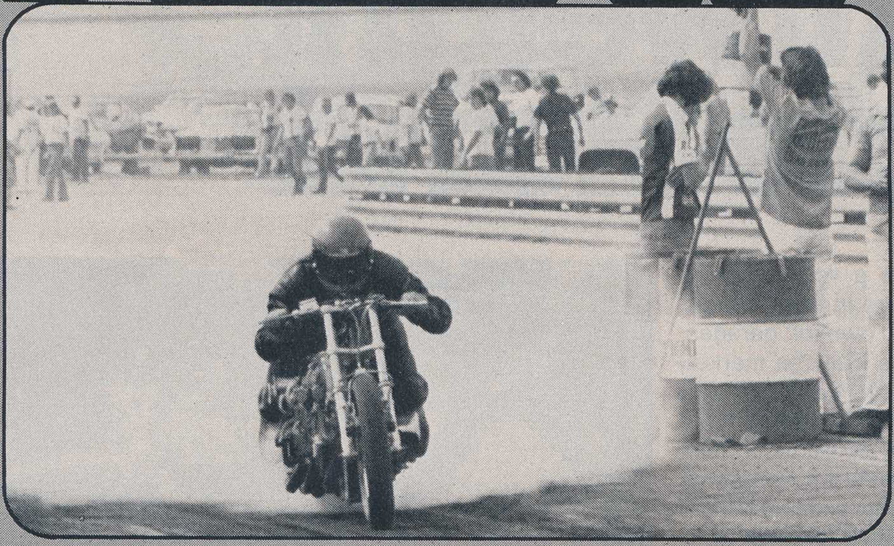
ALKY



A Cool Brew That Offers the Motorcyclist High Spirits and Hot Performance

by Mike Griffin

Guys who race with the stuff call it "the ideal racing fuel."

Alcohol.

It is the heady brew that yields increased power from the internal combustion engine than gasoline, yet is extremely easy on the powerplant's internal components. Indeed, within the cylinder this fuel can burn with uncommon cleanliness. Plugs, valves and piston crowns sometimes appear almost surgically clean after operating on alcohol fuel. Morever, oil pollution of this fuel tends to be much less harmful to the lubricant's integrity than with gasoline. And in comparison to nitromethane, well, just about anything used as internal combustion engine fuel is better than this heavy, dense, detonation-prone nitro-paraffin.

But, basically, the primary benefit provided by alcohol as fuel is that of increased power potential.

As we pointed out in our series entitled "Nitro!" (HOT BIKE, October, December, 1977), alcohol offers no startling power increases on the basis of inherent energy. Gasoline provides about 18,000 BTU per pound of the fluid. Methyl alcohol delivers about 9500 BTU per pound.

Under these circumstances it would appear that ounce for ounce gasoline offers more than twice as much energy as alcohol. But that's not the entire story, for we have not taken into consideration several important factors. The first is that of air/fuel blend. Gasoline, you see, does not deliver reliable power when mixed in air/fuel proportions richer than about 12:1. On the other hand, alcohol delivers its best power in far richer proportions like 5:1. So, a little math tells us that, in terms of BTU, methyl alcohol blended properly will provide about 22,800 BTU, which is a significant improvement. (Before we go farther, it should be pointed out that calorific values of various fuels, given in BTU, tend to vary, depending upon which book you're reading at the time. Consequently, the BTU figures given here should be considered not as absolute values but as general indicators.)

Another important factor is that of detonation resistance. In comparison to gasoline, alcohol can withstand dramatically high compression ratios without detonating. Gasoline generally has an upper compression ratio limit about 11:1 after which point its critical heat and temperature values are attained and the stuff lights off on its own.

On the other hand, however, alcohol can withstand a compression ratio of 15:1 with reasonable stability. So, this has the implication that the alcohol-fueled engine can deliver more power not only through its comparatively stronger fuel/air charge, but through its high compression ratio capacity as well. In other words, a relatively high compression ratio will contribute to greater power yield, and alcohol makes this possible.

There are a couple of drawbacks to the use of alcohol as fuel that readers should be aware of.

The first is that of atomization and distribution. Elsewhere in this issue (see Bits & Pieces, page 8) we discussed some of the problems encountered in gasoline engines caused by the fluid's relative reluctance to break up into desirably tiny droplets in the intake tract. In turn, this leads to poor charge distribution in a multi-cylinder engine, because the heavier droplets tend to fall out of suspension in the air when the intake airstream undergoes a change of direction, loss of velocity or loss of whatever heat it might have. Now these are not insignificant problems with gasoline, which is significantly less dense than alcohol (specific gravity of gasoline is about .7; of alcohol, about .8). So, when you consider the fact that the denser fuel is being dumped into the intake tract in more than twice the volume of gasoline, one realizes the potential gravity of the problem.

