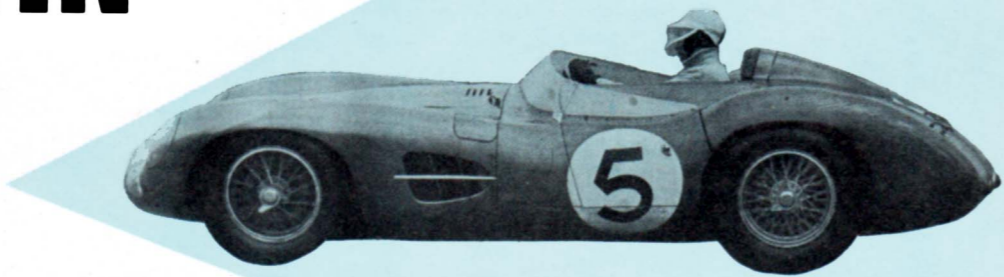


ASTON MARTIN DBRI 300



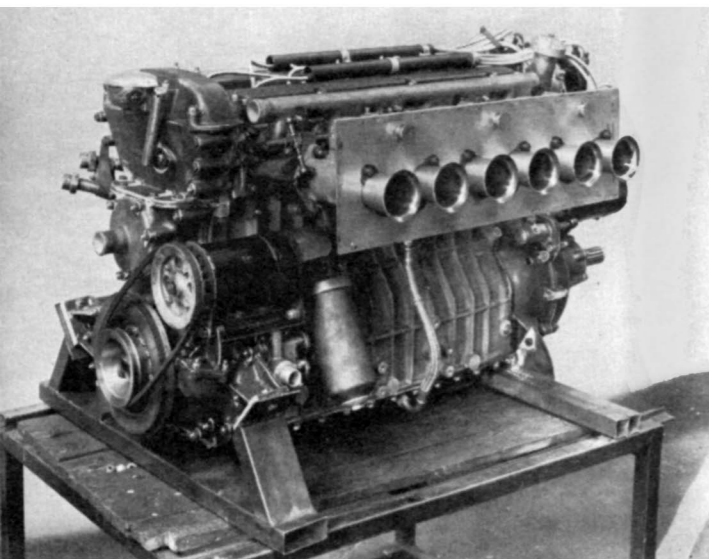
SCI Technical Report:

by Karl Ludvigsen

ENGLISH cars and a gent from Huddersfield named David Brown attained a long-sought goal. Since the war this balding, bespectacled industrialist has spent hundreds of thousands of pounds on machinery to perpetuate the name "Aston Martin", and on May 26 he had the pleasure of watching the latest Aston race car trample the cream of the Italian sports machines at one of the world's most trying road courses: the Nürburgring. His drivers were the impeccably fast Tony Brooks and newcomer Noel Cunningham-Reid, young men who had been groomed for Aston's racing program by Team Manager Reg Parnell and also by his predecessor John Wyer, now General Manager for David Brown Automobiles.

It was an all-English victory; but it was not important for that reason alone. Since the war, Jaguars have dominated fast courses like Le Mans and Rheims. Britain's own short sprint and club races are the province of home-grown iron like Lister and Tojeiro, while Cooper and Lotus must be reckoned with in any class under two liters. Yet through it all there's been no English car that challenged the eminence of German and Italian cars in the bulk of the world's classic sports car races: the 'Ring, the Mille Miglia, Targa Florio, once the Tourist Trophy and Mexican Road Race, and now Sebring.

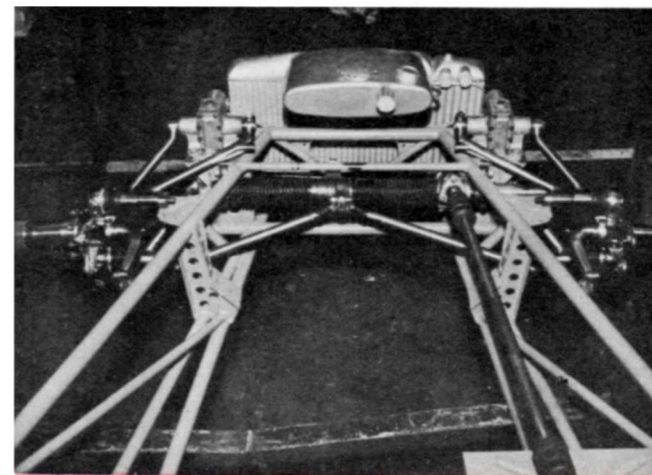
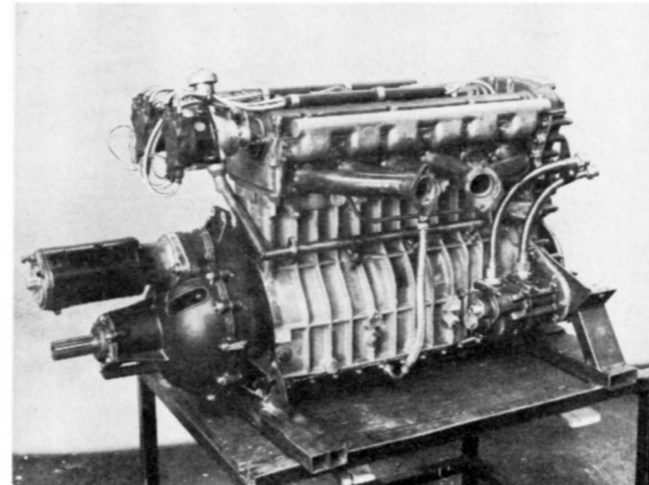
These and similar events can only be contested by well-balanced all-round sports-racing cars, on the order of the 300SLR Mercedes or 300S Maserati: not too big and not too small, with no more power than can be used and excellent suspension to keep it all on the road. With the possible exception of some HWM sports cars, Aston Martin



