

CHRYSLER'S VALIANT

A penetrating technical analysis of Detroit's latest compact

A FAINT IDEA of the labor involved in designing an entirely new automobile from the ground up can be conveyed by the fact that Chrysler's project Valiant required the services of over 600 engineers, stylists and draftsmen for a period of two years. But, as we shall see, the effort was quite worthwhile, for the Valiant is extremely well planned, right down to the smallest detail.

The Overall Package

In size the Valiant is remarkably similar to the "other two" and it might be noted here that the so-called new concept of compact cars is not new at all—we are merely returning to the prewar idea of what constitutes a popular-sized, low-priced automobile. Chrysler's problem was to produce a car combining high performance, economy of operation and low initial cost. Even a casual look at these three objectives indicates that the obvious key to a successful design is low weight. The Valiant's final weight of just over 2700 lb shows the result of this thinking and is remarkably close to the weights of low-priced cars in the early Thirties.

The Valiant's wheelbase is 106.5 in. and the overall length is 184 in. These dimensions allow a little more front and rear overhang than is available on its principal competitors and this, in turn, gave Chrysler stylists a chance to proportion their car more nearly in conformance with what has become popular in larger cars.

The powerplant is in front, of course, and since a relatively large 6-cyl unit was planned it had to be located a little farther forward than what might be considered standard practice. Accordingly, we find the engine tilted at 30° from the vertical, with a unique accessory arrangement. These two features cut down the overall length and excessive overhang, allowed more usable body space, reduced the transmission-cover tunnel size and gave the stylist a fairly free hand.

The seating plan specified that there be room for 6 adults and this was easy to accomplish with the engine well forward. An overall height specification that is not extremely low (54 in.) helped solve the problem; higher seats allow adequate leg room without the need for excessive overall length of body.

A not-incidental advantage of the Valiant package is the size of its trunk space—25 cu ft.

The Styling

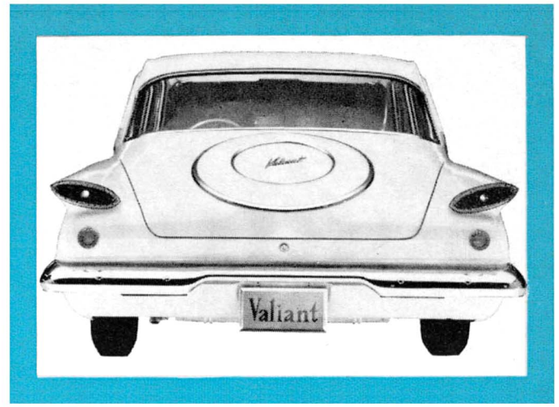
Without a doubt, the Valiant's appearance is really unique and distinctive. The front end treatment was developed to simulate the sporting, high-performance flavor of the firm's 300-series cars and, incidentally, was designed long before Studebaker's Lark was announced. Though there is a superficial resemblance to the Lark, a side-by-side comparison reveals some outstanding differences, and very little actual similarity.

Quite a large number of small styling details were developed to coordinate with body structural engineering—these will be explained later. Chrysler's well known director of styling, Virgil Exner, has this to say: "This family-size economy car has an aerodynamically clean shape which reduces drag and gives a fuselage styling appearance, an extension of the famous Chrysler Corporation wedge shape."

The Unit Body

The body/frame of the Valiant is a welded, reinforced shell of great strength and twist resistance. It has a torsional rigidity far in excess of what could have been obtained in a frame-and-body car of similar weight.

Its all-welded structure shows no evidence of wasted metal. The door pillars, for example, have structural inner panels which are formed into smooth, curved contours so that they double as trim panels. The windshield and back window side pillars are made in the same sensible way.

