Effect of Scavenging and Ports on Acceleration of Two Stroke Engine

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Abstract: *Since the two stroke engine fires on every revolution of the crankshaft, a two stroke engine is usually more powerful than a four stroke engine of equivalent size. This, coupled with their lighter, simpler construction, makes the two stroke engine popular in chainsaws, light duty motorcycles and mainly used in sports as drag bikes (ORIENTED FOR 0-60 OR 0-100 KMPH RUN IN OPTIMISED PERFOMANCE, So chose" PORT INDUCTION (TWO TROKES).*

Keywords— *Two Stroke, Ports, Cafe Racer, Engine performance."*

I. INTRODUCTION

A two-stroke (or two-cycle) engine is a type of internal combustion engine which completes a power cycle with two strokes (up and down movements) of the piston during only one crankshaft revolution. This is in contrast to a "four-stroke engine", which requires four strokes of the piston to complete a power cycle during two crankshaft revolutions. In a two-stroke engine, the end of the combustion stroke and the beginning of the compression stroke happen simultaneously, with the intake and exhaust (or scavenging) functions occurring at the same time.

Two-stroke engines often have a high power-to-weight ratio, power being available in a narrow range of rotational speeds called the "power band". Compared to four-stroke engines, two-stroke engines have a greatly reduced number of moving parts, and so can be more compact and significantly lighter.

II. BASIC OPERATION

To take you through a logical sequence of events we will assume the spark plug has ignited the compressed air/fuel mixture in the upper cylinder which causes the hot gasses to expand rapidly, driving the piston downwards. This act in itself will cause the bottom of the piston to compress a new amount of mixture which was introduced into the crankcase when the piston was in it's most uppermost position. As the piston approaches TDC it exposes the induction port allowing the new mixture to be drawn into the crankcase vacuum. With the piston now travelling in a downward direction in an almost simultaneous operation the introduction of a new mixture into the combustion chamber via the transfer ports will aid in the expulsion of exhaust gasses via the exhaust ports. The new mixture is also an aid to cooling the engine and is very important to high revving engines. As the piston moves in an upward direction again, it first closes the transfer port, followed by the exhaust port, and then compresses the new mixture for the next ignition phase

III. PORT WORK

The exhaust port designed by the computer is mapped out on a plastic template. Other cylinder mods are incorporated into the template. The template provides consistency between cylinders in one engine, and, other engines. The template insures a perfectly symmetrical exhaust port. The template also provides a reference if port work needs to be matched later. The cylinder is marked, and the cuts are made to the cylinder. The exhaust port is smoothed, sanded, then polished, and the exhaust flange matched. Port work involves matching all the mating surfaces and gaskets from the crab boot thru to the exhaust flange. Increasing the airflow thru the engine provides the most useable gains in Torque and HP Port work is not Black Magic! Port work IS; tedious, precision work, to perfect air flow!! We will work with your engine to achieve your goals.

IV. TABLE

Specifying details of Initial and Final Condition.

Specification	Stock (initial)	Upgraded
Stroke	50	45.92
C.G.	145	110
Top Speed	100	118
Bore	58	58.5
Fuel	Normal 82	Racing 106

A. Port Timing Basics

Air/gasoline enters the engine from the carburettor at a ratio close to 15:1. It enters via the intake port (as the piston rises) into the crankcase and then is transferred to the combustion area via the transfer ports (as the piston descends and the piston top uncovers the port opening to the cylinder). After it is burned the exhaust gas exits via the exhaust port. For higher rpm there needs to be more degrees of opening for each port because with more revolutions per minute there are more "cycles" dividing up the same minute which means each cycle of crank rotation takes a smaller amount of time so that more degrees opening are needed for the same amount of minimum time needed for movement of gases from one area to another.

1) Intake: For a piston port intake there needs to be around 120 degrees of port open duration for a peak rpm around 6000. Higher rpm needs more port duration. For a reed valve intake there needs to be holes in the piston that allows passage of fuel mixture from the carburettor to the crankcase starting at BDC (**bottom dead centre**). The total volume of the holes should be at least 20% more than the open flow volume of the valve.

2) Transfer port: Less duration favours low rpm power whereas more duration favours high rpm power. More crankcase compression ratio means there will be more pressure when the transfers open and so the entrance of fuel mixture will be more rapid, needing fewer degrees to make the complete transfer. Most common is around a 1.5:1 ratio but you can increase that ratio by stuffing the crank if you are targeting high RPM power. More ratios mean more pressure which is advantageous for high rpm power but a disadvantage to low rpm power. Why? At higher pressure the mixture enters the cylinder too fast at lower rpm and loops around to exit partially through the exhaust port before the ascending piston closes it off. Another factor is the angle of the transfer ports roofs. That affects the angle of mixture entry. A steeper angle gets the mixture up to the spark plug faster which is good for high rpm power but bad for low rpm power. A good example is two cylinders I have for the same engine. One had transfers with only 114 degrees and 45 degree roofs. The other had 120 degrees and 15 degree roofs. The one with the lesser duration achieved 8000 rpm, whereas the other only achieved 7500 rpm. But the one with 15 degrees had more power at low and mid range rpm. One way to cheat the system is design for high rpm power (long duration and steep roofs) but allow a bleed off of crank pressure by a narrow boost port that opens much earlier than the main part of the transfers. This does not ruin high rpm power because anything other than the main opening of the transfers is hardly noticed at top rpm. So it's like not even there at high rpm, but at low rpm it effectively releases much crankcase pressure before the main part of the transfers open so that the mixture enters at a slower speed to be less likely to loop around and exit the exhaust port.