After hotting up the production engine as much as they could, the factory did what others can't, and cast themselves a new and sturdier crankcase.

Frontal area is reasonable for a 3 liter machine, drag coefficient would appear to be especially low.

Twin distributors on tail end of twin cams should ensure adequate spark; large economy size pumps should do likewise with the oil pressure.



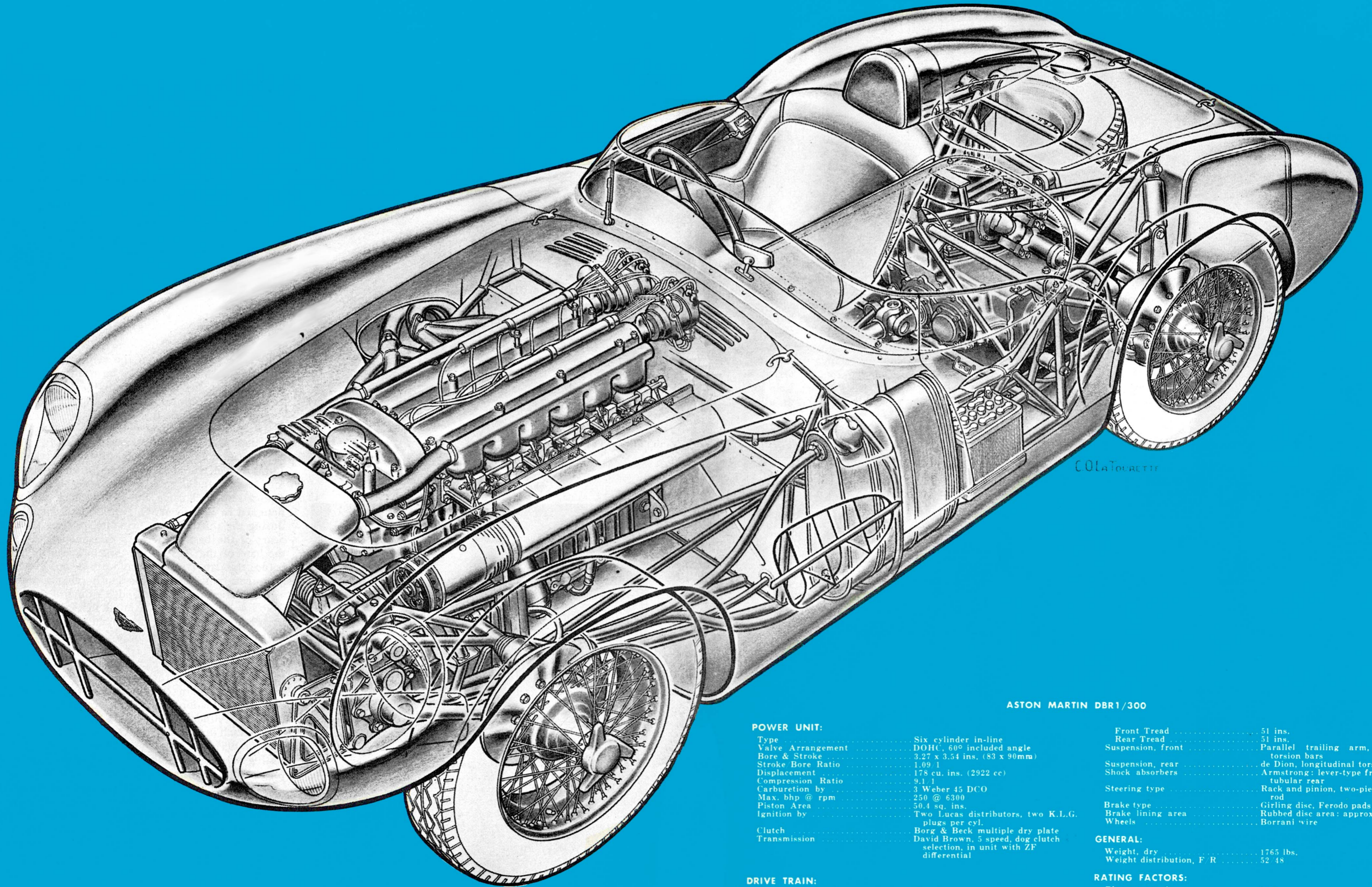
Upper trailing arm (or wishbone) operates piston-type shock absorber directly; lower ones are each attached to transverse torsion bars running full width of frame and held in special trunnions. All joints of the rack and pinion steering are protected by accordion-type rubber seals.

