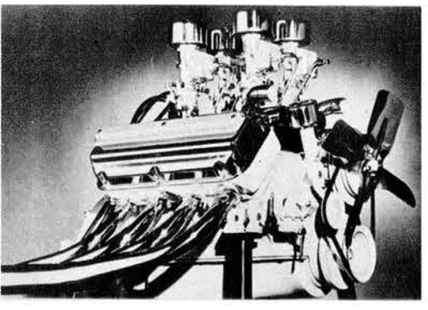
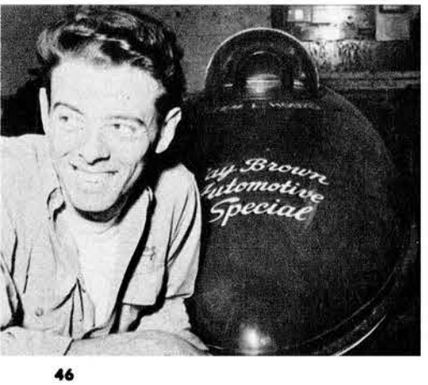
the new OHV Engines



Factory hop up. The Chrysler K310 engine which reportedly puts out 310 hp from 331 cubic inches, & on pump gas.



Ray Brown, an outstanding authority on modifying Chrysler engines. The Brown and Hooper drop tank set a new record in "C" lakester class at Bonneville in 1952. The Brown-built Firepower engine gave them a two way average of 197.88 mph. Brown will take the same engine to the salt again in '53. This time in Hooper's new fiberglass streamliner.

by Griff Borgeson
(with technical assistance from Ray Brown)

THE CHRYSLER, DeSoto and Dodge V-8 engines have one of, if not the best, design on the production car market. They resemble other postwar V-8s in all ways but one: the hemispherical combustion chamber. Racing engines have used the cup-shaped chamber for decades because nothing else can match its efficiency. It has shown up in American cars in the past, but they've always been cars that only the few could buy — cars like the J-series Duesenbergs and the Stutz DV-32. A lot of credit should be given the Chrysler engineers. They are the boys who sold the brass hats the idea of using the *ideal* combustion chamber in a mass production engine. The Chrysler-line V-8s will certainly go down in automotive history as a milestone in production engineering. These are great engines. You can get more out of them with less effort and expense than you can from any other available power plant.

If you own a car powered by any one of the three Chrysler-line V-8s — Chrysler, DeSoto, Dodge — all we say in this article applies to your engine. If you're thinking of buying one of these engines to install in another car, you've got a good selection. You can have the 140 HP Dodge, the 160 HP DeSoto, or the 180 HP Chrysler. You don't have to do any boring to get the piston displacement you want, unless you're one of the one in a million who isn't satisfied with what 331 cubic inches can give him. The modifications that pay off for all three engines are nearly identical.

Although the greatest advantages of these power units lie in the "top end"— the ports, combustion chambers, and valve train — it's there we concentrate our modifications. We start with the heart of the engine, the camshaft.

In order to retain the good low-speed torque characteristics of these engines so you can still operate around town at 10 to 15 mph in high gear, the only camshafts you can switch to with confidence are the Herbert roller-tappet cam, or Howard Billet with mushroom followers. Herbert is this country's roller-tappet cam specialist and the gimmick about roller tappets is that since the rollers themselves contribute a good percentage of the effective cam contour and since they roll so freely, more "radical" grinds are practicable than with the solid-tappet type of camshaft. The solid types have, of course, been experimented with.

The Herbert or Howard cams are machined from a steel billet and use adjustable pushrods which give a mechanical rather than a hydraulic means of adjusting clearance. A car intended for general road use can benefit to the tune of 15 to 20 HP from the installation of a 270° cam, assuming that you've upped the compression ratio half a point. This cam is most effective between 1000 and 4450 rpm. If you're willing to sacrifice some of your low speed torque you can go to a slightly wilder cam — say 280 degrees duration. With it you get an output increase of about 30 HP, along with somewhat rougher performance at low speed. While the 280-degree cam pushes your low-speed limit up to about 2000 rpm, top revs are moved up to 5500. With this you'll be slow getting away from stop signals but once you're really winding the engine, it'll take a hot car to stay with you. The wildest cam of all has 300 degrees duration. It is reserved for flat-out competition use, along with fuel injection and a separate exhaust stack for each cylinder. With this cam the engine is pretty dull below 3000 rpm but will wind to about 6700 rpm. This is the engine for the speed hobbyist out to set a record on the lakes or on the salt.

