1970

Volvo 1800E

Engineering Features

Source: Volvo Personvagnar AB, Göteborg Sweden

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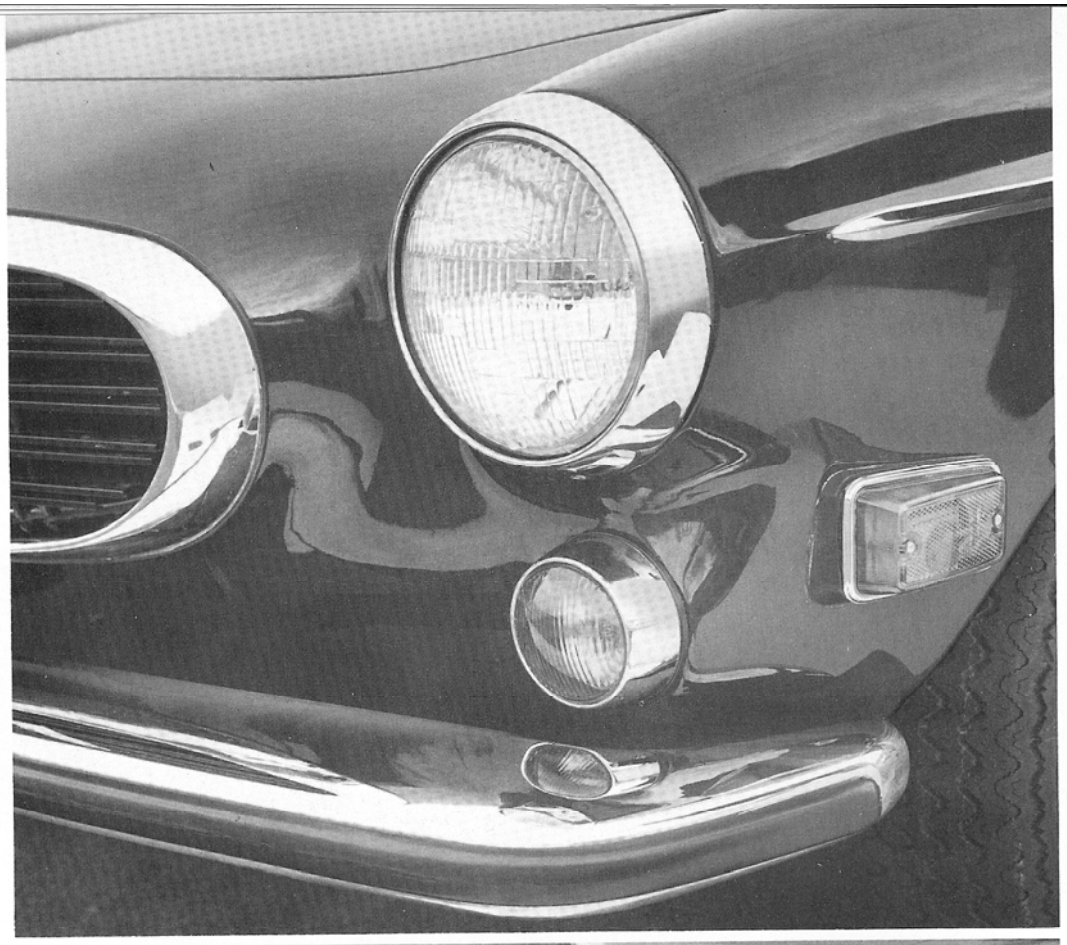
Source: Volvo Personvagnar AB, Göteborg Sweden

