



Souping the VW and Renault

SPORTS CARS

ILLUSTRATED

JULY 1956

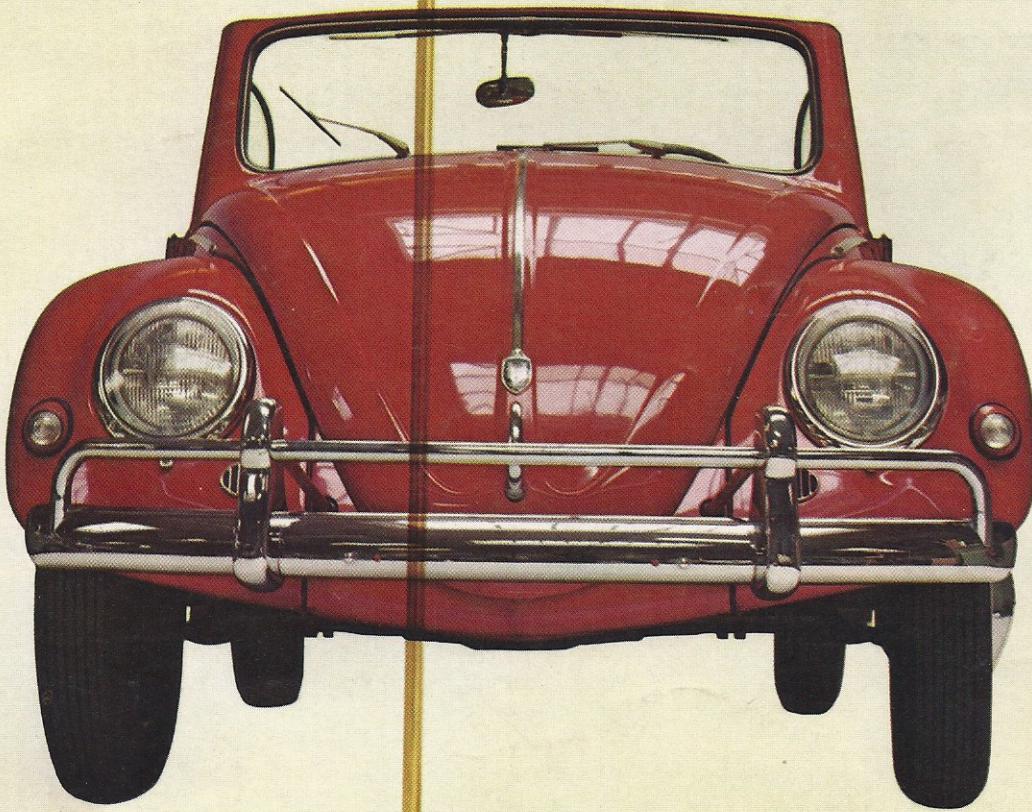
**14 PAGE
SPECIAL
SECTION**

35¢

IN U.S.A. AND CANADA

**LIGHT CAR
BUYERS' GUIDE**

- specifications
- performance data



**Tech Report:
PBX Special**

VOLKSWAGEN

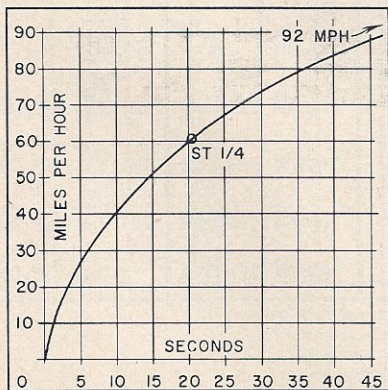
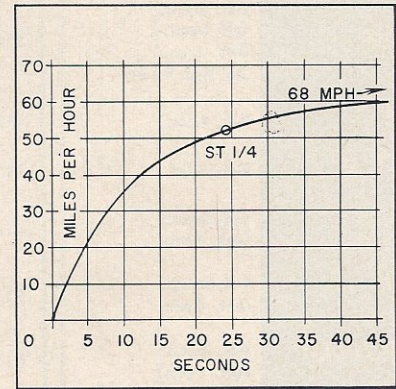
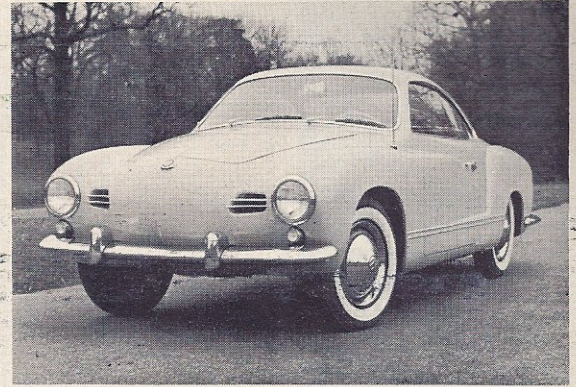
THE VW, discoverer of the gold mine that every other overseas manufacturer is scrambling for a share of, is still lord of the U. S. light car market. But from here on it's going to have to fight to hold its own.

