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DESIGN AND DEVELOPMENT OF ELECTRONIC SYSTEM FOR VALVE ACTUATING MECHANISM BY FUZZY LOGIC IN IC ENGINE

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ABSTRACT

The electronics play an important role in modernization of engines. Presently in engine the electronic system are used for fuel ignition, radiator temperature sensing, speed sensing. We have a new idea of introducing electronic system for valve actuating mechanism. We are likely to replace cam shaft with speed sensors, microcontroller and electronic solenoid valves. Here we use the fuzzy logic which is a type of programming based on artificial intelligence. Generally in an IC engine the rotary motion of cam shaft is transmitted to the reduction gear then from there it is taken to the rocker arm and finally to the valves. Due to the presence of more mechanical parts we face friction between them which in turn reduces the efficiency of the engine. So if we use a electronically controlled valve we can increase the efficiency of the engine. There will be wastage of power in the engine as the valve mechanisms are efficient only at the specific stipulated condition. By using the microcontroller powered by fuzzy logic the mechanism can function efficiently for all different speeds. And also high temperature resistant electromagnets are attached end of cylinder and piston. The electromagnet placed in cylinder is triggered by means of alternative pulses. so the exerted force on a piston slightly increases. so the both operations are combined and controlled by means of microprocessors &microcontrollers as far increase the efficiency.

Keywords: Nozzle hole, Brake power, Emission analysis, VCR Engine

1. EXISTING TECHNOLOGY

If cylinder heads are the heart of an engine, then the camshaft and valve train have to be the brains of the operation. Timing the opening, closing, lift, and duration of each valve event is central to increasing power and torque.

A valve train consists of valves and a mechanism which opens and closes them. The opening and closing system is called a camshaft. The camshaft uses lobes (cams) that push against the valves to open them as the camshaft rotates; springs on the valves return them to their closed position. This is a critical job, and can have a great impact on an engine's performance at different speeds.

Fig.1

The key parts of any camshaft are the lobes. As the camshaft spins, the lobes open and close the intake and exhaust valves in time with the motion of the piston. It turns out that there is a direct relationship between the shape of the cam lobes and the way the engine performs in different speed ranges.

To understand why this is the case, imagine running an engine extremely slowly at just 10 or 20 revolutions per minute (RPM) so that it takes the piston a couple of seconds to complete a cycle. To actually run an engine this slow would be impossible, but let's imagine that we could. At this slow speed, we would want cam lobes shaped so that just as the piston starts moving downward in the intake stroke, the intake valve would open. The intake valve would then close right as the piston reaches the bottom and the exhaust valve would then open right at the end of the combustion stroke and would close as the piston completes the exhaust stroke.

This kind of setup would work really well for the engine as long as it ran at this very slow speed.

2. WHY VALVE DOES NOT FUNCTION PROPERLY

When you increase the RPM, the 10 to 20 RPM configuration for the camshaft will not work very well. Just say if the engine is running at 4,000 RPM, the valves are opening and closing 2,000 times every minute, or 33 times every second. At these speeds, the piston is moving very quickly, so the air and fuel mixture rushing into the cylinder will also be moving at a very quick rate.

When the piston starts its intake stroke and the intake valve opens, the air/fuel mixture in the intake runner starts to accelerate into the cylinder. By the time the piston reaches the bottom of its intake stroke, the air/fuel mixture is moving at a pretty high speed. If you were to slam the intake valve shut, all of that air/fuel mixture would come to a halt and will not enter the cylinder. By leaving the intake valve open a little longer, the momentum of the fast-moving air/fuel mixture continues to force air and fuel into the cylinder as the compression stroke is started by the piston. In theory the faster the engine goes, the faster the air/fuel mixture flows and the longer we would want the intake valve to stay open. We would also want the valve to open wider at higher speeds. Also affecting the cams performance is lift, the duration, overlap and timing..