A roller tappet camshaft, which includes tappets and pushrods, will nick you $195, plus $75 to $100 for installation labor if you don't do your own work. The roller tappet cam goes in just as the stock cam does, but tappets and pushrods have to be changed and adjusted and guide bars have to be mounted in the valve chamber to keep the tappets from rotating. All this adds to the cost of labor.

There's a cheap way out. The results aren't those that more dollars can buy, but they're worth considering. You can convert the stock hydraulic tappets to solid ones. You remove the tappet, take out its guts (the ball and plunger) and you've "collapsed" the assembly, making it a solid tappet. Next, you buy a set of adjustable pushrods, install them, and pull your tolerances down real close — say to three or four thousandths of an inch. Stock cams for hydraulic tappet engines lack the clearance ramps that are put there to take up the clearance that's provided with solid tappets. But, with this pushrod adjustment, everything works very reliably and there's an increase in power output that makes the effort worthwhile.

Regrinding stock camshafts just hasn't worked out. There isn't enough meat on them to make re-working feasible. It seems that if you want a special grind you've got to go to cams ground from steel billets and suited to either roller or solid tappets.

Whatever you do with your Chrysler-line V-8 engine, if you're out for more power you must get rid of the hydraulic tappets. This method of lifting the valves in *any* engine is silent and effective up to a little over 4000 rpm. At that point the tappets "pump up," hold the valves constantly open and give the same effect as valve float. The Model Ts start walking away from you. My advice to the man who wants the best performance he can get at idle and at full throttle is: install a "Road Grind" cam. Its "duration"— intake valve opening on the intake stroke — is a mild 270 degrees. This is a cam that works well with the single stock carburetor or with duals. It can be used successfully with the stock exhaust system or, dual pipes will help it do its job even better. It's definitely not worth while to install a cam alone.

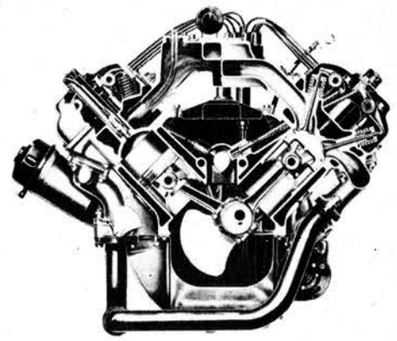
The horsepower gain from the special camshaft is good, but when you add improvements to carburetion, exhaust, and compression, you're really taking advantage of what a good cam makes possible and your HP shoots up. In fact, if money is extremely limited, I wouldn't even consider a camshaft.

To get the best results with a restricted budget I'd suggest improving the ignition system — which we'll discuss later — and installation of one of the four-throat or so-called "quad" carburetors. These are really a *big* improvement over the stock, two-throat pot. They operate like the stock item up to 20 or 25 mph and then the other two throats come in, bringing with them a surge of power that is certainly worth the cost of installation.

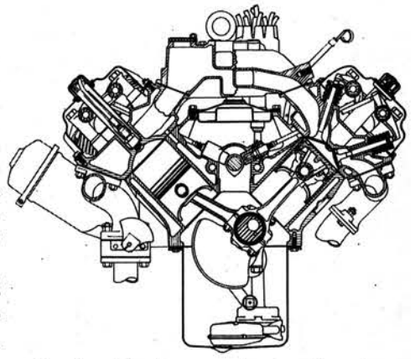
The Stromberg quad is about the cheapest and it's a very good carburetor. It retails for about $60 and an adaptor will cost you an additional $14. A specially-designed mainfold to take a quad carb would do a somewhat more efficient job, but there are none on the market just yet for Chrysler products. There probably will be, however, by the time these words reach print.

An advantage of the quad carb is that you get much of the effect of dual carburetors without the bother of linking two carbs together and synchronizing them. Still, the quad is a compromise with the dual carb principle. Four throats bunched together naturally cannot distribute the fuel as evenly as two carbs spaced well apart. The twin carb setup definitely gives you more horsepower gain at the "top end" — the upper reaches of the rpm range. The man who does lots of his driving on the open road won't regret having such a setup on his car.

