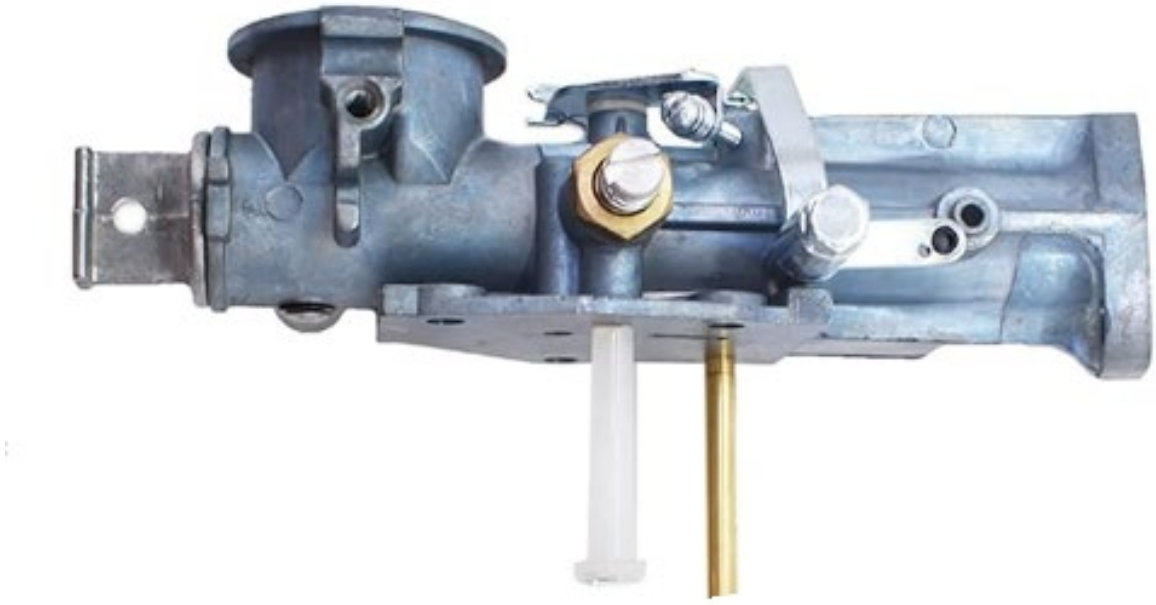
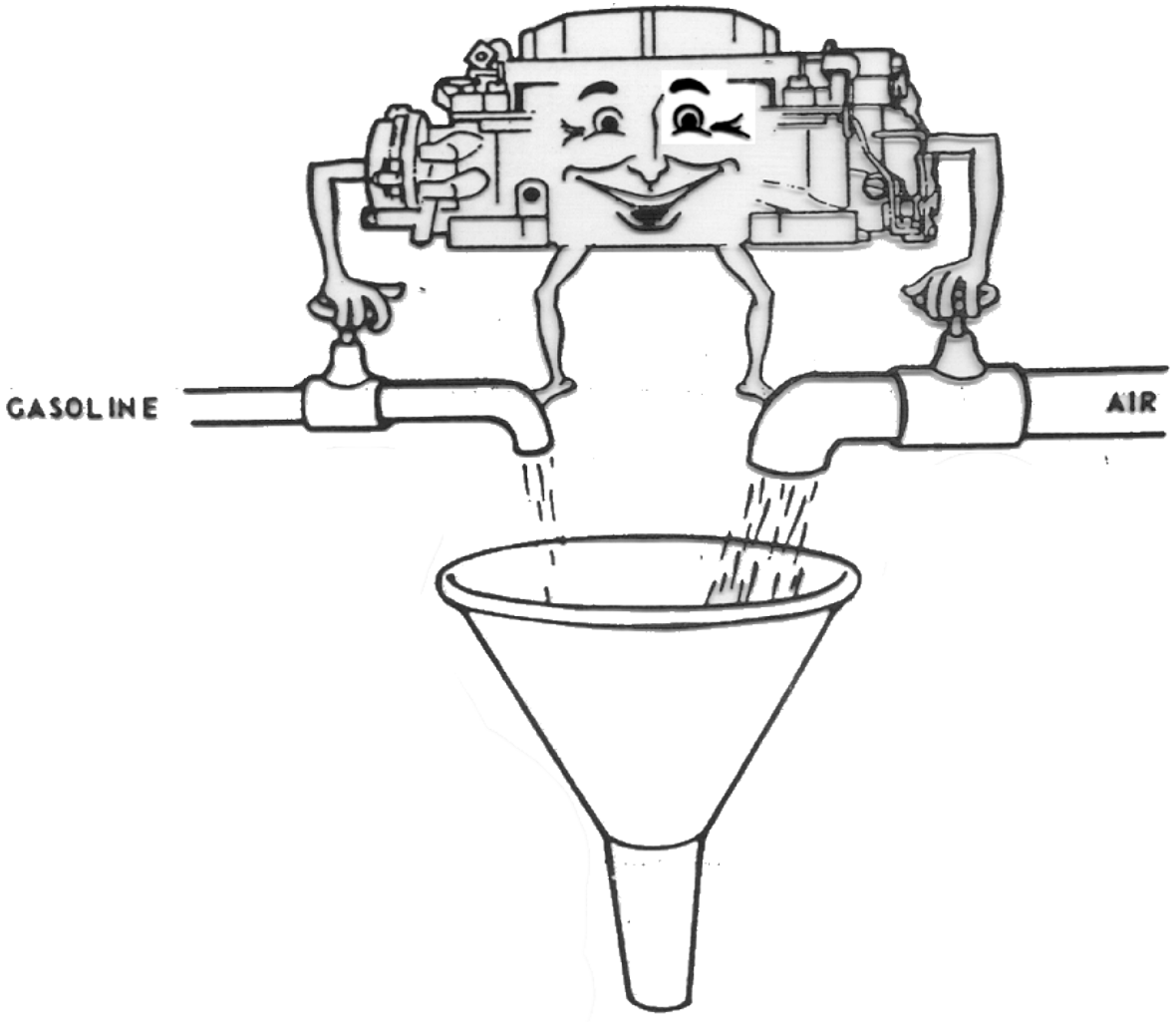
Carburetors



Carburetors

The Chemist!

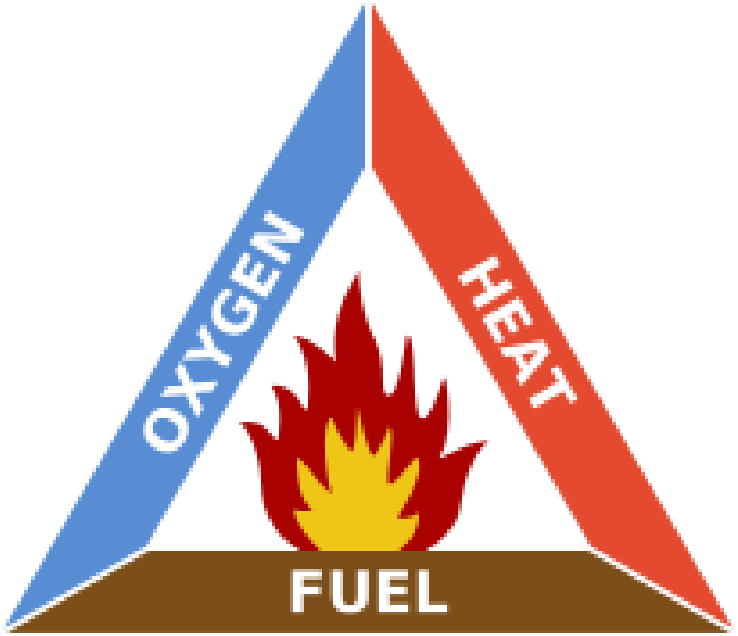


A Carburetors Job???