The VW has its limitations. Its rivals have made a careful study of them and recite them from memory. The most valid criticisms of the People's Car are (1) it's underpowered, lacks hill-climbing and passing ability; (2) it could use more passenger and luggage space.

As described on page 46, speed tuners have at last found a successful and inexpensive method of outwitting the engine's built-in breathing restrictions. VW owners who want their cars to go like Porsches have the answer to their wish. As for payload space, the VW is better than some. The important thing is that the VW is a four-place car designed to meet specific standards of size, cost, service and economy. No car is perfect, and no serious critic can claim that the VW is not a very successful solution to the problem of providing comfortable, cheap, reliable transportation for the largest number of motorists everywhere.

There are other considerations that will make it difficult for anyone to nudge the VW off its pinnacle in the U.S. One is the marque's gigantic dealer and service network, backed up by equally large stocks of replacement parts. Another is the psychological phenomenon known as acceptance. Tens of thousands of Americans have taken the VW to their bosoms and they spread the VW gospel wherever they go. Then there is the precision, quality finish that the factory manages to give its cars. Whether or not you admire their looks you can't help being impressed by the quality of paint, chrome and assembly — the way everything works just as it was intended to.

When competition gets tough, which it hasn't yet, who can best afford to play the price-cutting game — a newcomer or big, rich VW? The VW success story came true solely because of the virtues of the product, and these will retain their value for a long time to come.



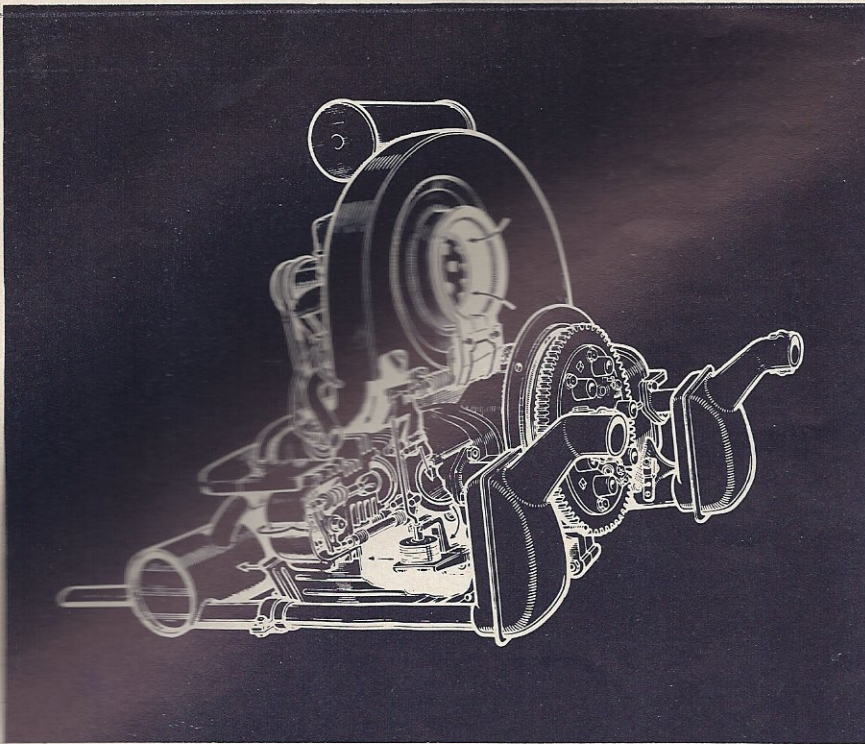
VOLVO

A FEW months ago a Southern California importer brought in his first shipment of Swedish light cars, the Volvo PV444's. Patriotic Swedes snapped up the lot, but he held on to one car. He knew that the best way to call the attention of large numbers of enthusiasts to an unknown machine is to race it. After one short highway trip in the Volvo he was convinced he had a winner. So far he has entered races twice at Palm Springs and once each at Torrey Pines and Santa Barbara. Four starts, four wins.

