

The Gadgetman Groove

A brief Dissertation on a New Retrofit Technology
Designed for Existing Gasoline Fueled Engines

Developed by Gadgetman Technologies

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History of The Gadgetman Groove

In March of 2009, while speaking with a pilot who holds several records for fuel efficiency in flight who was describing the turbulence over his wings, I had an idea. If I could make that kind of action occur inside an engine, something good would happen. Almost immediately, the shape and location popped inside my head, accompanied by an energy that made it impossible for me to do anything but apply this modification.

Beginning with a 2000 Land Rover, we began to find it working to enhance combustion characteristics across all gasoline engines. Now, more than three years later, this technology has spread to more than 20 nations and is in almost every state in the union.

Basically, what we have discovered is the shape known as The Gadgetman Groove has a profound effect on the naturally occurring pressure curve inside the intake manifold in such a way as to reduce the pressure available as the fuel is delivered to the cylinder. This reduction in pressure has the added effect of increasing the quantity of fuel that is in vapor state at the point of ignition.

Fuel that is normally burned in the exhaust (so-called "Waste Fuel") is given what it needs to burn inside the engine, enabling tremendous increases in fuel efficiency and all that means to an engine AND the environment.

Use of Vaporization in Carbs

There have been many innovations throughout history to help reduce the consumption of gasoline and other fuels. Spurred by the drive for economy, many inventors have dedicated their efforts to reduce fuel consumption by a variety of methods, each effective in their own way, on the applications for which they were designed.

Most notable among these developments was the Vapor Carburetor rage in the 1960's and early 1970's. Unfortunately, fuel chemistry changes that began in the mid-70's (and continue through today) rendered this method of fuel efficiency obsolete. However, the scientific principles reputedly used to generate the near-mythological increases (Claims as high as 200 mpg's) are still valid.

Utilizing heat to turn the fuel into a vapor is still an excellent method, but can be extremely difficult to generate gains in modern engines, as many now have fuel temperature and

pressure sensors. Given the extreme levels of controls on modern computer-controlled fuel delivery systems, any attempt at vaporizing the fuel by applying heat renders the entire system non-operational.

Standard Temperature and Pressure

According to the [Ideal Gas Law](#) (which I will refer to as the Law of Standard Temperature and Pressure or “STP”), in order to consider the vaporization rate, one must not only consider the relative BTU content (temperature), but also the relative pressure on the liquid.

Consider the boiling point of water. This is the point where water is rendered into vapor or steam. At sea level, the boiling point of water is 212 degrees F. In Death Valley, it is more like 215. In Denver, CO (“The Mile High City”), it boils around 203. This is because the atmosphere is much thinner there (less dense), a very clear example of the STP at work.

At lower pressures, less heat is required to vaporize a liquid. This law is what The Gadgetman Groove employs to deliver greatly enhanced fuel efficiency. The reason it works so well is because it does not attempt to modify the fuel at all, rather it asmplifies what the engine is already doing, effectively reducing the pressure inside the intake system, thus enabling most vehicle computers to accept the modification with more than satisfactory results.

Effects on Fuel

This increase in vacuum does not need to be a constant for the vaporization to take place. All that is necessary is for the liquid fuel to be exposed to a reduced pressure for an instant. Once vaporized, it tends to stay vaporized until a pressure is applied or heat is removed. As the temperature in an engine is very carefully controlled, and the vaporization takes place on the initial downstroke of the piston, the condensation (return to liquid state) is less an issue than one might assume.

Once the vaporization has taken place, the fuel vapor is then presented with a very powerful inrush of air. When this blast of air hits the fuel vapor, it changes chemistry ever so slightly, and becomes a volatile compound, waiting for ignition to occur. When the piston continues on its compression stroke, it further encourages the blending process, enabling vastly increased carburetion (air/fuel mixture) and much higher levels of power to be garnered from the combustion process.