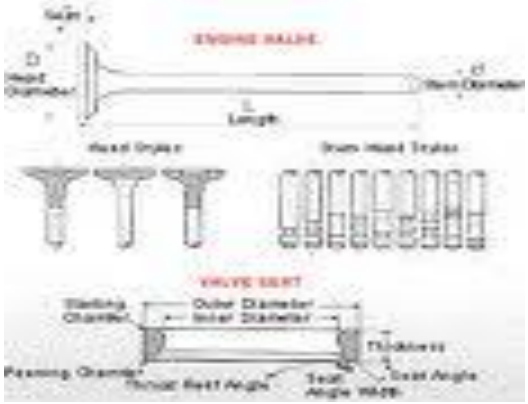

Fig.2

3. LIFT

One of the benefits of having separate compression and expansion cylinders is that the expansion Lift refers to maximum valve lift. This is how much the valve is "lifted" off its seat at the cam lobe's highest point. The intake and exhaust valves need to be open to let air/fuel in and exhaust out of the cylinders. Generally, opening the valves quicker and further will increase engine output. Increasing valve lift, without increasing duration, can yield more power without much change to the

nature of the power curve. However, an increase in valve lift almost always is accompanied by an increase in duration. This is because ramps are limited in their shape which is directly related to the type of lifters being used, such as flat or roller.

3.1 Duration

Duration is the angle in crankshaft degrees that the valve stays off its seat during the lifting cycle of the cam lobe. Increasing duration keeps the valve open longer, and can increase high-rpm power. Doing so increases the RPM range that the engine produces power. By increasing duration without a change in lobe separation angle will result in increased valve overlap.

4. OVERLAP

Overlap is the angle in crankshaft degrees that both the intake and exhaust valves are open. This occurs at the end of the exhaust stroke and the beginning of the intake stroke. Increasing lift duration and/or decreasing lobe separation increases overlap. At high engine speeds, overlap allows the rush of exhaust gasses out the exhaust valve to help pull the fresh air/fuel mixture into the cylinder through the intake valve. Increased engine speed enhances the effect. Therefore increasing overlap, increases top-end power and reduces low-speed power and idle quality.

Fig.3

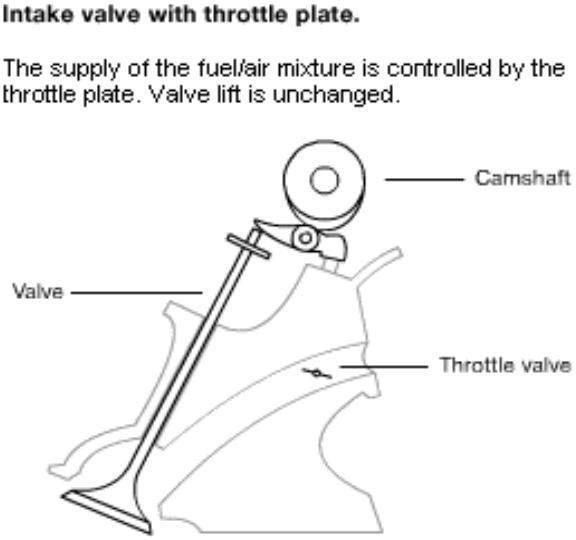

Fig.4

5. FUTURE TECHNOLOGY

- Variable valve actuating mechanism
- Valve electronics based on variable valve timing (b m w)

6. METHOD UNDER ANVIL (ADAPTED)

We have adopted different way of approach in constructing the electronic based valve actuating mechanism .we have incorporated four sensors in a flywheel which senses the position of the strip such as in valve timing diagram. We find four important points such as IPO, IPC, EVO, and EVC. We would like to place these sensors in respective points. From this sensor it is incorporated with the microcontroller which is programmed with fuzzy logic. The complicated task of writing the program can be easily done by using the mathematica 3.0 version software .It easily creates the program for the valve actuating with help of graph obtained. it can generate program by generating the graph plotting the point where it have to open. by sensing only the speed of the shaft ,the shaft (i.e.) fly wheel is sensed for its degree of movement .then it send the signal to the actuating mechanism. It is used for creating fuzzy logic using the mathematica software.

7. FUNCTION OF SOLENOID VALVES

Here the valve is controlled by the solenoid which is attached to the engine cylinder head. The solenoid gets the command from the microcontroller, where the power of the electric signal is in term of 5 v.