To combine air and fuel in specific proportions according to engine demand

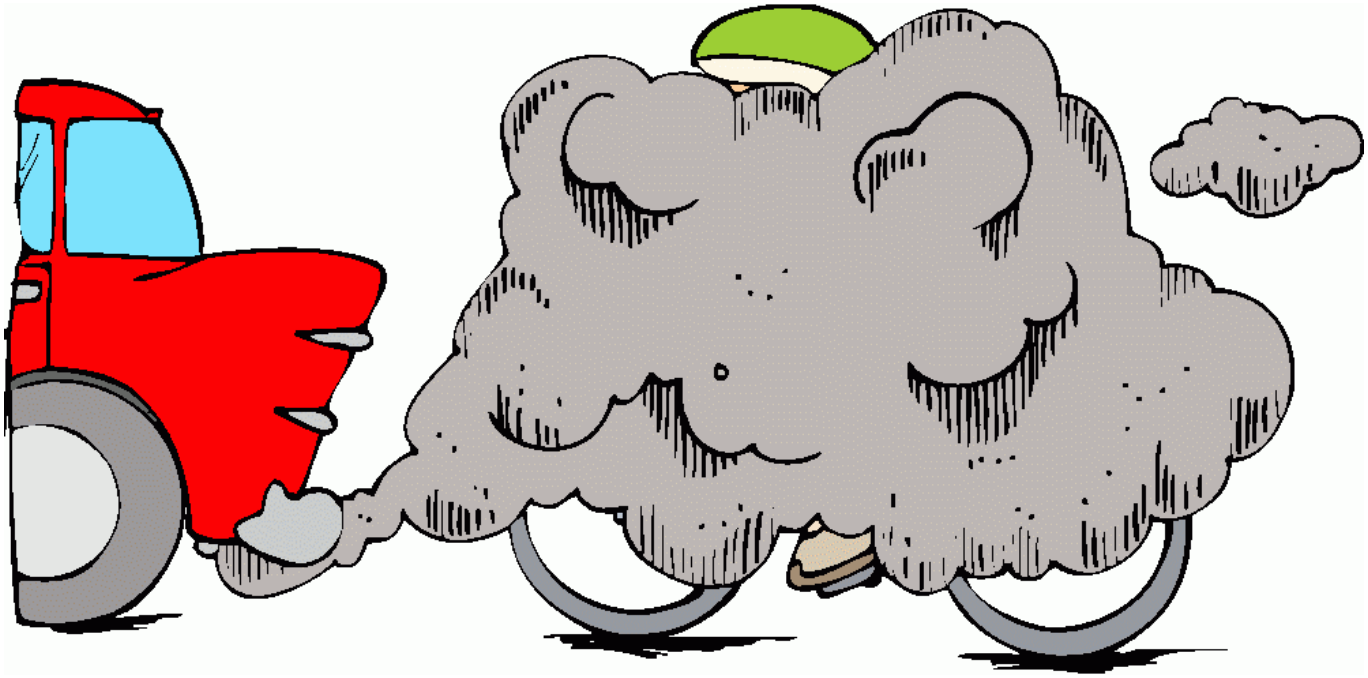
Why Mixing Air and Fuel is so Important

The presence of air is required in order to burn something, even fuel.



Carburetors

The addition of the smallest amount of air allows the fuel to burn, but not very well.



Carburetors

The more air that is introduced the more completely the fuel is burnt and the more energy is released.

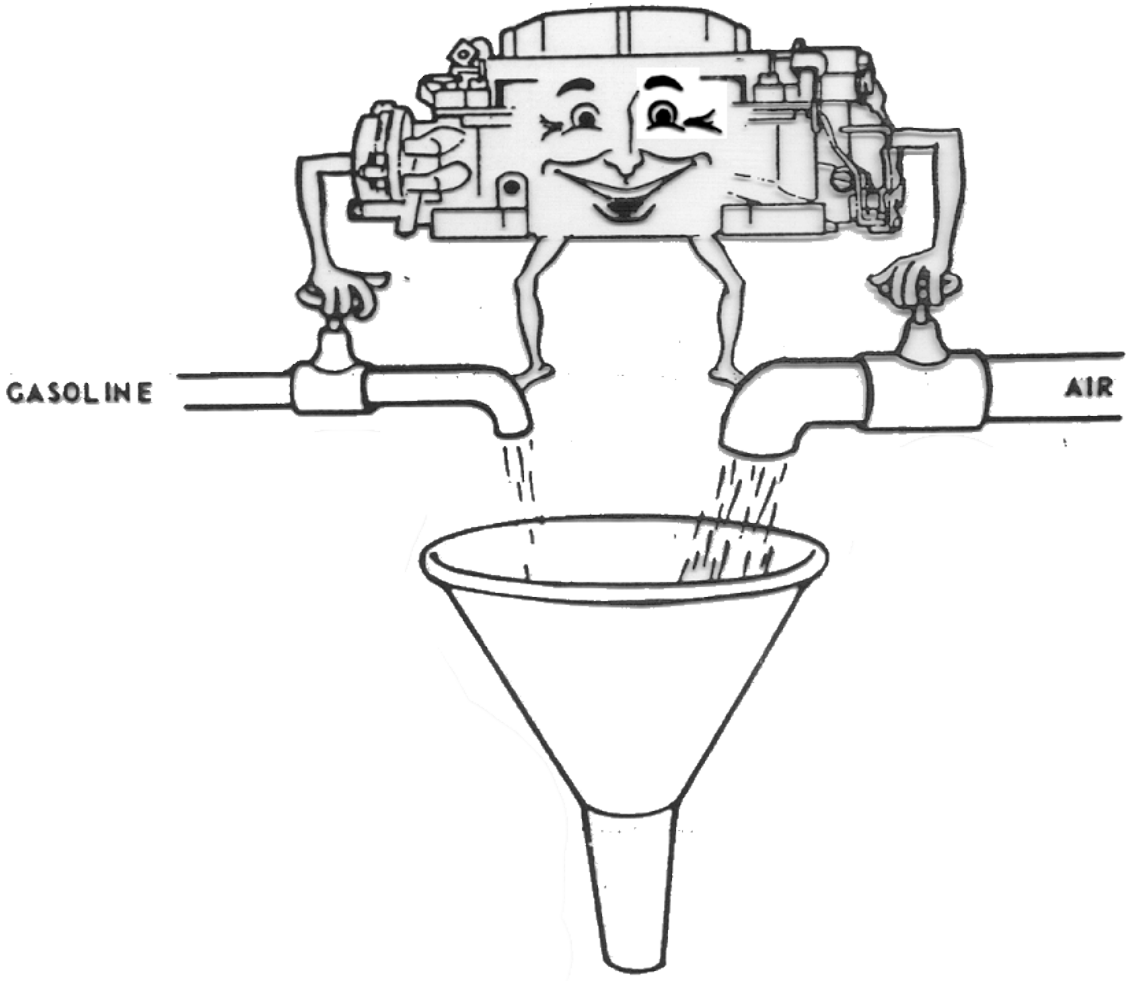
Introduce enough air and an explosion would result.

An engine cannot contain the pressures an explosion would generate.

Carburetors

…so getting the air/fuel mixture correct is important.

This is where the carburetor comes in.