All these modifications to the carburetion are aimed at getting more fuel into the engine. Another thing we can do to help this cause is, of course, enlarge and polish the intake and exhaust ports. The Chrysler-line V-8s have good, thick port walls, making it safe and simple to open them up considerably. The exhaust ports lend themselves particularly well to this sort of reworking. I won't deliver here a lecture on "How To Port And Polish" since that has been well covered in several books that deal with hopping up the older engines, and the same principles apply. But porting and polishing are as necessary and as beneficial for the Chrysler line as for any other engine and the job can be more easily performed on the Chrysler-line V-8s than on any other popular engine. Also, the Chrysler combustion chamber is machined very smoothly at the factory. Make it a practice to polish these to a mirror finish, just like the ports. This slows the formation of carbon deposits greatly, thereby eliminating a common source of hot spots that



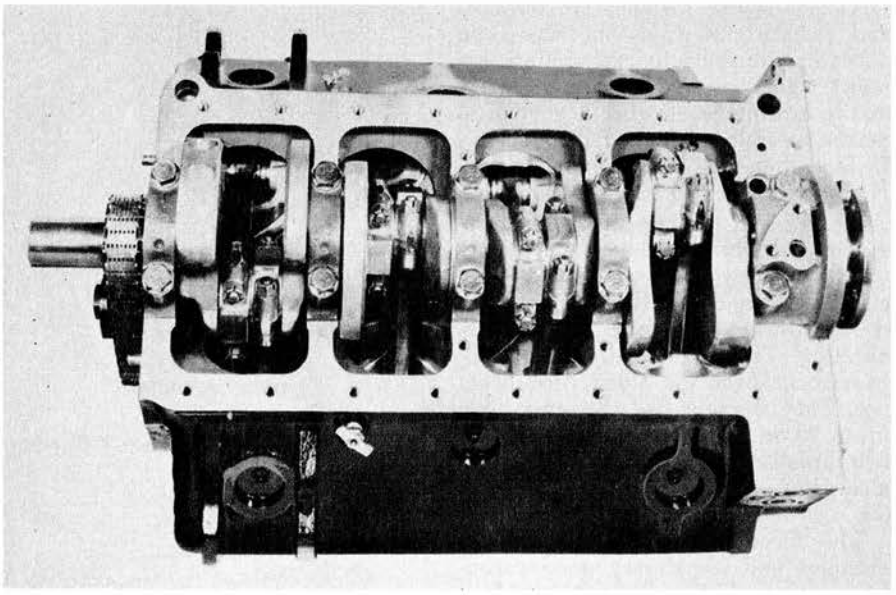
Cross section of Chrysler V-8 engine.



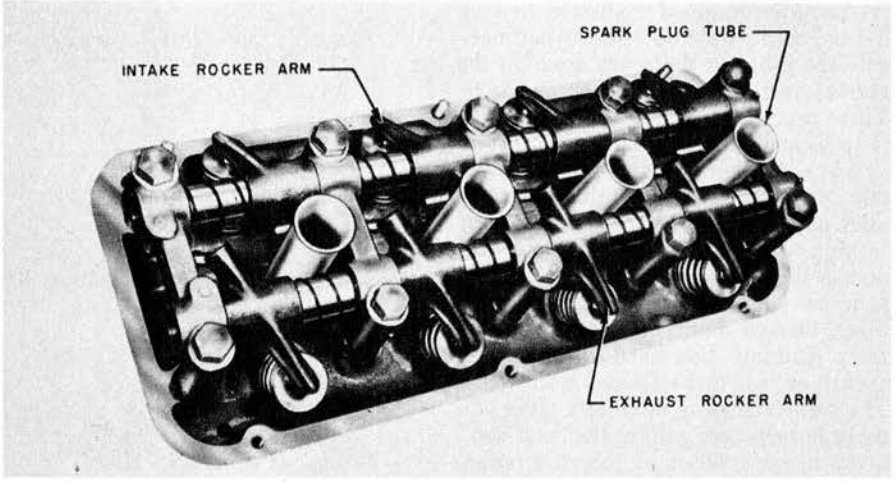
De Soto Firedome engine, section view.

Cutaway drawing of valve mechanism.

