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MODIFICATION OF TWO STROKE ENGINE TO INCREASE THE TORQUE

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Abstract

The main objective of this concept is converting a 50 cc moped into a sports bike or racing bike. This will make a small moped similar to a race bike. A street moped of 49 cc volume, 3.9 bhp and producing a maximun torque speed of 50km is converted into a racing bike of 70 cc volume and power of 9 bhp producing a torque speed of 100 km.This may bring a marvellous change in the field of bike racing and creates a revolution in this field.

Keywords: Two-Stroke Engine; Torque; Carburetor.

1. Introduction

1.1 TWO-STROKE ENGINE

The two-stroke engine is a type of internal combustion engine which completes a power cycle in only one crankshaft revolution and with two strokes, or up and down movements, of the piston in comparison to a "four-stroke engine", which uses four strokes. This is accomplished by the end of the combustion stroke and the beginning of the compression stroke happening simultaneously and performing the intake and exhaust functions at the same time.

Two-stroke engines often provide high power-to-weight ratio, usually in a narrow range of rotational speeds called the "power band", and compared to 4-stroke engines, have a greatly reduced number of moving parts are more compact and significantly higher.

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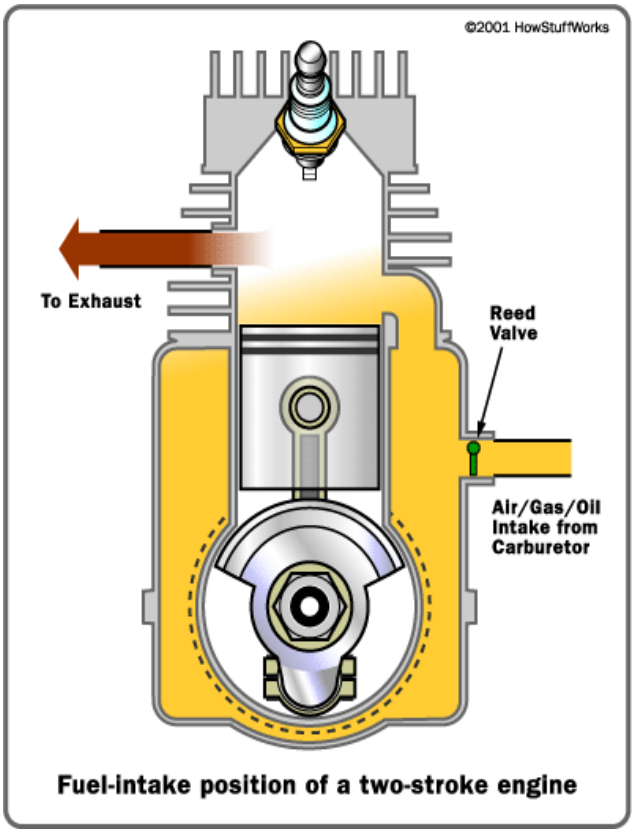

Fig 1.1 Two stroke engine

The heat transfer from the engine to the cooling system is less in a two-stroke engine than in a traditional four-stroke, a fact that adds to the overall engine efficiency however traditional 2-strokes have a poor exhaust emissions. The first commercial two-stroke engine involving in-cylinder compression is attributed to Scottish engineer Dugald Clerk, who in 1881 patented his design, his engine having a separate charging cylinder. The Gasoline spark ignition versions are particularly useful in light weight applications such as chainsaws and small, lightweight and racing motorcycles, and the concept is also used in diesel compression ignition engines in large and weight insensitive applications, such as ships locomotives and electricity generation.

1.2 Working

When the piston moves from bottom dead centre to top dead centre, the fresh air and fuel mixture enters the crank chamber through the valve. The mixture enters due to the pressure difference between the crank chamber and outer atmosphere. At the same time the fuel-air mixture above the piton is compressed. Ignition with the help of spark plug takes place at the end of stroke. Due to the explosion of the gases, the piston moves downward. When the piston moves downwards the valve closes and the fuel-air mixture inside the crank chamber is compressed. When the piston is at the bottom dead centre, the burnt gases escape from the exhaust port.

At the same time the transfer port is uncovered and the compressed charge from the crank chamber enters into the combustion chamber through transfer port. This fresh charge is deflected upwards by a hump provided on the top of the piston. This fresh charge removes the exhaust gases from the combustion chamber. Again the piston moves from bottom dead centre to top dead centre and the fuel-air mixture gets compressed when the both the Exhaust port and Transfer ports are covered. The cycle is repeated.