Summary

For a given amount of fuel the following is true:

Too little air = fuel not completely burnt

= wasted energy

= $$$$$

= ☹ environment

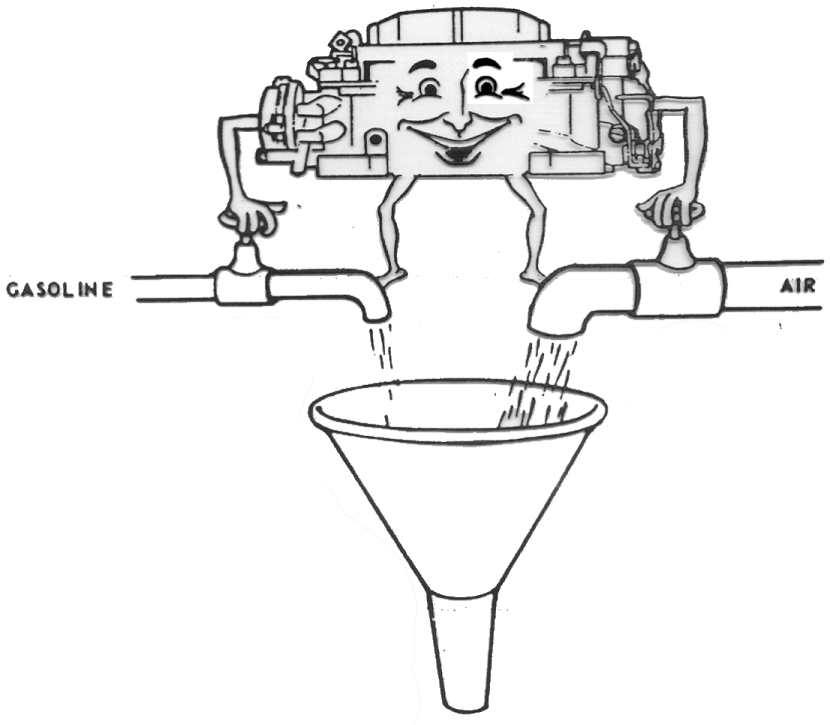
Too much air = explosion

Air / Fuel Ratio

A Term used to describe the amount of air and fuel being mixed.

Example: >> *14.7:1* <<

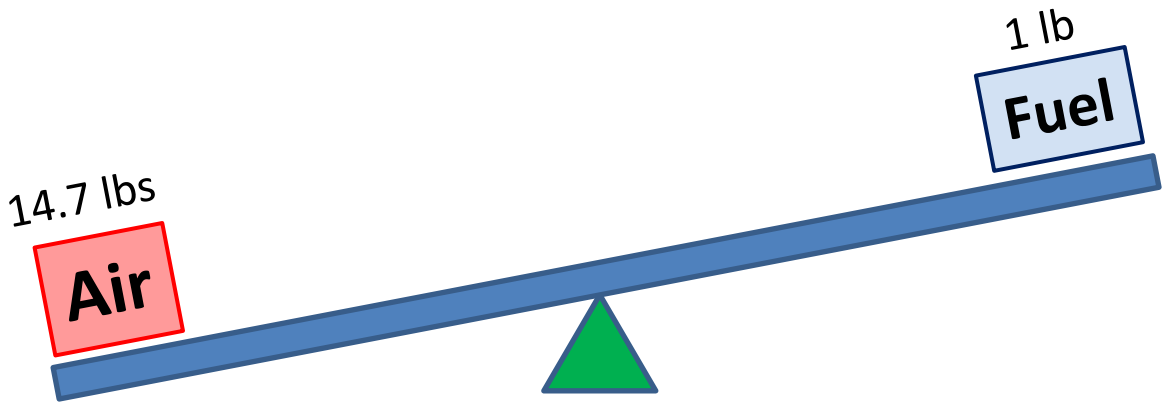
This means that the mixture is made up of 14.7 parts of air for every 1 part of fuel.



Air / Fuel Ratio Cont'd

The 'parts' are always expressed as a unit of ***mass***

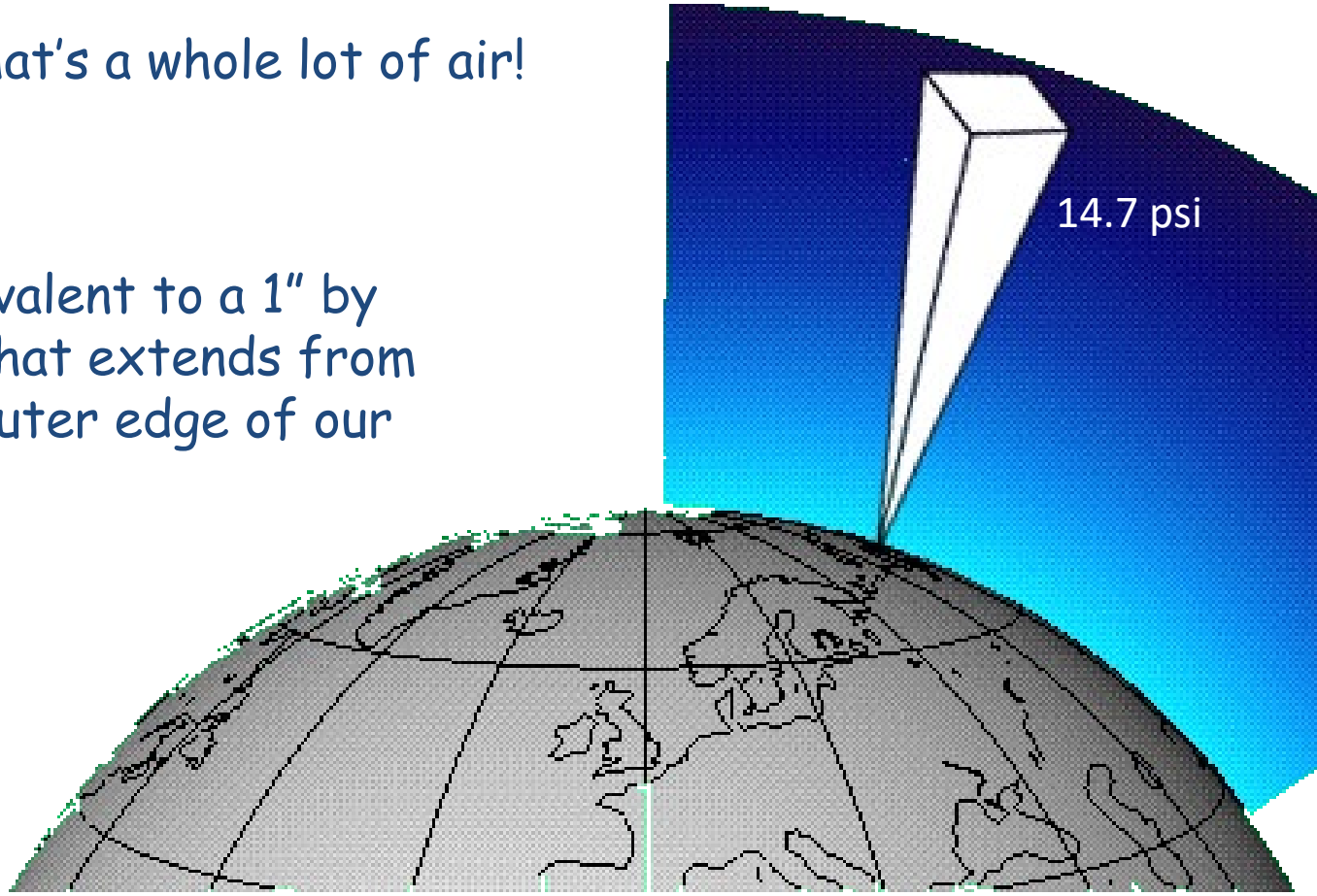
In our previous example, the carburetor is mixing 14.7 **lbs.** of air for every 1 **lb.** of fuel burnt.



Air / Fuel Ratio Cont'd

Think about it, that's a whole lot of air!

In fact, it is equivalent to a 1" by 1" column of air that extends from sea level to the outer edge of our atmosphere!



Air / Fuel Ratio Cont'd

This is why engines are sometimes referred to as 'air pumps'.

They simply consume huge quantities of air to burn a relatively small amount of fuel.