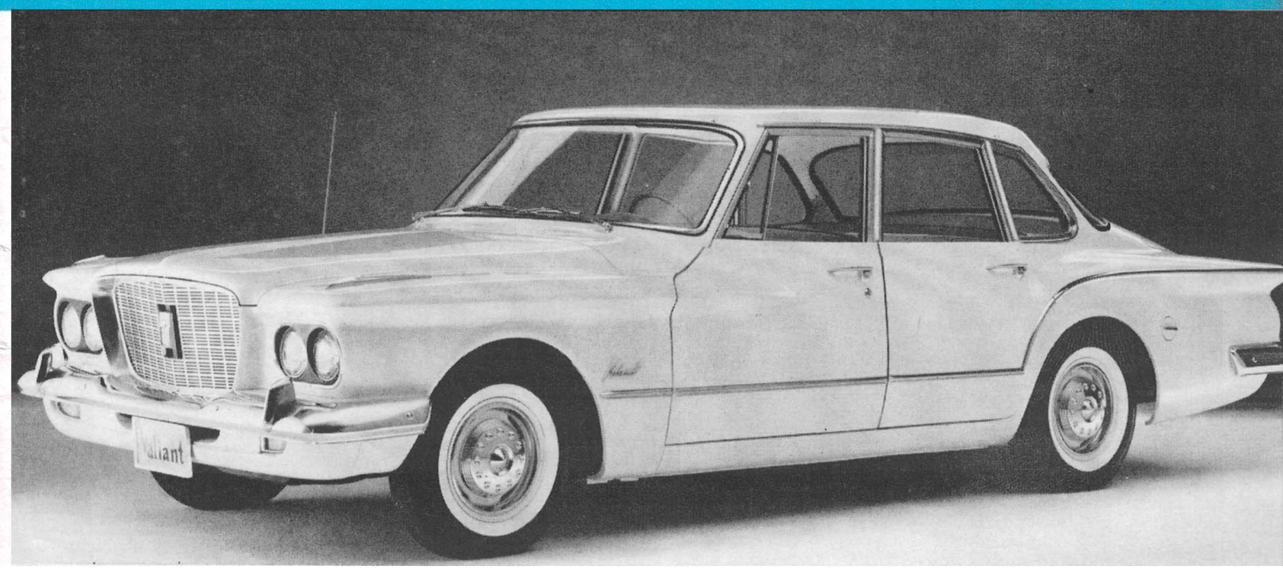


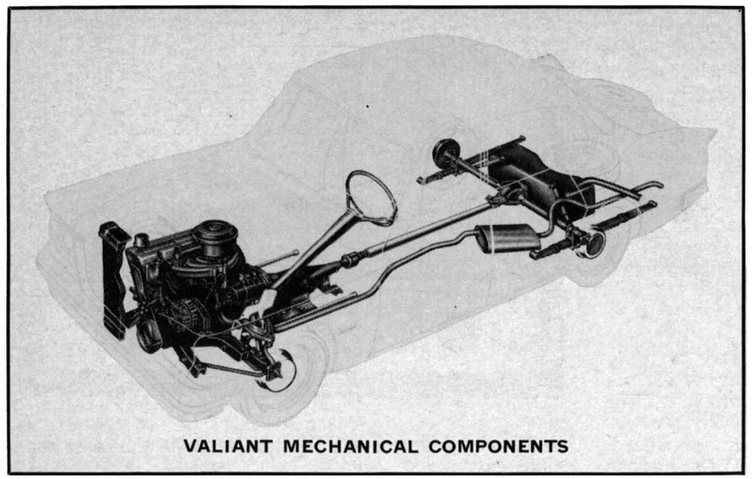
The plenum chamber not only carries all heating and ventilating air, but also boxes in the cowl for added strength. The front fender side-shields protect the engine from road splash and, in addition, act as vital front-end structural members. Everywhere throughout the body are these evidences of dual-purpose engineering.

The hood is reinforced with webs of stamped steel which provide it with excellent rigidity. A solid inner panel, shaped and cut out in the center, gives the trunk lid great strength.

Sturdy reinforcements are used throughout the lower body structure of the Valiant to carry driving, braking and suspension loads. These take the form of heavy box sections which distribute the major road forces to broad areas of the body structure, spreading them out so that each part of the car carries its share of the total load.

A welded structure ahead of the cowl consists of deep-section shear panels reinforced along their lower edges by big box-section rails. These panels are connected by a welded-in radiator yoke to form a structure of tremendous





VALIANT MECHANICAL COMPONENTS

torsional rigidity which transfers loads to the cowl and the remainder of the body structure.