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1.4 Specifications

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Engine Type	**:** 2 Stroke Air Cooled
Displacement	**:** 49.9cc
Compression Ratio	**:** compression
Maximum Power	**:** 2.61 Kw (3.5 BHP) **Maximum Torque** **:** 5.0 @ 3750 rpm
Cylinder Bore	**:** 46 mm
Stoke	**:** 42 mm
Ignition	**:** Fly wheel magneto 12V,50W Electronic ignition
Wheel Base	**:** 1222 mm
Tyre Size	**:** 2.5 x 16 mm
Wheel Type	**:** 2.5 x 16 mm
Brakes	**:**Front Brakes- Expanding
Suspension	**:** Front Telescopic spring fork Rear: Swing arm

2. DESCRIPTION OF EQUIPMENT

2.1 Carburetor

The basic principle of carburetor is the otto cycle used to power is both two and four stroke engine are feed with fuel. In which is sufficiently volatile and has ignition properties which allow to premixed with combustion air before the combustion is initiated by the spark plug. The mixer air is only inside the chamber the pressure and temperature conditions to induce natural ignition. For the reasons of power delivery petrol engines may be adjusted by fuel delivery alone without to control the airflow. In the otto cycle engines are fuel is premixed with the air is necessary to control the air flow and therefore the indirectly fuel flow. In automobile engines is fuel injection system used in most model, controlled by a central unit that adjusts the duration of time during the injector remain open to deliver fuel into the air stream.

2.1.1 Basic function

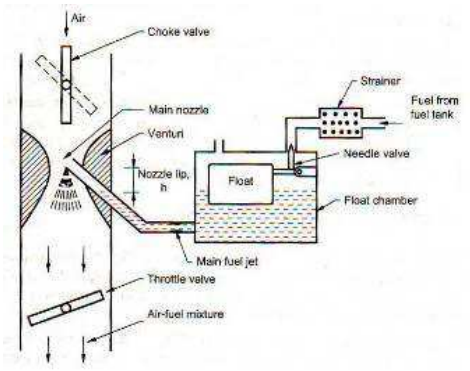

Fig 2.1 Carburetor

To control the power delivered the engine adjusting the airflow inducted according to the driver demand. The meter of fuel flow into the inducted air stream is the while keeping the air/fuel ratio in the optimum range over the engines entire to the working range. In the homogeneous the air and fuel mixture in order to make the ignition and combustion produced property.

2.1.2 Operating Principles of the basic carburetor

The liquid fuel is feed to the nozzle of the carburetor venturi and flows due to the vacuum generated by the air flowing past the venturi itself and form air flow pulsation generated by the piston movement. The caliberated jet placed upstream of the spray nozzle itself controlled the fuel nozzle reaching the spray nozzle.

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motor cycle carburetor are nearly always of the needle type and have a structural architecture as shown in the accompanying illustrations. The fuel are arriving from the tank is held inside the constant level float chamber. The liquid pressure head on the various jets is relatively constant. The difference between the float chamber fuel level and the level that the fuel must be raised to by the inducing vacuum remains constant.

The float chamber level is kept constant by means of a fuel inlet valve actuated by the float that follows free surface of the liquid in the float chamber. When the float chamber level drops due to the fuel used by the engine, in the float drops on the opened valve, so that additional fuel Can flow from the tank. The level of the fuel and float then increases and at certain point close the valve until the sequence is repeated. The level in the float chamber is therefore a calibaration element of the carburetor, since the metered fuel delivery changes with float fuel level, and therefore affects the mixture ratio. By having a high float level a greater fuel quantity is delivered compared to the case with a low float level, and for all operating conditions and for all carburettor circuits.

The weight of the float and the configuration of the lever arm that connects the float with the valve. by installing a heavier float, the free surface of the float chamber liquid must rise before the float force balance the increased weight making the float rise. The result will be a higher float chamber level and richer delivered mixture under the same condition

2.2 Reed Valve

Reed valves are a type of check valve which restrict the flow of fluids to a single direction, opening and closing under changing pressure on each face. Modern versions often consist of flexible metal or composite materials fiberglass or carbon fiber. Two-stroke engines suck their fuel/air mixture through the intake tract into the engine when the piston rises. This action creates a vacuum in the crankcase. On its descent, the piston forces the mixture up through the transfer ports into the combustion chamber. With earlier, piston-port engines, a part of that mixture would be backwashed into the intake instead of entirely through the transfer port. Reed valves act as one-way check valves that prevent this backwash.