A somewhat plain but very solid-looking machine, the Volvo is one of those cars you never forget having driven. You can't because you just can't accept the fact of the car's blazing performance. The twin-carb, 70 bhp sports engine revs with the willingness of a racing mill, but has the smoothness that can only be achieved through careful balancing and matching of internal parts. We are told that the engine's combustion chambers and ports are polished, that its main-bearing inserts are replaceable without removal of the crankshaft, and that a great many parts, including the entire electrical system, are standard replacement items available throughout the U. S.

We drove the well-flogged veteran of four race wins. The car had been in constant daily use as a demonstrator and town hack. In other words, it was not in tip-top tune. It peels rubber in First gear very cheerfully, and leaps to an indicated 30 mph in six seconds flat, a little time being lost in popping a shift to Second. Once in Second you can stay there all day if you choose. The acceleration and engine braking in this ratio are just plain astounding — an adjective that applies pretty accurately to everything about the Volvo's performance. Using First and Second only you can bound from zero to an indicated 40 in 8.7 seconds, to 50 in 12.4 and to 60 in 21.5. Factory literature says that a properly tuned PV444 will do the latter in 19.6.

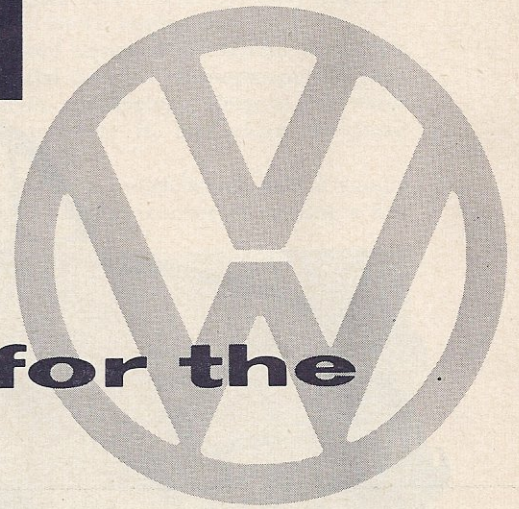
The Volvo handles precisely like a U. S. car, only better. Sturdy radius rods on the rear axle account for the car's right-now takeoff. It corners on rails. Front passengers ride in bucket seats; there's good room for three in the rear, and the luggage space is huge. Needless to say, the Volvos are selling on sight.



Cutaway of VW engine shows path of cooling air as it is forced around cylinders, oil sump, and transversely seated muffler.

Vitality

for the



By **RUSS KELLY**

IF THERE'S anything in the world that the top brass at Volkswagen has strong feelings about it is the owners who mess with VW engines. The factory has announced, for example, that dual carbs may be fine for the Porsche, but they're no good for the VW. The VW owner's manual bristles with warnings and admonitions that add up to the statement, "You want to soup it? DON'T!"

There are plenty of good reasons for this policy. The little car is known all over the world for its unbeatable reliability and economy, and this is a reputation that the factory does not want to have marred by souping attempts that may destroy the sound, sensible balance of VW engineering.

At the same time, however, not even the most fanatic VW devotee — and there are lots of them — would deny

that the car could use some additional power. Innocent passengers are sometimes completely shattered by their first experience with a grimacing, muttering VW driver, rowing his little car along with the gear lever, in mortal combat with a head wind. Or, there's the unforgettable experience of getting out in the middle lane to pass a car and suddenly finding yourself trapped and marooned, without enough acceleration to escape back to safety. Or, there's the familiar VW rolling-country technique of winding the needle off the speedometer dial going downhill in order not to have creep snail-like up the other side.