Efficient box sections are used throughout the body. All door pillars, sills, roof rails, windshield headers and belt-line rails are fully boxed to provide the maximum strength for the amount of steel used.

Over 5300 spot welds and seam welds are used to join the hundreds of steel stampings. Only two structural members are bolted in place. One is the K-shaped engine-support cross member, and the other is a short member which supports the transmission. Non-structural parts like the front fenders and grille are not welded in place, but are attached with bolts for ease and low cost in repairing collision damage.

Rustproofing

Each body is subjected to the most intensive rustproofing process ever used by the industry. Three major factors are involved in the Valiant's corrosion protection. First, the metal of critical body areas is thick, particularly in the sills and underbody, providing prolonged life. Second, the body protective coatings are applied in seven separate dipping operations, supplemented by six intensive spray applications. Third, these protective coatings include a newly developed water-thinned primer that is said to be far superior to any primers ever before developed for this purpose.

Tremendous attention has also been given to reducing interior noise and vibration. An item that might be overlooked is the "sculpturing" in the roof and fenders—this contributes to rigidity and absence of drumming. The simulated rear wheel cover serves a similar purpose. Another small but important item is what Chrysler calls "a keyhole grommet." In essence, this feature concentrates all wires and cables that pass through the dash panel into a single channel. A vinyl rubber cover plate snaps over the opening and gives a tight, soundproof seal.

In all, some 54 lb of sound deadener is sprayed on the inside of this body, and the factory undercoating (optional) adds another 33 lb.

Water sealing also received unusual attention during the design stages of this body, as evidenced by the Valiant's double barrier system. All seams and joints of the structure's outer surfaces are designed to simplify the task of sealing during assembly. After assembly, these seams are readily accessible for inspection and are easy to repair. Between the structure's outer and inner surface is a second guard against leakage—an elaborate system of internal traps and drains intended to assure a water-tight car, even after years of service.

Suspension and Steering

Although there is no interchangeability of parts, the Valiant's suspension system is virtually identical with that of the corporation's larger cars. At the front we find the usual ball-joint independent arrangement with torsion-bar springs, anti-dive geometry and a raised roll center. At the rear there are asymmetrical leaf springs to reduce acceleration squat. A small rubber buffer over the differential pinion nose gives the axle assembly an extra tilt at the extreme bump position and so allows a lower drive line, resulting in a lower rear-floor tunnel. All suspension units, front and rear, are rubber insulated.

A most important innovation in the ride department is a new tuning-fork application, in which the engine mass is used to cancel road shock. The front engine mounting is extremely flexible, up and down. This mount employs rubber in shear and is so "tuned" that the entire engine will vibrate exactly out-of-phase with any chassis motion. In this way the engine effectively damps out the majority of road-induced vibrations.

The steering gear is a re-circulating ball-type with every known anti-friction device incorporated, including needle bearings for the pitman-arm shaft. The steering column has a fully enclosed universal joint.

The Engine

With oversquare cylinder dimensions of 3.40 x 3.125 in., the powerplant is a completely new design and is, in fact, the first 6-cylinder ohv design ever produced by Chrysler. An enlarged version of this engine (one inch longer stroke, 225 cu in.) will be used in the Plymouth and Dodge Dart, but for the Valiant a piston displacement of 170 cu in. was deemed sufficient. This means that the smaller Valiant engine is somewhat "over-designed" and is, as a result, heavier than it might have been. As an example, the 4 main bearings are no less than 2.75 in. in diameter and the resultant crankshaft weighs about 65 lb.

