Duke's Mixture

(The following article, reprinted from the February 2002 Colorado Model Museum Flying Club newsletter *Exhibits,* was written in August 1989 by Duke Fox of the Fox Manufacturing Company, Fort Smith, Arkansas)

You can drive your car anywhere in our country and fill up your gas tank with any brand fuel, and reasonably expect it to perform about the same as any other brand. This is because gasoline refining companies have voluntarily established standards on viscosity,flashpoint. octane, etc., so that just about any automobile produced will run okay on various manufacturer's fuel.

Unfortunately, this is not true in the model airplane business. Commercial model fuels are sold with a variety of types and quantities of oils, and some measure nitro by weight, some by volume, and some don't seem to measure it at all. The reluctance of a fuel blender to put his ingredients on the can makes me a bit suspicious that he is trying to hide something — or perhaps, the absence of something. I would like to see each blender of fuel to voluntarily print on his container just what the ingredients are in his fuel so the modeler knows what he is getting. Also, I would like to see the quantities of each ingredient listed by volume.

All model plane fuel uses commercial methanol as its base. It is commonly known as wood alcohol because it was first produced from wood chips. Now, most of it is produced from natural gas I am told. In any event, methanol, when bought in tank car quantities, is quite reasonable in cost. It is not the alcohol that runs up the cost of model airplane fuel, it is what you put in it and put it in. While alcohol costs less than $1.00 a gallon, a good oil costs $6.00 to $8.00 a gallon, and nitromethane costs $30.00 to $35.00 a gallon when purchased in quantities. Under the pressure of competitive pricing, any fuel blender is constantly tempted to use less and less of the high priced ingredients and more and more of the low priced **ingredients.**

Now, about the ingredients themselves. Methanol is a single chemical, and not a mixture, as gasoline is. The manufacturing plants deliver it 99.9% pure or better. About the only thing that can happen to the methanol is if it is sloppily handled, it can be contaminated with water. It only takes a few drops of water in a gallon of fuel to produce noticeable flameout tendencies. Likewise, nitromethane is a nearly pure product and is sold in one grade only. You should note that nitro content by weight will be in the order of 2/3 the quantity as when nitro content is measured by volume. A modern RC motor of a .40 size class requires about 22% oil to be well lubricated and to give a good, long life. Larger motors need less oil, percentage wise, than small ones. The reason being that as the size of the motor increases, the displacement goes up as the cube, while the area to be lubricated goes up as the square. Thus, a motor with a 1 1/2″ bore would be as well lubricated on a 10% oil mix as one with a 3/4" bore would be with a 20% oil mix. Unfortunately, some manufacturers have been delivering fuel with as little as 12% and 13% oil, and recommending it for .40 size motors. The result of extended use of such of fuel is as you would expect, an abnormal rate of wear in the motor, and on rare occasions, a catastrophic failure.

Over the years a great many different oils have been used in the search for something that works better and costs less than castor oil. The most usual of these are the glycol type synthetic lubricants. The glycols have good lubricating qualities, but they have one major shortcoming, and that is that they vaporize at somewhere around 500' F to 550F. Lawn mowers, outboard motors and the like are never run hard enough so that this is of any signifIcance. But a model airplane motor that is run hard could have a piston and wrist pin temperature in a 700° F range, and because of this, the motor using pure polyalcoglycol lubricant is almost certain to have catastrophic ring, wrist pin, and upper rod failure. Castor oil is the only oil I know of that will continue to function at 800°F. Synthetic oils of the phosphate-ester type also have this shortcoming. Other oils that have been used are soybean oil, fIsh oil, and modifIed mineral oil such as turbine oil. I am sure that there are dozens of other oils that different fuel blenders have tried, and some are using. I would like to point out that lubrication is not the only requirement of the oil. The rusting of the steel parts such as crankshafts and bearings, is also a consideration. Motors that were run 30 and 40 years ago on a straight castor oil, alcohol, nitromethane mix show little rust. Some motors that have come back for repair have the bearings rusted until they are ruined. I have to believe that this was caused by some sort of a breakdown in some of the synthetic oils or additives used.

Over the years there have been a lot of different additives used in model airplane fuels. Propylene oxide mixes well in fuel and it only takes 2% or 3% propylene oxide to very materially improve the idling characteristics of a motor. However, the government has determined that propylene oxide is a carcinogen (cancer causing agent). Any blender who now uses propylene oxide is laying himself open to all sorts of lawsuits. Nitroethane is a sister chemical to nitromethane, and while it is not as effective a power additive as nitromethane is, it is very oily, and a very excellent solvent. Nitroethane is a very useful fuel ingredient for motors with an aluminum piston, because it keeps the inside of the motor nice and clean, as well as providing additional lubrication. A motor with an iron piston should not use a fuel containing nitroethane or synthetic oils because they tend to wash away the glaze castor oil puts on these surfaces, giving their long wearing characteristics. In summary, what I am saying is the oil in your fuel is probably the most important factor in how long your model motor serves you.