When the VW first appeared in this country many enthusiasts thought it looked like a natural for hot-rodding, but they found very quickly that the engine's designer had done his utmost to outwit them. He had built restrictions

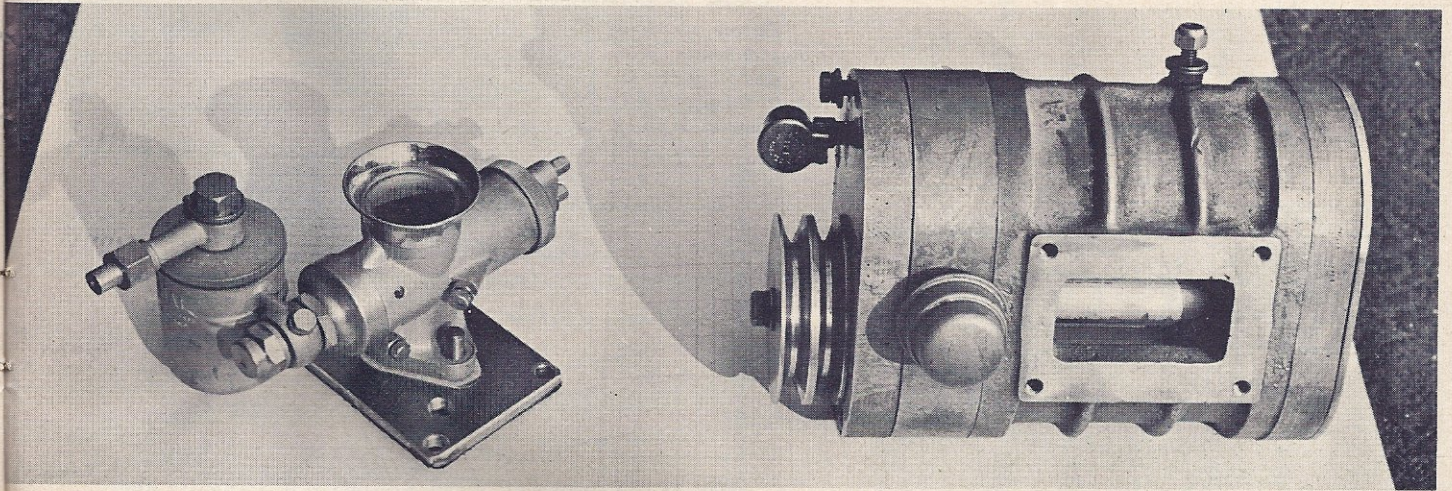
into the engine that are incompatible with high output per cubic inch. The head porting and valve arrangement are enough to make a strong man weep. The valves stand vertically in the heads and are of very small diameter. They *can* be enlarged, but then you're whipped at the ports.

The intake port is siamesed, entering the head as a single port and then branching to feed the two cylinders. Since a single port to each cylinder is generally considered necessary for good volumetric efficiency, standard hop-up procedure is to enlarge a siamesed port throughout and then divide it with a fabricated wall. But on the VW even this simple modification can't be carried out because of the thinness of the metal around the ports. An Austrian manufacturer makes special heads for his limited-production

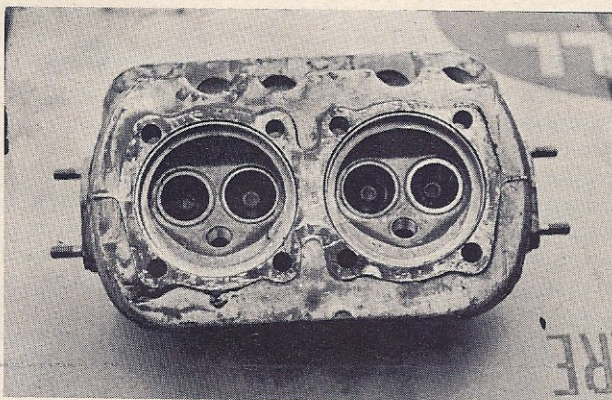
VW-based cars, but their price is prohibitively high.

However, a number of U.S. speed specialists have found ways to make VW souping pay, and they're doing it economically. They're doing it by *ignoring* the limitations of the heads. They're concentrating on (1) supercharging or (2) combinations of valve timing, compression ratios, carburetion, and exhaust manifold. Either treatment can make of the VW a pretty exciting poor man's *gran turismo* car, with far better torque and acceleration, good road averages, top speed of from 80 to 85 mph — and with *no* adverse effect on economy and reliability.