3) Exhaust port: Exhaust "blow down" is commonly used to refer to the time from exhaust port opening to transfers opening. In a more realistic sense it should be used to refer to the time it takes for the exhaust to blow out of the port and reduce the cylinder pressure to near zero (<5psi) so the intake charge can enter the cylinder thru the transfer and boost ports. So right at the end of the exhaust pulse is when the intake charge starts to "transfer" into the cylinder, not when the piston uncovers the transfer ports. That is because the exhaust pulse typically endures past the time when the transfers are opened.

4) Expansion chamber: Two strokes can function with significantly better power if they are aided in these 4 ways:

- Pulling in extra intake charge up from the crankcase into the cylinder,
- Pulling in extra intake charge from the carburetor into the crankcase,
- Preventing the intake charge from escaping through the exhaust port (so it can be used for combustion),
- Boosting the compression at top RPM for a faster burn and more power.

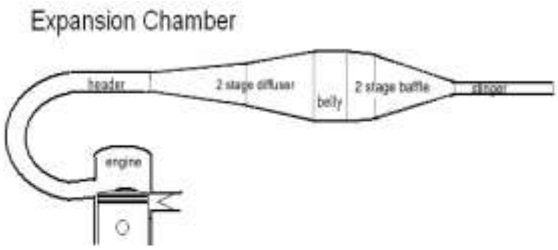

Fig 1: Expansion Chamber Nomenclature

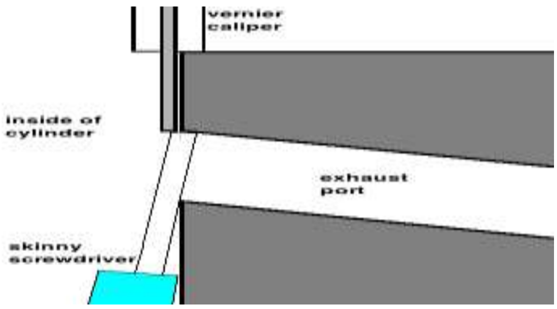

Fig 2: Measurements Of Ports

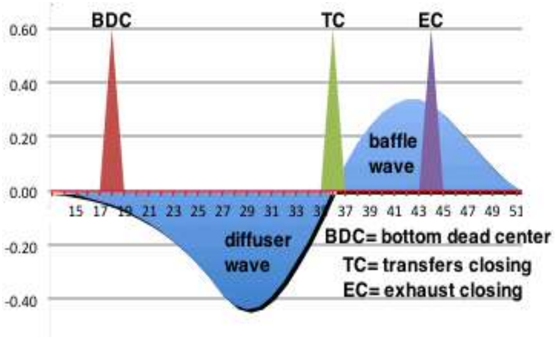

Fig 3: Expansion Diffuser Pressure Wave Graph

V. REFERENCES

Two-Stroke Performance Tuning – 28 Nov 1999

by A. Bell (Author)

Engine-tuning expert A. Graham Bell steers you through the various modifications that can be made to coax maximum useable power output and mechanical reliability from your two-stroke. Fully revised with the latest information on all areas of engine operation, from air and fuel, through carburetion, ignition, cylinders, porting, reed and rotary valves, and exhaust systems to cooling and lubrication, dyno tuning and gearing.

Two-Stroke Engine Repair and Maintenance Paperback

Paul Dempsey (author)

Written by long-time mechanic and bestselling author Paul Dempsey, *Two-Stroke Engine Repair & Maintenance* shows you how to fix the engines that power garden equipment, construction tools, portable pumps, mopeds, generators, trolling motors, and more. Detailed drawings, schematics, and photographs along with step-by-step instructions make it easy to get the job done quickly. Save time and money when you learn how to:

- Troubleshoot the engine to determine the source of the problem
- Repair magnetos and solid-state systems--both analog and digital ignition modules
- Adjust and repair float-type, diaphragm, and variable venturi carburetors
- Fabricate a crankcase pressure tester
- Fix rewind starters of all types
- Overhaul engines--replace crankshaft seals, main bearings, pistons, and rings
- Work with centrifugal clutches, V-belts, chains, and torque converters

VI. CONCLUSIONS

After all these all modifications in engine we can conclude that engine is running absolutely powerful and result in higher torque and acceleration rates .
Still bike is agile nimble and very punchy in terms of handling and delivers power in quiet linear manner.
Some cons of bike are there but still the other pros of bike will convince you for the good side of project.
Bike becomes lagging and under power until proper temperature fulfillment. Bike takes 15 minutes approx to heat up to certain temperature desired for fuel vaporization.
The bike conversion resulted in improved handling and but also brought some cons such as city driving is not so good with this bike cause of higher turning radius and leaning stance of rider.

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