was the only English outfit to pursue this goal sincerely. They were always just on the verge, and whether or not they follow through, it must be recorded that they made the grade in May. And the car, the DBR1/300, is a nice piece of design, drawing heavily from the past and pointing significantly to the future.

By the year 1948 the David Brown Companies (builders of Cropmaster and Trackmaster tractors, transmissions, axles, gears and gear cutters, steel castings, and once the Lucas Valveless and Dodson cars) owned the assets of Aston Martin and Lagonda. The latter boasted little more than a respected name and a promising prototype engine designed in 1945 by W. O. Bentley, famed for his creations during the thirties. This twin-cam 2½ liter six became the heart of the best postwar Astons, and is still recognizably the base of the RI's engine. Much heartache was endured before this latest version was worked out, however, and it does seem possible that too much reliance was placed in a basic design that was intended primarily for touring and which was produced by a mind that may have been past its prime. Ten years of development are justified only by a truly exceptional design, which, for example, the XK Jaguar can claim to be.

Features of Bentley's engine that remain in the Aston RI are the twin overhead-cam layout, valve angle and actuation, and chain cam drive. Early racing versions and current production Astons have cast-iron heads with one plug per cylinder and a single water outlet between the cam cases. This is just as W. O. laid it out. Around Le Mans time in 1954, the head was worked over in detail to allow casting in aluminum alloy and double the number of spark plugs, to be used in the competition cars only.

As such units go, the head is narrow and has very short built-in ports. It's deep, however, and a lot of water contacts the plugs, valve seats and valve guides. All the guides themselves are wet, pressed in place and partially retained by the inner-coil valve springs. Valve operation is very much like that of the Jaguar, with cup-type tappets shrouding the coils, but clearance adjustment is by selective assembly instead of shims. Valves are inclined at 30 degrees either side of the cylinder center line, giving a shallow combustion chamber and minimizing shrouding of the open valve. A thoughtful feature for production and maintenance is the use of a common horizontal plane for the



ASTON MARTIN DBR1/300

POWER UNIT:

Type Six cylinder in-line
 Valve Arrangement DOHC, 60° included angle
 Bore & Stroke 3.27 x 3.54 ins. (83 x 90mm)
 Stroke Bore Ratio 1.09 : 1
 Displacement 178 cu. ins. (2922 cc)
 Compression Ratio 9.1 : 1
 Carburetion by 3 Weber 45 DCO
 Max. bhp @ rpm 250 @ 6300
 Piston Area 50.4 sq. ins.
 Ignition by Two Lucas distributors, two K.L.G. plugs per cyl.
 Clutch Borg & Beck multiple dry plate
 Transmission David Brown, 5 speed, dog clutch selection, in unit with ZF differential

DRIVE TRAIN:

Axle torque taken by Chassis

CHASSIS:

Wheelbase 90 ins.

Front Tread 51 ins.
 Rear Tread 51 ins.
 Suspension, front Parallel trailing arm, transverse torsion bars
 Suspension, rear de Dion, longitudinal torsion bars
 Shock absorbers Armstrong: lever-type front, tubular rear
 Steering type Rack and pinion, two-piece track rod
 Brake type Girling disc, Ferodo pads
 Brake lining area Rubbed disc area: approx. 500 sq. in.
 Wheels Borrani wire

GENERAL:

Weight, dry 1765 lbs.
 Weight distribution, F/R 52/48

RATING FACTORS:

Bhp per cu. in. 1.40
 Bhp per sq. in. piston area 4.96
 Pounds per bhp-dry 7.06
 Piston speed @ max. bhp 3720 fpm
 Brake lining area per ton 562 sq. ins.

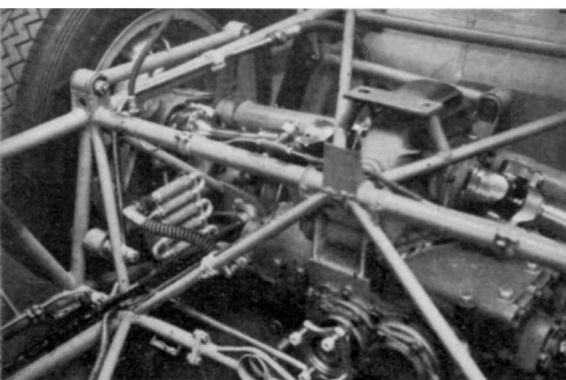
Only the minimum number of Protrusions and holes mar the DBR's smooth shape.