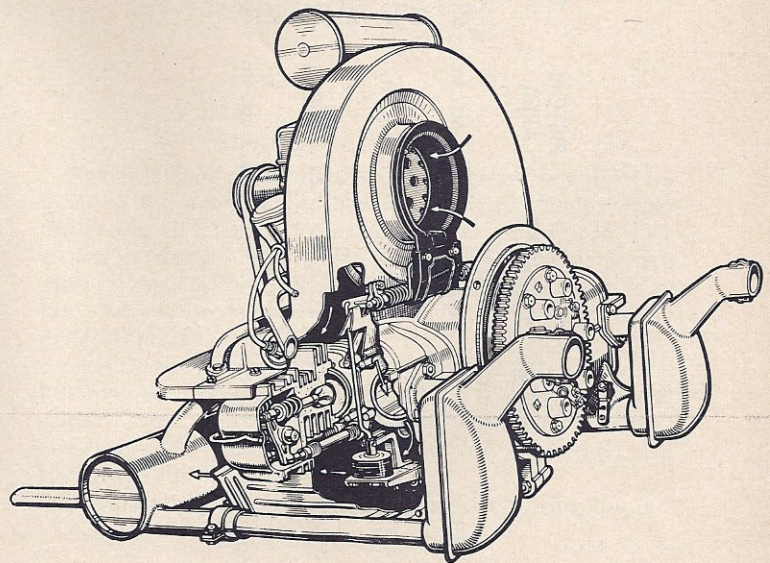
Aside from its built-in throttling the VW engine is an excellent base for hop-up operations, and it is anything but stressed. Engines produced before January of '54 were rated at 25 bhp at 3300 rpm and later models pull 30 at



Pepco three lobe Roots type blower, and a 1-1/64 inch throat diameter Amal-type carburetor. Because of air "slippage," blower is more efficient at upper rpm scale.

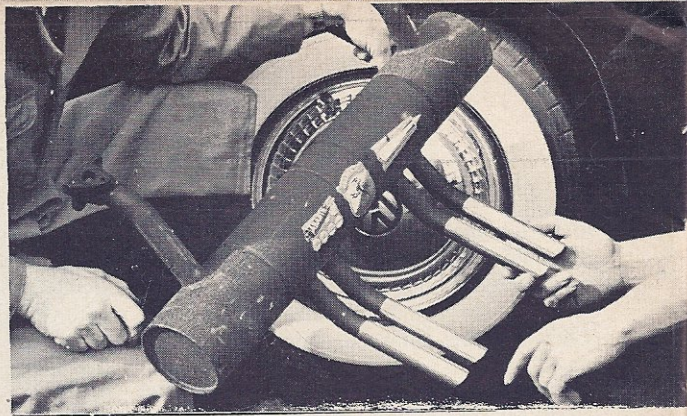


Stock head shows small sized valves. Any possible gain made by the installation of larger valves is effectively nullified by barrel spigots which cannot be relieved.



SPECIFICATIONS FOR VW

	BORE	STROKE	PISTON AREA	SWEPT VOLUME	COM- PRES- SION	IGNITION	CARBURE- TION	IN. OPENS	IN. CLOSES	EX. OPENS	EX. CLOSES	BHP
1953	75 mm 2.96 in.	64 mm 2.52 in.	27.4 sq. in.	1131 cc. 69. c.i.	5.8	BOSCH	Single Solex 28 PCI	2 1/2° BTDC	37 1/2° ABDC	37 1/2° BBDC	2 1/2° ATDC	25 @ 3300
54-55	77 mm 3.03 in.	64 mm 2.52 in.	29. sq. in.	1192 cc. 73. c.i.	6.6	BOSCH	Single Solex 28 PCI	2 1/2° BTDC	37 1/2° ABDC	37 1/2° BBDC	2 1/2° ATDC	30 @ 3400
1956	77 mm 3.03 in.	64 mm 2.52 in.	29 sq. in.	1192 cc. 73. c.i.	6.6	BOSCH	Single Solex 28 PCI	2 1/2° BTDC	37 1/2° ABDC	37 1/2° BBDC	2 1/2° ATDC	30 @ 3400
Modified	80 mm 3.15 in.	64 mm 2.52 in.	31.2 sq. in.	1284 cc. 78 c.i.	7.0	BOSCH	Dual Solex or Dual Amal type	19° BTDC	55° ABDC	54° BBDC	20° ATDC	40-45 @ 4400



Abarth dual exhaust system is an excellently engineered piece of equipment. Consensus has it as a must on stock, blown or modified VW's.



