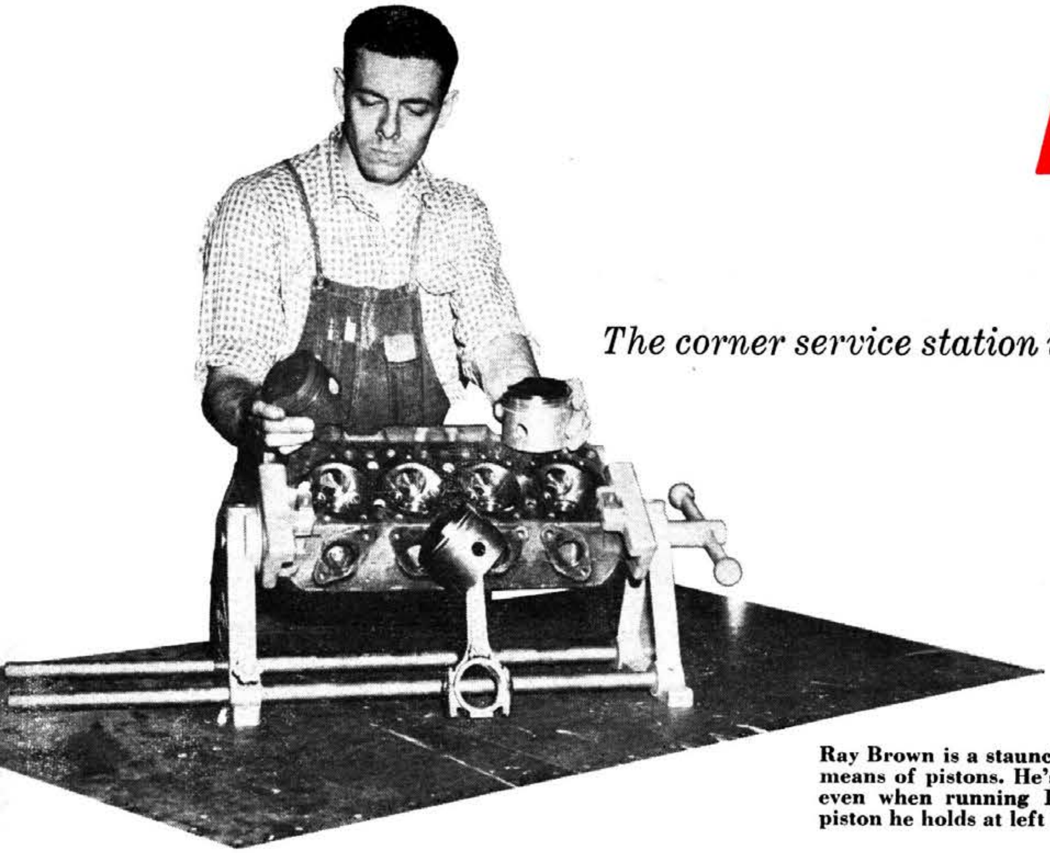


MORE COMPRESSION FOR MORE PERFORMANCE

The corner service station is pumping more octanes into the gas tank of your car, so now is the time to "Have your head examined"

BY GRIFF BORGESON

Ray Brown is a staunch believer in raising compression by means of pistons. He's never had a case of piston failure, even when running 13-to-1 ratios with nitro. The dark piston he holds at left has a super-hard Sanfordized finish.