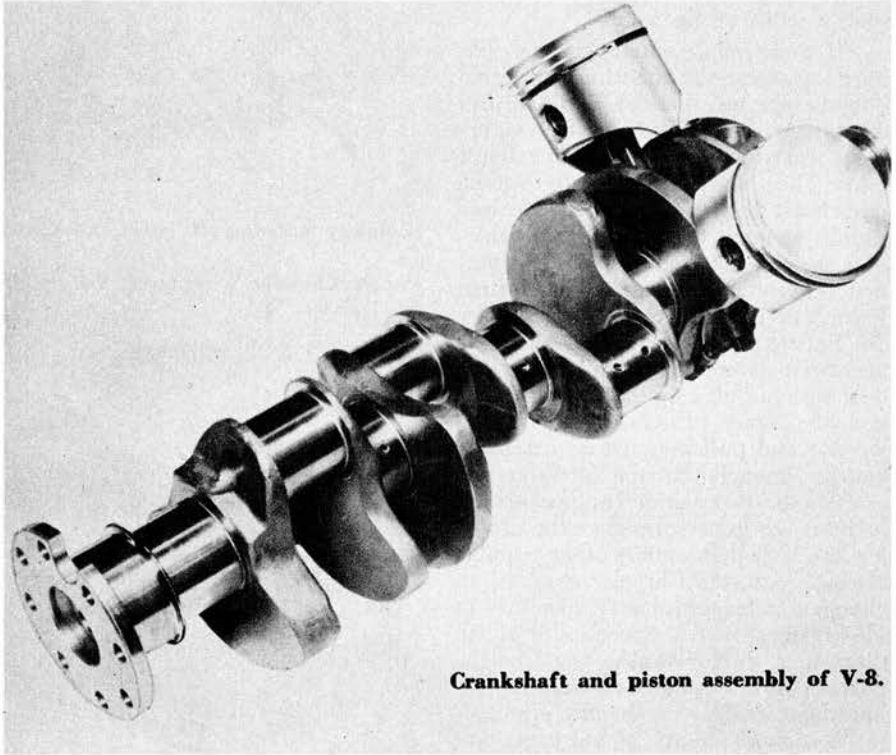
Stock Chrysler Firepower V-8 engine.



Lower end shot of Chrysler Firepower.



Valve mechanism atop the cylinder head.



Crankshaft and piston assembly of V-8.

cause premature firing of the mixture. Also, with the highly polished finish, more heat is kept in the combustion chamber, less heat is thrown away into the water jacketing.

The hemispherical combustion chamber is not the easy answer to all problems that a lot of "experts" would have you think. Experience has shown that, when running on gasoline, you can easily get into some pretty bothersome detonation problems if you get too high with the compression ratio in these engines. Raising it half a ratio is the most we'd care to recommend for general hop up practice. You can do this by having between 40 and 50 thousandths of an inch milled from the heads.

Milling the heads or block is one of the few *single* modifications we can make to these engines that, all by itself, makes a whopping difference in performance. Any reasonable increase in compression ratio, especially in an ohv engine, really pays off in horsepower and speed. Also, milling is one of the easiest, fastest, and cheapest things you can do to increase engine performance. If you have your engine apart — if you have the heads off — it's just plain wasteful not to have them milled. The operation should cost between $4 and $6 per head, depending upon your locality. Of course, when you take 50 thousandths off the heads, you've got to take an approximately equal amount off the intake manifold to get the ports to line up again. And, you must shorten the pushrods by the same amount.

As good as the valve layout is in the stock, Chrysler-line engines, there's a lot we can do to improve it. Don't get the idea that Chrysler Engineering missed any bets — they left that room for improvement there deliberately.

All these engines have a very healthy valve and port size. As we've already said, the ports lend themselves well to being opened up throughout their length. Porting, *and* increasing the valve area, gives a substantial increase in power output. On Ray Brown's conversions of Chrysler V-8 engines the 1 13/16 intake valves were replaced with valves of 1⅞ or 1 15/16 diameter. The stock exhaust valve is 1½ and is replaced with 1⅝ or 1¾. The ports are, of course, opened up to match the valves. This creates a vast increase in port and valve area and the increase in power is proportional. Other combinations have been tried, but we found that the stock 45 degree angle of the valve seats works best with this combustion chamber. It makes for very efficient "wedging" or sealing action and for efficient fuel flow.

It has been found necessary to increase, slightly, the valve spring pressure when installing a roller tappet cam. To fail to do this is to invite poorer-than-stock performance. The roller tap-

pet is about 2½ ounces lighter than the stock hydraulic unit. This takes a big load off the valve springs, but the gain is offset by the high lift and the severe contours of the roller tappet cam. The beefing-up we do to the valve springs is actually slight, and it's simple. In the case of the Chrysler, we retain the stock outer spring, but use a 33-pound 270 Offy inner spring in place of the 19-pound stock coil.

