagram shows a common motor layout -- with the rotor inside the stator field magnets.

In real life, though, DC motors will always have more than two poles. In particular, this avoids dead spots in the commutator. You can imagine how with our example two-pole motor, if the rotor is exactly at the middle of its rotation perfectly aligned with the field magnets, it will get "stuck" there. Meanwhile, with a two-pole motor, there is a moment where the commutator shorts out the power supply i.e., both brushes touch both commutator contacts simultaneously. This would be bad for the power supply, waste energy, and damage motor components as well. Yet another disadvantage of such a simple motor is that it would exhibit a high amount of torque ripple

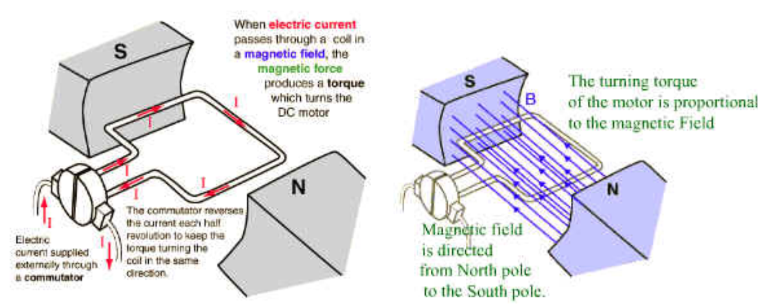

Fig. 5

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4.4 Relay

A relay is an electrically controllable switch widely used in industrial controls, automobiles and appliances.

The relay allows the isolation of two separate sections of a system with two different voltage sources i.e., a small amount of voltage/current on one side can handle a large amount of voltage/current on the other side but there is no chance that these two voltages mix up.

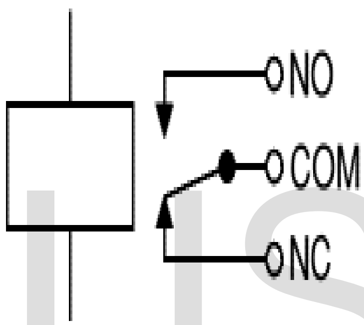

Fig. 6

electrically isolated high current circuit path. The basic relay consists of a coil and a set of contacts. The most common relay coil is a length of magnet wire wrapped around a metal core. When voltage is applied to the coil, current passes through the wire and creates a magnetic field. This magnetic field pulls the contacts together and holds them there until the current flow in the coil has stopped. The diagram below shows the parts of a simple

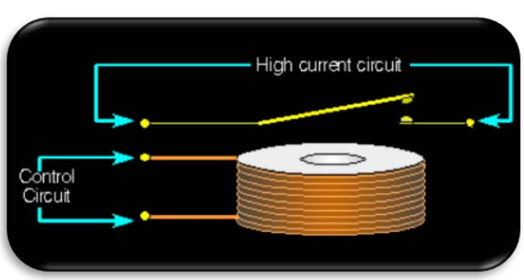

Fig. 7

4.4.1 Operation:

When a current flow through the coil, a magnetic field is created around the coil i.e., the coil is energized. This causes the armature to be attracted to the coil. The armature's contact acts like a switch and closes or opens the circuit. When the coil is not energized, a spring pulls the armature to its normal state of open or closed. There are all types of relays for all kinds of applications.

Transistors and ICs must be protected from the brief high voltage 'spike' produced when the relay coil is switched off. The above diagram shows how a signal diode (eg 1N4148) is connected across the relay coil to provide this protection. The diode is connected 'backwards' so that it will normally not conduct. Conduction occurs only when the relay coil is switched off, at this moment the current tries to flow continuously through the coil and it is safely diverted through the diode. Without the diode no current could flow and the coil would produce a damaging high voltage 'spike' in its attempt to keep the current flowing. coil is a length of magnet wire wrapped around a metal core. When voltage is applied to the coil, current passes through the wire and creates a magnetic field.

4.4.2 Specification

- Number and type of contacts – normally open, normally closed,
- Contact sequence Make before Break or "Break before Make. For example, the old style telephone exchanges required Make-before-break so that the connection didn't get dropped while dialing the number.

- Rating of contacts – small relays switch a few amperes, large contactors are rated for up to 3000 amperes, alternating or direct current

- Voltage rating of contacts – typical control relays rated 300 VAC or 600 VAC, automotive types to 50 VDC, special high-voltage relays to about 15 000 V

- Coil voltage – machine-tool relays usually 24 VAC, 120 or 250 VAC, relays for switchgear may have 125 V or 250 VDC coils, "sensitive" relays operate on a few milli-amperes

4.4.3 Applications:

Relays are used:

- To control a high-voltage circuit with a low-voltage signal, as in some types of modems,

- To control a high-current circuit with a low-current signal, as in the starter solenoid of an automobile,

- To detect and isolate faults on transmission and distribution lines by opening and closing circuit breakers.

- To isolate the controlling circuit from the controlled circuit when the two are at different potential

- To perform logic functions.

- As oscillators, also called vibrators. The coil is wired in series with the normally closed contacts. When a current is passed through the relay coil, the relay operates and opens the contacts that carry the supply current. This stops the current and causes the contacts to close again. The cycle repeats continuously, causing the relay to open and close rapidly. Vibrators are used to generate pulsed current.

- To generate sound. A vibrator, described above, creates a buzzing sound because of the rapid oscillation of the armature. This is the basis of the electric bell, which consists of a vibrator with a hammer attached to the armature so it can repeatedly strike a bell.

- To perform time delay functions. Relays can be used to act as an mechanical time delay device by controlling the release time by using the effect of residual magnetism by means of a inserting copper disk between the armature and moving blade assembly.

5. Technical Specifications:

Title of the Project : Design For Fuel Theft Prevention In Automobiles.

Domain : Mechanical – Automotive.

Use : Automotive.

Power Supply : 12VDC

Technical Support : Lords Institute of engineering and Technology

6. Advantages

a. Fuel theft control
b. Efficient
c. Fit and forget system

7. Result

Hence, By using this design for fuel theft prevention we can save fuel and it can be protectected in a fuel tank **.**

8. Reference

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9. Conclusion

- This paper describes an design of fuel theft prevention for automobile using a solenoid valve .
- The innovative system key is designed in which the system for fuel supply opens only when the ignition system of an automobile gets switched ON .
- This provides more protection to the vehicle even when the key fob is stolen.
- Fuel cut-off is used to reduce or cut the fuel when the vehicle is hacked by thief or misused by the other persons.
- Thus the techniques presented in this paper provide high security and reliability to the vehicle.