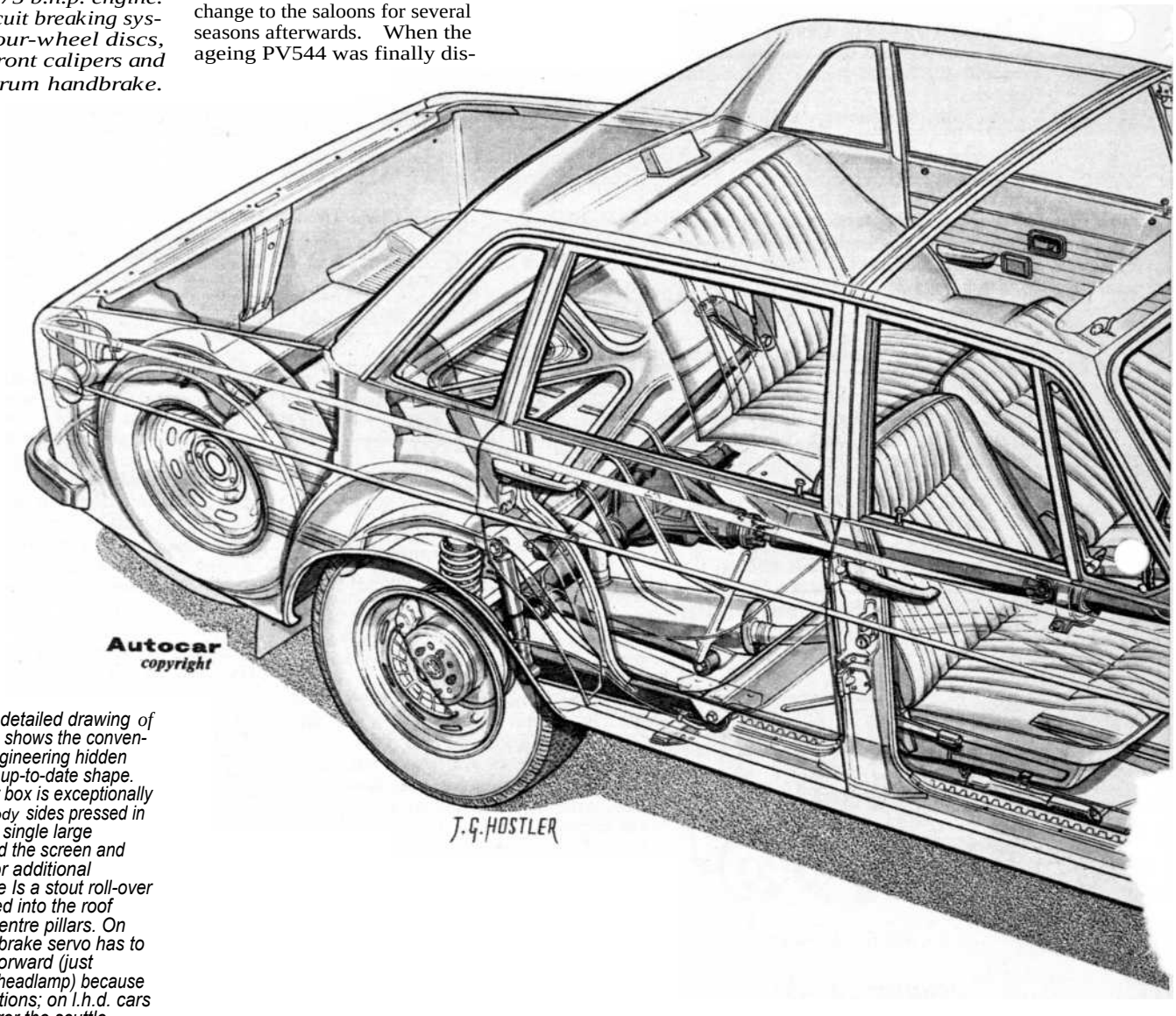
**DESIGNS ANALYSED-6**

# VOLVO 144 1,778 c.c.

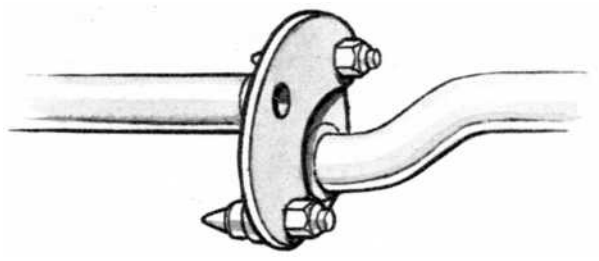
*FIRST really new model from Volvo for several years. Mostly well proven mechanical assemblies are used, with suspension revised and developed for the bigger, heavier car. - Safety foremost in the designers' minds, particularly in body engineering and disc brake layout. Roomy, well-planned interior with thoughtful touches and additional safety features. Volvo 144S with 100 b.h.p. likely to be most popular in Great Britain but the 144 has single carburettor 75 b.h.p. engine. Divided circuit breaking system with four-wheel discs, twin-spot front calipers and separate drum handbrake. Overdrive or automatic transmission optionally available. Many important British components. A Swedish design intended to sell world wide*

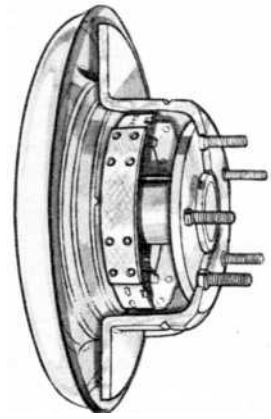
SINCE 1956 the Volvo saloon car range has been based on two cars, when the PV544, developed from a design first shown in 1944, was supplemented by the more modern 120-series Amazon design. Though the well-known 1800S sports coupe` was released in 1961, there was little change to the saloons for several seasons afterwards. When the ageing PV544 was finally discontinued in the winter of 1965-66, rumours of a radically new Volvo began to spread; at the time Volvo had just completed a modern new factory assembly plant in open territory near to Gothenburg airport. At first the new car was reputed to have a completely new engine, and later a 2-litre version of the legendary B18 unit, but when the car was finally announced in the autumn of last year it was seen to have an engine and transmission line closely related both to the 120 series and to the 1800S sports coupe. The 144S, in fact, is the most powerful Volvo yet built, as its 100 b.h.p. (net) power unit is identical with that of the revised 1800S.

Production began in October 1966, and between 3,000 and 4,000 cars were made before the end of the year. For 1967, Volvo plans are flexible, but of a total of about 140,000 cars which are scheduled, only about 10,000 will be 144s. The 144