Special 80mm 7-1 piston on left slightly domed. Piston on right has concave head and a compression ratio of 5.8-1. Barrel is stock cast iron.

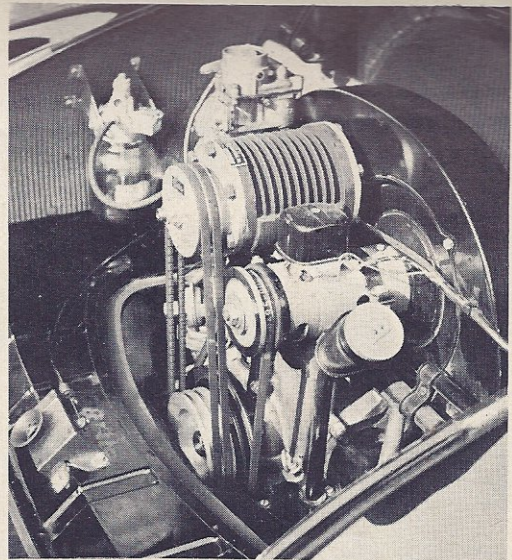
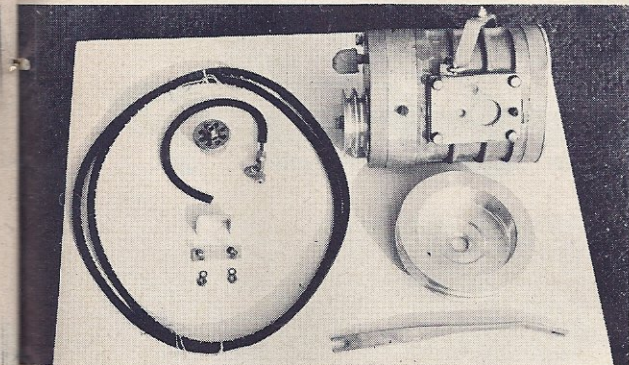
3400. At this crankshaft speed, piston speed is a paltry 1500 feet per minute — almost as low as the power output. With standard tires the 3.5 to one top gear ratio gives a road speed of about 21 mph for every 1000 rpm and a top speed of about 65 mph.

Then engine base itself is of rugged design. The horizontally opposed four cylinders are mounted on a rigid, barrel-shaped, built-up aluminum crankcase. This case splits down the center line of the four main bearings. Mains 1, 3 and 4 are of the bushing type and No. 2 is a split-insert shell. The short, husky connecting rods carry lead-bronze steel backed inserts. The firing order is 1-4-3-2 and out of balance forces within the engine are almost non-existent. All this is reassuring to the owner interested in improved performance.

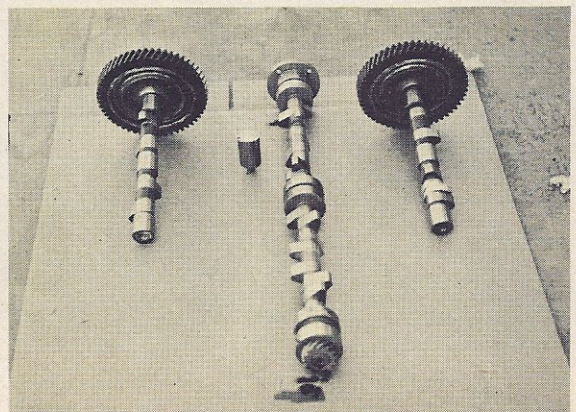
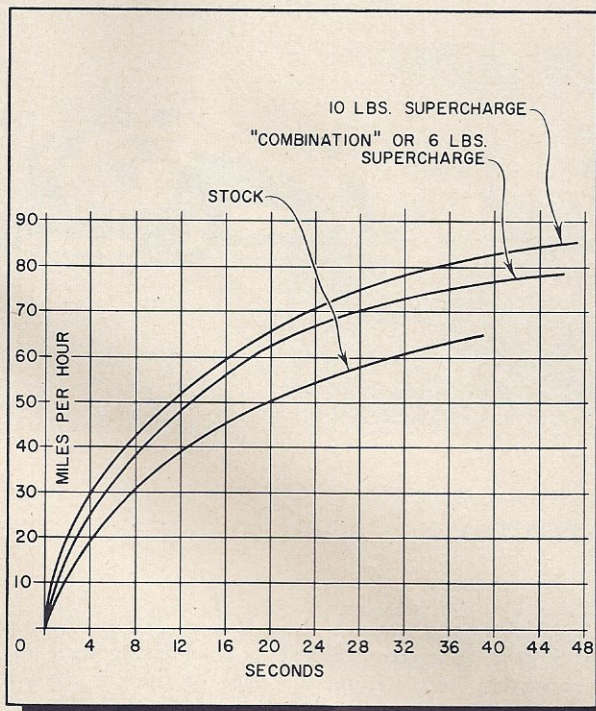
Probably the country's leading practitioner of factory permitted modifications to VW engines is JEM Engineering of Sherman Oaks, California. Their combination yields an increase in power output of about 40 percent and incorporates most of the major changes possible from the standpoint of practicability. Non-factory-permitted methods can be equally reliable.

