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Design and implementation for PCV CATCH-CAN System in 163cc

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Abstract
The idea is to reuse the evacuated gases from the crank case in the intake manifold for combustion rather than venting them to the atmosphere. Over time, a thin coating accumulates inside the intake manifold. The vapors are a combination of gasoline, air, extremely minute quantities of water, and oil vapor. Basically, unclean materials that should not be used in the intake manifold. Although this isn't a major issue in vehicles, it is in turbo cars, hence this method is best suited for turbo applications and exceptionally strong race engines. The problem would be the same whether the vehicle was factory turbocharged or had performance turbocharging added to it. As a consequence, even if you drive a factory turbo automobile, this adjustment should help keep the intake manifold clean (which essentially all modern diesels). A clean manifold would result in a happier engine and maybe better engine life and performance. When the temperature of the engine rises, so do the NOx gases. With the help of the PCV CATCH-CAN, we can reduce the temperature of the engine, leading in a reduction in NOx emissions. When the crankcase pressure is high and the intake temperature is low in a running engine, the PCV CATCH-CAN assists in maintaining an even temperature in the engine. In this project, used a container which is of the size 0.2323 m^2 (232.28151 cm^3). In which it has a filter. The container is attached with 2 pipes which also has a drain plug.

Keywords: Implementation, container, alleviates, crankcase, PCV CATCH-CAN

1. Introduction
Oil Catch-cans are low-cost gadgets that have a significant influence on direct-injected engines. A common Catch-can might connect to a pipe that travels from the top of the crankcase to the intake manifold of your engine. They keep oil and other contaminants from accumulating within. This pipe alleviates crankcase pressure caused by blow-by (when pressure escapes the combustion chamber by seeping past the piston rings). The problem is that this pressure relief tube allows oil and other nasty crankcase components to reach the intake manifold, which is not where they should be. These pollutants tend to concentrate inside the intake; if left uncontrolled, this accumulation can lower fuel economy and horsepower, as well as cause misfires. However, with port-injected engines, the gasoline sprayed into the intake functions as a cleaner, wiping away any possible oil accumulation. Because there is nothing blocking direct injection engines from delivering gasoline straight into the cylinder, oil buildup can occur. (Gokten M 2008) [1].

2. Aim
The project's goal is to devise a method to prevent oil and other contaminants from accumulating within the engine. An oil Catch-can is used before recirculation to filter and capture excess oil. It also keeps oil mist or vapor from entering the crankcase, which is known as blow-by. The loss of compression produced by air escaping past the piston rings into the crankcase is known as blow-by. After capturing the oil droplets, clean air may be reintroduced to the engine intake for increased combustion (Walhekar VK 2019) [2].

3. Scope
The project's goal is to devise a method to prevent oil and other contaminants from accumulating within the engine. An oil Catch-can is used before recirculation to filter and capture excess oil. It also keeps oil mist or vapor from entering the crankcase, which is known as blow-by. The loss of compression produced by air escaping past the piston rings into the crankcase is known as blow-by. After capturing the oil droplets, clean air may be reintroduced to the engine intake for increased combustion (Adam MS 2013) [3].

4. Engine breathing system

During an engine cycle, suction and pressure are generated inside the crank case when a piston moves from TDC to BDC and back again. When the piston moves from TDC to DC, pressure is developed inside the crank case, and suction is made when it moves from BDC to TDC. If we do not release this pressure and suction, it will cause internal engine difficulties, causing the engine to malfunction and even the piston to move unevenly. This is why the breathing system of an engine is significantly more important than the engine itself (Hanna RA 1967) [4].

5. Negative crack case ventilation system

If the engine produces more blow-by gases than the PCV system can handle, a rising surplus accumulates in the crankcase, generating excess pressure and, eventually, oil leaks. When confronted with increased internal crankcase pressure, even the most perfectly sealed gaskets leak.