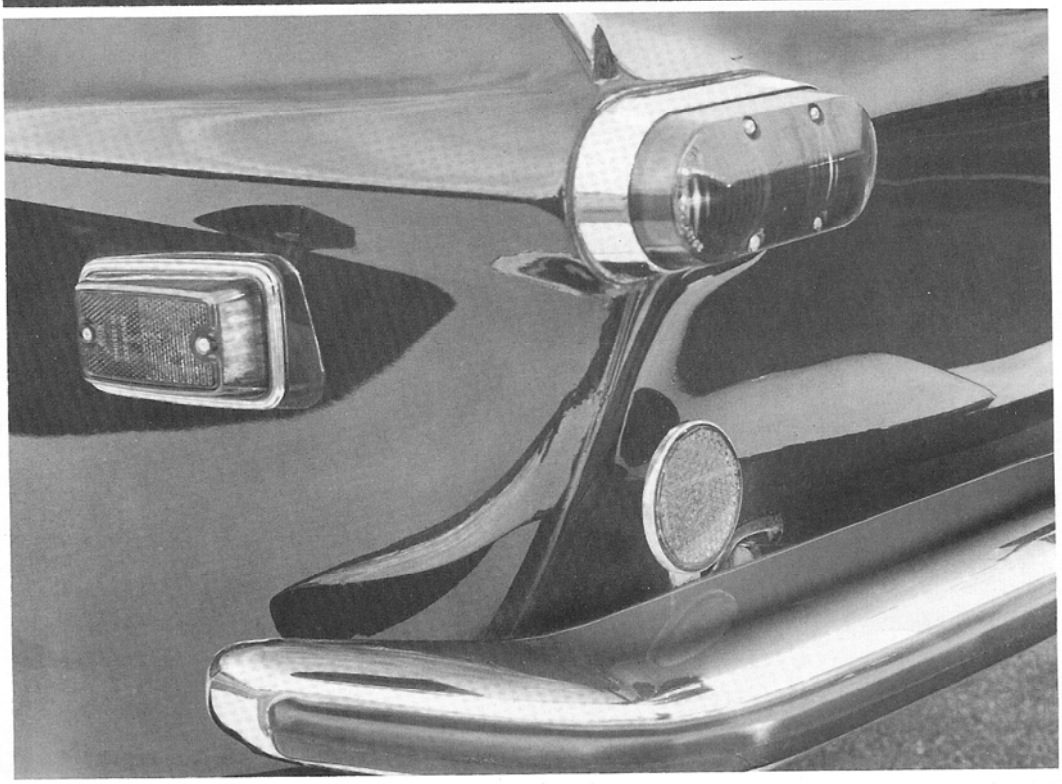
The new sports car was an instant hit. Following its international debut here in April, 1960, Volvo was swamped with orders for its P-1800 prototype.

Nine years later, styling and the basic suspension layout are the only holdovers from the 1960 prototype. Many important new features have resulted in a completely up-to-date sports car, still very much in demand. Through the years the sports coupe has acquired new names as engine power has increased, P-1800 S, 1800 S and, now, 1800 E.

The "E" stands for electronic fuel injection. This is the major improvement but only one of the many new additions and changes this year. The coupe also features a new four-wheel power disc brake system, a stronger four-speed transmission coupled with electric overdrive, new instruments and many interior refinements.

This book traces the history of the Volvo 1800, now – more than ever – a modern high-performance automobile. The book also enumerates the coupe's standard equipment and explains its solid engineering and advanced features.