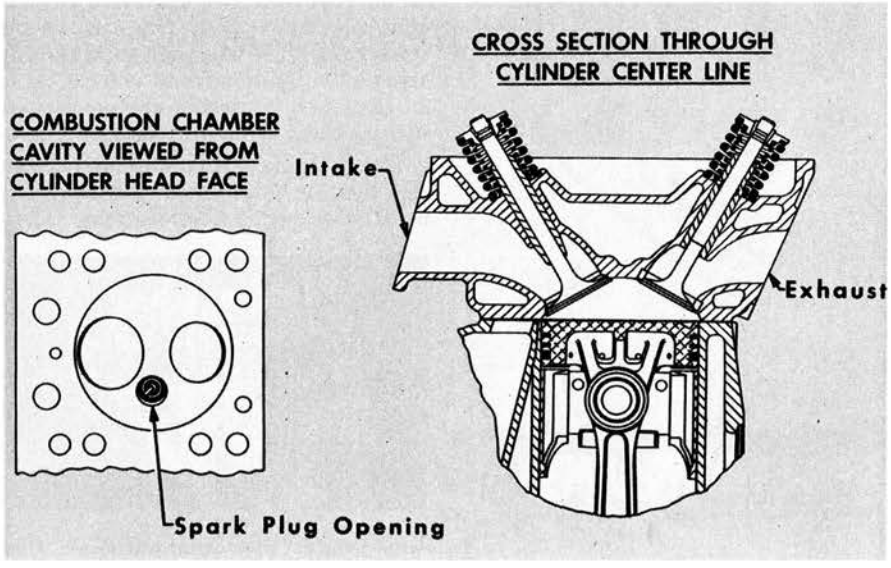
There's a temptation to try to push valve float or "toss speed" higher and higher in the rpm range by beefing up the springs more and more. But you can put extreme amounts of spring pressure behind a valve and still reach an early toss speed in any pushrod engine. The reason for this is that the pushrod just can't take that much loading — it distorts, bends, failing to put the valves through their full operating cycle. A distorted pushrod can not always be detected by the naked eye but you know it's there when you punch the throttle and the engine just goes mushy. Once distorted, there's no repair that can be made to the rod — it must be replaced. So be content with the smallest increase in spring pressure that you can use to get the job done. Let's face it — the valve gear in even a strictly stock OHV engine takes a beating.

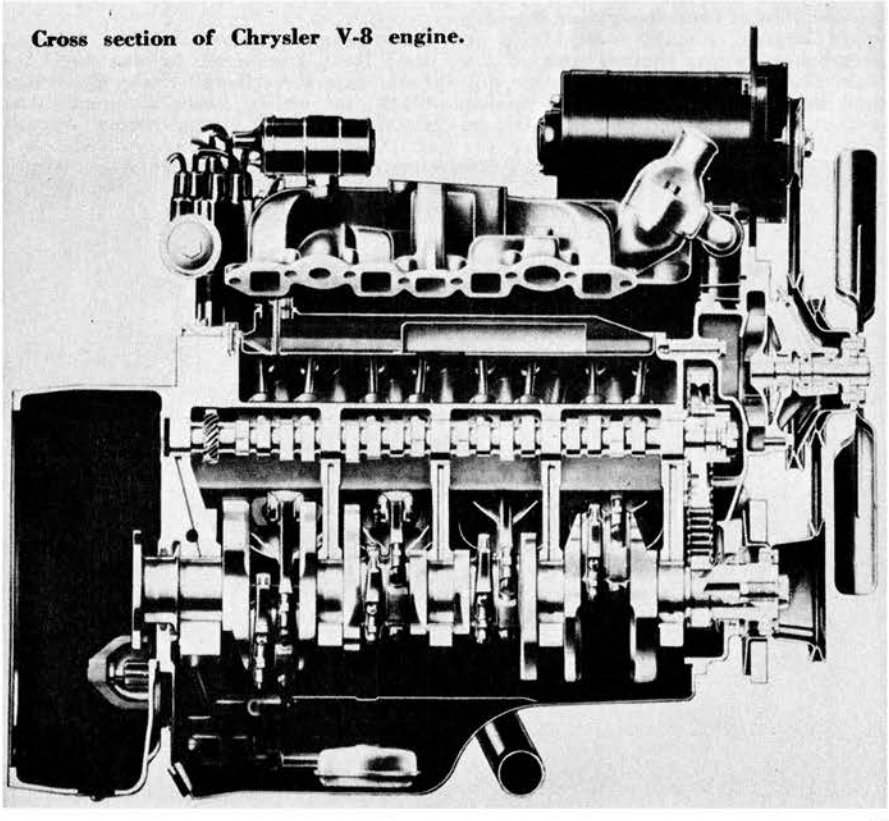
The Chrysler-line engines use extremely long rockers. This is another "flaw" that many of the experts pounced upon when the Firepower engine first appeared. Those rockers would crumble like potmetal under heavy loads, they predicted. Well, it hasn't worked out that way. The rockers in all three engines have proved entirely reliable and have given no trouble, even with extreme lift and extreme valve action. Brown ran a Firepower engine in his and Malcolm Hooper's wing tank at Bonneville in '52 and frequently revved over 6100 rpm (top speed was 201 mph). No rocker trouble. But in view of the punishment planned for that engine, the exhaust rockers were polished and shot peened. Chrysler should be quite content with its rockers. There are other makes that don't hold up so well.