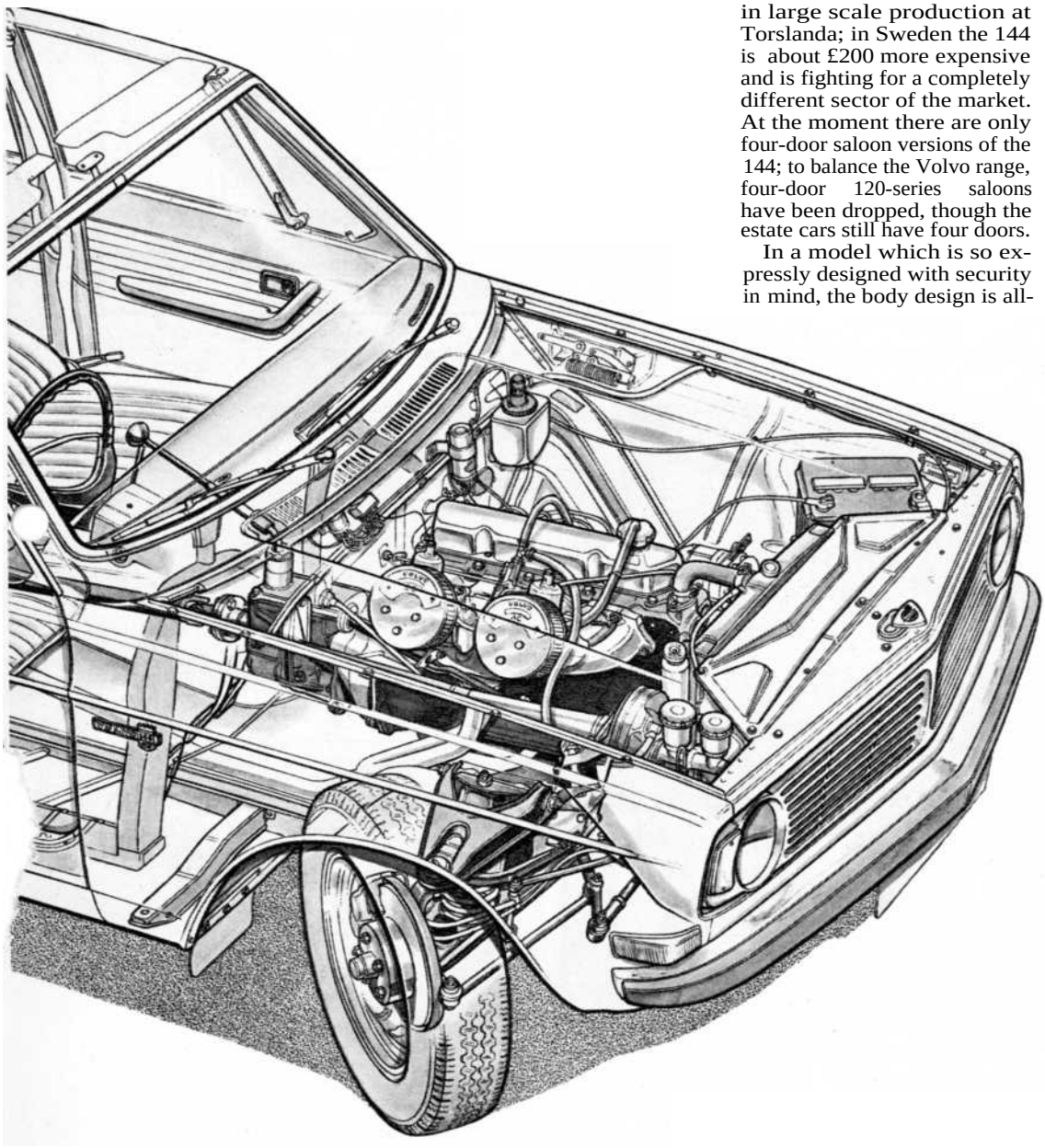

John Hostler's *detailed drawing of the Volvo 1445 shows the conventional Volvo engineering hidden underneath an up-to-date shape. The passenger box is exceptionally strong, with body sides pressed in one piece, and single large pressings round the screen and* rear window *for additional rigidity. There Is a stout roll-over pressing welded into the roof between the centre pillars. On r.h.d. cars the brake servo has to be fitted well forward (just behind the o/s headlamp) because of space limitations; on l.h.d. cars it is much nearer the scuttle. Front* suspension *and steering are mounted on a separate cross-member, but rear suspension trailing arms are attached direct to the underpan. The 144 has a single Stromberg carburettor. Overdrive is optional, as is automatic transmission*





*Above: Simple, but effective. This joint in the middle of the steering column is designed to collapse without transmitting thrust if the column distorts*

*Left: The rear disc brake also doubles as a drum for the separate handbrake mounted inside the hub. The disc calliper has been omitted for clarity*



and 144S will begin to arrive in Great Britain this month; when we visited the Volvo Gothenburg factory in February, a small percentage of right-hand-drive cars was going down the production line.

Though one is immediately struck by close styling similarities with such up-to-date European cars as the Hillman Hunter, the revised Cortina and even the Ford Taunus 20M, the 144 is a completely home-brewed design. As with the 120 series, Norwegian chief stylist Jan Wilsgaard and his temp were responsible for the final shape; only the 1800S sports coupe is attributed to an outside influence-Frua.

Components and the basic design philosophy of the 144 have been mulling for several years, but this basic design was not frozen until 1963. After that date Volvo designers began to refine the car and build in the series of unique safety features for which the car is notable. The car is not meant to replace the 120 series, which continues in large scale production at Torslanda; in Sweden the 144 is about £200 more expensive and is fighting for a completely different sector of the market. At the moment there are only four-door saloon versions of the 144; to balance the Volvo range, four-door 120-series saloons have been dropped, though the estate cars still have four doors.

In a model which is so expressly designed with security in mind, the body design is all-important. Broadly speaking, the Volvo 144 has a modern though conventional unit body-chassis shell, made of pressed steel throughout, thoroughly rust-proofed and sealed during assembly. In the modern idiom, this structure is laid out to have front and rear sections (boot area and engine bay) which will crumple progressively, absorbing energy during collisions, but has an extremely strong passenger box. Apart from the general layout of the front and rear sections, strategic folds make sure that crumpling really will take place at an intended place.