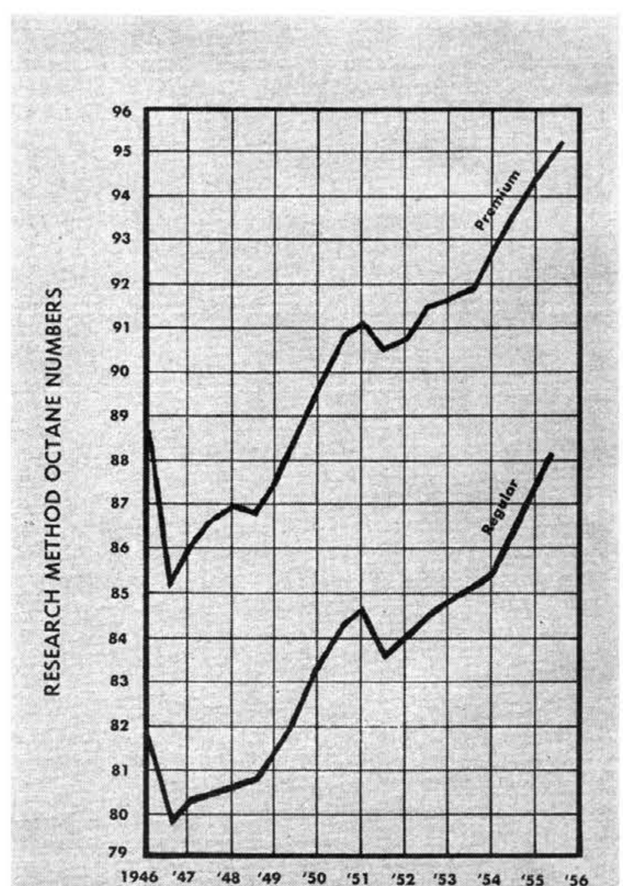
IN ANY ordinary year, the American public is lucky to get an increase of just a few tenths of an octane in the gasoline it buys. But recently big things have been happening to automotive fuels. For the last couple of years the national octane average has been taking giant-sized steps —well over a whole octane number per year. Today's pump fuel is far superior in anti-knock qualities to any we've ever had before. And you ought to be taking advantage of it.

One way is to switch to regular-grade fuel. If you're still buying premium just because your three-year-old car with 7.5 to one compression ratio used to detonate on regular, you can start saving money right now. With a tankful of the regular elixir that's coming out of the pumps today, your engine may tinkle a bit when it's pulling hard. But you can eliminate even that vestige of knock by backing off a shade on the throttle or dropping down a gear—and save yourself a nickel or so per gallon of gas.

However, if you *really* want to hit the performance-with-economy jackpot using the new fuels, the way to do it is to raise your car's compression ratio. In fact, unless you own a compression leader like the '55 Cad or '55 Buick, you aren't making anything like full use of the performance potential in premium fuel. It's something like feeding *filet mignon* to a penful of pigs.

If your car is of fairly recent vintage and has an overhead valve layout, it could probably run smoothly and without pinging at a compression ratio as high as nine to one, instead of the 7.5 or so it probably uses. It can certainly handle 8.5, and this is enough to take far more advantage of the new premium fuels. The graph at the right shows how average octane ratings of regular and premium gasoline have gone up in recent years.

There are several ways to get the job done, depending on the make and model of the car you own. The method you choose will, of course, determine how much it will cost you in cash and/or labor.



TRENDS IN GASOLINE ANTI-KNOCK QUALITY
NATIONAL AVERAGE

MILLING

The traditional, time-honored method of boosting compression is milling of the cylinder head or heads. A slice of an eighth-inch or less is shaved off the gasket surface of the head, so that the volume of each combustion chamber is uniformly reduced. This is a simple, straightforward operation, and with valve-in-block engines there are seldom any complications. In some cases reliefs or cavities are made in the block to permit the gases to pass more freely in or out of the valves.

Another way to get a higher compression ratio is to mill the gasket surface of the block itself. But this means you have to haul the engine out of the car and remove the head-studs from the block. It's major surgery and is seldom practiced.

BORING

A method of raising compression that's often overlooked is boring the cylinders. Naturally, if the combustion chamber volume remains the same but cylinder volume is increased, the ratio of the cylinder to combustion chamber volume will go up. If you're planning to buy new pistons and get a rebore anyway, it often pays to go the limit in boring and get the highest possible compression ratio. You can get spectacular results by combining head milling with boring.