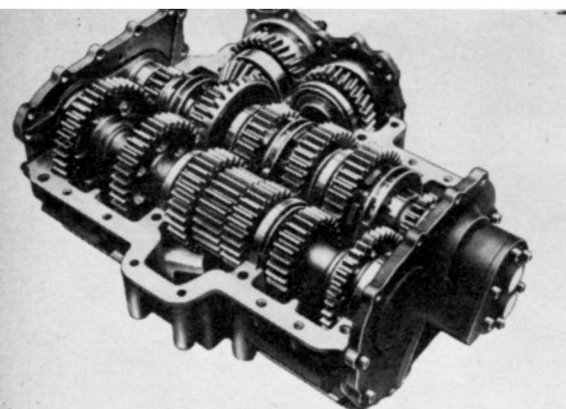
parting lines of cam bearing caps and housings on both sides. This simplifies head machining and assembly.

Unique for a six, in our book, is the water outlet system in the redesigned head. A neat manifold along each side collects hot water from six oblong ports just above the intake and exhaust openings and ducts the flow forward into a tee, from which one short hose feeds into the header tank. They tried two separate hoses to the header, but that wasn't the answer.

Once pioneers in the use of Solex twin-throat side draft carbs, Astons are now back to the standard fixtures: Webers. Three 45 mm double-bodied units are carried a short distance from the head by fabricated piping. Cool air comes from the low snout via a flexible pipe and an alloy



To keep oil temperatures low the hard working differential-gearbox has its own radiator as well as an oil pump. The short panhard rod and the two right side radius rods may be seen in the background.



The works of the gearbox are viewed here from the rear. Spur gears which offset the pinion shaft also permit ratio changes in the final drive to be made without tearing the whole shebang apart.



The very neat cockpit layout indicates the thoroughness of the car's planning. All the electrics are mounted on panels for instant access. The shift lever has a proper gate in the vintage tradition.

balance box. Exhausting is equally familiar, with two short, separate manifolds and twin pipes coming down through the right fender and under the door. Three big holes chopped down there look hairy, but draw heat away from the nearby driver.

To set off its twelve plugs, the alloy head was laid out to include two Lucas distributors driven from the back ends of the cams. Most of these cylinder head refinements were carried out on the DB3S series Astons during 1954 and 1955. In 1956 a lot of research was funneled into the cast iron block, which was the main anchor that W. O. Bentley had hung on the Astons. It was too heavy and too high; it didn't adapt readily to dry sump lubrication or direct fuel injection.

Okay, so we'll make it in light alloy, they said. But it wasn't that easy. Often compared to the Offy bottom end, the ex-Lagonda block-crankcase casting was barrel-type, and three of the four mains were supported by split bearing carriers that are bolted together around the main journals before the whole assembly is threaded in from the clutch end of the crankcase. In the Offy, though, each carrier bolts firmly to eight studs in the case, while the Bentley interpretation demands that the machined exterior of each circular carrier mate perfectly with corresponding interior bores. Set screws are used only to locate the carriers.