Part of the passenger box strength is achieved by using a few large pressed steel panels rather than a multitude of small welded-up parts. A single pressing is continuous from the windscreen pillar to the rear quarter panel, surrounding both door openings without a loin. Both the windscreen and rear window frames are pressed in one unit to ensure a good fit and complete sealing. These frames are very strong, and are designed to stay as undistorted as possible if the car should roll over; there is an additional pressed roll-over bar welded under the roof panel between the centre pillars. To keep down cost and ease replacement after minor accidents, front wings and the front grille panel are all bolted on to the main structure.

The windscreen has the latest thick plastic interlayer between its laminates which prevents penetration when struck. Naturally, burst proof door locks are standard. All-alloy bumpers are fitted with full-width rubber inserts and rubber-faced over-riders. The rubber is meant to absorb minor impacts without damage to the rest of the bumper'-- feature tested inadvertently during our stay in Sweden with complete success.

Next in line among the safety features is the unique braking system, supplied to Volvo by Girling. In many ways it is like the more complex layout used in the Rolls-Royce Silver Shadow. Disc brakes are fitted to all four wheels, the front callipers having two pairs of pistons, each with an individual brake circuit. A small separate drum handbrake is fitted, built into the rear hub. A Girling vacuum servo reduces pedal pressures and gives power assistance to the split braking circuits from the tandem master cylinder.

The hydraulic circuits are 30 arranged so that one circuit operates one pair of pistons in each front calliper and a single rear brake. With the circuits in perfect condition, the system is in complete balance, acting as a conventional braking layout. If, however, there should be a

circuit failure or accidental rupture, braking is still present on a pair of spots in the front brakes (half the capacity, as it were) and on a single rear disc. Though this emergency system unavoidably gives unbalanced three-wheel braking, Volvo claim that up to 80 per cent efficiency remains. There is also a pressure relief valve in each rear circuit, set to limit rear wheel locking under emergency braking; this setting does not adjust with the vehicle loading. Large segmental pads are fitted to the front callipers.

A final important safety feature is the steering column, which has a Volvo designed joint arranged to break if the steering box and lower column are disturbed in a collision (see drawing).

Two engines are offered in the Volvo. The lower output 75 b.h.p, unit powers the 144, its 1,778 c.c. breathing through a single 1 3/4in. Stromberg CD constant-vacuum carburettor. Previous 15 b.h.p. engines fitted to the 120 series used a single downdraught Zenith carburettor. However, the 144S is likely to be the most popular in Great Britain. Though the displacement is not changed, a more sporting camshaft, a 10-to-1 compression ratio, and twin 1 3/4in. HS6 S.U. carburettors help to boost the power output to 100 b.h.p. (net) at 5,600 r.p.m. It is still a docile engine yet peak torque is at 3,500 r.p.m. The only air cleaners are a pair of small pancake units, one for each carburettor; in fact, the engine is identical with that fitted to the 1800S coupe.

It will be remembered that the B18 engine series has an excellent reputation for life and ability to stay on-tune for long periods. The crankshaft is supported by five main bearings, and the side camshaft is, unusually, gear-driven. The engine is immensely tough; rally tuned versions as used by Tom Trana in works cars are reputed to produce about 140 b.h.p. using the standard carburettors.

A 4-speed, all-synchromesh, gearbox is standard on both models, with a long, though rigid, central gear lever. A Laycock overdrive is optional on top gear only, with a step-up ratio of 0.756 to 1. The rear axle is 4.1 to 1 in standard form, but 4.56 with overdrive. Yet another option is the fitment of Borg-Warner Type 3 5 automatic transmission, with the 4.1 to 1 rear axle.

## Suspension

Basically, the 144's suspension is the same as that of the 120 series, with conventional double wishbone-coil spring front suspension on a separate cross beam, and a live rear axle located by upper and lower trailing arms, coil springs and a Panhard rod. At the front, upper and lower wishbones are pressings, both connected to the vertical link by ball joints, with sealed lubricant. There is a stout anti-roll bar. The separate cross-member is truly massive, being rubber mounted to the structure proper; it also supports the front engine mountings.