Whether the single-pipe-with-crossover exhaust system causes power-robbing back-pressure on the stock engine is a controversy that we needn't haggle over here. One sure thing, however, is that when you start pumping more fuel through the engine, the efficiency of the exhaust system becomes critical. A dual exhaust system — a separate pipe for each manifold — is more helpful than you might believe. A set of duals, with headers in place of the stock manifolds, can give you 10 to 20 more horses — horses that were being absorbed by the old single pipe and crossover. I've proved this to my own satisfaction right on the dynamometer. The whole issue costs about $100 and installation, if you don't do your own work, is about $20. A good exhaust system is of the greatest importance. If you doubt it, ask the man who owns one.

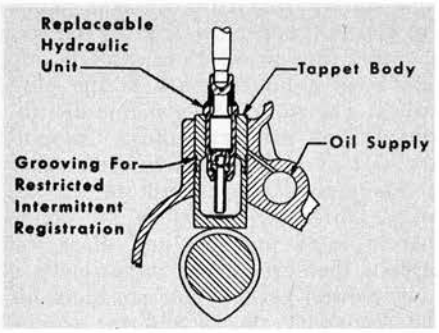
The Chrysler-line V-8's are among the few engines that come from the factory equipped with a dual point distributor. This idea is actually as old as the hills, but it went underground during the big economy drive of the late Thirties. Now, with higher compression ratios and much displacement, we need a good, healthy spark. The dual point system meets this need by increasing the dwell — the period of time during which the breaker points are closed. Longer dwell gives the coil a longer time in which to saturate and this gives a hotter spark at the plug points. The stock Chrysler-line distributor has a "primary" and a "secondary" set of breaker points. One set of points deliver the current to all the plugs while the other set of points merely serve to open and close the circuit, thereby giving the primary a longer dwell period. You can block off the secondary points and the engine will still run on all eight barrels.

We improve on the stock system and get the full benefit of the dual point distributor by switching to a four-lobe rotor cam and two coils. The stock cam

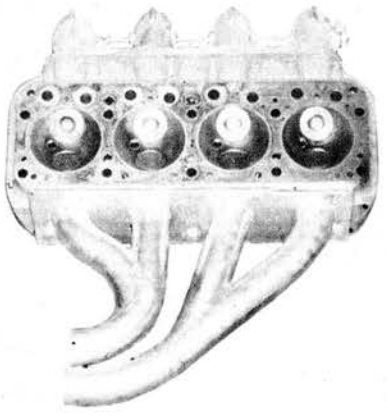


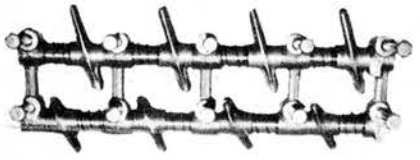


Cross section of Chrysler V-8 engine.



Section of Chrysler hydraulic tappet

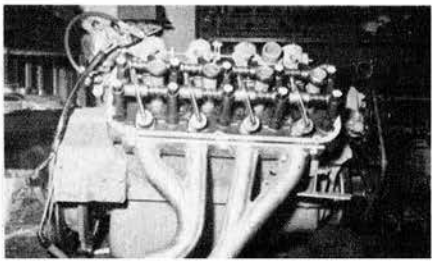




Another view of same head from Brown's record engine. Rocker assembly is in foreground. Short, intake, rockers are stock. Long, exhaust, rockers were polished and shot peened to help insure against any possibility of failure.

