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Design and Fabrication of Automatic Brake in Vehicle

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Abstract: *The aim of the project is to design and construction of a module used for vehicles within the hill stations. Automotive vehicle braking system is used once vehicle is moving upward direction. These sensors began within the automotive business particularly for crash detection in airbag systems. During this work, Ratchet and pawl mechanism is known to arrest the backward motion to the automotive. The ratchet is placed within the front drive shaft and also the pawl is fitted with the frame. Once the vehicle is moved within the hill road, the lever should build the pawl to the touch the ratchet. If the vehicle tends to move backward direction, the pawl would stop the ratchet to move Counter Clock-wise direction with respect to front wheel. Because the vehicle is in neutral position, the pawl engaged the ratchet and also the vehicle didn't move in. The IR TRANSMITTER circuit is to transmit the Infra-Red rays. If any obstacle is there during a path, the Infra-Red rays mirrored. This mirrored Infra-Red rays are received by the receiver circuit is termed "IR RECEIVER". The IR receiver circuit receives the mirrored IR rays and giving the management signal to the negative feedback circuit. The negative feedback circuit is used to activate the solenoid valve.*

Keywords: *Hill station brakes, ratchet and pawl mechanism, IR sensor, pneumatic actuator etc.*

I. INTRODUCTION

In this work the mechanism has been developed to stop the vehicle from rolling backwards when the vehicle is moving in the hill roads. Ratchet and Pawl mechanism has been identified to arrest the motion to the front axle. Anti-Roll Back mechanism has been fabricated and tested on the front axle assembly. The mechanism works well. Ratchet and pawl mechanism is used in many applications effectively where the one side power transmission is required for example in (i) Giant wheel- It is the large wheel used in the amusement parks to rotate along the horizontal axis to rotate in one direction while carrying the number of passengers. (ii) Clocks- where the hands rotate in clockwise directions only. (iii) Baffle gates- in the entrances of many buildings which rotates about vertical axis in one direction. (iv) Shaping Machines – in the crank and slotted arm. In the hill station, the most common problem to the drivers is to park their cars in the slope and to start up the car. While waiting in the traffic, the cars have to move on step by step very slowly, this situation is a difficult one for the drivers to make their car not to roll back in the slope. So the mechanism has to be developed to stop the vehicle from rolling back and it should not stop the vehicle in accelerating forwards. This function can be achieved by using the ratchet and pawl mechanism. The ratchet and pawl has to be designed and has to be fit in the front drive shaft in case of the front drive vehicles. The Maruti Swift Dzire car is considered and the ratchet and pawl has to be designed for it. In order to design for the worst case the road maximum slope is considered- Zoji pass Road Kashmir which has 21.80% with gradient 2/5.

II. LITERATURE REVIEW

Roop Singh Takur et.al.[1] Says in the paper "Improving Quality of Vehicle Tracking Systems in Hill Stations Using IEEE 802.16 Networks" that IEEE 802.16 standard was designed to support the vehicle tracking system applications with quality of service (QoS). Tracking system is used for tracking the vehicles in hill stations with quality of service (QoS). With the help of subscriber station (SS) can track the vehicles. Subscriber station's will provide signals to the mobiles and vehicles. In this paper, we propose a scheme, named vehicle tracking system, to track the vehicles without any interrupt in hill stations with quality of service (QoS). The idea of the proposed scheme is to track the vehicles in the roads of the hill stations which is coming in opposite direction and back of the vehicle. Analysis and simulations are used to evaluate the proposed scheme. Literature

N. Ramesh krishnan et.al.[2] Says in the paper “The New In-Depth, At-the-Scene, Accident Investigation Database in India” that India’s staggering record of traffic fatalities has created an urgent need to understand, and mitigate, the factors involved in these crashes. But understanding relies on having quality, in-depth data available for analysis. To provide such data, a consortium of vehicle manufacturers and researchers, with support from the police, developed a methodology for investigating and recording crash and injury details for road traffic accidents occurring on South Indian highways.

P.Balashanmugamet. Al.[3] Says within the paper “Fabrication of High Speed Indication and Automatic pneumatic Braking System” that for the Indian road transport scenario worries, accidents are getting every day to day cause a shot has been created during this project to reduce such mishaps. In our project a high speed indication is given and automatic braking is applied by removing the fuels provide to the engine once the setup speed is exceeded. In our project, we've got used solenoid valve associated an operational electronic equipment circuit using LM324IC. The alternations to be created to implement this project within the vehicles are mentioned.