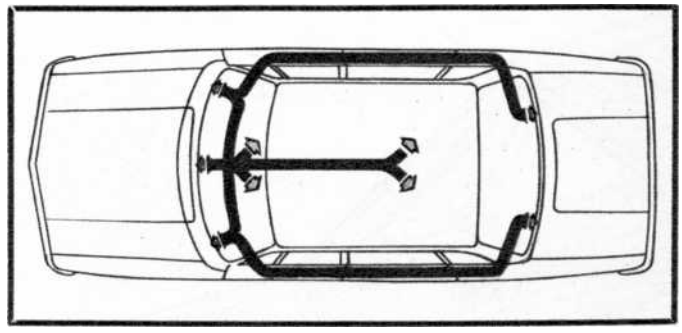
At the rear, detail improvements over the 120 series have resulted in reduced " parasitic" springing effects in the rubber bushes, and both upper and lower trailing arms are much longer than before; this reduces rear end steering effects under severe roll. The long pressed lower trailing arm supports the coil spring just behind the axle tube, with the dampers on a separate mounting ahead of the tube. It is interesting to note that Volvo dampers come all the way from a General Motors subsidiary. The Panhard rod has its frame mounting under the near-side chassis member, and its axle mounting just outboard of the differential casing on the opposite side.

Spring rates and damper settings have been thoroughly revised on the 144; our brief tests on ice-covered Swedish roads proved that the ride is more supple and better controlled than that of previous Volvos.

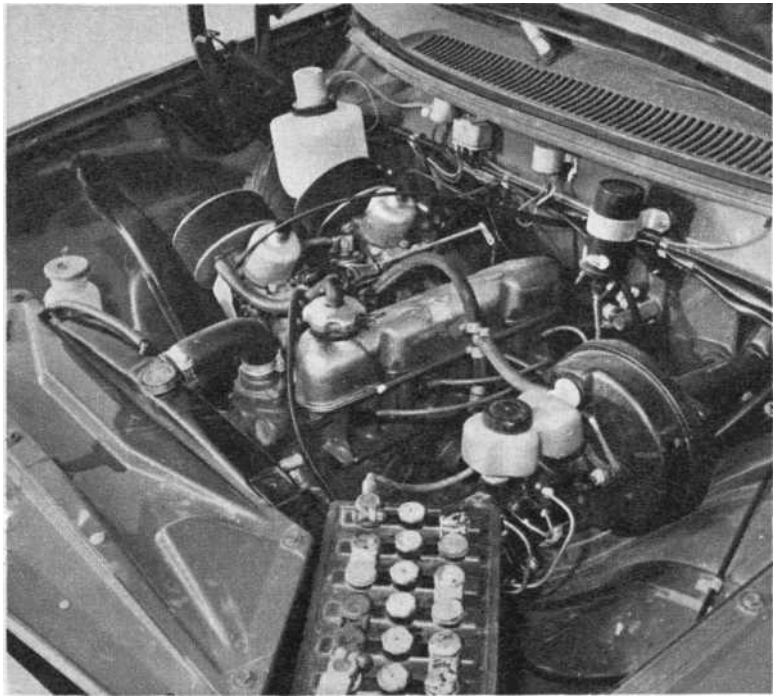
Wheels have 4.5in. rims, safety ledges, and are shod with 165-15in. Pirelli Cinturatos (made in Britain) for the British market. In Sweden, and certain export countries, cross-ply tyres are standard.

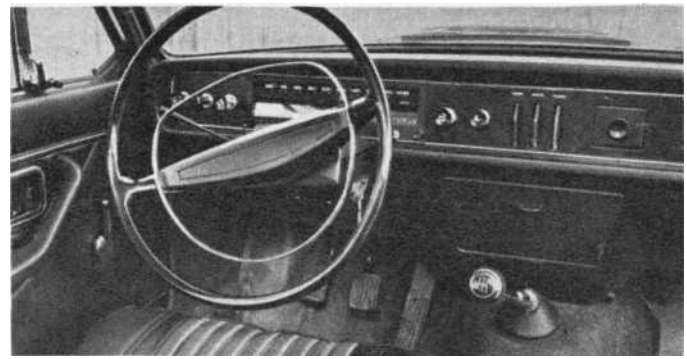
For the new car, a complicated heating and ventilation system has been devised, yet there are no fresh air vents on the facia and no stale-air extractors in the rear quarter panels. Apart from the normal warm air trunking to the front footwells and the screen, warm air can also be fed into the rear seat footwells via the prop-shaft tunnel. The rear window is kept clear by fresh warm air channelled through ducts along the car floor just inboard of the sills, and thence up behind the

*Heated air for the rear window is carried back alongside the sills, on the door, while air for the rear seats is channelled through the prop-shaft tunnel*