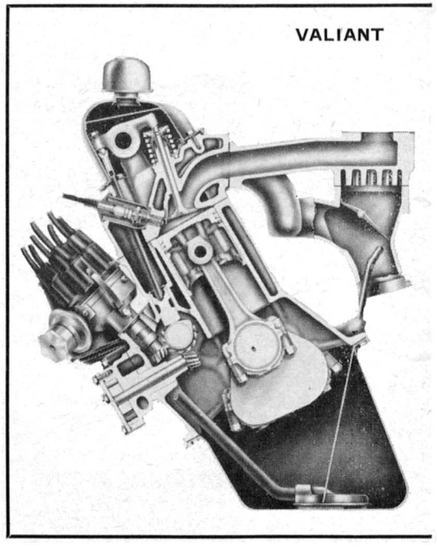
Nevertheless, this engine has been made as compact and light as possible. Both the block and head are cast-iron, but good design practice in the proper disposition of material has kept the weight slightly below that of the former L-head (side-valve) 6. The block has two interesting features: 1) the usual stamped-steel side cover has been eliminated, and 2) the lower split-line, or gasket surface is .875 in. below the crank centerline, thus giving considerable extra rigidity and simplifying the oil pan seals. An interesting weight-saving feature found in the head is the use of stamped steel wells to form pockets for the spark plugs. (See cross-section.) Weight has also been saved by holding wall thicknesses to close tolerances and by the use of aluminum in such parts as pistons, intake manifold, water-pump housing, oil-pump housing, oil-filter pad, water-outlet elbow, distributor body and alternator housing. In addition, the clutch housing, manual transmission extension (but not the case), and entire automatic transmission case (which includes the torque-converter housing) are aluminum die castings.

As already noted, this powerplant is tilted 30° from the vertical so that the cylinder head is several inches to the right of true center. Because a normal hood is crowned, this tilt does not give a lowered hood line. The primary reason for tilting the powerplant was to permit re-arrangement of the accessories so that the engine could be located farther forward. The water pump is on the side of the engine and the fan blades sweep very close to the block. The net result is a very compact unit (for an in-line 6) in terms of radiator-core to front-of-dash space. An incidental advantage of tilting shows up in the intake manifolding, for here unusually long passages were desirable for their ram-effect. This would be awkward to achieve with a vertical engine. The manifold, by the way, is somewhat similar to the designs used for many years by Hudson-Essex and White Truck (though somewhat longer). An exhaust-heated hot-spot is provided, and, with aluminum as the material, plus heat pick-up fins, warm-up time should be short. The exhaust manifold is, of course, cast iron and it features very easy bends due to the extra room provided by the long intake manifold branches. The carburetor used is a single-barrel, downdraft Carter, with automatic choke.

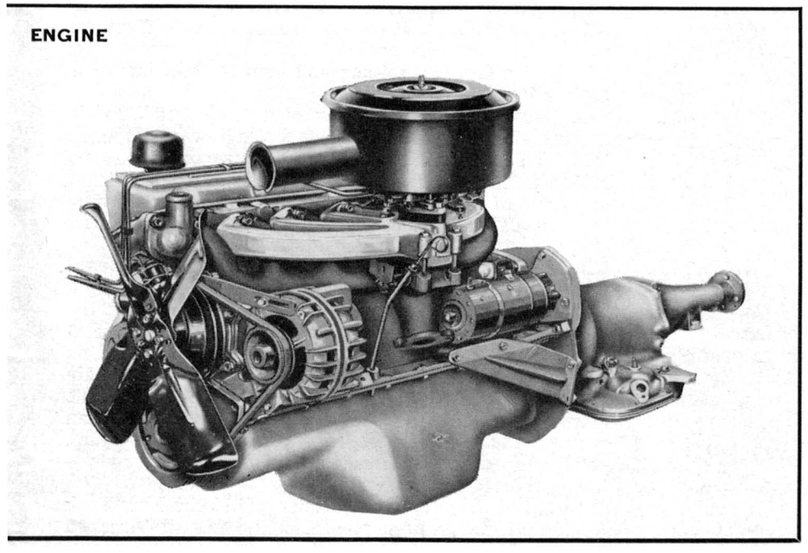
Combustion chambers are the usual wedge shape and the compression ratio of 8.5:1 is said to permit the use of regular grade fuel. Because the bore is large, it follows that the valves are large, yet properly cooled via water passages which completely surround each valve seat.