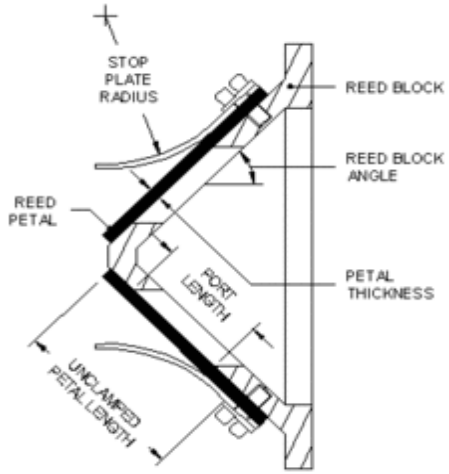

Fig 2.2 Reed valve

A reed valve consists of flexible reed petals that sit over an opening in a wedge-shaped block. The block fits between the carburetor and the engine. With a lower pressure zone on the engine side, the reed petals flex open to allow fuel/air to pass, when the lower pressure switches to the intake tract side, the reed petals are forced tight against the reed block to seal off the intake tract.

The reed petals pulse as the engine cycles, at roughly a one-to-one ratio. When the engine turns 8000 engine revolutions per minute, a reed opens 7980 times per minute. Needless to say, when the engine is running close to peak rpm, the reeds are really buzzing. With each cycle, the reed petals slap against the reed block, shortening their life span. The first reeds, like GEM reeds, were made of stainless steel. These reeds were very durable and could be run a long time, but when they did break, the metal was sucked into the engine— destroying it. Eventually, epoxy-based glass fiber laminate (fiberglass) reeds were developed. Fiber reeds didn't last as long as stainless steel, but when they started to fray, they didn't cause catastrophic damage.

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Carbon fiber reeds are similar to glass fiber reeds, but they are a little lighter and stiffer at the same thickness. To achieve a compromise between lighter carbon and less expensive yet more durable glass fiber, a hybrid was developed. Manufacturers have experimented with other materials as well, including Kevlar and itanium.

Moto Tassinari uses a multiple reed block design that has a larger number of shorter petals that have less distance to travel. Boyesen pioneered the dual-stage reed petal, where a smaller, lighter petal is overlaid on a longer, stiffer petal to provide a longer duration of fuel/air flow. It's a good idea to visually inspect the reeds on a bike for fraying or chipping whenever you examine the piston rings. Boyesen and Moto Tassinari dominate the reed business. As a rule of thumb, when the MXA crew wants more midrange, we call Moto Tassinari, and when we want to increase high rpm power, we hit up Boyesen (although this is not a hard-and-fast rule).

2.3Air Filter

The air and fuel burn in the cylinder and it is this burning or combustion that produces torque/power in the engine. This is where the function of the air filter comes into picture. It prevents dusty air to enter into the engine. Because for the bike to give the best performance the air and fuel mixture ratio should be just be perfect or rather balanced, it cannot be very rich or very lean that can be harmful to the engine. Therefore, this function of the air filter makes it vital to keep it in good shape. If the air filter is choked with dust particles the airflow to the engine get blocked, which results in improper fuel burning and thus reduces the engine performance greatly. The dirt gets settled inside the metal of the engine piston and so files away the piston insides like actually an emery paper.

2.4 Piston and Piston Rings

A piston is a cylindrical engine component that slides back and forth in the cylinder bore by forces produced during the combustion process. The piston acts as a movable end of the combustion chamber.

Fig 2.3 Piston

The stationary end of the combustion chamber is the cylinder head. Pistons are commonly made of a cast aluminum alloy for excellent and lightweight thermal conductivity. Thermal conductivity is the ability of a material to conduct and transfer heat. Aluminum expands when heated, and proper clearance must be provided to maintain free piston movement in the cylinder bore. Insufficient clearance can cause the piston to seize in the cylinder. Excessive clearance can cause a loss of compression and an increase in piston noise.