6. Positive crack case ventilation system

This mechanism prevents the crank case-generated mist from being released into the atmosphere. It uses the full air and fuel combination and participates in the combustion process in the combustion chamber. Because it prevents pollutants from increasing, this device is known as a positive crank case ventilation system (Simão M 2017) [5].

7. PCV Valve

Positive crankcase ventilation is used to remove unburned fuel and combustion byproducts that have entered the crankcase via the piston rings. The crankcase is pressured by blowby fumes, which must be removed before they condense and combine with the oil, resulting in sludges or dilution of the oil with unburned gasoline. If the pressure in the crankcase is not relieved, the oil may seep through the gaskets. Breather systems balance blowby-induced crankcase pressure and maintain the crankcase at a pressure just below atmospheric pressure to prevent blowby oil and gas from leaking into the atmosphere.

8. NOx

Nitrogen oxides (NOX) are produced when gasoline burns in an engine with air present. NOX is formed when nitric oxide (NO) and nitrogen dioxide mix (NO2). NO poses no health concerns at ordinary atmospheric concentrations.

9. Oil sludge

Oil sludge, often known as black sludge, is a deposit within an internal combustion engine that resembles gel or is semi-solid and can accumulate to dangerous proportions. When moisture and/or excessive heat are introduced into engine oil, tainted engine oil is commonly the outcome.

10. Blow by gases

Blow-by is the gas that escapes from the piston, rings, and liner system of reciprocating internal combustion engines. The blow-by is a complex mixture of air, burned and unburned gases, and oil mist. To reduce external pollution, the blow-by is recycled in the air intake system. This is known as Closed Crankcase Ventilation (CCV). The CCV causes significant issues such as air intake system fouling, high oil consumption, and contributes to the phenomena of exhaust catalyst poisoning. Previously, a simple oil separation system based on baffles was adequate. Emissions standards are tightening, forcing the construction of a more effective blow-by separation system

9. Catch can

A Catch-can is technically an oil/air separator. Using Catch-cans or oil separators, oil droplets are separated from the air traveling from the engine breather and via the intake system.

12. Materialized

The engine model is Honda gx160 with a displacement of 163cc. The Compression ratio 9:1with the Bore and stroke 27”x1.8”. This is a Centrifugal type of Pump, self-priming with a Volute rigid mounted cast iron also a Impeller 4vane cast iron. It uses Mechanical seal (Pump case/impeller) silicon cardide/silicon carbide the Priming time is 159 sec @16.4 ft, The Drive is system direct with the Discharge capacity of 290 gal/min this engine Dimension in LxWxH is 20.1x15.2x17.9. The Dry weight 57 lb the Fuel capacity is 0.82 gal which will last for max of 1.9 hours.

13. Design of catch can

We have used a container which is of the size 0.2323 m^2 (232.28151 cm^3). In which it has a filter. The container is attached with 2 pipes which also has a drain plug.

1. The filter element is made by the imported filter paper: small aperture, good uniformity, high efficiency of filtering. It can filter impurities in violent changes in temperature, to be ensure enough flow and filter the harmful impurities of engine effectively.
2. Applying high grade adhesive and the superior quality oil resistant rubber pieces, Stick receives firmly, good sealing and oil resistance.
3. The center pipe is used standard thick material with good strength.
4. Antirust processing for the end covers of filter element, the center pipe, and hull etc. Metal parts.

14. PCV working

It keeps too much oil from being drawn out of the crankcase. It regulates the amount of vacuum provided to the crankcase. When the vacuum is high and the rpm is low, the valve gently closes to restrict airflow. When the vacuum drops at greater rpm, the valve opens wider to increase airflow. In the case of forced induction or a backfire, it acts as a one-way check valve. It keeps the crankcase from compressing. A PCV valve schematic with low, high, and backfire speeds.

15. Catch can internal

Increasing the area to slow the flow and collect oil mist enlarging the area to halt the flow and collect oil mist Oil separator with baffle plates (takes up less space and increases the route for blow-by) enlarging the area to halt the flow and collect oil mist Oil separator with baffle plates (takes up less space and increases the route for blowby) Centrifugal oil, vortex oil, or swirl oil Separators that expand the area to decrease the flow and collect oil mist Oil separator with baffle plates (takes up less space and increases the route for blow-by).