The first step is the fitting of oversize, high compression pistons. 3.15-in. (80 mm) pistons are used in both the large and small bore engines. They bring the cubic capacity up to 78 cu. in. (1284cc) — a seven percent increase for the big-bore job and 13 percent for the pre-'54 engine.

BELOW: Complete Pepco kit is simplicity in itself. Shown here are belts, brackets, crankshaft-pulley and tiny pop-off valve to smother any backfire effects.



The Judson vane type compressor installed using a stock 28 PCI carburetor. The little Ghia coupe accelerated from 0-60 in 15 seconds, half of stock time.



Semi-race cam on left, Iskenderian "404" with radiused tappet in the center, and full race grind on the right. The "404" grind forms basis for VW cams.

The resulting compression ratio is only seven to one. Higher ratios have been tried but without success.

This increase in bore also has the theoretical advantage of increasing the piston area. The higher compression ratio — stock is 5.8 — aids mainly in two ways. First, it improves the pumping action and so improves volumetric efficiency. Second, by compressing the gasses more tightly it increases burning efficiency. All of these advantages, with perhaps the exception of the last, are unfortunately directly dependent upon the rather primitive induction setup. This is where the second factor is introduced and the word "combination" becomes significant. This factor is altering the valve timing.

The problems of camshaft engineering are not just confined to the opening and closing of valves. Among other things the all-important consideration of getting the valve to follow the contour of the cam at high engine speeds must be dealt with. The position of the engineer who must face the additional handicap of modifying another man's design is not an enviable one.

Iskenderian Racing Cams of Los Angeles have developed not one but three refinements on the VW cam: a road grind, a semi, and a full-race. Norris Baronian, the firm's knowledgeable young engineer was very generous with hard-to-get information.

He explained that the VW designers, following the dic-

(Continued on page 64)

Renault

(Continued from page 45)

save a lot of work by taking the parts off and laying them out in sequence. Try the other way and find out why.

A replacement manifold is available from Renault and is actually the optional '55 manifold. It is perfectly satisfactory and could be easily modified to a two-carburetor set up but we haven't reached this stage yet.

The new manifold requires two extra studs in the head. The studs that come in the kit have metric threads so you are better off using 5/16" into the head. The muffler installation presents no particular problem. On our own job we used a Hollywood muffler, cut out the holding brackets from the Renault muffler, made bands from 1/16 strap iron to hold the brackets to the muffler, welded up the pipe to go from the manifold to the muffler, and assembled the works. If you are wondering about the tail pipe, we have a consolation for you. The stock Renault doesn't have one either.

Last but not least, comes the carburetor. The stock one is a small Solex without an accelerating pump and has little to recommend it except a very excellent choke system that consists of a secondary carburetor and no obstructions in

the carburetor throat. It can be used with the replacement manifold with a small adaptor at considerable loss of power. The factory recommendations call for a 32mm Solex, PBIC, a very fine carburetor indeed and it should be for a \$34.00 list price. It can be replaced successfully by a 431 RS Carter carburetor for less than \$12.00 and it fits and works perfectly. It has a universal mounting flange which must be centered before installation. The main jet is adjustable from the outside and it is otherwise a stock W.O. Carter.

