One of the most important factors for a good running engine is to . .

KEEP IT COOL!

WHAT cools your engine? You will probably say water, but you will be wrong unless you're operating a boat. Actually your so called water cooled automobile engine is really air cooled. The water is merely a conducting agent to carry the heat away from the engine to the radiator and thence to the outer air.

Radiators are really misnamed because they do not depend on radiation, instead they are really heat exchangers. The water absorbs heat from the engine, carries it to the radiator and the radiator transfers the heat to the air that flows through it. A radiator is able to do this because it is designed to expose a large surface area to the air. Its cooling capacity is determined by its abiliity to conduct heat to the air that flows through it and not by the amount of water capacity. An engine or radiator could have twice the water capacity and still not cool properly because water does not have cooling properties.

Increasing the water capacity of cylinder heads or water tanks does not help cool an engine. All that is accomplished by this procedure is to increase the length of time that it takes to get the water hot. Adding 1 pint to the capacity of each cylinder head only means that if the engine has a tendency to overheat, it will take a few seconds longer to get the extra water boiling. If you have a Ford V8 in this predicament, you will simply have 23 quarts of boiling water instead of 22.

When we discuss heat quantity we do not mean temperature, instead we mean heat in quantity or BTU's of heat. A simple analysis of this statement can be arrived at by imagining a group of bonfires. The temperature of each bonfire may be the same but more heat is generated from 12 bonfires than from one. Twelve bonfires would boil 12 times more water than one. Instead of using bonfires and buckets of water as standards, we use British Thermal Units (BTU's). A BTU is the amount of heat required to raise the temperature of 1 pound or water 1 degree centigrade. When designing a cooling system an engineer is interested in the rate that the engine produces BTU's and the rate that the radiator can dissipate them under all conditions.

In a very few minutes time an engine can produce enough heat to reduce itself to a molten mass of metal. Of course you couldn't make an engine actually melt itself because certain vital parts would fail first but if you could capture the heat energy (BTU's) generated over a period of time and then suddenly unleash this energy on the engine it could be accomplished. The foregoing is a theoretical possibility, but certain parts of engines will actually melt in operation when water is lacking. Without water to carry the heat away from the engine, combustion chambers can melt and pistons seize or collapse. Temperatures as high as 4500 degrees fahrenheit can exist in the burning gases in the combustion chambers. After the work is done and the exhaust gases leave the chambers, the temperature may still be as high as 1800 degrees, which is still enough to melt aluminum heads. If the temperature is so high, you may ask, why doesn't the surface of the chamber melt even though water is on the opposite side? This doesn't take place because the metal's rate of heat conductivity is fast enough to carry the heat away as rapidly as the surface absorbs it.

One point in cooling an engine that is overlooked more than any other is the rate of flow through the radiator. In most cases the water flows so rapidly at high engine speeds that there is a troughing effect. In simple terms, the water flows in a straight line from the inlet to the outlet and does not spread evenly over the surface of the whole radiator. In so doing only a small portion of the heat transfer surface is used, the rest of it goes to waste. Many track cars have had their cooling improved by reducing the rate of flow, not by cutting down the pump impeller blades, but by placing restrictors in the water outlets of the heads. This accomplishes a twofold purpose inasmuch as it reduces the rate of flow in the system and produces a pressure in the engine water jacket.

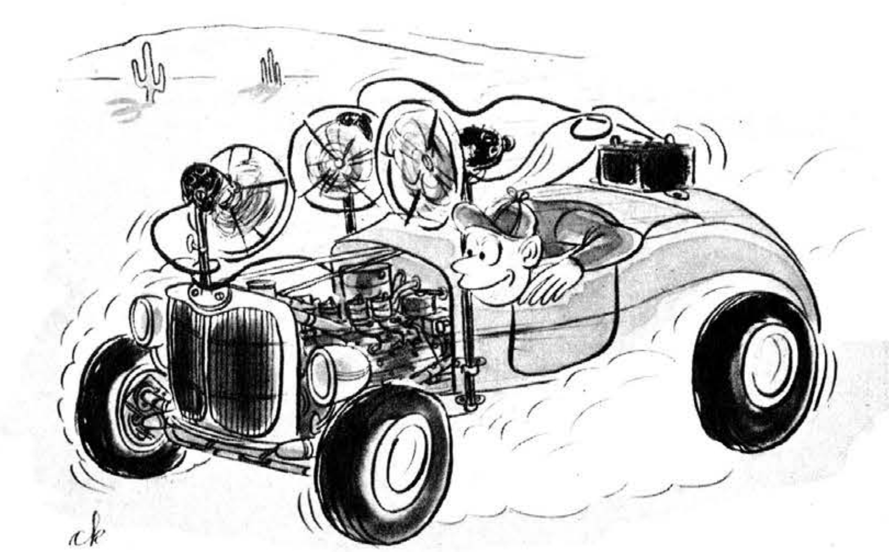
In line with this same principle is the seldom realized part that the thermostats play in the passenger car engine. Their removal often causes an engine to overheat because of too rapid a water flow.