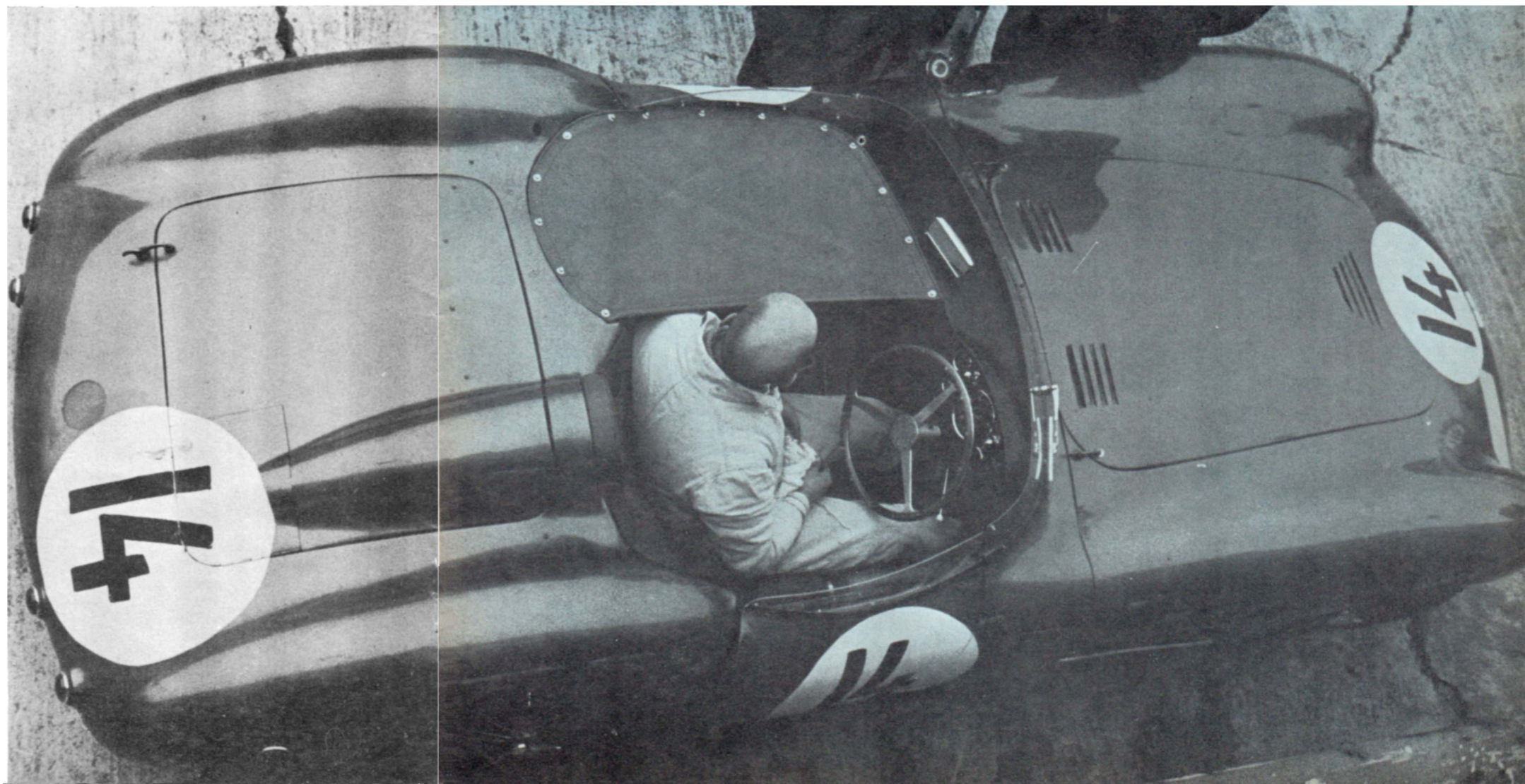
Using alloy carriers in an iron block, as in current production Astons, high temperatures and hard work would

cause the fit to tighten, if anything. This didn't hold when the block was alloy too, unlike the Meyer-Drake version, and satisfactory stiffness and stability couldn't be obtained. Hence a new block design for the DBR1/300. A sage decreed that the old 60 degree head, described above, should fit. (A new head was on the way but progressing slowly. More on that later.)

Main difference in the R1 block, then, is the use of two-bolt caps to support the main bearings. The crankcase sides come well down past the crank center line—virtually as far as did the older block—so the deep main caps can get plenty of side support. A deeply "waffled" exterior makes the new block look grotesquely different, but it actually resembles the old one very much in general layout. This was, of course, dictated by adaptability to the older head, and it was decided to use the old crankshaft forgings as well. Since old W.O.'s cylinder spacing was quite close, both these requirements blocked the installation of seven instead of four main bearings—a step that might have lengthened the life span of this engine. As it is, the mains are 2½ inches in diameter and very wide, while the two inch rod journals are nearly the same width. Just enough room is left for thin connecting webs and three big counterweights. It's plenty husky as long as the boys refrain from revolving it more than 6300 times per minute. But then the figure used to be 6000.

(Continued on page 60)

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A McGRAW-HILL BOOK

Elkart Lake

(Continued from page 59)

at Road America, they had covered 480 miles. Hill, in eight minutes and thirty seconds more than six hours, covered 500 miles. He averaged 81.4 miles an hour. His fastest lap was a 2:49.3.

The speed trap at Road America, set up along the short back stretch, revealed some interesting data on the different way the different cars attack this circuit. The D-Jags, Charlie Wallace in particular, clocked the highest speeds through there reaching 135.9 (this, mind you, is an average involving some acceleration out of one corner and the braking for the right angled number five corner, (it is not a top speed). Hill went through the traps consistently at around 121 miles an hour. The difference is in the braking. Ferrari's notoriously hard brakes are not meant for the short stop-and-accelerate courses that are characteristic of American road racing. Hill has learned to baby these brakes (one good charring from improper application and they are gone). For the first corner, for instance, he was backing off just after the start-finish line and touching his brakes first at the number five marker. (Porsches, for instance, could sail full bore up to four or even three before worrying about the matter of slowing.) "How fast could you go if brakes were no concern?", he was asked after the race. "Oh, 2:40, 2:41, maybe, for one or two laps," he said.

