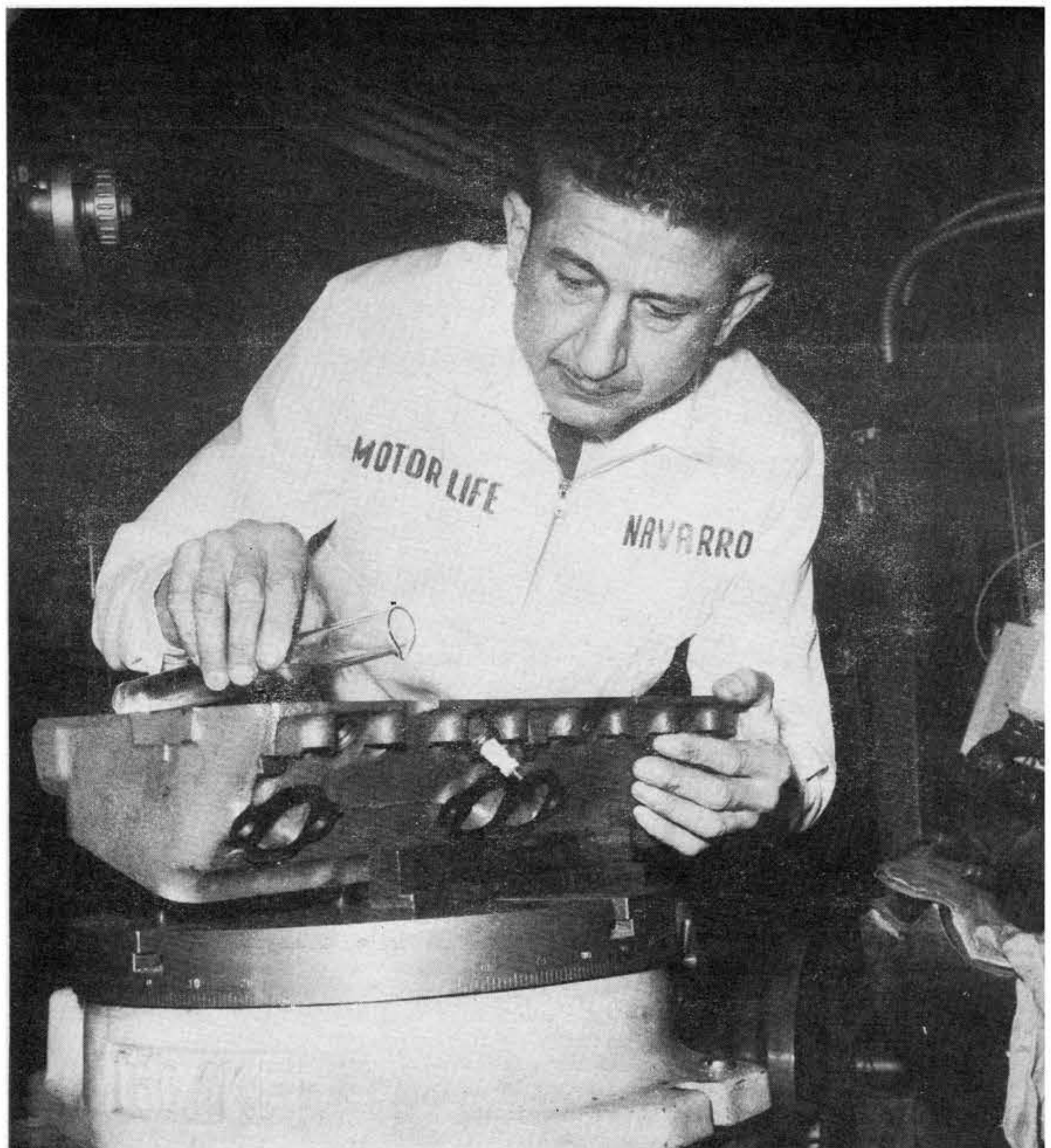
What makes a car a DRAG winner?