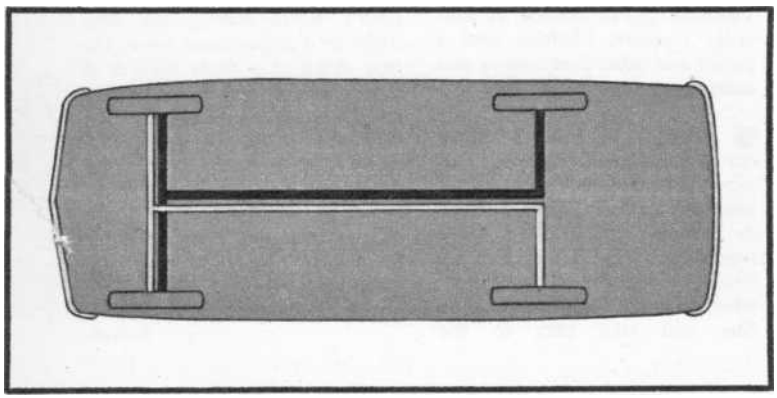
*Plain and simple the new 144 has much practical thought in its details. The aluminium bumpers have full width rubber inserts and anti-corrosion treatment is* extensive





*Left: The engine is the well-proved B.18 unit, shown here in "S" tune with twin S.U. carburettors. The cooling system is sealed and all reservoirs are easy to reach and see-through plastic. Above: Interior styling is modern with all-black trim and much crash padding. The long central gear lever is positive to use and there is face level ventilation.*

*This very simple diagram illustrates the Volvo split-braking system. Each circuit operates a pair of calliper cylinders and a single rear brake; up to 84 per cent efficiency is claimed if one circuit is out of action*



rear seats to vents in the rear parcel shelf.

Front seats are reclining, and have hinges designed to collapse if the car is struck violently from behind; this is to minimize whip-lash injuries to passengers' necks, which have been noted more and more often in accidents. Seat belts have been standard on Volvo cars since 1957, and those on the 144 are of a new design. As with the previous belts, there is a fixed buckle housing on the prop-shaft tunnel between the front seats, while the buckle of the belt proper is in the form of a tongue. Neat stowage brackets are fitted near the top of the screen pillars; there are reinforced anchorages if rear-seat belts are to be fitted.

Facia design is restrained, even sombre, but the almost uniform black has safety (through non-reflection) in mind. There are no sharp protruding knobs and switches. Heater controls take the form of handwheels (internally lit at night). There is a sliding pointer fixed on the face of the speedometer which, say Volvo, should be set to any speed limit which is important. The pointer is said to be more easily read than a figure on the speedometer.

More than in any other new model we have studied recently, the Volvo 144 has had safety engineered into it from the very beginning. In any case, Volvo engineering and longevity are renowned both in the U.S, and in Great Britain. Even in its early saloon form, the 144 and 144S seem certain to succeed; Volvo can probably look forward to a lengthy production run without major changes.

In Great Britain, the higher powered 144S has a suggested retail price of £1,415, and the 144 is to sell at £1,354.

Graham Robson

## ENGINE

| | |
|---|---|
| Cylinders | 4, in line |
| Cooling system | Water, pump fan and thermostat |
| Bore | 84.14mm (3.313in.) |
| Stroke | 80.0mm (3.15in.) |
| Displacement | 1,778 c.c. (108.5 cu in.) |
| Valve gear | Overhead, pushrods and rockers |
| Compression ratio | 10.0-to-1 |
| Carburettors | 2 S.U. HS6 |
| Fuel pump | AC mechanical |
| Oil filter | Full flow, renewable element |
| Max. power | 100 b.h.p. (net) at 5,600 r.p.m. |
| Max. torque | 107 lb. ft. (net) at 3,500 r.p.m. |
| Max. b.m.e.p. | 149 p.s.i. at 3,500 r.p.m. |

## TRANSMISSION

| | |
|---|---|
| Clutch | Borg and Beck, diaphragm spring, 8.5in. dia. |
| Gearbox | 4 speed, all synchromesh |
| Gear ratios | Top 1.00, OD Top 0.756. Third 1.36. Second 1.99. First 3.13. Reverse 3.25. |
| Final drive | Hypoid bevel 4.1 to 1. With O/D 4.56 to 1 |