A distributor setting of five to eight degrees in advance of factory timing is advisable. The factory tappet clearance (set hot) of .008 and .012 can be modified to an even .010 all the way around. For competition a hot .006 setting will improve the performance. The valves are adjusted more easily by making a little slot in an old wrench to fit the flats of the adjusting screws. This completes the engine work.

We made a few modifications to the suspension, like installing a '55 Renault stabilizer bar and heavy duty airplane type shock absorbers borrowed from a Plymouth.

The Renault factory puts out souping up equipment of their own under the brand name of Autobleu. Their kit, for \$265, includes a reground cam, a modified cylinder head, a manifold slightly larger than the one we used

and the 32 PBIC carburetor. They also offer a larger distributor with a tachometer take-off and a tachometer. The cylinder head they offer has larger valves and ports than the stock head and is sold on an exchange basis. A word to the wise: The intake valve on the old head is exactly the same size as the exhaust valve on the new head. The new head gives remarkable performance considering the fact that the original 7.25:1 compression ratio has been retained. However, the workmanship on the exchange head leaves a lot of room for improvement. The manual spark control we incorporated with the distributor is a great help in starting. Autobleu considers their valve timing top secret.

Top speeds were increased from:

15 miles to 22 miles an hour in 1st.

35 miles to 60 miles an hour in 2nd.

68 miles to 80 plus miles an hour wide open in high.

Not bad for an engine that fits in your vest pocket.

With the old manifold and stock setup the engine puts out 21 hp at 4100 rpm. With the new manifold the power is boosted to 28 hp at 4500 rpm, while with the complete Autobleu kit 35 hp at 5500 rpm is claimed.

With an extractor type tuned exhaust and larger carburetor, a compressor and a strong tailwind — oh well, a fellow can dream, can't he? #

VW

(Continued from page 49)

tates of low weight and compactness, chose a radius-type cam follower. This design is excellent for use with the hollow-flank or constant-acceleration cam which happens to be an Iskenderian specialty. Using the same principles applied in their 404 and Offenhauser grinds, the VW cam lift was increased and the rate of opening and closing accelerated. The popular road grind has a lift of .318-in. at the cam. The opening rate is such that at top dead center the valve is already .060-in. off the seat and is fully open at 90 degrees after TDC, when the piston has reached maximum velocity. This in itself is a tremendous step in overcoming the disadvantages of the VW's small valves and restricted porting.

The inevitable loss of power at low speeds associated with high-performance valve timing has been kept to a minimum here because the stock VW is so "under-cammed" that the low-speed characteristics of the modified

camshaft are almost within the limits of "normal stock" practices. A smooth idle is possible and if anything is lost "at the bottom" the increase in compression ratio effectively offsets it. The drawings show the various grinds compared to stock VW timing. Naturally, increased overlap is exploited as a means of improving breathing efficiency. But to take full advantage of this modification, a well-engineered exhaust system is essential, and that's the third important part of the combination.

Actually, it's the most important single factor and, by itself, it makes a big improvement in performance. It is interesting that even the factory relented on this point after reportedly being against it earlier, and has fitted dual exhausts to its latest models. But most tune-up experts continue to swear by the excellently-engineered Abarth exhaust system for all VW's.

The stock VW intake manifold's extreme length and small diameter exaggerates all the classic ills of carburetion. Pulsation, wall-friction, uncontrollable column inertia are only a few of the maladies that deliver unbalanced volumes and mixtures to the VW's cylinders. Some owners are con-

tent to settle for the limited top speed of the single-carb modified unit, feeling that the extra expense of fitting dual carbs is not worthwhile for only a few mph gain in top speed and very little improvement in acceleration. But the marked reluctance of the engine to rev freely with the single *vergaser* actually takes a lot out of overall performance figures. Higher shifting points reached sooner in second and third gears make this final change very desirable.

It's true that the fitting of two carbs, even with their short manifolds, will not completely cure all the VW's breathing problems, but it does increase the venturi or carburetor throat area. The importance of this at high revs becomes clearer when it is realized that throttle action is simply a method of varying the effective throat area. For the dual-carburetor conversion, two stock Solex 28PCI carbs with stock jets may be used, which involves the fabrication of special manifolds and throttle linkage. A complete kit, containing two Amal-type carbs and all necessary incidentals, is available from Competition Chemicals, Iowa Falls, Iowa, for \$80.

The cost of the complete "VW com-