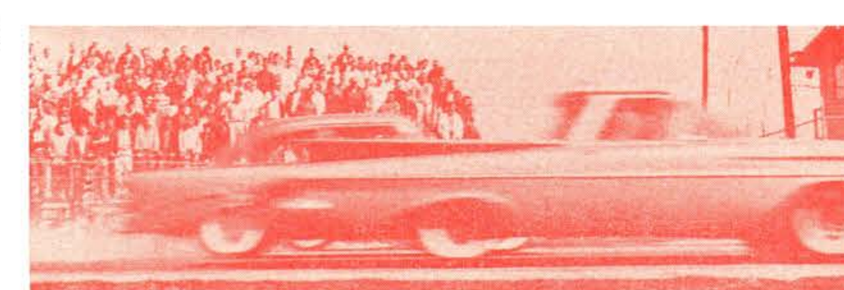
When cars seem the same MODIFICATIONS can make the difference



MEASURING WITH FLUID IS OFTEN THE ONLY SURE WAY TO DETERMINE COMPRESSION RATIO OF MODIFIED ENGINE.

BY BARNEY NAVARRO

Comparing the performance of one stock car with another is currently a very difficult if not impossible task. One can spend every weekend at a drag strip covering a period of six months and still not be able to arrive at a definite conclusion regarding any two cars. So many differences appear that the question naturally arises, why do some of them perform so much better than others? The time-honored answer to this inquiry, though the cars may come from the same assembly line, is that some are just naturally lemons and others extra fine examples. More recently, however, a new



explanation has been offered—superior tuning.

Though superior tuning may be a partial explanation for faster than normal quarter-mile times, it is really necessary to examine the current definition of the procedure in order to understand what is happening. A number of years ago, tuning consisted of adjusting carburetion, ignition and valve clearances either to factory specifications or to specs that deviated slightly to conform to differences in fuel, altitude or other variables. Now the loose usage of the expression has extended the generally accepted meaning of the word to a large number of modifications far removed from actual tuning.

Modification isn't mentioned since the word is indicative of alteration from the stock state. However, whether the term is used or not, a great deal of the so-called tuning is actually modification or the application of tricks that may be considered unethical. Since challenging the stock state of a competitor is a rather costly procedure when only a trophy is at stake, an engine rarely gets protested.

One of the simplest tricks employed to get more useful work out of an engine is to eliminate the horsepower consumption of the generator. This is accomplished by electrically shorting the generator's terminals. When shorted, the generator will not generate any current, so it takes considerably less power to turn it. In fact it becomes nothing more than an idler pulley with a small cooling fan.

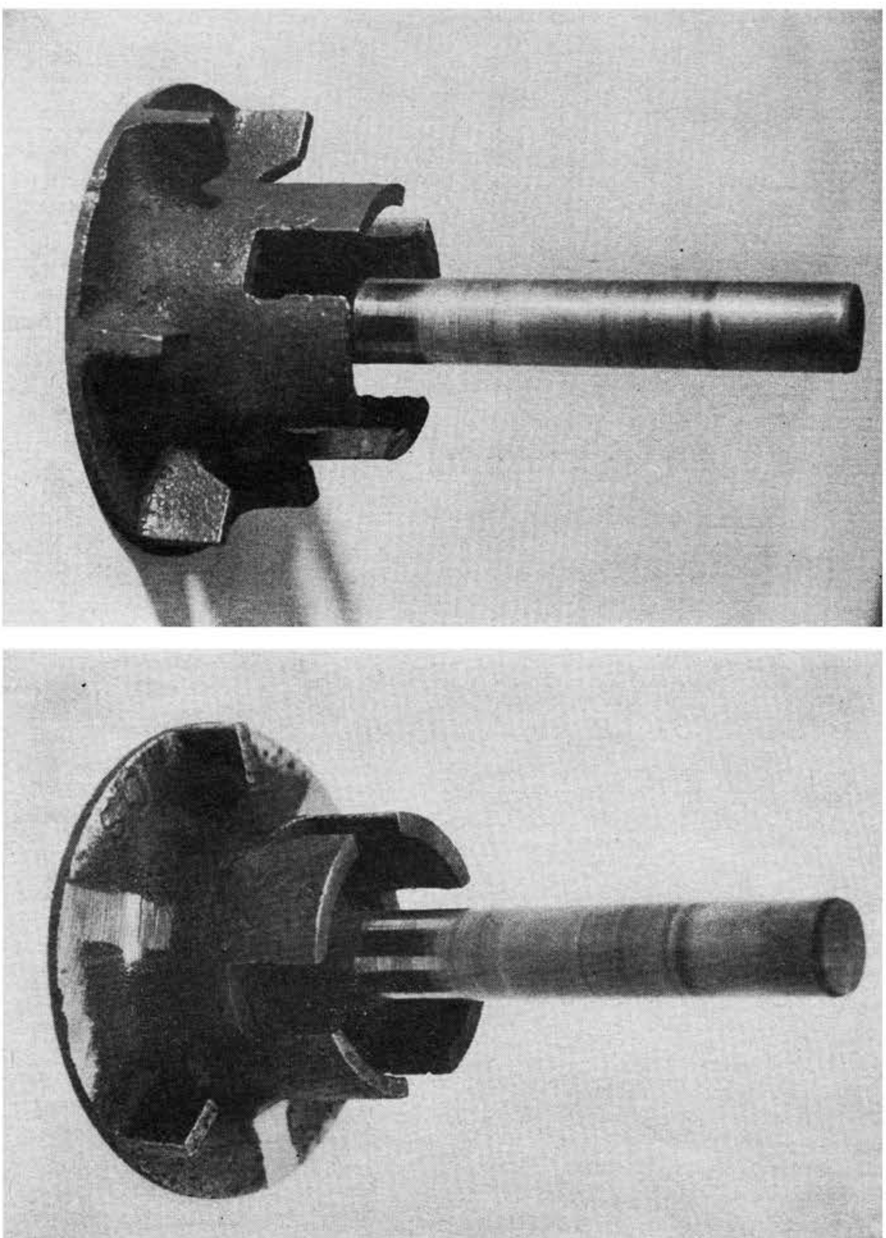
Shorting the generator causes no damage to its windings or brushes, but disconnecting it and still driving it with the accessory belt will cause it to burn out. The belt cannot be removed because this is too flagrant a violation of the rules to be overlooked.