A piston pin bore is a through hole in the side of the piston perpendicular to piston travel that receives the piston pin. A piston pin is a hollow shaft that connects the small end of the connecting rod to the piston. The skirt of a piston is the portion of the piston closest to the crankshaft that helps align the piston as it moves in the cylinder bore. Some skirts have profiles cut into them to reduce piston mass and to provide clearance for the rotating crankshaft counterweights.

A ring groove is a recessed area located around the perimeter of the piston that is used to retain a piston ring. Ring lands are the two parallel surfaces of the ring groove which function as the sealing surface for the piston ring. A piston ring is an expandable split ring used to provide a seal between the piston an the

cylinder wall. Piston rings are commonly made from cast iron. Cast iron retains the integrity of its original shape under heat, load, and other dynamic forces. Piston rings seal the combustion chamber, conduct heat from the piston to the cylinder wall, and return oil to the crankcase. Piston ring size and configuration vary depending on engine design and cylinder material.

2.5 Ignition

The ignition is a primary system within all small gas engines. It produces and delivers the high-voltage spark that ignites the fuel-air mixture to cause combustion.

Fig 3.6 Spark plug

No spark means no combustion, which means your engine doesn't run. Below are the components found in small engine ignition systems. Some systems will include breaker point ignitions while others depend on solid-state ignitions.

2.6 Silencer:

Due to atmosphere protection and to prevent bad content of gases, normally silencer is provided to any system to which combustion take place or that generates the exhaust gases. When an engine runs, high pressure exhaust gas is released. This causes a pressure wave in the air causing and explosion very fast to form a steady noise. These are two group low frequency from 50 HZ to 500 HZ. To reduce the noise, the engine exhaust is connect to exhaust pipe to the silencer it is also called as muffler in automobile vehicles. In the muffler the gases or the polluted air are allowed to expand gradually and to cool.

3. ALTERATIONS

Our project consist of various automobile parts and we were going to alter some parts of the moped. They are,

1. Engine bore,
2. Carburetor,
3. Reed valve,
4. Piston,
5. Chain sprocket.
6. Silencer

3.1 Engine bore Specifications

Table - 1 Engine bore Specifications

	Before	After
Volume of the cylinder	49 cc	70 cc

Bore diameter	39 mm	46 mm
Stroke length	42 mm	42 mm
Fuel inlet	7 mm	10 mm
Exhaust	12mm	17 mm
Weight	2.6kg	2.4 kg

3.1.1 Volume of the cylinder

The volume of the cylinder is increased by increasing the diameter of the cylinder from 39 mm to 40 mm. generally the volume has been the source of brake horse power and torque. It is directly proportional to the power and torque. Here the volume of the cylinder is increased by using manual boring in lathes and by odd grinding to increase the fuel inlet port and the exhaust port. this may increase the fuel intake and exhaust. This may result in increase of brake horse power and torque of the engine. The weight of the bore is also reduced from 2600 mg to 2400 mg. These weight loss increases the performance of the engine.

3.1.2 Fuel inlet And Exhaust

The intake and exhaust valves open at the proper time to let in air and fuel and to let out exhaust. Note that both valves are closed during compression and combustion so that the combustion chamber is sealed.

INTAKE: This stroke of the piston begins at top dead center. The piston descends from the top of the cylinder to the bottom of the cylinder, increasing the volume of the cylinder. A mixture of fuel and air is forced by atmospheric (or greater) pressure into the cylinder through the intake port.

COMPRESSION: with both intake and exhaust valves closed, the piston returns to the top of the cylinder compressing the air or fuel-air mixture into the cylinder head.

POWER: this is the start of the second revolution of the cycle. While the piston is close to Top Dead Centre, the compressed air–fuel mixture in a gasoline engine is ignited, by a spark plug in gasoline engines, or which ignites due to the heat generated by compression in a diesel engine. The resulting pressure from the combustion of the compressed fuel-air mixture forces the piston back down toward bottom dead centre.

EXHAUST: during the exhaust stroke, the piston once again returns to top dead centre while the exhaust valve is open. This action expels the spent fuel-air mixture through the exhaust valve(s).

Air exhaust level is equal to that of the air fuel intake. Hence the exhaust port diameter has been increased from 12 mm to 17 mm. Due to increased exhaust port size it requires more air fuel mixture and hence the inlet port diameter has also been increased from 7 mm to 10 mm. This alteration makes the gradual increase in the power. Increase in the level of the air fuel mixture increases the Brake Horse Power(bhp).At normal condition, maximum speed in rpm of the wheel is just 5000 rpm and that of the brake horse power of the engine is 3.5 bhp.After alteration on the inlet port and exhaust port, at 5500 rpm the Brake Horse Power is found to be 6 bhp but the maximum speed in rpm has found to be nearly 10,000 rpm and that of the Brake Horse power of the engine is 9.5 bhp.