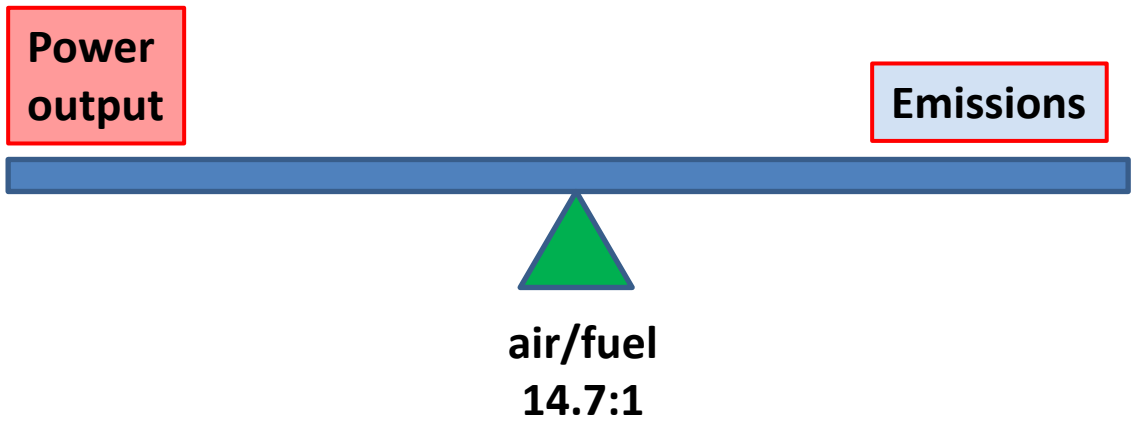
Air / Fuel Ratio Cont'd

It just so happens that the mixture used in this example, 14.7:1, is a well known mixture called the ***stoichiometric*** mixture.

Stoichiometric means "**ideal**".

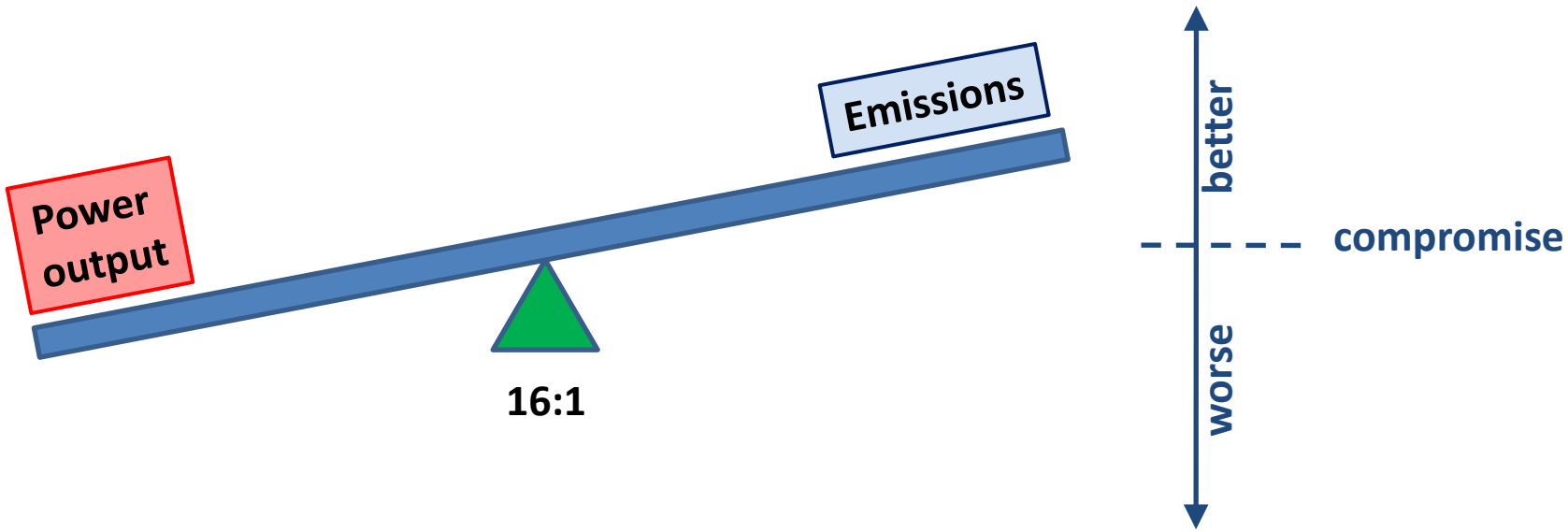
Air / Fuel Ratio Cont'd

A 'stoichiometric' mixture represents the 'ideal' balance between power generation and emissions levels.



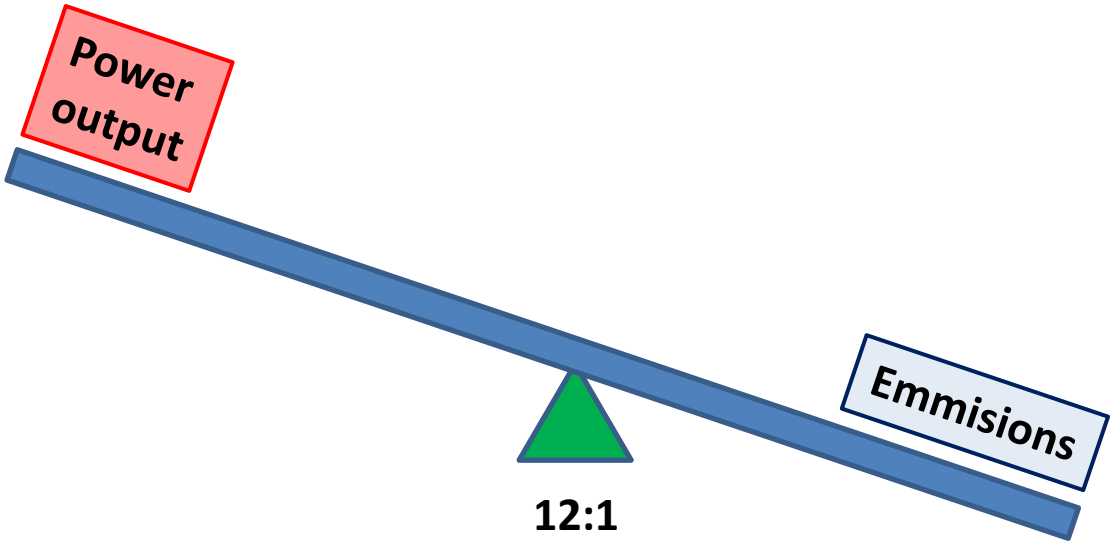
Air / Fuel Ratio Cont'd

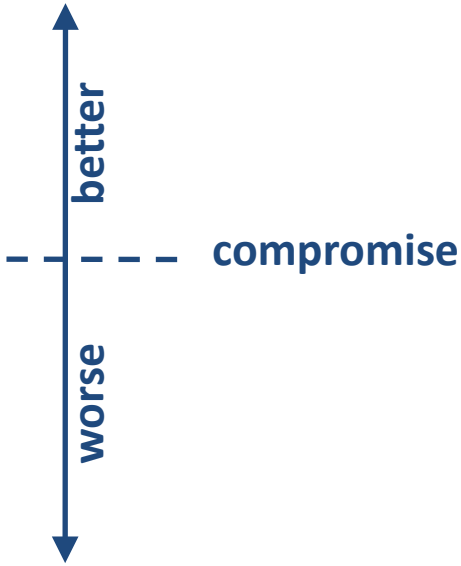
It is possible to mix the air and fuel for better emission, but the result is reduced power output.