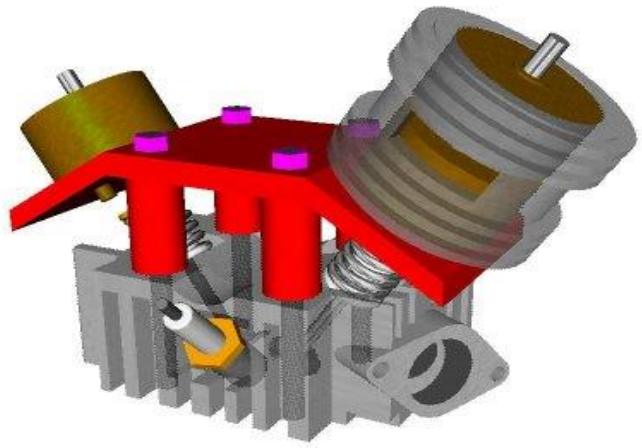

Fig. 5

Then the electric signal of 5 v rating increased to required voltage by the amplifying device. The solenoid valve have to actuate according to the signal received it can function fast even for 4000rpm because this have been used in other systems for actuating mechanism.

Electro magnetic power augmented system:

We know that the torque developed in ic engine ,

$$T = F*r$$

T –Torque (N-m)
F –Force exerted on a cylinder(N)=P*A=(Pressure*Area)
r –Radius of crank (m)

So by increase the force we can increase the work output .This is done by attach a electro magnet on a bottom of a cylinder by means of non magnetic material and a permanent magnet is attach on a piston

We know that opposite poles are repulsing each other. During compression stroke & exhaust stroke the electromagnet are triggering positive pulse so the force required to push the piston reduced.

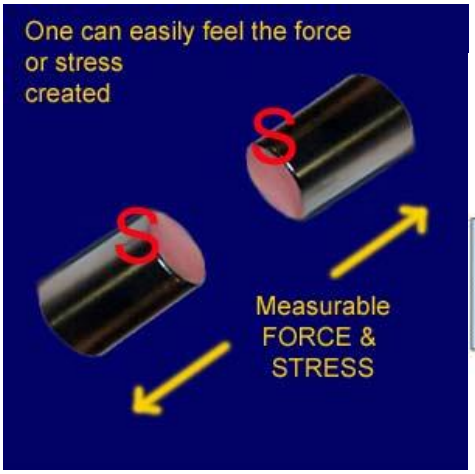

Fig.6

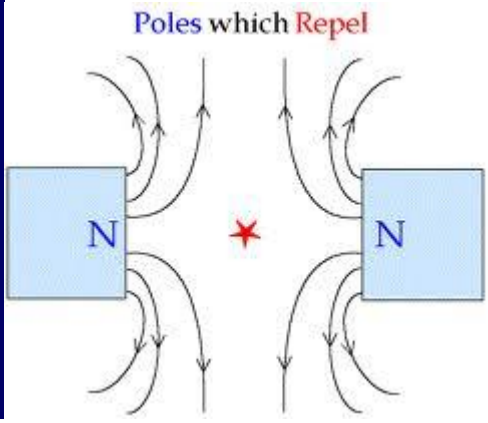

Fig.7

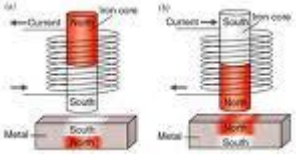

Fig.8

During suction and power stroke triggering a negative pulse two magnets attracted so force created will increase. The Flow diagram of combined electronic value and electromagnet power system as shown in figure.