3.1.3 Carburetor

Before & After

Fig 3.2 Carburetor

The fuel intake port diameter has been increased from 7 mm to 10 mm and hence more air fuel mixture is needed for uninterrupted flow of mixture. Thereby carburetor intake has to be modified or replaced quiet bigger one.so, the 12 mm fuel intake carburetor is replaced with that of the 19 mm fuel intake carburetor (i.e) tvs 50 carburretor is replaced with that of the Tvs Max 100 carburetor. The work of the carburetor is to mix the right amount of fuel with air so that the engine can able to run without any trouble. if there is not enough fuel is mixed with air, the engine runs leanly giving improper power which may damage the engine.

The max 100 carburretor is capable of having 19 mm fuel intake diameter and throttle has been set to it's extreme level and hence the fuel mixture on maximum throttle will be more while accelerating.

3.1.4 Reed valve

Reed valves are a type of check valve which restrict the flow of fluids to a single direction, opening and closing under changing pressure on each face.Two-stroke engines suck their fuel/air mixture through the intake tract into the engine when the piston rises. This action creates a vacuum in the crankcase.Durability isn't the only advantage to different reed materials. A stronger, stiffer material allows the reed to be thinner and lighter.

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Before & After

Fig 3.4 Reed valve

The lighter reciprocating mass of a reed increases performance. If the reed is too thin, however, it can start to flutter at high rpm.In the replaced carburretor the fuel intake must be quite higher than that of the normal carburetor as required by the engine. Hence the reed valve inlet is increased slightly by its edges the fuel inlet to the carburretor has been increased which allows a maximum level of fuel.The reed valve used here has been increased in size from 6 mm to 10 mm by using the reed valve of max 100 the 10 mm size has been achieved. Reed valve used here is an one way valve.

3.1.5 Piston

Fig 3.5 Original piston

The above image represents the piston used before the alteration whose size is smaller than that of the cylinder.

Fig 3.6 Altered piston

A piston is a reciprocating component of the cylinder of an engine and is made gas tight by the piston rings. It's purpose is to transfer force from expanding gas in the cylinder to the crankshaft through the piston

rod or connecting rod.in our engine the piston is also acts as a valve by covering and uncovering ports in the cylinder walls.

Hence the new piston from the tvs heavy duty engine is replaced for that of the old piston and it fits our engine. This makes the engine to run perfectly without any damage to the cylinder and head of the engine.

3.1.6 Chain sprocket

Fig 3.7 old chain sprocket

Fig 3.8 new chain sprocket

Chain sprocket is defined as the sprocket gear pulley which is used to drive the wheel has been altered. The number of teeth in the chain sprocket is decreased from the original chain sprocket in order to increase the rpm or speed of the wheel. This minor replacement of chain sprocket has been used to increase the wheel rotation from the speed before.

3.1.7 Silencer

When an engine runs, high pressure exhaust gas is released. This causes a pressure wave in the air causing and explosion very fast to form a steady noise. In order decrease the noise the normal silencer s used. The normal silencer can able to reduce only the noise but not to increase the performance of the engine. This type of silencer may increase the flow of exhaust due to the cone shape attachment at the centre of the silencer. due to quicker exhaust fuel burning also done quicker thereby increase in the performance on the engine.

4. APPLICATIONS

- It is applicable for all two wheeler mopeds under 70 cc.
- Used for easy making of sports bike.
- The parts of the engine was simple in design and it can be used for street racing.
- Two stroke petrol engines- very light vehicles such as scooters, mopeds, three wheelers can be able to use this type of engine.
- The engines are also preffered for small, portable machine applications such as karts, model airplanes and dirt bikes.
- Motor boats, small engines such as chain saw, and engine generators can able to use this engine.

5. CONCLUSION

The project carried out by us made an impressing task in the field of automobile industries. It is very usefully for sports bike riders to ride at power implemented moped. This project has also reduced the cost involved in the concern. Project has been designed to perform the entire requirement task which has also been provided. Generally the sport bike price is quite higher than the normal bike, but due to this advantage, it can be achieved at lower cost.

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