The Combustion Process

The combustion process in a standard internal combustion engine (ICE) consists of four cycles or strokes. These are:

- 1) Intake**
- 2) Compression**
- 3) Combustion**
- 4) Exhaust**

During the intake stroke, the intake valve opens and the fuel is allowed to be drawn into the engine. As the piston reaches the bottom of its stroke (Bottom Dead Center or BDC), the intake valve closes and the piston is lifted. This begins the Compression stroke. As the piston nears the topmost position (Top Dead Center or TDC), the spark plug is fired, thus beginning the Compression stroke, and power is delivered to the crankshaft. Once the piston reaches BDC again, the exhaust valve is opened, allowing the remaining vapor to be expelled into the exhaust system.

With The Gadgetman Groove, all of its work is done during the intake stroke. Because of the dynamics of the motion generated by the normal rotation of the crankshaft in relation to the position of the piston, there is a pressure wave created inside the intake manifold. At TDC, vertical movement is minimal, resulting in minimal movement of the intake air stream.

As the crankshaft rotates the first 90 degrees, the piston's vertical movement increases. This is represented as the low pressure point in the cycle, the point at which vacuum is the highest. As it passes the 90 degree point, the piston begins to slow until it reaches BDC where it then reverses direction to begin the compression stroke, awaiting ignition and combustion.

Because of the unique shape of The Groove and considering its placement and the normal pressure wave, during the first half of the intake stroke, it retains the air. This causes the piston to pull harder on the air in the intake manifold, reducing the pressure. As the fuel is in the intake system right along with the air, it is exposed to greatly reduced pressure, forcing it to change to a vapor.

Then, as the piston passes the midpoint and begins to slow the air is released to allow for the completed blending process.

Combustion Efficiency

Given the current state of combustion, efficiency gains in vehicles tested suggest most fuel is not consumed during the combustion stage, but is in fact burning during the exhaust phase. Fuel not consumed in the engine is captured by the Catalytic Converter ("Cat") where the remainder of the so-called 'Waste Fuel' is consumed (burned), reducing the amount of unburned compounds emitted into the atmosphere.

In the current methodologies of combustion, only a small fraction of the power contained in the fuel is actually used to propel the engine. The rest of it, having failed to be blended with the oxygen prior to combustion, exits the engine still burning. This is where The Gadgetman Groove has its greatest effect.

By encouraging a greatly enhanced pressure wave, we are able to realize much higher rates of vaporization of the fuel. This enables the engine to utilize the power contained in the fuel much more effectively. This fact alone creates a much higher thrust ratio, resulting in higher levels of Torque (load handling) and in Horsepower ("Get up and go").

Throttle Assemblies

The way The Gadgetman Groove accomplishes this vaporization enhancement is by utilizing the dynamics present at only one location in the engine: The Throttle Assembly (Air intake valve).

The throttle assembly (Throttle Body) is a very simple device included in a carbureted, Throttle Body Injected (TBI) or a Multi Port Fuel Injected (MPFI) system. It consists of a round passage through which the air flows into the engine and a slightly ovate disk that, when rotated, alternately opens and closes the passage. When more air is allowed into the intake manifold, more fuel is delivered.

With Carbureted engines, the air flow was directly responsible for the fuel being drawn into the engine by what is known as "The Venturi Effect". To explain it quite simply, as air passes over a tube, the pressure is reduced inside the tube, resulting in fuel (on the other end of the tube) to be drawn into the intake manifold and across the throttle plate(s). In the TBI and MPFI systems, a variety of sensors are applied which, when linked to the computer, tells the computer how much fuel is required.

Groove Placement

In considering the function of the throttle plate (the valve itself) one can clearly see the air being drawn into the engine at that point undergoes some marked changes in behavior. As the air enters the valve assembly, it is in the shape of the passage, and in a basically stable pressure. Once coming into contact with the throttle plate, being sloped in the passage, the air begins to be compressed. It is at this point The Gadgetman Groove is applied.

Taking advantage of the high pressure zone thus created, as well as the pressure wave naturally created by the demand of the piston, The Gadgetman Groove alternately retains and releases the air passing by the throttle plate, all in a single downstroke of the piston. It is also completely in harmony with normal engine functions, as the engine itself controls the timing of the enhanced wave form.