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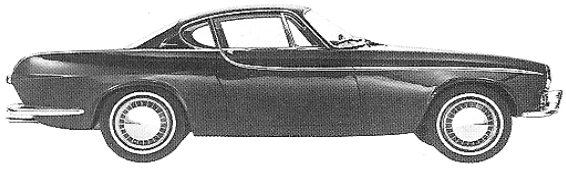
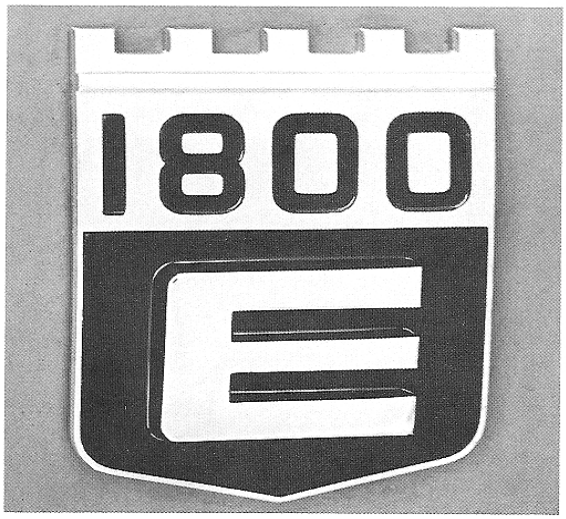
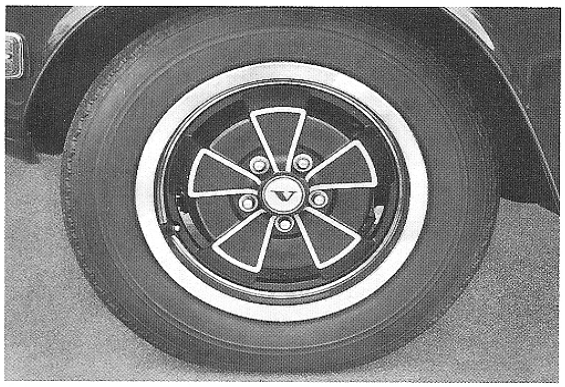


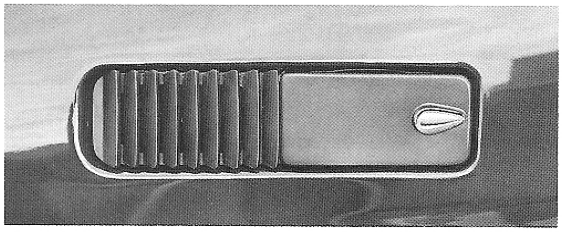
1961 Volvo P-1800.



1800 E rear emblem.



Mag-type wheel and radial tire.



Flow-through ventilation grille and locking gas cap.

The most surprising aspect of the story is that the 1800 was ever built at all. With plant facilities always at full capacity, building a completely different, limited production two-seater was a big step for Volvo.

The sports coupe's history extends back to the early 1950's when Volvo management became interested in fiberglass body construction. In 1956, when Volvo was just beginning to sell cars in America, a prototype was exhibited in New York. Encouraged by the reception given this special roadster model the go-ahead was given in 1957 to build a limited production sports car using components from the 122 sedan.

But, difficulties set in. No one, least of all Volvo, hard pressed to produce enough sedans for growing markets, was able to put the sports car into production. The result was that the original ideas were scrapped and a completely new design, eventually to be constructed and assembled in England, was started in 1959.

This was the model shown here in April, 1960.

Since then, first assembly in 1963, and then body construction has been moved to Sweden, where Volvo today uses its original assembly plant in Gothenburg to assemble the 1800 E.

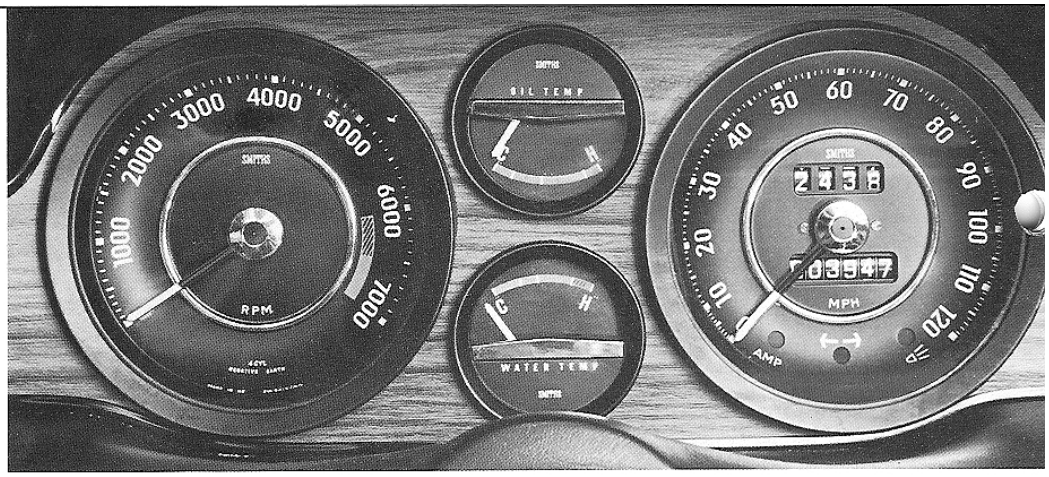
The car's sheetmetal has not changed over this long period, reflecting the success of the original design. Only new trim, bumpers and grilles have been used to distinguish later models.