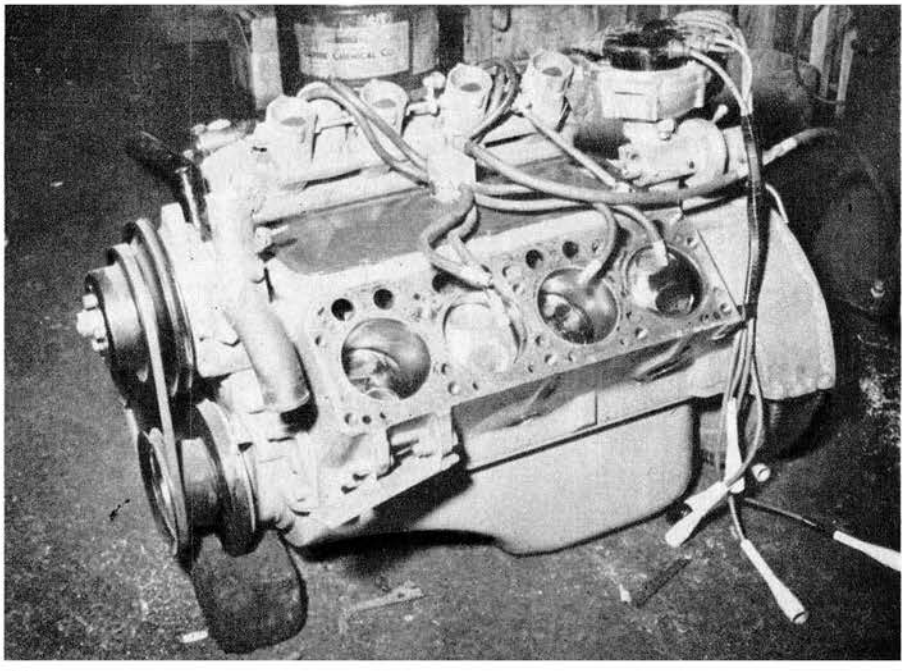
that opens and closes the breaker points in the distributor has eight lobes, and all the current comes from a single coil. With a four-lobe cam conversion, each set of points feeds only four barrels and draws current from a coil all its own. This gives each of the coils a much longer time in which to saturate and works the breaker points just half as much. Theoretically, the points, coils, and condensers should double their useful life. This conversion is your guarantee that you'll never "run out of spark." The four-lobe cam, twin-coil distributor will supply a husky spark well beyond the rpm limits of the engine. It's a desirable addition to any modified engine, including the mild "road job." A converted distributor costs about $60. You can use the stock coils or, if you want to be doubly safe on the ignition front, you can go to the higher capacity coils and condensers such as those offered by Mallory.

Magnetos are much more costly items and their installation is justified only in all-out competition running. Their great advantage lies in the fat spark they deliver at the plugs at extreme rpm. Both Scintilla and Harman & Collins make fine ones. If you're going to switch to fuel injection and run on the Dry Lakes or at Bonneville, consider investing in a mag.



Same engine with head installed. Harman and Collins magneto is mounted in place of usual battery type ignition.

Same engine, valve chamber covered, fuel lines connected to one bank of fuel injector. Note fuel distributor block to which hoses connect. Also visible are high dome racing pistons.



An ignition modification that must be made as soon as an engine's compression ratio is upped is changing the spark plugs. With an increase in compression, it has been found best to drop a step colder in the heat range, to be able to retain the stock gap in the plug points. I've used Champion J-8 plugs with excellent success. The Autolite resistor plug that the factory uses — again contrary to much expert opinion — operates very successfully, even in the hottest engines. They were used experimentally at Bonneville at speeds of over 190 mph and proved very satisfactory.

Connecting rod and main bearing trouble has long been one of the big fears of the car owner who goes after more than stock performance from his machine. This is no problem with the Chrysler-line V-8s. All three engines have five main bearings — a wonderful thing that enables them to stand up under terrific loads. They use simple, lead-babbit bearings instead of other alloys, but the bearings stand up perfectly. Brown's Bonneville engine was hopped up to deliver almost double its original rated horsepower. We inspected the lower end bearings after 70 miles of screaming, high-speed running on the salt and we found scarcely any bearing wear at all. If you're souping for general road use, rather than gunning for Bonneville records, you can just forget about the lower end.

The question is frequently asked: is it a good idea to bore or stroke one of these engines?