III. METHODOLOGY

In this work, Ratchet and Pawl system is recognized to capture the retrogressive movement to the auto. The ratchet is set in the front drive shaft and the Pawl is fitted with the edge. At the point when the vehicle is moved in the slope street, the lever needs to make the pawl to touch the ratchet. In the event that the vehicle tends to go in reverse heading, the pawl would stop the ratchet to move Counter Clock-wise course regarding front wheel. As the vehicle is in impartial position, the pawl connected with the ratchet and the vehicle did not move. The IR TRANSMITTER circuit is to transmit the Infra-Red beams. In the event that any obstruction is there in a way, the Infra-Red beams reflected. This reflected Infra-Red beams are gotten by the collector circuit is called "IR RECEIVER". The IR beneficiary circuit gets the reflected IR beams and giving the control flag to the control circuit. The control circuit is utilized to actuate the solenoid valve. On the off chance that the solenoid valve is actuated, the compacted air goes to the Single Acting Pneumatic Cylinder. The packed air initiates the pneumatic chamber and moves the cylinder pole. On the off chance that the cylinder pushes ahead, then the breaking game plan actuated. The breaking game plan is utilized to break the wheel steadily or abruptly because of the cylinder development. The breaking rate is fluctuated by modifying the valve is called "Stream Control Valve". The innovation of pneumatic has increased gigantic significance in the field of working environment justification and mechanization from antiquated timber works and coal mines to cutting edge machine shops and space robots. It is hence vital that experts and designers ought to have decent information of pneumatic framework, air worked valves and extras. The air is packed in an air compressor and from the compressor plant the stream medium is transmitted to the pneumatic barrel through a well laid pipe line framework. To keep up ideal proficiency of pneumatic framework, it is of essential significance that weight drop amongst era and utilization of packed air is kept low. The point is to outline and build up a control framework based a smart electronically controlled car slowing mechanism is called "Programmed Brake for Hill Station". This Braking framework comprises of IR transmitter and Receiver circuit, Control Unit, Pneumatic breaking framework. The IR sensor is utilized to distinguish the slopes impediment. There is any deterrent in the way, the IR sensor detects the slopes snag and giving the control flag to the breaking framework. The pneumatic breaking framework is utilized to break the framework.

A. Pawl Activator By Compressed Air

Every valve wants a way by that it may be operated (e.g., cycled or actuated). There are a unit a range of choices to realize this including: hand wheels, levers, gears, and actuators. Actuators area unit away by that a valve may be machine-driven in order that no human interaction with the valve package is important to cycle the valve. Actuators may be remotely operated and may act as closure mechanisms just in case of associate emergency state of affairs, wherever in human interaction may be dangerous.

“At a basic level, an actuator is a control mechanism that is operated by an energy source. This energy can be hydraulic pressure, pneumatic pressure, or electric current which moves the internal mechanical parts of the actuator.” said Russ Robertson, Cameron’s actuation product manager, “They can be designed to fail-open (in the case of actuator failure, the valve will stay open) or fail-close (in the case of actuator failure, the valve will stay closed). They also are distinguished by whether they are for quarter-turn (e.g., ball valves, plug valves) or linear (e.g., gate valves) valve operation.”

B. Types

1) *Double Acting* :Actuators in a double acting configuration have air/liquid supplied to both sides of the piston, with one side being higher pressure which achieves the movement required to actuate the valve. This configuration uses the air/liquid as energy to both open and close the valve.

- 2) *Spring Return* – Actuators during a spring come back configuration have air/liquid equipped to only 1 facet of the piston, and also the energy to maneuver the mechanisms comes from a spring on the other facet. This configuration uses the air/liquid as energy to open or shut the valve, whereas the spring acts to have an effect on the other motion.
- 3) *Pneumatic* – Pneumatic actuators utilize compressed air to generate the operating energy. These actuators are quick to respond, but are not ideal for environments under high pressures, as gas is compressible. Pneumatic actuators can be either spring return or double acting.
- 4) *Piston Style* – Piston style actuators generate linear force by the air functioning on the piston. The conversion of this linear force to force (for use in rotary valves) is achieved by specific mechanism styles.
- 5) *Scotch Yoke* – A scotch-yoke mechanism includes a piston, connecting shaft, yoke, and rotary pin. The yoke is offset forty five degrees from the axis of the piston at the 2 ends of travel and at ninety degrees to the piston shaft once within the middle travel position. The inclined scotch-yoke design is right for offset valve effort.
- 6) *Rack and Pinion* – Unlike traditional actuators, that manufacture a 90-degree flip of the pinion, rack, and pinion, actuators output a 180-degree flip. This variety of mechanism is especially appropriate for activating plug valves.
- 7) *Diaphragm Style* – The diaphragm-style mechanism includes a rubber diaphragm and stem in an exceedingly circular steel housing. This variety of actuators is right for valves requiring shorter travel, like diaphragm valves and globe valves.
- 8) *Hydraulic* – Hydraulic actuators use liquid as a way to use pressure to the actuators mechanical elements. They usually can exert associate outsized amount of force, as a results of liquid is not compressible, and but area unit usually restricted in acceleration and speed. Hydraulic actuators area unit usually either spring return or double acting.
- 9) *Piston style* – Piston-style hydraulic actuators perform the same means that at gas piston-style actuators, but utilize liquid instead of gas to return up with the operative energy.

