Re: Venturi question

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* *From*: "Sorcerer" <Headmaster@xxxxxxxxxxxxxxxxxx>
* *Date*: Wed, 13 Sep 2006 13:32:03 GMT

"RP" <no_mail_no_spam@xxxxxxxxx> wrote in message
news:1158151088.204766.146940@xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
|
| Sorcerer wrote:
| > "RP" <no_mail_no_spam@xxxxxxxxx> wrote in message
| > news:1158122514.441410.277650@xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
| > | Sorcerer wrote:
| > | > <matt271829−news@xxxxxxxxxxx> wrote in message
| > | > news:1158097941.649861.101980@xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
| > | > | Sorcerer wrote:
| > | > | > <matt271829−news@xxxxxxxxxxx> wrote in message
| > | > | > news:1158004973.423968.104990@xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
| > | > | > | Hi
| > | > | > |
| > | > | > | It seems to be a well−established fact that the temperature
drops
| > | > | > | inside a venturi tube (e.g. causing icing in carburettors).
The
| > only
| > | > | > | explanation I've been able to find is that "the expansion of
fluid
| > as
| > | > | > | it passes the throat causes a temperature decrease". I'm not
sure
| > what
| > | > | > | "passes" means here. The pressure inside the throat is lower
than
| > the
| > | > | > | pressure either side, right?
| > | > | >
| > | > | > No, not right. A venturi is narrower in the middle.
| > | > | > The gas is squeezed down, that RAISES its pressure and
temperature,
| > | > | > it cools by losing heat to the tube, but then it cools again as
it
| > | > leaves
| > | > | > the exit upon expansion.
| > | > |

| > | > | The standard explanations (e.g.
| > | > | http://en.wikipedia.org/wiki/Venturi_tube) say that pressure is
lower
| > | > | in the narrow part of the tube.
| > | >
| > | > "Wikipedia does not have an article with this exact name. Please
search
| > for
| > | > Venturi tube) in Wikipedia to check for alternative titles or
| > spellings."
| > | >
| > | > Wackypedia is a disaster, any idiot can write it, and they do.
| > | >
| > | > Let's put it this way... As a piston falls in the engine, the lowest
| > | > pressure is in the manifold, the highest is atmospheric in the air
| > filter.
| > | >
| > | > Venturi tubes are also used to measure water flow and the
introduction
| > | > of chlorine gas to kill bacteria; the lowest pressure is in the
| > reservoir,
| > | > the highest at the faucet. Likewise air pressure is lowest at the
top of
| > the
| > | > atmosphere.
| > | >
| > | > Thus in the case of a carburettor the flow is from high pressure to
low,
| > | > but in the water example it is from low pressure to high. If you
say
| > | > the pressure is lower in the narrow part of the tube, lower than
what,
| > | > inlet or exhaust?
| > | >
| > | > | If that really means that the density
| > | > | of the gas (in terms of molecules per litre, say) is lower in the
| > | > | narrow part, then the gas would be expanding as it *entered* the
| > narrow
| > | > | part, and compressing as it *exited* the narrow part. This is what
I
| > | > | can't get my head round. Is it really true that the gas is being
| > | > | compressed as it *exits* the narrow part??
| > | >
| > | > The gas is decompressed as it leaves. If you let the air out of a
truck
| > | > tyre the valve will frost up. The pressure in the valve stem is
| > | > slightly lower than the pressure in the tyre (100 PSI), but is much
| > higher
| > | > than atmospheric (15 PSI).
| > | > So if you have a restriction the gas or water squeezed down at
| > | > the start of the tube and then drops pressure as it leaves, but