16. External oil separator

External centrifugal oil separator (Because the oil separator is also coupled to the breather system, blow-by gases might be pulled up this drain and into the separator, decreasing its

usefulness. As a result, in order to maintain a low gas velocity in the drain, a wide diameter drain tube must be employed. If the oil separator is working properly, any oil mist that enters the drain should quickly escape before reaching the breather connection. Because the PCV valve is located on the side of the head in this engine, we cut the pipe from the center and position the container in the middle. The container in which we have inserted a filter that will aid in the collection of oil in the container. As result the name, Air will flow from one side of the catch can to the other. The air will be fed into the system from the PCV valve side, cleaned, and then fed into the intake. While this process is taking place within the catch can, the oil will be removed with the help of the filter and collected inside the container, where it will flow via the pipe linked to the bottom of the container, also known as the Catch can. This oil will be kept. Once the engine has been serviced, the catch can is drained and replaced with a new filter.

17. Design of catch can

Engine Displacement = S (in liters)
Engine speed is N. (in RPM)
Volumetric efficiency is VE.
V = the force of the stroke (in liters per minute)
VE = 90%
S = 0.163 L
N = 3000 rpm
3% blowby rate (0.03)
V= (N*S*VE)/2*blow by rate
= (0.163*3000*.90*0.03/2
V = 6.6015 liters per minute
A = Catch can's cross-sectional area (in meters squared) Blowing-by volume (in liters per minute) Crucial speed for oil dropout is Vc (in meters per second)
A = (Vb*0.0000167)/Vc
A = (6.6015*0.0000167)/1
A = 0.00011024505 m^2
Now with the help of this knowledge it helps to design a Catch can which will be any shape but should accommodate the area of 0.00011024505 m^2.

18. Catch can specifications

By taking a catch can which is in a cylinder from it will be easier for the oil to be stored and filtered.

Cylinder volume formula

V= πr2 h
R=3.25 cm
H=7 cm
=π*3.25*7 ≈ 232.28151 cm^3

As we have the solutions, we have reached the requirement for having a catch can which can accommodate 0.0011024505 m^2. With the help of the cylinder volume formula 0.2323 m^2 (232.28151 cm^3).

19. Design criteria

Extra oil that escapes through the piston seals is collected in an oil catch container. Opens up a new door to your car's engine area for the engine to function effectively, the oil that lubricates the pistons must be precisely measured with no waste. However, the practice usually produces oily blowby. The oil catch container keeps blowby from entering the engine's intake. The oil collect container is located between the PCV valve and the crankcase. The catch can, which must be cleansed and emptied on a regular basis, becomes clogged with surplus oil. Although commercial oil catch cans are available, some individuals create their own versions out of steel wool or empty food jars. If the blowby is kept out of the air intake, the engine will last longer. The engine should preferably be started and operated with fresh air. If the blowby passes through, the air will no longer be fresh. As a result, deposits build up and engine performance diminishes. These deposits contain carbon, which must be removed. Because of carbon accumulation, your engine becomes less efficient, resulting in irritating rattling while idling and unanticipated ignition failures. Furthermore, they shorten the lifespan of the components, which may necessitate more frequent repairs. With blowby cycling through, no engine functions at peak efficiency, and all engines eventually experience irreversible damage. That implies that an oil Catch-can might be helpful for all engines. However, installing an oil catch can be especially beneficial for drivers of high-performance vehicles. This is because these vehicles must continually perform at their peak. Furthermore, due of the larger probability of deposit formation than in prior engines, vehicles with more modern gasoline direct injection (GDI) or direct fuel injection (DFI) engines benefit especially from oil catch can technology. Technically, any vehicle can run without an oil collecting container. If you don't install one, you'll have to discover other ways to deal with blowby in your automobile. One method is to remove the DFI engine's manifold and clear away the deposits. An oil catch container is a device that keeps surplus oil from entering the engine's intake manifold. Although it is not often used in automobiles, diesel, turbocharged, and supercharged engines regularly use it.