Engines having an individual carburetor and intake port for each cylinder are not so susceptible to this shortcoming. But those having manifolds and carburetors shared by a couple of cylinders or more deserve special consideration here. (Fortunately, in the motorcycle world such common-feed configurations are not too common. But in the automotive field it's a different matter indeed.)

You know when you spill alcohol on your hand, how your skin gets cold? Well, that's due to alcohol's relative high latent heat of evaporation. And in the internal combustion engine this can be both good and bad.

For our purposes, latent heat of evaporation describes how much heat a fuel can absorb as it comes in contact with engine parts, specifically carburetor, manifold, intake port, valve and combustion chamber.

Methyl alcohol's latent heat of evaporation rates high in comparison to that of gasoline. Alcohol rates about 500 BTU/lb., while gasoline is in the neighborhood of 130 BTU/lb. Simply put, what this means is that alcohol will absorb several times more heat than gasoline as it passes through the engine. How does this benefit the internal combustion engine? This is what the late Sir Harry Ricardo had to say about it in his book, "The High-Speed Internal-Combustion Engine."

> "In the case of alcohol, owing to the very much higher latent heat and to the fact that the proportion of fuel to air is also much greater, the latent heat of evaporation plays a supremely important part, and results in a really marked increase in power as compared with other fuels, although the total internal energy of unit mass of mixture is lower than that of either petrol or benzol. Moreover, there is introduced a feature which is not observed to so marked an extent with other fuels — namely, that the power output with atmospheric induction increases very considerably when a very over-rich mixture is used, because more fuel is then evaporated, the temperature of the charge is lowered and the gain in weight of charge considerably more than outweighs the loss due to the greater specific heat of the products of combustion and to the greater displacement of oxygen by fuel vapor."

Okay, that's the good effect of a high latent heat of evaporation. The undesirable part has to do with that recurring headache, atomization.

The colder air is, the less willing it is to carry fluid droplets in suspension. And the passage of alcohol through a carburetor, manifold and port often chills these components to the point where ice forms on their exterior surfaces. This exterior icing is not a problem in itself, at least not to the motorcyclist. It's what happening inside that's important.

If alcohol fuel is puddling or running down the intake port and manifold floor, the engine's power output will tend to be erratic, if not just plain poor. Moreover, it will likely complicate tuning, plug reading, and such. Too, fuel mileage will be seriously compromised. (Combine this last point with the fact that you'll be using about twice as much alky as gasoline under ideal conditions, and that motorcycles tend to have comparatively small fuel tanks anyway, one quickly sees that fuel consumption is not a minor concern.)

So, there are two fundamental points to keep in mind. 1) When switching to alcohol fuel do not complicate matters for yourself from the start by also fitting a larger-than-stock carburetor. The greater venturi size of a bigger carburetor will result in less velocity through the intake tract. And less velocity here means the ability of the air to suspend droplets within it goes down. Instead, start gradually; one modification at a time.

Point 2) has to do with the surface texture of port and manifold. Do not, repeat, do not polish these surfaces to a mirror smoothness. This causes several problems, the most serious of which is that of droplet "re-atomization."

Once a droplet falls out of suspension in the inlet duct, it still has a chance to be picked up again by the moving airstream, if the surface with which it is in contact is not too smooth. The tiny hills and valleys in an unpolished or just mildly cleaned up metal surface prevent the droplet from getting too comfortable, allowing it to be better buffeted by the passing airstream. But the mirror-polished duct, well that's a very different matter, for the smooth surface just does not want to give up that droplet the airstream. The droplet finds it easier to roll and scurry across the floor than to jump back up into the passing air.

Again, this less-than-ideal fuel flow can well cause irregular and/or mediocre power output. The suggestion here is to clean and match the ports and manifolds as needed, but resist the temptation to mirror-finish them, for that offers only a pleasing appearance.

Motorcycle enthusiasts experienced in alcohol as a fuel will find this article basic, to say the least. Indeed, the field is very complex, far beyond the scope of humble HOT BIKE. However, for safe, reliable use of alcohol, it is not crucial that the interested motorcylist be intimate with all its thermochemical complexities. What he needs to know are 1) its fundamental properties, 2) what makes alcohol good — or bad, as the case may be — for a given application, and 3) how to go about getting a sound, safe start in using this intriguing fuel.

So, in next month's issue of HOT BIKE we will delve even deeper into the properties and application of alcohol fuel as used by the motorcyclist.