Since the accessory belts cannot be removed, the sharp operators loosen them slightly so that they will slip under rapid acceleration and high rpm. Loose belts conserve some of the power that is wasted on water pumps, power steering pumps, fan and generator. The power saved is not derived merely from the necessity of the accessories to do less work but their radial or rotational rate of acceleration is lessened; in other words, the flywheel effect of these items is reduced.

Because an engine running on a drag strip maintains high rpm shortly after leaving the starting line, the water pump needn't be as efficient as one meant for universal road use. The high speed operation makes it possible to reduce the size of the impeller blades or remove half of them and still get efficient cooling. Obviously, cutting down the pump's capacity for flowing water through the engine is going to conserve energy and will leave more horsepower for the rear wheels. A pump so modified is not without shortcomings; idling in traffic on a hot summer day will cause overheating since its low speed pumping ability is inhibited considerably.

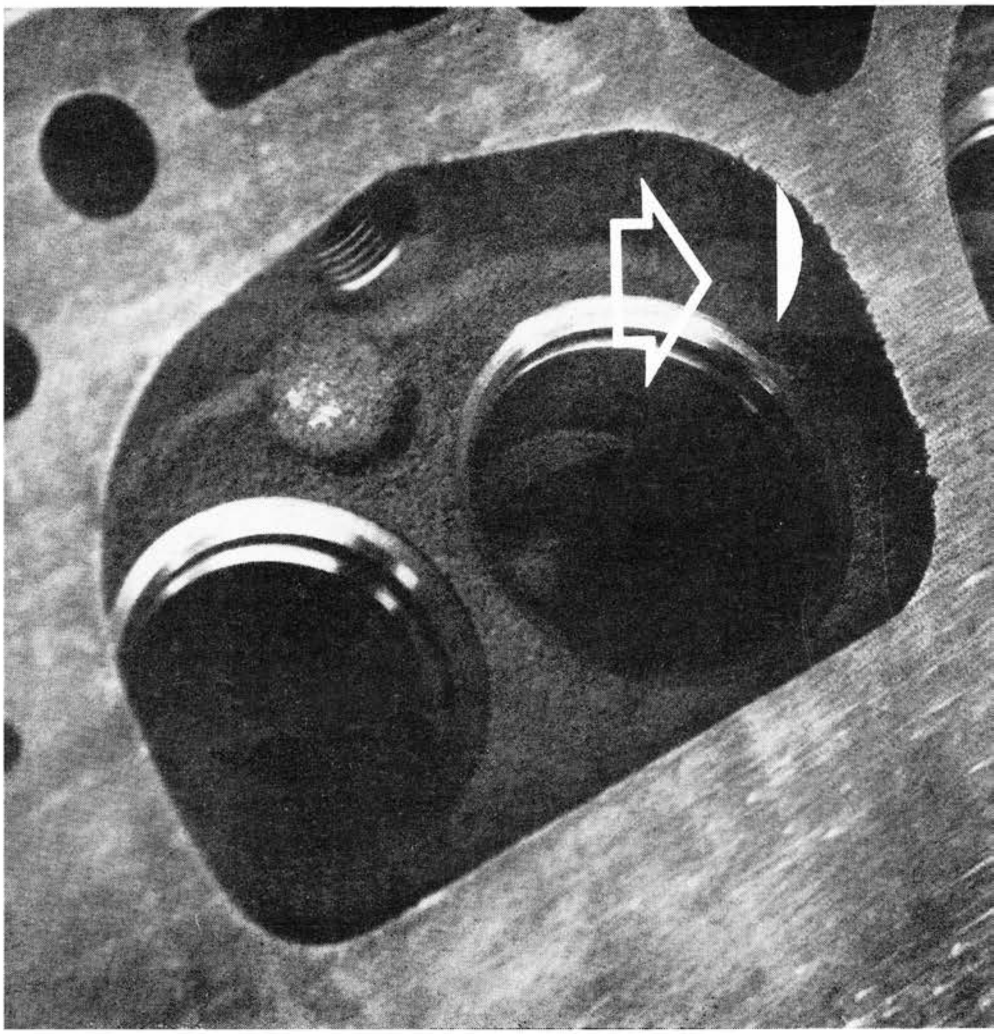
According to strip rules, air cleaners can be removed and the mixture richened by the installation of larger jets or smaller metering rods. However, the boosts that some engines receive from carburetion modifications stem from more than these minor factors. The removal of the air cleaner or cleaners on some cars improves breathing slightly but it can't be compared to the enlarging of the carburetor venturii.