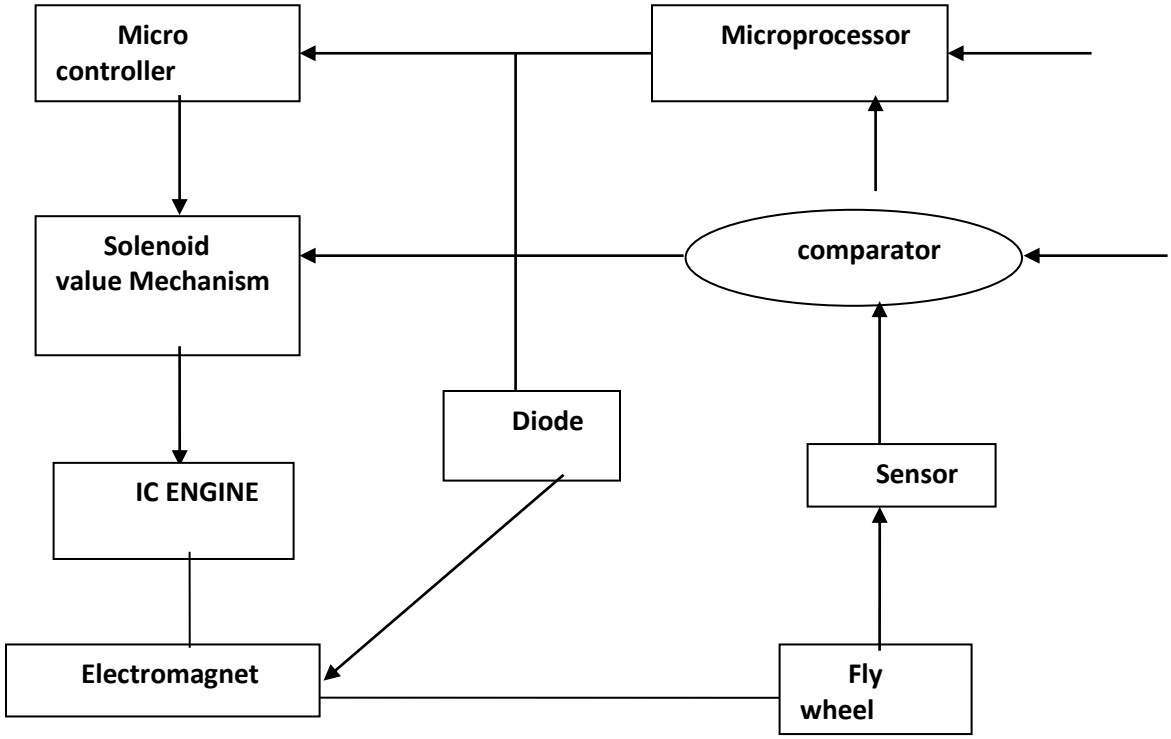

Fig. 9

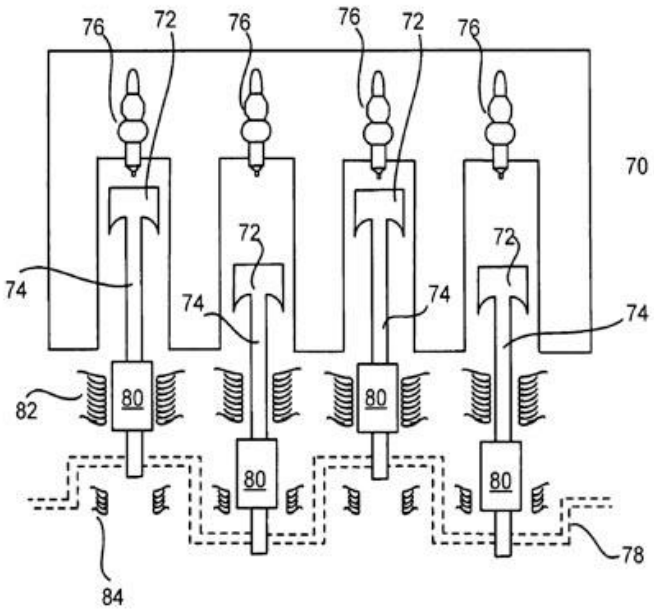

Fig. 10

8. ADVANTAGES

- The 15% of the torque generated is saved because of the absence of the cam shaft.
- Solenoid valve allows a complete freedom in the valve control.
- High efficiency
- Solenoid valve functions with good precision.
- Microcontroller is of very less cost.

9. DISADVANTAGES

- The deposition of dirt results in malfunction of the component.
- The microcontroller if damaged it should be completely replaced.
- For very high temperature it is not valid.
- Heating up of solenoid valves will take place.

10. CONCLUSION

This is just the idea we have developed and there is lot of chance in development in this technology. Microcontroller can be used in I C engines because comparing to microprocessor the speed of the microcontroller is significantly higher and it has inbuilt memory. The operation of solenoid valve comparing to the mechanical valve is very smooth and fine.

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