As the fuel is vaporized, then combusted more efficiently, there are other factors that affect the engine's increases in efficiency. Since less fuel is required to perform the normal operations, there is less particulate matter (either in vapor or solid state) to exit the engine. This results in lower back pressure as gases with reduced mass are forced into the exhaust stream, and through the Cat, which is a natural blockage. Since there is less back pressure, the engine is allowed to "breathe" more easily, resulting in yet another enhancement to its operations.

Uncovering Inconsistencies

In a few rare instances (2 in 700 tests), the modification can result in an engine (in the most advanced computer controlled models) to consume additional fuel, despite there being less need of it. The reasons for this occurring are still under investigation, but there are only two main components that are suspected to be the cause(s):

- 1) The Manifold Absolute Pressure Sensor (MAP)**
- 2) The Catalytic Converter Efficiency Subsystem.**

The MAP sensor is a device placed in the intake air system at any one of a number of points in order to monitor the difference between the ambient (outside) and manifold pressures. When the accelerator is depressed, it opens the passage between the intake manifold and the atmosphere from which the air is being drawn. This causes an equalization between the two zones. The computer interprets this as a demand for acceleration and adjusts the fuel delivery accordingly. (An additional benefit of the MAP and other monitors in its class is the engine automatically adjusts for altitude considerations.)

Since The Gadgetman Groove enhances the entire pressure wave, not only are the lows lower, but the highs are higher. It is the high pressure sensitivity of certain sensors that actually reduces the gains The Groove is attempting to create. Note I said "reduces the gains", not eliminates them.

The second system we theorize as having this effect is the Catalytic Converter System, and only (once again) in certain of the most advanced computer controlled monitoring systems.

As fuel efficiency increases, there is less fuel burning in the exhaust system, reducing the temperature therein. Since Cat efficiency is measured according to temperature, and as the reduction in temperature of the exhaust can negatively affect the readings, the computer, in its attempt to keep the catalytic converter operating at max efficiency, must therefore add more fuel to compensate for the decrease in temperature.

In other words, if the catalytic converter drops below a certain temperature, the ECU will 'Over-fuel' the engine until the catalytic converter has something to do. And what is the only thing the cat was designed to do?

Burn fuel.

In field tests, we are finding there are three standard systems that have negative effects on the benefits of The Gadgetman Groove modification as it relates to enhanced efficiency. These are (in order of importance) the Positive Crankcase Ventilation (PCV), the Manifold-Absolute Pressure sensor (MAP) and the Post-Cat O2 sensor.

Future Value

While current EPA regulations cite the need for these systems, we find the current systems profoundly negative when attempting to increase combustion efficiency in conjunction with The Gadgetman Groove. As these are all based on application of dynamic vacuum, and enhancing the vacuum curve the basic principle upon which this modification is based, each system represents an additional load on the intake manifold, greatly reducing the potential gains.

In actuality, these systems do not need to have dynamic vacuum applied to meet the EPA's criteria. In fact, the law is worded indicating these systems need only be allowed to "vent" into the intake air stream. This being the case, it is highly recommended they be reconfigured to

vent into the air stream prior to the throttle assembly, which is where the modification (and the enhancement) takes place.

As The Gadgetman Groove alters the waveform present in the intake, this results in the intake manifold experiencing much higher levels of vacuum. The systems with flow (PCV, EGR and EVAP), being presented with this higher level of vacuum will experience higher flow rates, altering the function of each.

We will address each system independently.

Positive Crankcase Ventilation

The PCV system in modern cars draws filtered intake air from the plenum prior to the throttle assembly through the crankcase and then through the PCV valve into the intake manifold. One can meet the EPA requirements for crankcase ventilation by removing the PCV vacuum supply line from the intake manifold and capping that port. This will leave all vapors generated from the motor oil and cylinder blow-by to be vented with near (yet still below) atmospheric pressure as required by EPA regulations.

Most engine control systems will allow this modification without presenting an error code, which occurs only on the most advanced control systems capable of PCV monitoring. This can easily be determined by an inspection of the PCV valve vacuum supply line. In all test cases, this is easily surmountable.

This single modification to the engine is vital to experiencing the greatest gains in efficiency with the least amount of effort. Field tests have shown this may increase mileage (when performed with The Gadgetman Groove modification) from 10% to more than 100% with attendant reductions in emissions as well as gains in Horsepower and Torque.