## CHASSIS AND BODY

| | |
|---|---|
| Construction | Integral with all steel body |

## SUSPENSION

| | |
|---|---|
| Front | Independent, coil springs and wishbones, anti-roll bar, telescopic dampers |
| Rear | Live axle, twin trailing arms, Panhard rod, coil springs, telescopic dampers |

## STEERING

| | |
|---|---|
| Type | Gemmer, cam and roller |

## BRAKES

| | |
|---|---|
| Make and type | Girling, disc brakes all round, drum handbrake |
| Servo | Vacuum |
| Dimensions | F, 11.6in. dia. R, 11.6in. dia. |
| Swept area | F, 212 sq. in. R, 198 sq. in. |
| Total | 410 sq. in. |
| Handbrake | 55 sq in. |

## WHEELS

| | |
|---|---|
| Type | Pressed steel, 4 stud fixings, 4.5in. wide rim |
| Tyres | Make Pirelli. Type, Cinturato radial-ply, tubed |
| Size | 165S—15in. |

## EQUIPMENT

| | |
|---|---|
| Battery | 12-volt, 60 amp hr. |
| Alternator | Bosch 30 amp |
| Headlamps | Bosch, sealed beam 45-40watt |
| Reversing lamp | Twin standard |
| Electric fuses | 9 |
| Screen wipers | Two speed, self-parking |
| Screen washer | Standard, electric |
| Interior heater | Standard, fresh air |
| Safety belts | Standard, lap and diagonal |
| Interior trim | Pvc seats, pvc headlining |
| Floor covering | Carpet |
| Starting handle | No provision |
| Jack | Screw pillar |
| Jacking points | 4, under body sills, near wheels |
| Windscreen | Laminated |
| Underbody protection | Rubberised paint |
| Other bodies | None |

## MAINTENANCE

| | |
|---|---|
| Fuel tank | 13 Imp. gallons (no reserve) (58 litres) |
| Cooling system | 14.2 pints (including heater) (8 litres) |
| Engine sump | 6.6 pints (3.75 litres) SAE 10W/30. Change oil every 3,000 miles; change filter element at first 3,000 miles then every 6,000 miles |
| Gearbox and overdrive | 3.2 pints SAE80<br>Top up oil every 3,000 miles |
| Final drive | 2.3 pints SAE80<br>Top up oil every 3,000 miles |
| Grease | No points |
| Tyre pressures | F, 20; R, 23 p.s.i. (normal driving) 2 up<br>F, 20; R, 26 p.s.i. (normal driving) 4 up<br>F,24; R,27 p.s.i. (fast driving) 2 up |

## DIMENSIONS

| | |
|---|---|
| Wheelbase | 8ft. 6.4in. (260cm) |
| Track: front | 4ft. 5.1in. (135cm) |
| Track: rear | 4ft. 5.1in. (135cm) |
| Overall length | 15ft. 2.7in. (464cm) |
| Overall width | 5ft. 8.1in. (173cm) |
| Overall height (unladen) | 4ft. 8.7in. (144cm) |
| Ground clearance (laden) | 7.1in. (18cm) |
| Turning circle | 30ft. 4in. (9.25m) |
| Kerb weight | 2,735 lb. (1,240kg) |

## PERFORMANCE DATA

Top gear m.p.h. per 1,000 r.p.m. 15.9 with 4.56 axle
Overdrive top m.p.h. per 1,000 r.p.m. 20.9
Mean piston speed at max power 2,940ft/min

**Volvo 144S Major components from British suppliers.**

| | |
|---|---|
| Borg and Beck | Clutches |
| Borg-Warner | Type 35 automatic transmission (optional extra) |
| Girling | Disc brakes and vacuum servo |
| Laycock | de Normanville overdrive (optional extra) |
| Pirelli (G.B.) | Cinturato tyres |
| S.U. | Carburettors |
| Zenith | Zenith-Stromberg carburettors |

Note: Volvo 1800S bodies are pressed and assembled by Rootes Pressings (Scotland) Ltd., at Linwood.
Volvo spend about £14 million with British suppliers every year.

**Differences between Volvo 144 and 144S engines.**

Compression ratio: 8.7 to 1
Carburettor: One Stromberg 175CD
Max. power: 75 b.h.p. at 4,700 r.p.m.
Max. torque: 105 lb. ft. at 2,300 r.p.m.
Max. b.m.e.p.: 146 p.s.i. at 2,300 r.p.m.
Mean piston speed at max. power: 2,470 ft. per min.