C. Selection Of Actuators & Air Cylinders

Actuator and air cylinder designs from SMC offer innovative pneumatic cylinder design features for the automation industry. Engineers trust SMC actuators to provide long life, and reliable service. SMC products are specified in all major industrial markets. SMC actuators are created to provide you with the largest array of choices.

Air Cylinder Features Our standard air cylinder features include:

- 1) A wide range of bore sizes, with 16 'inch' bore sizes and 18 'metric' bore sizes.
- 2) multiple mounting configurations and
- 3) Auto switches capability as a standard on most series.

SMC merchandise area unit designed for preciseness performance and responsibility. Our world production facilities offer product availability from all industrial countries round the world. gas and electrical mechanism merchandise from SMC area unit out there in a very wide selection of designs, together with linear, guided, rod less air cylinders, rotary, gripper, and specialty air cylinders. whether or not gas or electrical actuators, every series comes with a hands of ordinary choices and connected merchandise.

Linear: Basic Air Cylinder Basic linear cylinders are used to give straight-line, in/out linear movement for a spread of applications. On the market as single acting (spring extend or spring return) and double acting designs with single rod or double rod configurations, non-rotating, and exactitude non-rotating models.



Fig. 4.1 Linear Basic Air Cylinder

Body designs include crimped, round, or tie rod. Single acting cylinders develop thrust in one direction and have lower air consumption compared with the equivalent size of double acting cylinders. With a double acting air cylinder, gas pressure is also alternately applied to supply force in each directions.

D. Linear: Compact Cylinders

A compact cylinder functions within the same manner as a basic cylinder with each single acting and double acting, single or double rod, and non-rotating models. However, SMC compact cylinders minimize house needs letting precise, direct mounting within the slightest of house attainable.



Fig. 4.2 Linear Compact Cylinders

E. Linear: Rod less Air Cylinder

A rod less air cylinder differs from a basic air cylinder therein no connecting rod extends outside the cylinder body. Instead, the inner piston is connected to associate degree external carriage, by means that of a magnetic or mechanical coupling system. SMC's rod less air cylinders square measure ideal for long stroke applications as a result of their unaffected by rod overhang, bending, piston binding, and uneven seal wear, and to be used in confined areas wherever area may be a premium.



Fig. 4.3 Linear Rod less Air Cylinder

F. Rotary Actuators

SMC manufactures each Rack and Pinion and Vane style gas positioner merchandise. Combination rotary models mix compact linear cylinders and motion capability. Combinations are offered that embrace rotary gripper capabilities. once the applying necessitate motion motion but one revolution, rotary cylinders will mount right at the instrumentality joint while not taking on space with long stroke lengths, which might be needed to try and do a similar job with a linear cylinder. SMC's gas positioner units are able to do arc lengths of 90°, 180°, 190°, or maybe 270°, counting on the configuration. SMC offers each electrical and gas positioner merchandise.



Fig. 4.4 Rotary Actuators

G. Solenoid Valve

A solenoid valve is an electromechanically operated valve. The valve is controlled by an electrical 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 is 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.

There are several valve style variations. Normal valves will have several ports and fluid methods. A 2-way valve, for instance, has a pair of ports; if the valve is open, then the 2 ports are connected and fluid might flow between the ports; if the valve is closed, then ports square measure isolated. If the valve is open once the coil isn't energized, then the valve is termed usually open (N.O.). Similarly, if the valve is closed once the solenoid isn't energized, then the valve is termed usually closed. There's additionally 3-way and a lot of sophisticated designs. A three-way valve has 3 ports; it connects one port to either of the 2 alternative ports (typically a provide port associate degreed an exhaust port).

Pneumatic Directional Control Solenoid Valves – AVP Series

NITRA™ pneumatic AVP series directional control solenoid valves square measure 3-way stackable valve style valves with 1/8" NPT ports. They supply 2-position, usually closed, spring come back operation with either twenty four VDC or one hundred twenty VAC solenoid coils. The AVP series will be utilized in individual valve applications or multiple valves will be field assembled (stacked) to share provide air, simplifying piping connections. The DIN style wiring instrumentation includes crystal rectifier indication of the solenoid coil standing.



Fig. 4.5 Solenoid DC valve

So comparing above we require a simple linear motion to activate pawl mechanism to ratchet so we select simple basic linear actuator.

H. atchet and pawl

Air brakes use compressed gas to form the brakes work. Air brakes stop massive and significant vehicles. Safely; however the brakes should be maintained and used properly. Air brakes are 3 completely different braking systems: service brake, emergency brake and brake systems. The brake system uses elements of the service and emergency brake systems to prevent the vehicle if the service brake fails. B. Air brake elements the air brake consists of the subsequent elements.