Exhaust Gas Recirculation

This system was originally developed to reduce the quantity of Oxides of Nitrogen (NOx) present in the exhaust. These compounds are created as a direct result of poor combustion, and are being found to be eliminated with The Gadgetman Groove in many modified engines. When the EGR system was rendered inoperative in modified test vehicles, the levels of NOx was unaffected, leading to the natural conclusion this system was being rendered anathema to goals of system efficiency once The Groove has been applied.

Additionally, as the engine is being forced to draw excessive exhaust into the intake system, it is being shown to increase the temperature of the exhaust, further increasing NOx rather than reducing them as the system was originally intended.

As most EGR systems are closely monitored by the ECU, and as the EPA has strict regulations about tampering with this system, altering the function of this system is not recommended as an enhancement to the Gadgetman Groove modification.

Evaporative Emissions Control

With the EEC or EVAP system, vacuum is applied to the fuel tank, drawing the vaporous emissions from normal expansion and contraction caused by temperature changes into the intake manifold. Once again, it is only required by the EPA these fumes be allowed to vent into the intake. Dynamic or manifold vacuum is not necessary to comply with this regulation. In addition, by applying vacuum to any liquid (in this case, the gas in your tank), the reduced pressure will force the higher level Hydrocarbons (HC's) in the fuel to boil off. In this process, the higher level HC's are drawn from the fuel with no tangible benefit to the operator.

Due to current testing protocols (where mandated by local laws) and electronic monitoring and operation of this emissions control system, some vehicles may not have the option of capping and rerouting this system to "passive" vacuum (occurring between the filter and the throttle), yet it is highly recommended to achieve the highest possible gain from The Gadgetman Groove modification.

After many applications of this 're-routing' of the EVAP supply line by technicians across the United States, we are finding it is acceptable on a wider basis than originally thought. It is recommended this system be rerouted to a position between the throttle assembly and the air filter, further enhancing the gains possible with The Groove alone.

Vacuum Testing

Any and all systems that represent direct flow to the intake system are to be examined closely, as all vacuum leaks (whether by accident or design) will degrade combustion efficiency. Standard testing and repair procedures apply, with encouragement being given to apply a vacuum tester that actually generates reduced pressure, as the dynamics of vacuum versus pressurizing the systems (as in smoke type tests) will cause inaccurate conclusions as to the integrity of the affected systems.

Further, simply measuring the vacuum present at any location with the engine running provides little or no real information about a leak which may or may not be present. To find a vacuum leak in the most effective manner requires applying a vacuum and monitoring the level maintained by the system.

A loose hose will tighten under vacuum and release under pressure. A small crack in a line will not show with a smoke test, but will with a vacuum test. Hence the encouragement for applying vacuum to all vacuum-based systems to obtain accurate results when testing for system integrity.

In performing your tests, the first test should be on the brake booster, as this is the single most overlooked area for vacuum leaks. Any system that does not hold a 20" Hg level is suspect and should be repaired.

Conclusion

In summary, the current emissions control systems engineered into gasoline fueled engines were based on extremely poor combustion. In enhancing the rate of combustion, these

systems are rendered not just obsolete but disadvantageous to efficient engine operations.

The Gadgetman Groove modification has already proven that tremendous increases in efficiency can be achieved with positive effects on all gasoline engines. To maximize efficiency, consideration needs to be given to the systems engineered based on poor system efficiency. Certain systems that were engineered to combat pollution, given the ability to affect such dramatic changes in combustion efficiency with The Gadgetman Groove, should be considered mainly vestigial and likely counterproductive to achieving maximum efficiency.

With the advent of this technology, we may have to re-engineer some of these systems to take full advantage of the potential offered by enhancing fuel efficiency with The Gadgetman Groove. This single modification, should it be engineered into the engine's control systems, could revolutionize our conception of efficiency of the internal combustion engine.

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For information on how you can learn this technology, go to <http://www.GadgetmanGroove.com> and click on "Become a Gadgetman" or see a Gadgetman near you.

Video reports are available at <http://www.YouTube.com/GadgetmanGlobal>