The 1-2-3 boys — Hill, Shelby and Crawford — all drove the entire distance unassisted. Each made two pit stops. All won their respective classes, and Crawford, who was particularly impressive in the Glenn Carroll-prepared Porsche, also easily won the handicap trophy.

Other hardware collectors for the day: First in Class B, John L. Haas/Robert H. Roloson (Corvette); first in Class E, Ebbv Lunken/Jim Kimberly (1.9 Ferrari). Kimberly's two-litre Maserati went out after a few laps with Jack McAfee at the wheel. A broken valve spring apparently. Class G, Dr. and Mrs. M. R. J. Wylie (Lotus).
Denise McCluggage

Aston Martin DBR1 300

(Continued from page 37)

Bentley's 1945 concept included a two-stage roller chain-drive for the cams, the intermediate sprocket located just below the top of the block and serving also to drive the water pump, which is carried in the cast timing chain cover. The new block was laid out to take the first—or lower—chain stage, and the water pump position is substantially as before. When the 60 degree head is fitted, as in this DBR1/300, the upper chain stage is simply added. For the new head under development, or any further projects, it is equally simple for the intermediate sprocket to drive a positive train of two gears to each cam. This

(Continued on page 61)

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Aston Martin DBR1 300

(Continued from page 60)

was done very neatly on one experimental engine.

Just as in the iron block, the water pump feeds a duct cast along the top of the exhaust side of the block. This directs the coolest water where it's most needed, and allows the coolant around the liners to circulate by convection only. Speaking of liners, they seem to have undergone some change. The Lagonda design, like Triumph and Alfa Giulietta among others, had flanges at top and bottom of the liner, which was compressed into place and sealed by the cylinder head alone. To relieve stress on the centrifugally cast wet liners, David Brown's engine team adopted Ing. Jano's neat Lancia solution. The liner is firmly clamped by a flange at the top only; the bottom end hangs in an appropriate bore and is sealed by "O" rings.

Dry sump lubrication was set up conventionally with a single pressure pump and double scavenging unit. Like the D Jag, oil is cooled by a radiator block to the right of the Marston water unit.

Perhaps in connection with some of David Brown's broader industrial interests, Wyer's crew adapted a C.A.V. diesel injection system to one DB3S engine with a 60 degree cylinder head. A colossal Mercedes-style air box was riveted up, with an air valve at the front end and ram tubes to the ports. Injection nozzles were out in the air box and aimed down the ram tubes, which looked like rather the long way around, but apparently someone is satisfied. The engine *has* performed fairly well in a DB3S. Like most technicians today, however, Wyer feels that fuel injection must be designed into an engine, and this may account for the recall of the 95 degree cylinder head that was first announced for the DBR1 series. This head was a nice enough rig, with exhaust valves inclined more than intakes, twin ignition, revised water circulation and the abovementioned gear cam-drive, but it just couldn't produce enough more beans than the older head to warrant a reliability risk. We think the Aston Martin boys have returned to the back room to devise something that will be more worth the trouble—perhaps direct injection and positively-closed valves. These days a new three liter engine should be in the 280 horsepower bracket, and thirty more ponies could easily be harnessed by the 'Ring winner's chassis.

To contrive a framework for Bentley's engine, David Brown had hired another renowned designer from the same era: Prof. Dr. Ing. Eberan von Eberhorst. First famed for his association with Dr. Porsche and for most of the design work on the 1938 Auto Union Grand Prix car, Prof. Eberan seemed a good choice to create the DB3 Aston Martin competition sports car. As it appeared in 1951, its big-tube frame, trailing arm front end, steering geometry and de Dion tube location were twins to that Auto Union car. For the DB3S the

(Continued on page 62)

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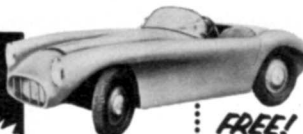
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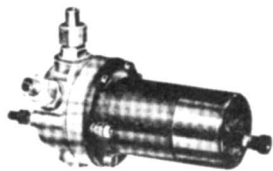
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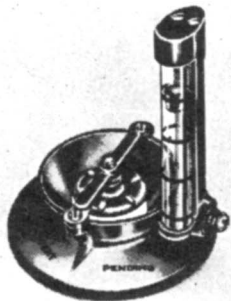
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Aston Martin DBR1 300

(Continued from page 61)

de Dion placement was changed from a Panhard rod to a vertical slide to eliminate snaking on bumpy straights, the same advantage with less friction given by a Watt's linkage on the DBR1/300. The two big tubes have now given way to a chromoly truss frame, with a 60 pound cut in weight. The front end and steering remain, though wishbone layouts are under trial.