Air / Fuel Ratio Cont'd

It is also possible to mix the air and fuel differently and achieve more power output, but the emissions increase



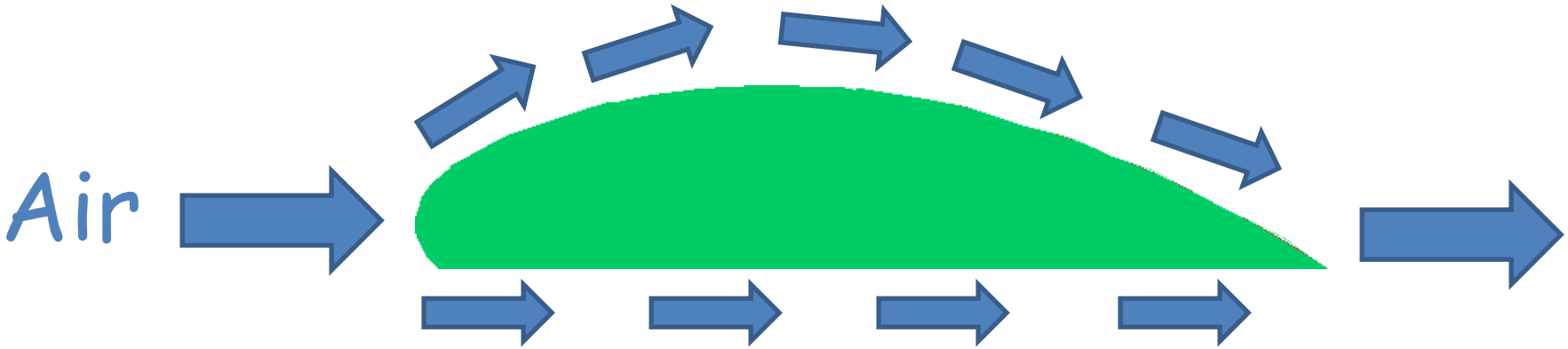


Carburetor Operation- Bernoulli's Principle

Bernoulli's Principle

As the velocity of a fluid increases the pressure exerted by that fluid decreases.

Carburetor Operation - Bernoulli's Principle



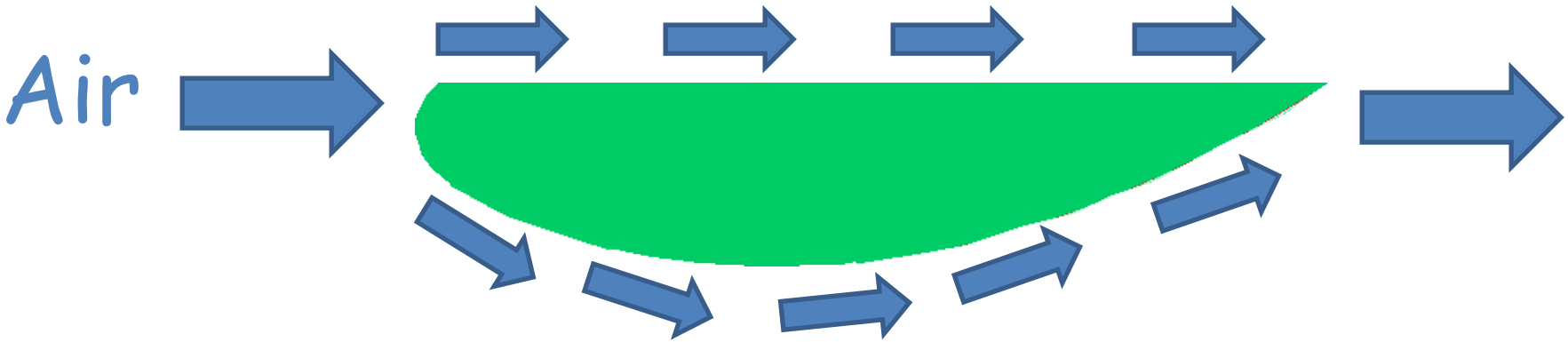
Bernoulli's Principle & Airplanes

The air (fluid) moving over the wing takes a longer path than that going under.

It has to speed up to join again at the tail end of the wing.

The speeding up results in a lower pressure above the wing than below.

Carburetor Operation - Bernoulli's Principle



Bernoulli's Principle & Race Cars

Race cars use wings like airplanes but in reverse.

By turning the wing upside down force is created.

The downforce works to hold the car in contact with the ground

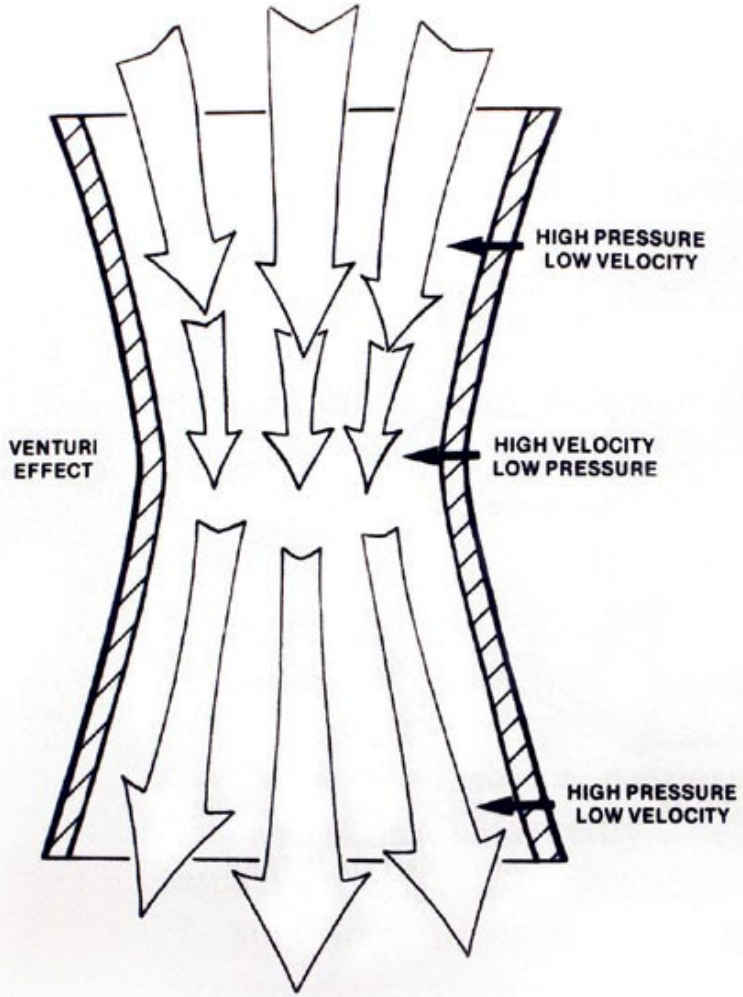
Carburetors

Carburetor Operation - Bernoulli's Principle

Carburetor Operation - Venturi

Venturi

A device in the carburetor that utilizes Bernoulli's Principle to introduce fuel into an airstream.

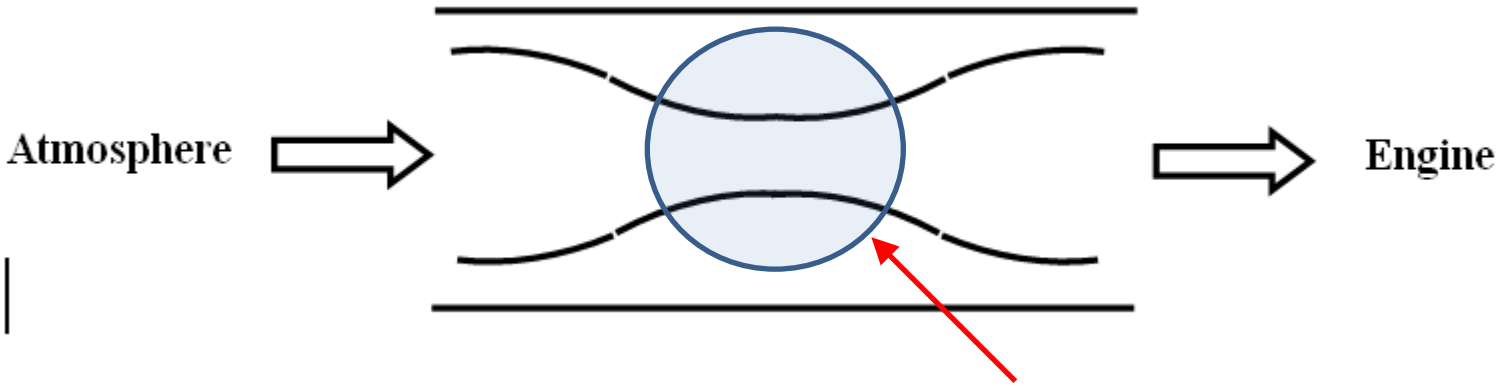


Carburetor Operation – Venturi cont'd.