Like all Volvos the coupe uses unit construction, box-section pillars and a fully welded body for maximum strength. In comparison with most sports cars no thought ever has been given to racing potential. If extra weight was needed for stability, bracing and durability, it was added. The original cars weighed just over 2400 pounds. Today the weight has been increased to 2529 pounds.

Another reason for extra weight is Volvo's thorough body and chassis protection. In Sweden, where salted roads are an everyday reality in winter, protection of body parts susceptible to rust is an important Volvo sales feature.

The 1800 E body is therefore dipped in a special rustproofing primer and gets three coats of paint inside and outside plus a final color coat that is sprayed wet-on-wet three times.

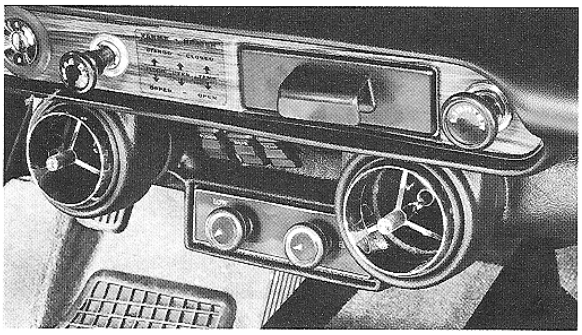
Protecting the underside equally well are two sealing compounds, sprayed on during final assembly. One's a permanent sealing wax; the other, the familiar black glop.



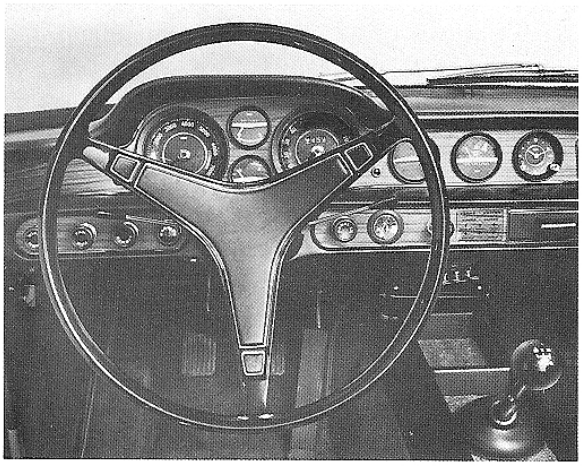
Tachometer, water and oil temperature gauges and speedometer.

The clean lines of the 1800 E are at their best in the long hood, semi-fastback top and short rear deck – a combination more than ever in vogue today. As is typical of all Volvos, doors are wide for easy entry and exit.

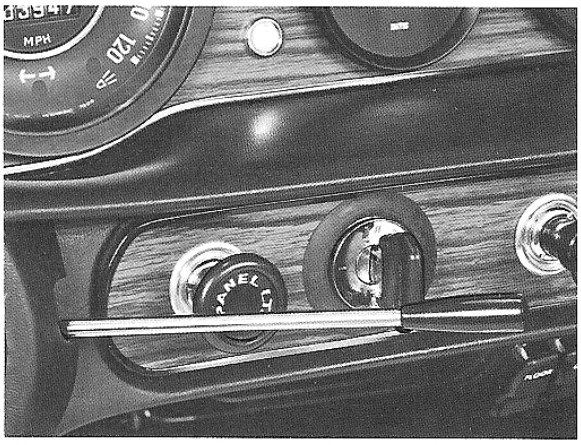
In comparison with other sports cars built then the width of the 1800 was far greater in 1960. Even today, the 1800 E is wider than its competitors to permit wider seats and more passenger room.