Air compressor pumps compressor pumps air into the air storage tanks (reservoirs). It's connected to the engine through gears or a v belt. The mechanical device could also be air cooled or cooled by the engine cooling system. It should have its own oil provide or it should be greased by engine oil. If the mechanical device has its own oil provide, check the oil level throughout the pre-trip review. Air compressor governor compressor governor controls once the compressor pumps air into the air storage tanks. Once air tank pressure rises to the cut-out level (around a hundred twenty five pounds per sq. inch-psi), the governor stops the compressor from pumping air. Once the tank pressure falls to the cut-in pressure (around one hundred psi), the governor permits the mechanical device to begin pumping once more.

Air storage tanks hold compressed air. The number and size of the tanks vary between vehicles. The tanks will hold enough air to allow the brakes to be used several times even if the compressor stops working. Air tank drains allow you to drain water and compressor oil that may accumulate in the tanks. Water and oil tend to collect in the bottom of the air tank and are bad for the air brake system. The tank must be drained completely to remove all moisture. Otherwise, water can freeze in cold weather and cause brake failure. Each air tank is equipped with a drain valve in the bottom. Fig 8 shows the air storage tank arrested. The same can be achieved if this model is fitted in the car. This will be the case while fitting this mechanism in the drive shaft of the car. When it has been done the car cannot move in reverse direction in the slope as the pawl locks the ratchet.

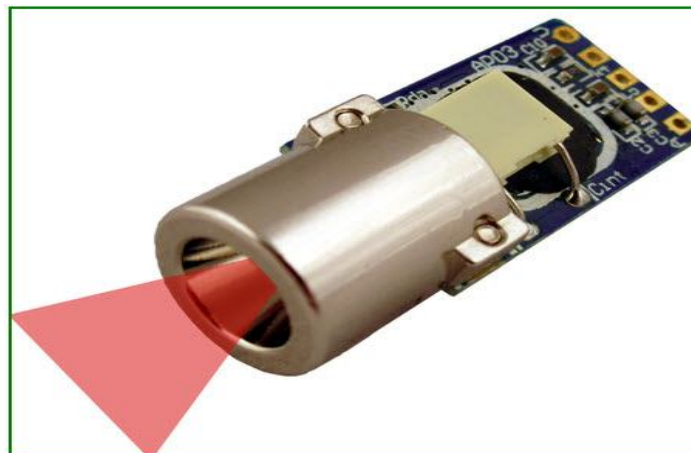


Fig. 4.6 Fabrication of Ratchet and Pawl

The fabricated mechanism is fitted in drive shaft for testing experimentally to check whether the functionality has been achieved. The hand driven lever is turned in forward direction, similar to forward motion of the car, the pawl does not stop the ratchet to rotate. The hand lever is turned in opposite direction similar to the reverse motion of the car in the hill road, and the pawl stops the rotation of the ratchet. So, the drive shaft and the wheels did not rotate.

I. IR SENSOR

An infrared device is an device that emits so as to sense some aspects of the environment. An IR device will live the warmth of an object likewise as detects the motion. These varieties of sensors measures solely actinic ray, instead of emitting it that's known as a passive IR device. sometimes within the spectrum, all the objects radiate some variety of thermal radiations. These varieties of radiations area unit invisible to our eyes which will be detected by Associate in nursing infrared device. The electrode is solely associate in Nursing IR light-emitting diode (Light Emitting Diode) and therefore the detector is solely associate in Nursing IR photodiode that is sensitive to IR light-weight of identical wavelength as that emitted by the IR light-emitting diode. Once IR light-weight falls on the photodiode, the resistances and these output voltages, change in proportion to the magnitude of the IR light-weight received.



IV. ADVANTAGES AND APPLICATIONS

A. Advantages

- 1) Brake cost will be less.
- 2) Free from wear adjustment.
- 3) Less power consumption
- 4) Less skill technicians is sufficient to operate.
- 5) It gives simplified very operation.
- 6) Installation is simplified very much.

B. Applications

- 1) For automobile application
- 2) Industrial application

V. CONCLUSIONS

Thus the mechanism can stop the vehicle from rolling back in hill roads. This would be more helpful for the drivers to drive their cars comfortably in hilly roads and he can take off the car in the uphill without rolling back the car. The project safety auto brake system for hill station vehicle using IR sensor has been successfully designed and tested. It has been developed by integrating features of all the hardware components used. Presence of every component has been reasoned out and placed carefully thus contributing to the best working of the unit. Secondly, using highly advanced IC's and with the help of growing technology the project has been successfully implemented.

VI. ACKNOWLEDGMENT

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