As the engine turns the piston draws air through the carburetor.

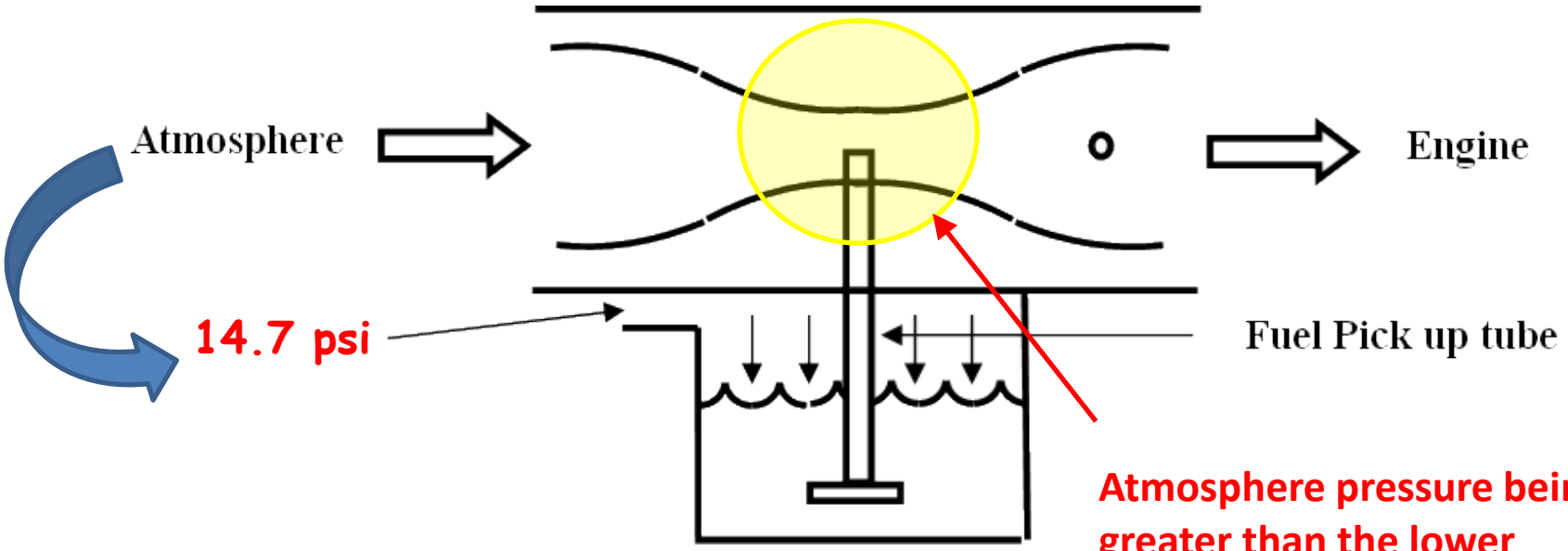
This air is forced to speed up as it moves through the narrow region (restriction) of the Venturi.

Following Bernoulli's Principle, the pressure exerted by the air will be reduced creating low pressure region in the centre of the Venturi.



Carburetor Operation – Venturi.

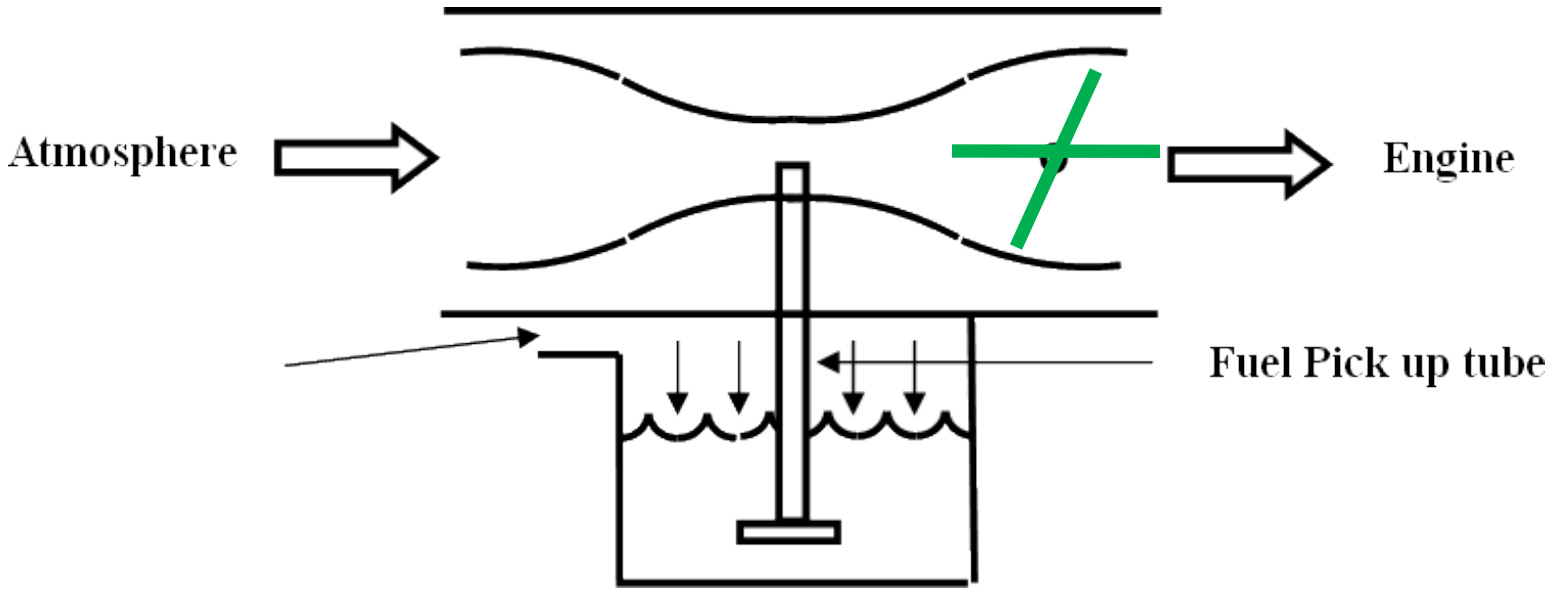
Now let' put that low pressure to good use.



Atmosphere pressure being greater than the lower pressure created in the Venturi pushes fuel into the air stream.

Carburetor Operation – Speed Control (Throttle Valve)

By controlling the amount of air that is allowed to flow through the Venturi to the engine, speed can be varied using the **Throttle Valve**



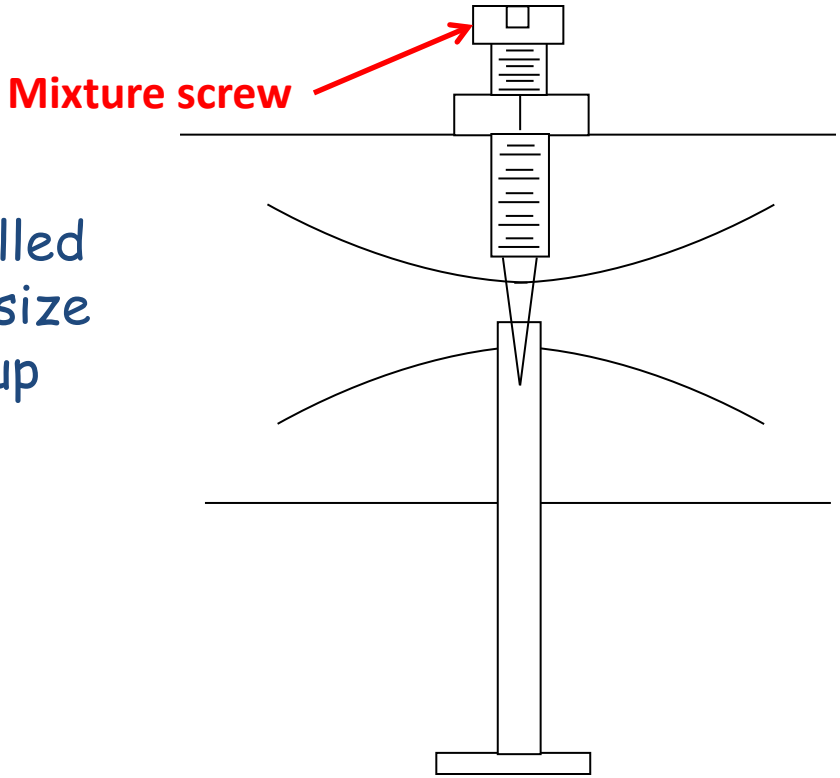
The **Throttle Control Lever**, is connected to the Throttle Valve and allows you to vary the speed manually (pull/push)

Carburetor Operation – Venturi cont'd.