Optional Volvo air conditioning.



Padded three-spoke steering wheel.



Electric overdrive lever with indicator light.

From the side the only distinguishing changes for 1970 are the new alloy/steel sports wheels and the addition of vents in the rear fenders for the flow-through air ventilation system. A new 1800 E emblem replaces the "S" emblem in the rear and a new black aluminum grille is used up front. The locking gas cap, which in previous models was on the rear deck, has been moved to the left rear fender, behind the flow-through vents.

Another important addition is an almost invisible grid of defrosting wires on the rear window. The grid draws a maximum of 150 watts to keep the glass mist and ice free. It is controlled by a lighted two-position dashboard switch. Up front, the new cemented-in-place windshield meets 1970 federal safety requirements.

While the outside of the 1800 E is very similar to older models, the inside has been considerably altered. The most obvious new feature is the instrumentation. There are six white-on-black, non-glare gauges plus a clock along the slim, wood grained dashboard. Flanking the water and oil temperature gauges are a large tachometer and a speedometer with odometer and trip odometer. The oil temperature gauge, an unusual feature that has been continued on the new model reads the temperature in the oil pan.

To the right of the steering wheel are a fuel gauge, oil pressure gauge (which also features a red warning light) and the clock with a micrometer adjustment for perfect setting.

Warning lights indicate hand brake application or brake circuit failure and show whether the electric overdrive is engaged.

On the lower dash are control knobs for the three-position electric wiper and washer, two-speed heater fan, parking and headlights, four-way hazard warning flashers, rheostat adjustable panel lighting and the electric rear window defroster. Also along the lower dash is a central ashtray and cigarette lighter. A passenger assist handle is provided.

Facing the driver is a padded, three-spoke steering wheel with horn buttons on each spoke. On the steering column are two levers. The left one is for operating directional signals and, following Volvo practice, this lever also controls the highbeams. The right side lever, operating vertically, engages or disengages the electric overdrive.

For improved rear visibility the inside mirror now hangs from the roof with a breakaway attachment. It was previously mounted atop the dashboard. Its tinted glass has an anti-glare feature, operated by a slide on the bottom. Also new are the full width

padded sun visors. A feature found in all Volvos is tinted glass on all windows to reduce radiated heat.

A welcome addition is a locking center console and tray from which sprouts a new gearshift lever. Map pockets under the dash also are furnished. Fuses, formerly located in the engine compartment, are moved inside the car. The fuse block is located above the left map pocket.

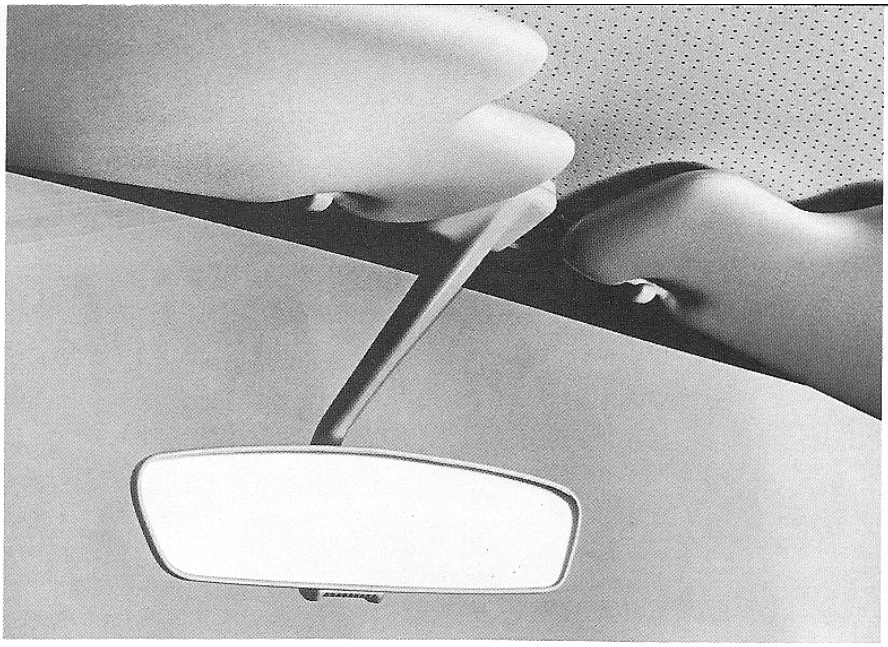
To prevent theft a steering wheel lock has been combined with an ignition warning buzzer. The ignition key removed, the steering wheel can only be turned a fraction before the lock becomes engaged. Opening the doors with the key in the ignition activates the warning buzzer, a reminder not to leave the key behind.