Many modern carburetors have removable boost venturii so it is possible to enlarge the main venturii with special tapered reamers after they are removed. Enlargement of from three-sixteenths to one-quarter inch is possible with many carburetors. After the reaming is done, the machined surface is polished with fine emery cloth, which also rounds sharp edges. Sandblasting with dust-grade sand is employed to camouflage the machine work so the ven-



STANDARD water pump impeller is shown at top. Below it is a unit that has had three of its six vanes ground off to reduce the power drain imposed by the pump. Even such a slight change can have vital results.

STOCK combustion chamber has straight walls around valves, but, by undercutting the chamber wall (in the shape of white half moon) adjacent to the intake valve, a more graceful flow path for fuel results.



turii show no apparent deviation from stock.

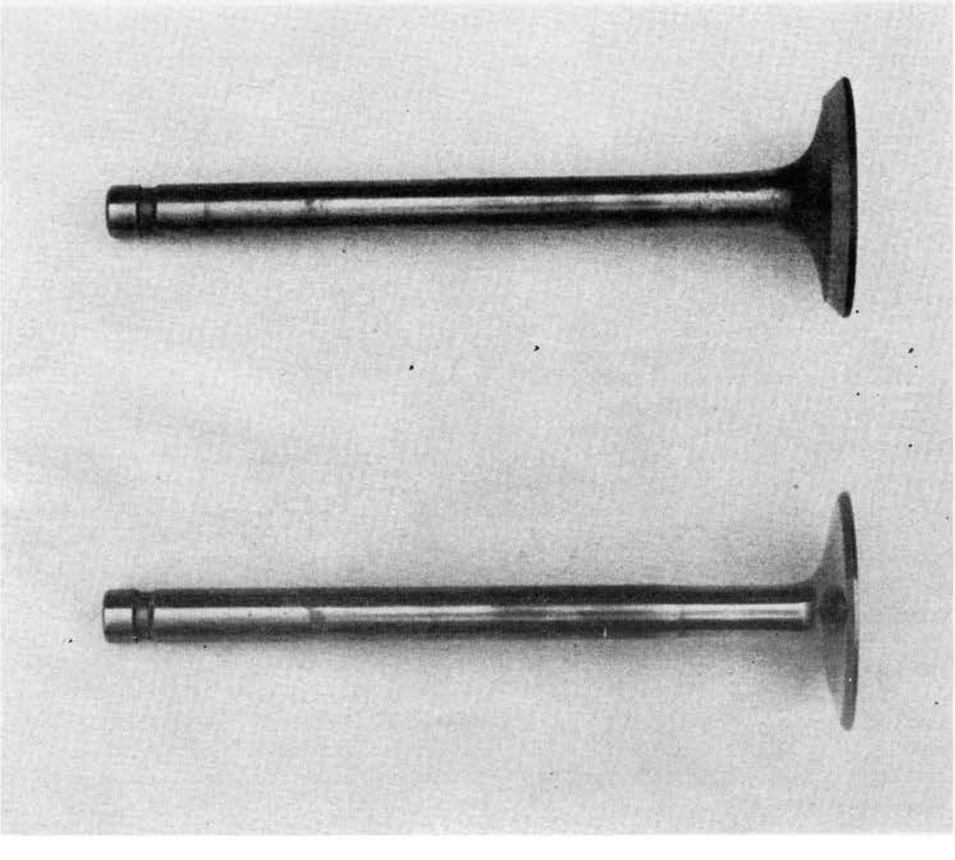
As a venturi enlargement slows down air flow velocities, less venturi vacuum is generated with any given flow of air than occurred with the stock carburetor, so larger jets are required to maintain fuel mixture richness. Often it is necessary to enlarge all fuel passages from jet to boost venturi to further reduce fluid friction. Without enlarging the passages, it is often found that the mixture will be too lean even with the jets completely removed.