Gasoline is not "pulled" into the Venturi, it is pushed!

Carburetor Operation – Air/Fuel Mixture

Since the fuel/air mixture is so important it would also make sense to have a way to fine tune the amount of fuel that is allowed to enter the airstream.



This is done by using a screw called a **Mixture Screw** to adjust the size of the opening on the fuel pick up tube.

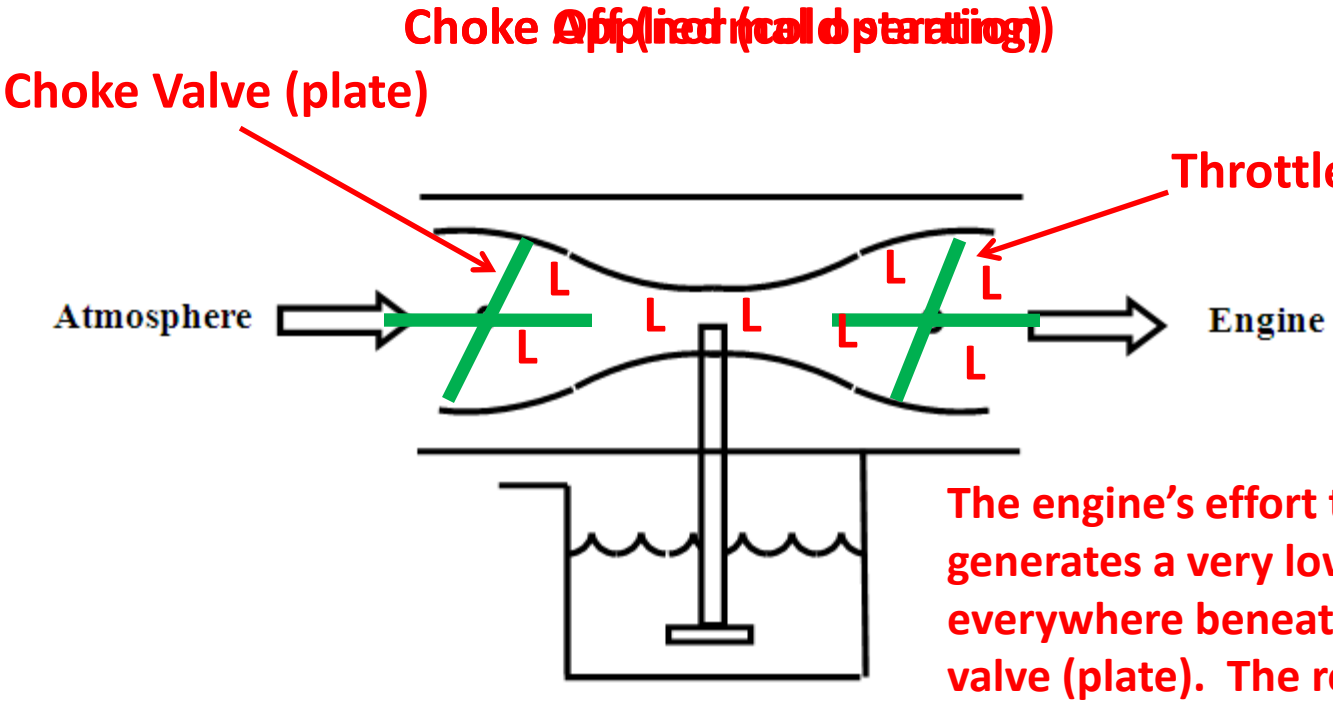
Carburetor Operation – Choke Valve

Choke systems help cold starts.

During cold conditions fuel is difficult to ignite and therefore the engine has difficulty starting.

The solution is to temporarily put a lot of fuel into the cylinder in hopes of creating enough fuel vapor that ignition can be achieved.

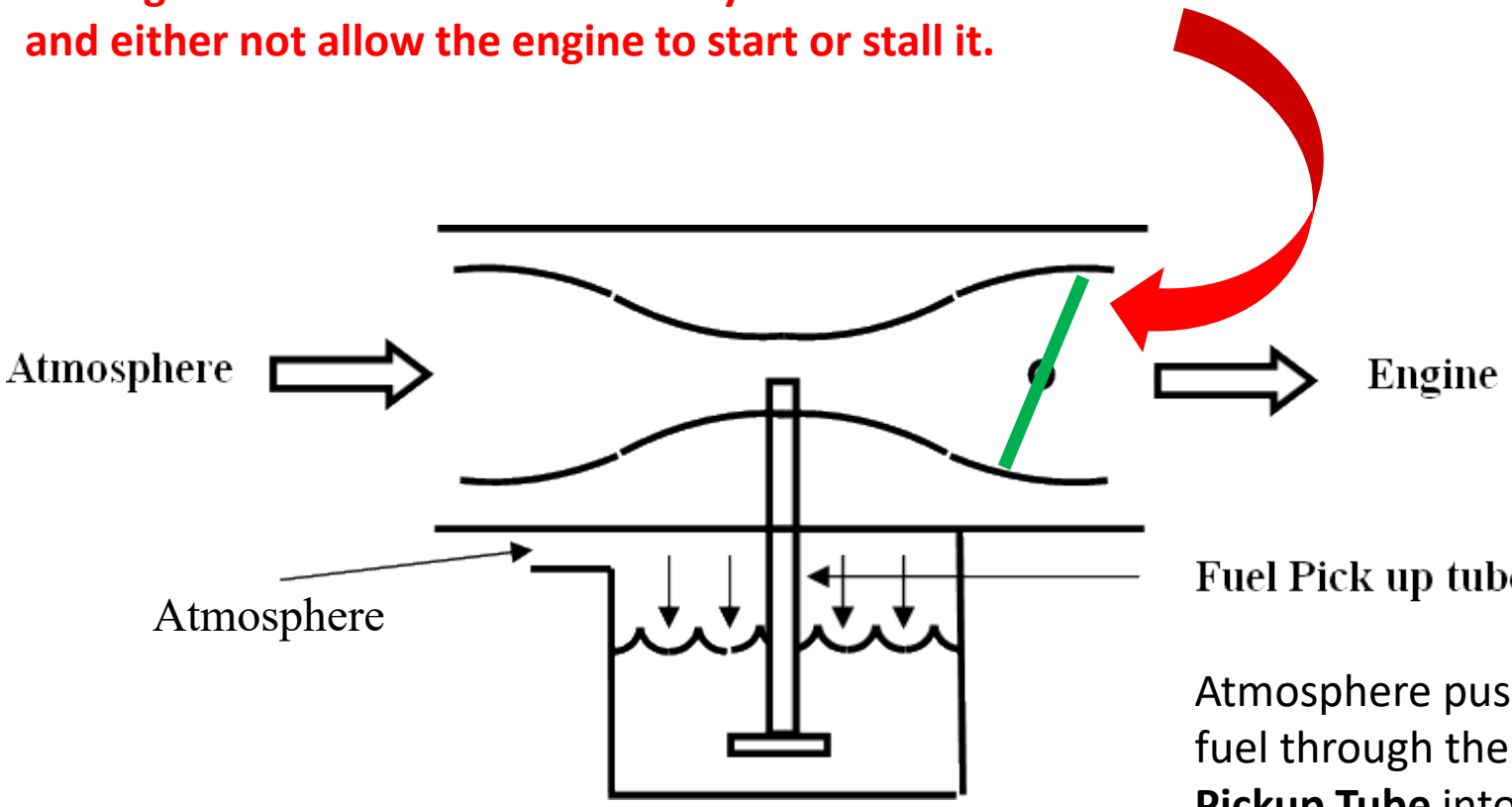
Carburetor Operation – Choke Con't



The engine's effort to draw in air generates a very low pressure everywhere beneath the choke valve (plate). The result is a very rich mixture with much fuel being pushed up the tube and little air being combined with it.