Standard equipment on all Volvos since 1959 are three-point shoulder/lap safety belts. Hung on the door posts, they feature a new combination hanger and adjusting handle. The Volvo system allows the belts to be attached by a one-hand operation to a quick-release mount between the seats.

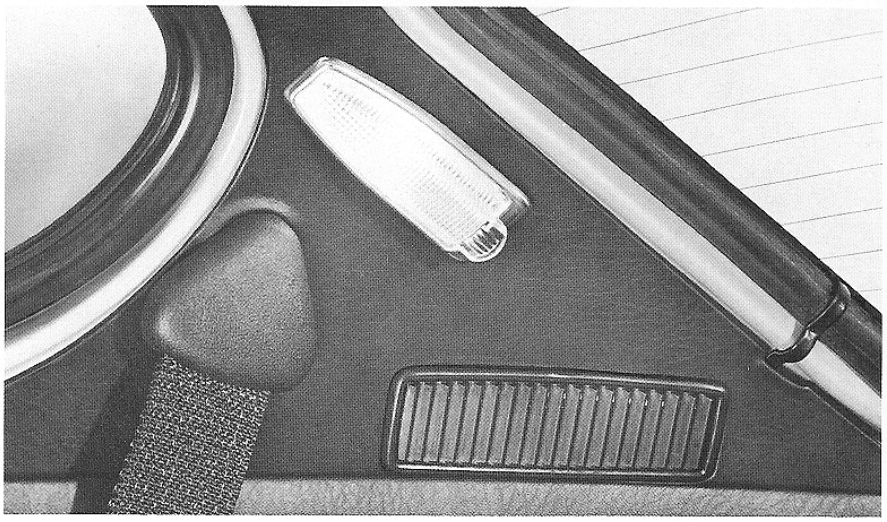
Other standard equipment on the 1800 E includes durable nylon carpeting, armrests built into the door trim pads, interior lamps for each door and a passenger side map light.

The leather upholstered seats in the 1800 E are retained from the 1800 S, but now feature fully reclining backrests, adjusted by a lever on the outboard side.

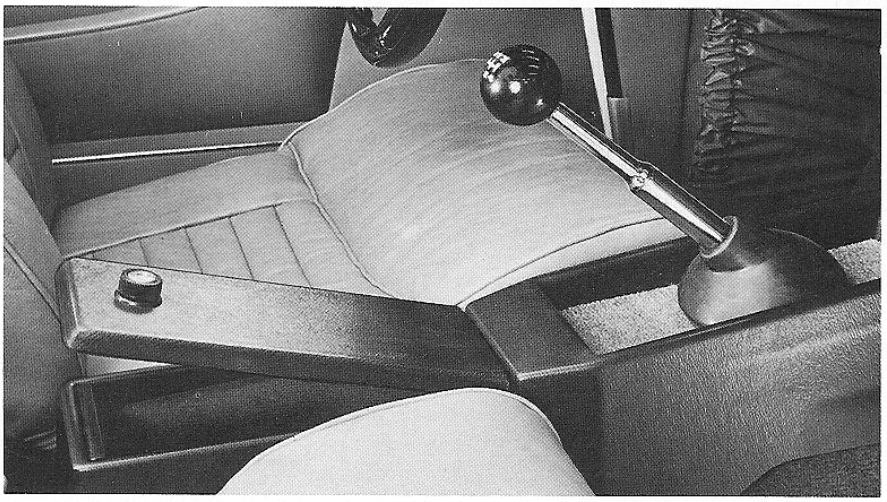
Cushions and backrests are foam-filled and further support comes from rubber straps under the cushions. The seats are fitted with matching, adjustable vinyl head restraints, raised to a new minimum height position. Volvo's exclusive lumbar support feature can be adjusted with a knob instead of screwdriver. The knob, marked "firm" to "soft," adjusts a band in the backrest to alter tension in the lower part of a passenger's back.