Both milling and boring are, however, sometimes criticized—often without justification—because the removal of metal may weaken the engine's structure. It's true that the engine's water jacketing is limited, and you always run the risk of hitting sand pockets in the casting that will cause leaks if broken. Other structural weaknesses, too, can sometimes be caused by removal of metal—the strength of the combustion chamber itself, for example. The combustion chamber may seem remote from the gasket surface of the head, but actually it's attached to it. Any substantial thinning of the metal where the chamber meets the gasket surface can add to the chamber's tendency to vibrate and thus contribute to the complex phenomenon of pinging. Nevertheless, with most makes and models, reasonable milling and boring are not likely to attack structural strength, because most engines today have a superabundance of beef.

SPECIAL PISTONS

If you want to take no chances at *all*, you might prefer a compression-raising method that has no effect on the engine's structure—special pistons. A large number of specialty manufacturers supply rugged, well-made pistons designed to increase the compression ratios of most popular car makes and models. These get results that are hard to improve upon, but they're usually pretty costly. The pistons themselves are often quite expensive, and their installation is no simple, bolt-on operation. The engine has to be torn down pretty thoroughly to get them in. Furthermore, with the new pistons you need new wrist pins, piston rings and rebalancing of the crankshaft-piston-con rod assembly. Special pistons are the *de luxe* treatment, for the man who can afford the best.

THIN GASKETS

At the other end of the dollar scale—in theory, at least—is the replacement of the stock metal-and-asbestos head gasket with one made of an almost paper-thin metal sheet. Thin gaskets may be the cheapest method of increasing compression ratio, but they are not always effective. There was a time, many decades ago, when a few cars in the world had cylinder heads that were hand-lapped or polished to make perfect metal-to-metal contact with the block. It was so perfect that the engine needed no head gaskets at all. Since then manufacturing standards have changed even for the top-money cars, and it's difficult today to find even a new engine in which the gasket surfaces mate well enough to make possible an effective seal with a gasket made from what amounts to shim stock. This applies even when liberal amounts of "gasket goo" are used.

FACTORY OPTIONAL HEADS

Some manufacturers—Hudson and Nash, for example —carry special high compression heads which are readily available to the public. Several other makes provide higher compression heads for their automatic transmission models than for their standard shift jobs. If you have or are planning to buy one of the low compression versions, you can usually have one of the higher compression heads installed. But before you do, you should compare the cost of the job with the cost of having the head milled yourself, because the economies of mass production are not always passed on to the consumer. However, the factory conversion is likely to include valuable, hard-to-get refinements like specially designed spark advance controls.

SPECIAL OPTIONAL HEADS

Many specialist manufacturers market a wide assortment of excellent high compression heads for nearly all of the flat-head engines. Unfortunately, comparable "street use" custom heads for ohv engines would be far more costly and complicated to build, and they just don't exist.

We don't know of a single custom head that is not made of cast aluminum alloy. This is a real advantage, because the light metal's fine heat-conducting ability by itself permits half a ratio more compression than the factory-original cast-iron heads. Custom heads are modestly priced and give excellent results which have been demonstrated by the tens of thousands already in use.

But we're now in the era of overheads, and flathead lore is already well known. Let's look at some typical high compression conversions for ohv engines. They will illustrate what you can do for your own ohv-engined car.

HIGH COMPRESSION CHECK LIST ON NEXT PAGE

HIGH COMPRESSION CHECK LIST

The chart below gives a pretty clear idea of the types of conversion that can be made to your car to increase its compression ratio for taking advantage of now-available high octane fuels. It is difficult to quote prices for the work involved because prices vary across the country and from one shop to the next. It is impossible to give step-by-step instructions for each make and model because they would fill a thick book. But there are specialists in most cities and towns in the U.S. who are expert in making performance modifications to all the popular engines. They are the men to contact for specific advice on getting the most out of your car.

Chevrolet V-8

Frank McGurk of Inglewood, California, is an outstanding authority on tuning of the in-line and V-8 Chevs. He recommends milling the V-8 heads up to sixty thousandths of an inch, which bumps the compression from 8.0 to about 8.65 to one. The insides of the ports must be bevelled with a file or grinder to maintain alignment of the ports in the heads with the ports in the manifold.