As a further aid to breathing, the intake manifold becomes the subject of some modifying. The passage openings of the manifold are matched to the intake ports of the heads. Usually this is accomplished by grinding the intake manifold openings and the ports with a die grinder in such a manner as to get accurate joining of each. The aim is to present a smooth flow path for the fuel mixture to follow.

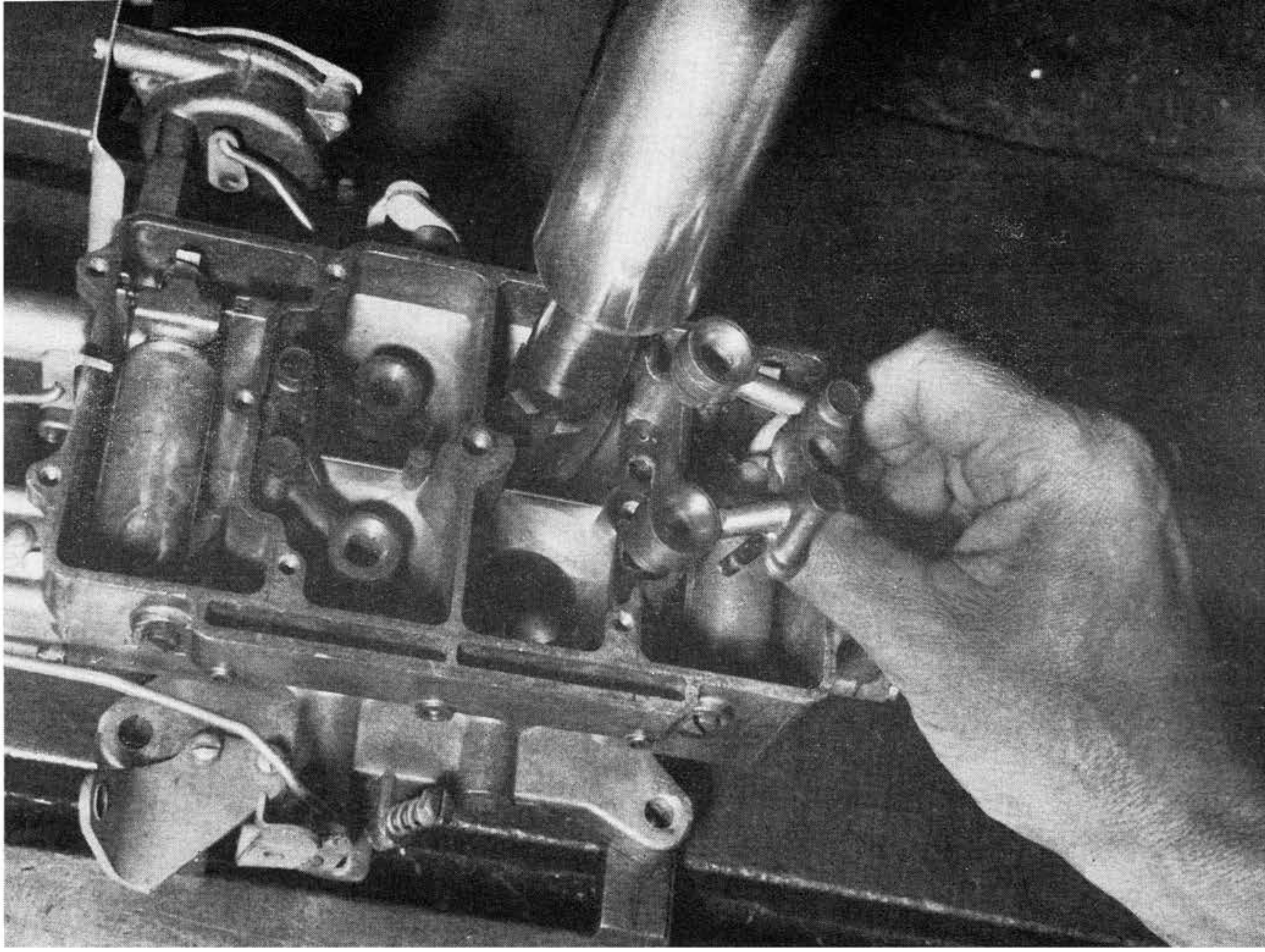
Another area of the intake manifold receives attention but it has nothing to do with flow resistance even though it deals with induction. The subject is still volumetric efficiency but deals with the heat riser passage. By plugging this passage so that exhaust gases cannot flow through it from bank to bank, the intake manifold is kept cooler. The resultant lower temperature allows the fuel mixture to flow through the intake manifold with a minimum of heat absorption. The lower the temperature of the fuel mixture, the more concentrated the charge that reaches the cylinder.