The increased pressure in the block reduces the tendency toward formation of steam pockets and raises the boiling point of the water. The temperature at which water boils is directly proportional to the pressure exerted against it so a higher pressure naturally means that a higher temperature will be necessary to produce boiling. This same principle is applied with the use of the pressure cap which we find on most modern radiators.

A 7½ pound pressure cap will allow the temperature of the water in the radiator to reach over 233 degrees

. . . An engine can produce enough heat to reduce itself to a molten mass of metal.

High temperatures on the desert do not leave much of a temperature differential between the air and radiator water, so it is hard to cool an engine in this area.



BY POPULAR DEMAND

The editors of HOP UP have received numerous letters from readers who are in dire need of some hard to get part, have a car they want to sell, or want to trade something. We are taking this opportunity to announce a new monthly feature . . .

SWAP N SHOP

Here's how it will work. In 25 words or less, list the article or articles you want to buy, sell or trade in a letter and send it along with $1.00. We will not be responsible for the accuracy of the ads but we will edit any that seem misleading. Only one car per insert may be listed. NO COMMERCIAL ADVERTISING WILL BE ACCEPTED. Money must accompany each insertion.

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REMEMBER

This feature will start with the August issue so get busy and send us your letter now. Address all such letters to:

HOP UP

SWAP'N SHOP

530 W. Colorado
Glendale, Calif.

without boiling. This device is quite useful at high altitudes where low atmospheric pressure may drop the boiling point to 190 degrees fahrenheit. On the desert it is a must, because air temperatures may be as high as 120 degrees which doesn't leave much of a temperature differential to cool an engine. If you expect to maintain an operating temperature of 180 degrees these figures would only give a differential of 60 degrees which would be like trying to cool boiling coffee by adding water from the hot water faucet instead of the cold. Using the extremes possible with the 7½ pound pressure cap, it would be possible to have a 110 degree differential. This figure is obtained by subtracting the air temperature from the operating temperature which in this case is assumed to be 233 degrees minus 120.

Cooling is not limited to the transfer of heat to the outer air but can also be accomplished through the medium of certain fuels. Yes, fuels, even though their basic purpose is to produce heat, they can contribute to the cooling of an engine. It is this cooling ability that makes alcohol so useful as a racing fuel. Its cooling effect is due mainly to its latent heat of evaporation. That is, the heat required to vaporize it. This latent heat is 3.7 times that of gasoline. Twice as much alky is required to obtain a proper mixture so we multiply 3.7 by 2 and find that 7.4 times more heat is absorbed from the engine to vaporize alcohol than gasoline. Anyone who has had experience with track cars can tell you how much alcohol will do for a cooling problem. A car that boiled at every race while using gasoline has often run cool after switching to methanol.

The refrigerating effect of alky is not the only factor that contributes to cooling. The actual combustion temperature of burning alcohol is lower than that of gasoline. The temperature of the charge is lower at the time of ignition than when gasoline is used and remains lower throughout the whole cycle.

Not to be overlooked is the tendency of a rich mixture to absorb heat. We know that fuels absorb a considerable amount of heat when vaporizing. A rich mixture means that more fuel is being consumed for the same quantity of air. This larger quantity of fuel requires more BTU's of heat to vaporize it so more heat is absorbed from the engine to accomplish the task. Again we find a twofold effect because rich mixtures also burn cooler.

Compression ratio also has an effect on the cooling requirements of an engine. Higher compression produces a higher expansion ratio after ignition takes place which results in more heat energy being used to push the pistons down leaving less heat to go out the exhaust. Exhaust gases are actually cooler with higher compression ratios.

Tying in with compression ratios is the matter of spark timing or point of ignition. Late ignition or retarded spark will not only reduce the power output of an engine but will cause it to overheat. Firing the fuel charge late has an effect akin to operating with a lower compression ratio. The expansion ratio of the charge is reduced so less heat energy is consumed in pushing the pistons down and more is transferred to the water jackets. At the same time the throttle must be depressed farther to supply more fuel mixture to maintain the same horsepower output . . . this also means more heat.

If you have an 8 cylinder water boiler don't make the common mistake of adding to its boiling capacity by enlarging its water capacity. More cooling ability is what you want and this can be obtained by enlarging the heat transfer area and improving its efficiency.

Cooling can also be accomplished thru the medium of certain fuels, even tho their basic purpose is to produce heat (but not in the radiator as this guy is doing).