With good breathing provided, special care was taken to achieve a lightweight valve gear which will allow engine speeds of over 5000 rpm. The short pushrods have already been mentioned. The rocker arms are very light sheet metal stampings. Tappet clearance adjustment is by self-locking screws, since there is no automatic hydraulic lash mechanism. Quieting ramps on the cams allow settings of .010 for intakes, .020 for exhausts, hot. Synthetic rubber umbrellas prevent oil from being sucked into the combustion chambers via the intake valve guides. The exhaust valve locks are a 4-bead design and these allow free valve rotation during the interval of no-lift.

Miscellaneous engine items include full-pressure lubrication, full-flow oil filtration and a 4-quart oil capacity. A rubber-bonded type vibration damper is used as a part of the front crankshaft pulley. The new alternator, which replaces the usual d.c. generator, weighs only 12 lb and at idle speed (500 rpm, crankshaft) the output is 10 amperes instead of the usual zero output of old-style generators. Maximum d.c. output is 35 amps with a voltage regulator setting of 13.7–14.3 volts and is available at a speed as low as 30 mph.



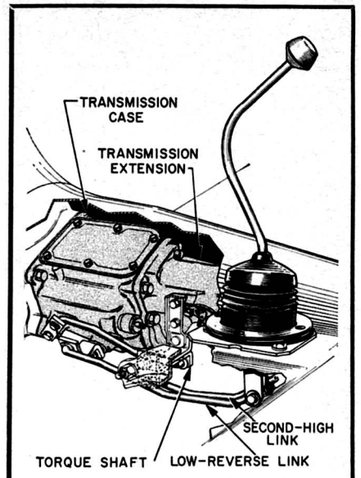
VALIANT ENGINE



The Transmissions

Two transmissions will be available on the Valiant, a conventional 3-speed manual unit and an extra-cost automatic. The manual transmission is an entirely new design, of light construction, as permitted by the small engine. It has helical gear teeth (for silence) throughout, with a sliding low and reverse gear and the usual blocker-ring synchronizers for 2nd and high. A sporting type floor-mounted control lever gives positive, direct actuation. Incidentally, this assembly is bolted to the aluminum clutch housing so that it tilts 30° from vertical in the opposite direction from the tilt of the engine (thus, the included angle between engine and gearbox is 60°). This put the side-mounted shift levers a little lower and out of the way of the close-fitting tunnel housing. Short external control rods run forward from the wobble-stick to the side levers, preventing the transmission of engine rock to the hand control lever.

The automatic transmission of the Valiant differs radically from the "other two" in that it has 3 speeds forward instead of 2. In principle this unit is identical with Chrysler's Torque-Flight, with push-button control. In design, however, the Valiant Torque-Flight is completely new, smaller in size and over 100 lb lighter than the unit used with the firm's



VALIANT MANUAL TRANSMISSION

big V-8 engines. Housed completely in aluminum, it weighs only a few pounds more than the standard transmission.

Since the automatic has 3 speeds, performance should very nearly approximate the accelerative ability of the standard transmission. In first gear, for example, we have the double multiplication factor of gears and converter. Breakaway torque and acceleration from a standstill should be better than with stick shift. Since the converter becomes a low-slip fluid coupling at high rpm the lower numerical gear ratios should give higher maximums in first and 2nd. However, the auto-shift points are pre-set to minimize engine noise or buzz and a well driven stick-shift car can always beat an automatic in overall performance.

The Drive Train

The propeller shaft of the Valiant follows previous Chrysler practice by using a sliding trunnion-type universal joint in front to eliminate slip-splines. The usual cross-type joint is used at the rear. A floor tunnel of very modest size covers the drive line and also serves as a passage for the exhaust system.

The rear axle is specially designed for this car. Though not new (except to Chrysler) it uses the Spicer style of center section, consisting of a large differential casting with axle tubes pressed into it. The drive pinion is the large offset type which lowers the propeller shaft and tunnel.

Conclusion

The most refreshing portion of the Valiant story is the fact that Chrysler's answer to the demand for a more sensible, more practical automobile does not coincide with that of its competitors. The most encouraging sign of all is the meticulous thought and careful planning which went into the development of the Valiant.