Although blocked heat riser passages may result in higher horsepower output, such a practice is bad for gas mileage and low rpm throttle response in cooler weather. It also makes dual exhaust systems considerably louder.

In addition to the blocked heat riser routine, those "that leave no stone unturned" place wet towels on the intake manifold just prior to making an important run. On engines having a manifold configuration that contains a few external pockets or valleys between the passage



INTAKE valves in their stock form (top) have a very wide face which impedes fuel mixture flow when only partially open. Narrow face of recontoured valve provides freer flow under the same operation.



CARBURETORS aren't free of the modifier's tricks. Here a Ford carb is having its main venturi enlarged with a taper reamer. After the top is removed, the boost venturi can be removed (one pair is being held at right), providing easy access to the main venturi area. Butterflies and shafts must also be removed so that the venturi can also be reamed from the under side.

DRAG MODIFICATIONS *Continued*

branches, pieces of ice are placed to insure a low induction temperature.

The intake valve offers the greatest resistance to fuel mixture flow in the whole induction path so it, too, receives attention. The underside is the only portion that has an effect on flow, so its contour is altered and polished to provide the most streamlined shape. At the same time the valve face is narrowed to approximately one-half of its original width because a wide face impedes flow considerably when a valve is partially open.

Downstream from the valve in wedge-chambered overhead valve engines and L-head engines a flow problem still exists, so combustion chamber modifications are in order. The wall of the chamber adjacent to the intake valve gets its contour changed so that the fuel mixture can flow around the valve more easily. A portion of the wall is ground away and undercut so that the mixture can travel a graceful curved path.

Of course removing metal from the combustion chamber walls lowers the compression ratio. Compression reduction is undesirable so the heads must be milled or high compression pistons employed. In either case, an obvious deviation from stock must be anticipated. Whether or not the change is noticed upon inspection, depends on the cleverness of the mechanic.

A gullible inspector will sometimes assume that an engine suspected of running with a higher than stock compression ratio can be crudely checked with a compression gauge. A rough comparison would be possible if it weren't for the installation of a camshaft with longer duration of opening. An intake valve that closes later than stock will cause a lower gauge reading, thereby covering up a different illegality unless the timing of the cam is checked. Considering the number of hot cams being used in the stock classes at drag strips, it is reasonable to assume that they are seldom checked.

In classes where suspicions are strong and at strips where "tear downs" are inevitable, more subtle methods must be employed. These procedures are inferior to the installation of special cams but they do help. In lieu of a long timing cam, retarding the stock cam five to seven degrees can often help high rpm performance. Retarding the cam helps keep the intake valve open longer on the compression stroke which will often assist in getting a bigger charge into the cylinder through ram effect even though the valve actually opened later. If less top end power is desired and more low rpm torque is wanted, advancing the cam a like amount will be of benefit because of earlier intake closing.

If valve float is a problem and a special cam is inadvisable, special 75-ST aluminum alloy valve spring retainers are employed. These retainers, after they are hard anodized, resemble standard steel ones to such a high degree that only a person with a well-trained eye could spot them. Their weight is only one-third that of steel retainers and accomplishes what stiffer springs would without adding to camshaft and lifter wear. Stiffer springs are to be avoided at all costs unless periodic replacement of the cam is acceptable.

After considering all of the potentials that exist to improve performance on the drag strip, they must be viewed in the proper perspective. No matter what the single modification might be, in itself it will not create a startling impression. Outstanding performance results from the accumulative effect of a great number of modifications. •