Sufferance was probably granted the front end because it was greatly improved from Auto Union days. One problem then was change in camber under heavy braking, thanks to weak upper trailing arms. Eberan's Aston design—with triangulated upper arms embracing hydraulic shocks—was the perfect answer. A torsion anti-roll bar, thin because of its shortness, connects those arms at the pivots. The bottom arms, single but heavier, turn in two big-needle roller bearings each and are connected by spherical blocks to transverse torsion bars. To get these in they had to be crossed, Kurtis-fashion, with each anchor above the opposite pivot. A single casting at each side takes all the stresses from arms, shocks and anchors, and feeds them into the chassis through six bolts. This structure, and the ball-jointed steering knuckle, is unchanged after six years.

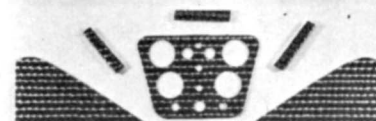
The same can be said of the steering, which features a rack and pinion gear and a split, two-piece track rod. Now, as before the war, this still causes mild wheel fight in bumpy cornering. But the precision and simplicity seem to be worth it.

Taken by itself, the light, neat truss-type frame looks strong enough in bending but weak in torsion, especially from the stressed-sheet cowl forward. It would be weak if the engine and rear-mounted gearbox weren't bolted down firmly in a calculated manner.

Just aft of the front suspension on each side are two mounts, welded to drilled pillars. At the center of the firewall is a rectangular opening, into which a special separate clutch-housing casting is bolted at three points. A group of studs spaced on the back of the block in the shape of an inverted "U" attach the engine to this casting. The clutch within is a small-diameter dry multiple-disc rig developed for English race cars by Borg and Beck, and the starter motor protrudes out to the rear, above the drive shaft. Torque and engine rpm are carried back by a conventional Hardy Spicer prop shaft.

Rear suspension on the DBR1/300 is entirely new and very well worked out, having the "Lotus-like" quality of the frame itself. A two-piece de Dion tube is bolted together at the center, forming a vee behind the final drive unit. The hubs and most other fittings are welded up of light sheet stock, as very little meat is needed to support the Girling disc brake calipers. Parallel trailing arms on each side guide the hubs up and down, working in wide rubber bushes. Lateral loca-

(Continued on page 63)



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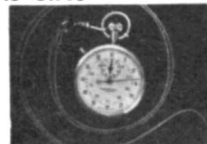
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Aston Martin DBR1 300

(Continued from page 62)

tion, as mentioned, is by a Watt's linkage, with the vertical member straddling the axle tube in the center, and the guiding rods extending to each side of the frame. This locating method was used by Ray Martin on the 1953 Cooper-Alta for Stirling Moss, and a parallel development to that on the Aston appeared on the 1956 Alfa Romeo "Sportiva." In the G.P. field Vanwall is an adherent, while Connaught, BRM and Kurtis use variations on the theme. It has, in other words, been accepted.

Eberan's Astons had rear torsion bars across the frame, but the R1 has slightly longer bars placed lengthwise with levers at the back ends connected to the hubs by links. Shocks are Armstrong tubulars, placed well behind the hubs. Perhaps needless to say, every last chassis nut is split and cotter-pinned in place.

All these suspension parts are grouped respectfully around a monumental-looking final drive aggregation. As David Brown Industries are in the transmission business in a big way, the postwar Aston gearboxes have always been handsome in appearance and smooth to handle. Perhaps due to unfamiliarity with operating conditions over a rev range double that of commercial vehicles, however, some of the racing boxes and rear ends have tended to fall apart. There has also been much variation from car to car.

The DB3 had a synchronized five-speeder laid flat, in unit with the engine, and a hypoid rear end. With but four speeds and synchro, the DB3S box was arranged vertically and drove a spiral bevel gear set. Now the DBR1/300 appears with five constant-mesh (spur, not helical, to reduce thrust bearing complications) ratios selected by dog clutches, and a general layout reminiscent of the 1937 Mercedes W125 final drive. So far, this new box has not distinguished itself, apart from the outings in May, since it broke on the DBR1/250 prototype at Le Mans last year, and shed several cogs on both R1/300's in the latest 24 hours. It started to go bad in the Empire Trophy last spring, but didn't have enough time.

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(Continued on page 64)

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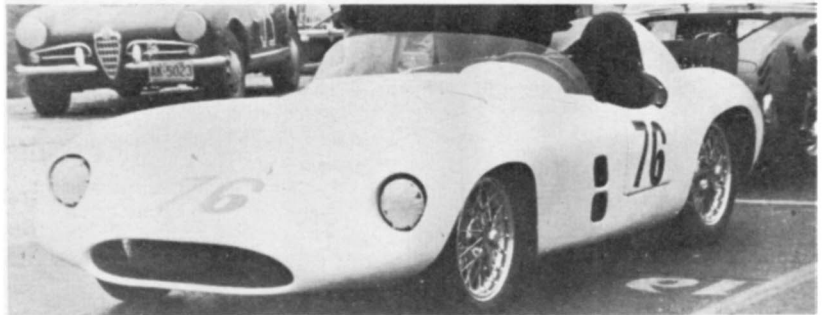


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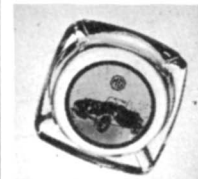
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Aston Martin DBR1 300

(Continued from page 63)

a gear-type oil pump which circulates lube through a small gilled-tube cooler in the right rear wheel well. The shifting rails are interlocked with a valving system, which directs oil under pressure only to those gear sets that are under load.