20. Conclusion

The project's goal is to devise a method to prevent oil and other contaminants from accumulating within the engine. An oil Catch-can is used before recirculation to filter and capture excess oil. The project's goal is to devise a method to prevent oil and other contaminants from accumulating within the engine. An oil Catch-can is used before recirculation to filter and capture excess oil. When the piston moves from TDC to DC, pressure is developed inside the crank case, and suction is made when it moves from BDC to TDC. If we do not release this pressure and suction, it will cause internal engine difficulties, causing the engine to malfunction and even the piston to move unevenly. If the engine produces more blow-by gases than the PCV system can handle, a rising surplus accumulates in the crankcase, generating excess pressure and, eventually, oil leaks. Positive crank case pressure prevents the crank case-generated mist from being released into the atmosphere. Positive crankcase ventilation is used to remove unburned fuel and combustion byproducts that have entered the crankcase via the piston rings. It keeps too much oil from being drawn out of the crankcase. It regulates the amount of vacuum provided to the crankcase. Nitrogen oxides (NOX) are produced when gasoline burns in an engine with air present. NOX is formed when nitric oxide (NO) and nitrogen dioxide mix (NO2). Oil sludge, often known as black sludge, is a deposit within an internal combustion engine that resembles gel or is semi-solid and can accumulate to dangerous proportions. Blow-by is the gas that escapes from the piston, rings, and liner system of

reciprocating internal combustion engines. A Catch-can is technically an oil/air separator. Using Catch-cans or oil separators, oil droplets are separated from the air traveling from the engine breather and via the intake system. Increasing the area to slow the flow and collect oil mist enlarging the area to halt the flow and collect oil mist Oil separator with baffle plates (takes up less space and increases the route for blow-by) enlarging the area to halt the flow and collect oil mist Oil separator with baffle plates (Takes up less space and increases the route for blowby) Centrifugal oil, vortex oil, or swirl oil Separators that expand the area to decrease the flow and collect oil mist Oil separator with baffle plates (takes up less space and increases the route for blow-by). External centrifugal oil separator (Because the oil separator is also coupled to the breather system, blow-by gases might be pulled up this drain and into the separator, decreasing its usefulness. The engine model is Honda gx160 with a displacement of 163cc. The Compression ratio 9:1with the Bore and stroke 27”x1.8”.

V = the force of the stroke (in liters per minute)

V = 6.6015 liters per minute

A = Catch can's cross-sectional area (in meters squared)

As we have the solutions, we have reached the requirement for having a catch can which can accommodate 0.0011024505 m^2. With the help of the cylinder volume formula 0.2323 m^2 (232.28151 cm^3). Just for safety we have taken twice the size of the required cross section area. An oil catch container is a device that keeps surplus oil from entering the engine's intake manifold. Although it is not often used in automobiles, diesel, turbocharged, and supercharged engines regularly use it.

21. References

1. Gokten M, Kurnaz G, Ergen OR, Copley D. The development of high efficiency crankcase ventilation and oil mist separator for a heavy-duty diesel application. SAE Technical Paper; c2008.
2. Walhekar VK, Gavade S, Soni G, Bhargava A. Development of Low Cost Closed Crankcase Ventilation With Oil Mist Separation System on Light Duty Diesel Engine. SAE Technical Paper; c2019.
3. Adam MS. Environmental impact assessment fish packing and processing facility Maldive Marine Products Pvt. Ltd. Hulhumalé Industrial Zone; c2013.
4. Hanna RA. 'The awntyrs off arthure at the terne wathelyne': an edition based on bodleian library ms. Douce 324. Yale University; c1967.
5. Simão M, Pérez-Sánchez M, Carravetta A, López-Jiménez P, Ramos HM. Velocities in a centrifugal PAT operation: Experiments and CFD analyses. Fluids. 2017;3(1):3.