Carburetor Operation – Idle Speed Control

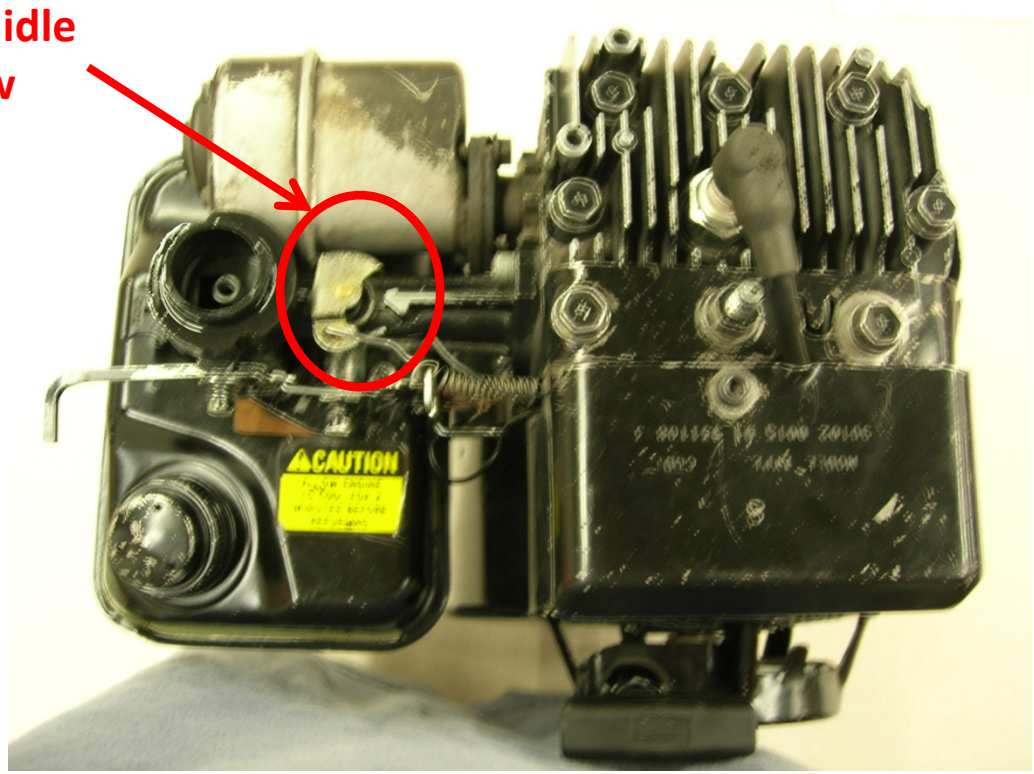
Closing the throttle valve all the way would shut off all air and either not allow the engine to start or stall it.



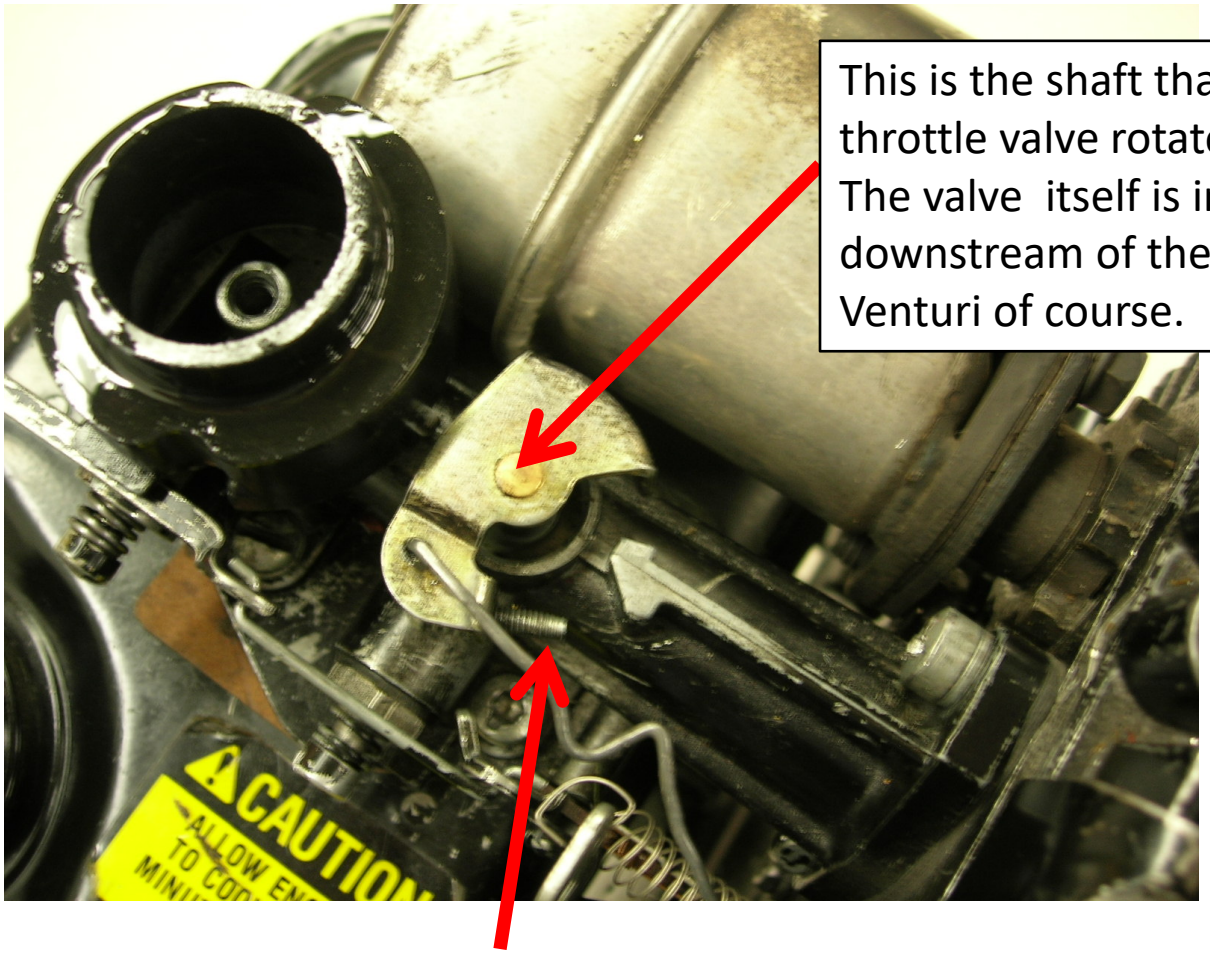
Atmosphere pushes fuel through the **Fuel Pickup Tube** into the venture

Carburetor Operation – Idle Speed Control

Location of idle speed screw



Carburetor Operation – Idle Speed Control



Turning the **Idle Set Screw** opens the throttle valve and speeds up the idle

Turning it out allows the throttle valve to close more slowing the idle

Idle Speed Control

https://www.youtube.com/watch?v=MfTpU6HS4cA