If you have your engine bored one eighth of an inch (McGurk manufactures pistons for all such special conditions), you increase the displacement of the engine from 265 to 283 cubic inches, automatically raising the compression ratio to about 8.54 to one. Quite a few Chev V-8 owners are demolishing the traffic-light competition by going to the big bore and increasing crankshaft stroke one-fourth inch (by using special pistons). This produces a whopping 306.6 cubic inches and a compression ratio of about 9.25 to one.

Chevrolet Six

All of the 216 cubic inch, 3.5 inch bore Chevs from '41 to '52 can be fitted with Power Dome pistons. These increase the CR from the stock 6.5 to 6.7 to a much heftier 7.5 to one. On any of the 235 cubic inch engines with $3\frac{9}{16}$-inch bore, the CR becomes 7.95 to one. In the small-displacement engines one-eighth inch can be milled from the head, giving ratios of 7.5 or 7.7, depending upon the original CR. Ninety thousandths is the recommended milling limit for the larger displacement sixes and results in a CR of about 8.5. Each one-sixteenth inch of overbore increases the CR of the sixes by approximately two-tenths of a ratio.

Cadillac

Caddys, from '49 through '52, had pistons that came to within ninety thousandths of the top of the block. In the '53 and later engines, the pistons are flush with the top of the block at top dead center. Thus, by simply putting the late-model pistons in any '52 or earlier engine, you get a 1.3 ratio increase. The same effect can be obtained with less bother, perhaps, by milling the heads ninety thousandths, resulting in a CR of about 8.8. The later Cad engines are equally adaptable to milling, but they leave little to be desired in compression ratio.

Chrysler

Ray Brown of Los Angeles is the master of the modified Chrysler. When he learned that he could run a nitro-burning Chrysler V-8 at 13 to one compression and stay out of trouble, he figured that just about anything was possible with gasoline. After all, the compression limit with nitro in flat-head engines had been 8.5 or 9.0 to one! So he set up a 10.5 to one CR FirePower engine and found it would run without a trace of detonation and with nearly normal spark advance. It was, of course, a competition engine.

Brown favors raising compression by means of pistons, which are made by JE and Turner in sizes and shapes to give any ratio you may want. For street use, 9.5 to one is enough.

Milling of the Chrysler heads is complicated by the fact that if you take fifty thousandths off the heads you must take one hundred thousandths off the head manifold surfaces in order to re-align the bolts and ports. Sixty thousandths is the very most one should risk taking off the gasket surface of the head but that amount, or even fifty thousandths, will give a very substantial increase in CR. The same points apply to all the Chrysler-produced V-8's.

Ford V-8 Ohv

This engine lends itself nicely to milling, which will give just about any results desired. What is milled from the head, times a factor of 1.4, must be milled from the head's manifold flanges in order to preserve alignment of ports and bolt holes. A top limit of 8.25 to one is suggested by expert Barney Navarro, of Los Angeles, unless other changes are made, including the distributor diaphragm.

While the Ford ohv V-8's are normally supplied with a 7.6 CR, an 8.5 CR conversion is available, putting out 20 more bhp. This is a good deal for the man who wants the most, but getting it as original equipment, instead of after you buy the car, is recommended for reasons of cost.

Ford Six Ohv

This engine will show satisfying improvement with seventy-five thousandths milled from its head, boosting its CR to about 8.5 to one. There is enough adjustment in the rocker arms so that no modifications to them or to the pushrods need be made.

Mercury

Like Ford and Lincoln, the Mercury yields good results from head-milling. Like Ford, the standard 7.6 CR can be improved upon by means of a factory-available 8.5-to-one kit. It is best bought with the car, rather than later.

Studebaker

Good light-alloy heads are available for the flat-head six. The V-8 will tolerate very nicely the milling of ninety thousandths from its heads, giving a new CR of 8.5 to one.