Actually, with the various cu. in. afforded with the three engines (Dodge, DeSoto and Chrysler) it seems unnecessary to bore or stroke. Sure you can bore them — ⅛ inch oversize — and you can stroke ¼ inch before the rods begin to approach the block too closely. But the present bore: stroke ratio has been worked out pretty well at the factory and it's a balance that is very well left alone. I would say that unless you're going out for competition in a displacement class that demands boring and/or stroking, or are building a sports car and want to save every pound of weight you can, then forget it.

The factory has done a terrific job of balancing these engines statically and dynamically. This is a great improvement over the past practice of almost all manufacturers and it's a good demonstration of Chrysler's progressive and thorough approach to giv-

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ing the public a great product. Of all the engines we've balanced (at Ray Brown's) we've been able to improve them very little.

Now if it is felt necessary to increase the size of one of these engines by boring and/or stroking, it will also be necessary to balance all over again the pistons, rods, crankshaft, clutch, and flywheel. This has to be done because when you bore way out and have to go to larger and therefore heavier pistons and pins, you throw off the balance of the whole crankshaft assembly. And it's easy to see that when you stroke a crankshaft, you render its counterweights ineffective. I can't stress strongly enough the importance of static and dynamic balancing if you make these modifications to gain displacement. When you balance an out-of-balance engine you eliminate roughness, get longer engine life, and you eliminate sources of possible mechanical failure due to high speed pounding effects. The job costs $35 to $40 for any of the ohv V-8s.

Now let's suppose you've installed a cam, headers, special carbs and distributor on your Chrysler-line V-8, and everything is buttoned up and ready to go. Or is it? No, it isn't—not by any means. We've now come to the last phase and one of the most important phases of all hop up procedure: *final tune up.*

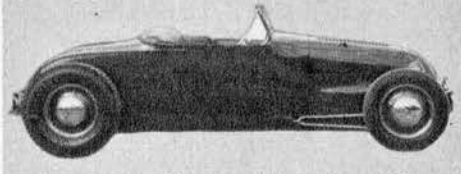
Even though you may have done all your own work up to this point, unless you're an experienced tuneup specialist, you can save time and, probably, money by getting such an expert to make all the necessary adjustments *on the road.* Shop adjustments are not enough.

Let's take the carburetion for example. If you've installed a quad carb there's no synchronization necessary other than factory-type adjustment. But if you've mounted duals, there's no substitute for real experience in getting both pots to function identically at all times. It's a tricky, difficult thing to learn. It's necessary to seat the butterfly valves in their bases in the carb bodies. It often requires loosening the screws, delicately shifting the butterfly on its rod so that it will seat tightly, so that each valve in each carb will function identically. The linkage between the controls of the two carbs must be adjusted to stay just so and it should stay that way for a long time. This all takes a certain knack—one that only experience can teach.

After you've installed your very desirable, modified ignition system, the timing should be set by means of a timing light aimed at the timing mark on the vibration damper. But that dot is just a rough guide—an approximation put there at the factory. To be right on the dot doesn't mean that your timing is right on. A good hop up tuneup man tackles the problem this way: He times the engine according to that timing mark. Then he goes out on the road and loads the engine as much as he can, readjusting the timing until the engine just pings slightly at full load. It musn't be a ping just a few times and then, as the revs mount, the pinging should vanish—that's the ideal timing adjustment. It has to be made "by the seat of the pants"—the only correct way.

After 5,000 miles or so on the road that timing mark will have even less meaning because many things like carbon deposits will have happened within the engine to affect how it should be timed correctly. Countless tests on the chassis dynamometer have convinced me that spark adjustment is the most critical of all. Just being a shade off can make a 10 to 20% difference in power output. If you're advanced too far you can drop 30, 40, or 50%. If you are retarded too much you'll drop plenty, but not that much and not that fast. So, after you're all done with the service manuals and the timing light, the best thing to do is go out on the road and make your final adjustments there. Get a good tuneup man. It takes an educated seat of the pants.

COVER ROADSTER



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in. These louvers, in case you hadn't noticed in the photos, are punched from the outside in, instead of from the inside out as most louvers are.

The grille was made, by Neil, of round aluminum rod welded together and then after much filing (by Flint) of the joints it was buffed to a high polish, and clear lacquered.

In between working on parts of his engine, (and while Valley was performing the body work) Dick was making the front and rear bumpers, headlight brackets, split wishbones (which incidentally are made from model T wishbones) and other incidentals so necessary to the finish and operation of a roadster.

Dick did almost all the mechanical work on the car himself, including the mounting of the hydraulic brakes from a later model Ford ('46).