| > | > in the water example the exit pressure is greater than the entry
| > | > pressure.
| > | > In numbers, 100 ft head of water at the faucet, 0 feet head at the
| > | > reservoir which is on a hill.
| > | > Faucet closed :
| > | > At 50 feet, there is 50 feet head of water on each side the venturi.
| > | > Faucet open:
| > | > Water flows, there is then 50 feet head on the inlet side of the
| > | > venturi, 49 feet head on the other, and 99 at the faucet.
| > | >
| > | > In other words the faucet is supporting the weight of 99%
| > | > of the water, the venturi 1%.
| > | >
| > | > Look up Boyle's Law and Charles's Law.
| > | > Androcles
| > |
| > |
| > | I think the question is "where did the heat go?" So far we've
| > | outlined three distinct cooling processes between us. Actually four,
| > | because you and tadchem mentioned the vapor compression cycle
| > | (refrigerator). This cooling cycle is not however due, or even
remotely
| > | related to the venturi effect. This would fall under the category of
| > | plain old evaporative cooling instead. On the other hand evaporative
| > | cooling can occur at the venturi outlet providing that the mixture
| > | exiting the outlet contains liquid in some form. But this cooling
| > | effect wouldn't be related to the venturi effect, it would only be
| > | incidental.
| > |
| > | The process that you outlined isn't adiabatic. It requires a heat
| > | sink. This was dubbed the "gas cycle" when it was first invented. The
| > | restricted portion of the venturi would have to be maintained at a
| > | temperature lower than the gas within it. If no heat sink is present,
| > | then the cooling effect will only occur temporarily, i.e. until the
| > | venturi and gas temps equalize.
| > |
| > | The adiabatic process that tadchem outlined causes cooling of the
| > | entire volume of compressed gas, not just the gas at the outlet. This
| > | is evident in his example of the aerosol can. It is the entire can
that
| > | cools rather than just the nozzle. The throttling effect
(Joule−Thomson
| > | process) that I mentioned causes a temperature drop that is
| > | proportional to the drop in pressure, or in other words a cooling of
| > | the gas exiting any orifice, be it a venturi or otherwise. Though
there
| > | would be some cooling within the connecting tubing and in the venturi,
| > | it would be a much smaller effect than that occurring at the outlet
| > | where the pressure drop is greatest. Evaporative cooling would occur
| > | in similar fashion, since the throttling effect is essentially just a
| > | further evaporation of the gas, so to speak. In the throttling effect,

| > | even though the gas is already in vapor form, it still has internal
| > | "cohesive" PE, and depending upon conditions, that PE may be either net
| > | positive or net negative. The gas may cool down, or it may heat up,
| > | depending upon its initial density and temperature, and of course it's
| > | composition. This is one of the reasons that real gases aren't ideal.
| > |
| > | So take your pick, or mix and match.
| > |
| > | Matt, can you describe in more detail the actual system that you have
| > | in mind? I'm no expert on this subject, but I might be able to describe
| > | the process in terms other than this or that "effect". Basically, any
| > | time a gas cools, it's because it has lost heat energy. That's a
| > | bit of a tautology, but at least it tells us that the heat had to go
| > | somewhere. I *think* your question is two−fold: How did the heat
| > | transfer occur, and where did the heat go. Based upon your questions
| > | so far, I'm really not sure what you're looking for other than a
| > | better understanding.
| > |
| > | But now that you've brought the subject up, I'd like to know a little
| > | more about it too. Maybe someone else can help us all out.
| > |
| > | Richard Perry
| >
| > "Heat" is the mean kinetic energy of the molecules of the gas.
| > "Temperature" is the mean kinetic energy of the molecules of the gas
| > per unit volume.
| > Thus a glowing cigarette is red "hot", but only locally, it is not going
| > to significantly raise the temperature of a room.
| >
| > In simple terms, "hot" gas pushes the piston simply by bumping into it,
| > that increases the volume, the piston absorbs the mean kinetic energy
| > of the gas molecules which it transfers to the wheels, the molecules have
| > less kinetic energy and are "cooled".
| > When a diesel engine piston compresses air, it squeezes the gas
| > into a smaller volume and raises the temperature. Fuel is then
| > injected and the temperature is high enough to ignite the fuel.
| > As the piston passes TDC the burning process forces the piston
| > down to turn the flywheel and give the car kinetic energy.
| > The exhaust valve opens and the kinetic energy of the gas
| > is wasted as "heat", that heat is then distributed into a greater
| > volume and the temperate of the car's interior is raised to a
| > level of human comfort. When too high, the driver opens the
| > windows and thus increases the volume, lowering the quantity
| > of heat per unit volume.
| > Androcles
|
| Temperature is the KE per molecule.

How awkward, my living room has rather a lot of molecules.
The temperature is somewhere between 0 Kelvin and 3000 Kelvin.
Adjust the thermostat for me, please.
Androcles

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