An elaborate gate up in the cockpit overwhelms the stubby lever and, Mercedes-like, has a system of sliding bars to guide the unwary driver through the five ratios. Most handlers so far have praised the ease and speed of shifting this box—when it lasts through the race, that is. The fully-machined half-shafts have Hardy-Spicer universal joints and splined couplings. Hung from one point high in the front and two lower down in the rear, the transmission contributes a lot to frame stiffness.

Moving the five speed box to the rear was more in accord with modern thoughts on weight and mass distribution—with which Prof. Eberan did not fully concur. Without fuel, which is stored right in the tail in Gallay tanks, both the DB3 and DB3S had about 56 percent of the weight on the front wheels. This, plus the suspension layout, gave them a basic understeer which allowed genuine drifting. But due to a low polar moment of inertia (engine in unit with gearbox, placed well back) the machines were still *oversensitive* to control in some high-speed situations. A dry DBR1/300 now has 52 percent of the weight carried at the front, and a much higher polar moment of inertia. As a result it's better than ever, especially on fast bends like those at Spa; and with Brooks it outhandled everything at the Nürburgring.

Always faithful to Girling, Aston Martin waited until 1955 before appropriate disc brakes were available, but since then the simple single-spot units have been used exclusively. In '56 they were modified to allow 45-second replacement of the thick Ferodo pads. At first specially offset Dunlop wire wheels were required to leave room for the discs and calipers, but for the DBR1 Borrani wheels have been specified. For some time Astons have enjoyed the complete attention of the Avon Tire Competition Department: Avon serves only Aston, and Astons use no other tire.

We cannot recall having heard one nasty remark about the looks of any Aston Martin—styling is a big factor with them, even on the starkest racing car. Body designer Frank Feeley gets credit for many jobs well done. One instance of apparent confusion was the front end of the DBR1/250 prototype (Le Mans, 1956), but the shapes were perfectly cleaned up for this year. Aerodynamics are always sound enough, though mainly in the "draw, cut and try" class.

The shell of the latest car is pounded out of aluminum-magnesium alloy sheet

(Continued on page 65)

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Aston Martin DBR1-300

(Continued from page 64)

and hung on a light tubular framework. Dzus fasteners are used wherever practical, such as on sections of the belly pan. All the body shapes seem to be clean except for one quirk that manages to bend water from the wheels into the cockpit on a wet track. Smith instruments decorate the typically English dash, which features a mammoth 8000 rpm tach and smaller dials for charging, water and oil temperatures, and oil pressure. Pivoted from the floor, the drilled brake and clutch pedals are bracketed by the accelerator and by a "dead pedal" for bracing the left leg.

End product of all this is a versatile competition car which must now be reckoned as a threat in any major sports car race. While in full agreement with present design trends, it happily includes many typically English ideas. It isn't mere slavish tracing of the Italians. Though not yet fully proven, the DBR1/300 seems to be more than a match for the 300S Maserati, which would mean that the English have the fastest three liter sports car going. In all probability the DBR1 series will be the basis for Reg Parnell's competition program in the near future, and there may be the embellishment of a newer engine, as discussed. There's also the DBR2 to consider, but this is literally another story which seems to us to have less lasting significance than the R1, though it is more likely to succeed as a basis for a production car.

"No comment," was John Wyer's quick answer when asked if Aston Martin had a Grand Prix car in the works. However, you may recall the *Formule Libre* single-seater with which Parnell snuck off to Australia over a year ago. You may also note how suitable the DBR1 suspension parts and gearbox would be to a G.P. car, and that next year's Formula is for 2½ liter cars *on gas*, with which Wyer's crew have plenty of experience. That heavy engine block was always an obstacle, but now that it's been given a diet . . . it's all up to David Brown, of course; but at this rate he'll soon have a new world to conquer!

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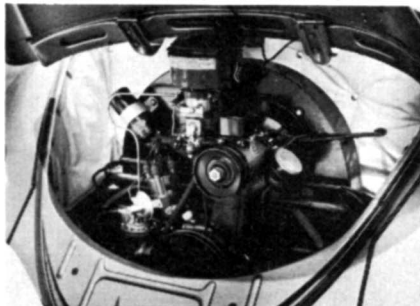


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