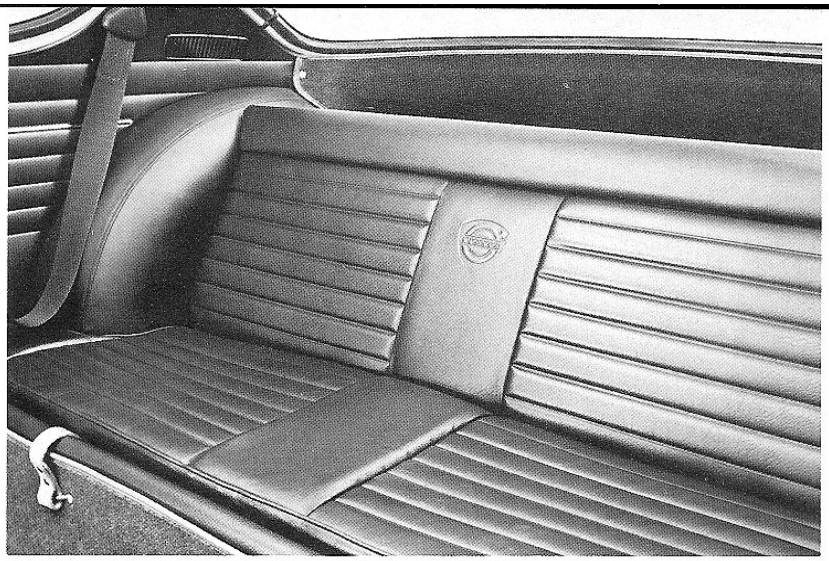
Tinted, anti-glare mirror and padded visors.

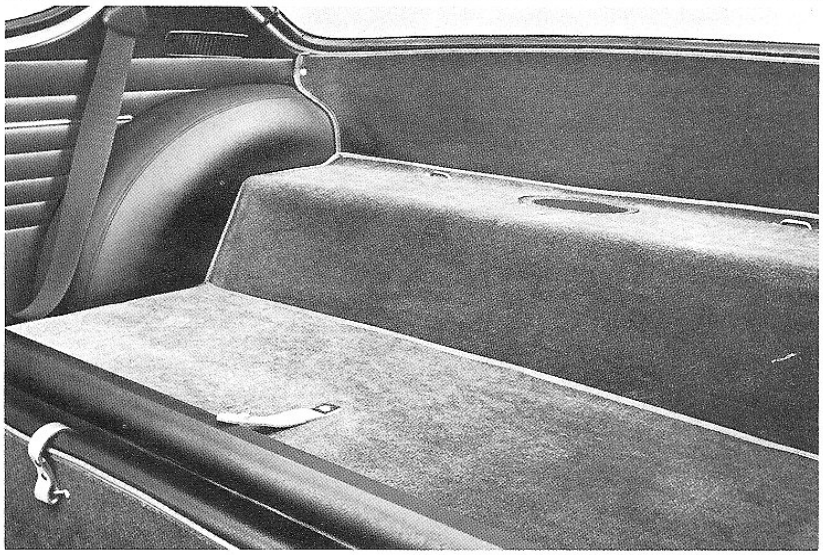


Flow-through ventilation grille and rear window electric defroster.



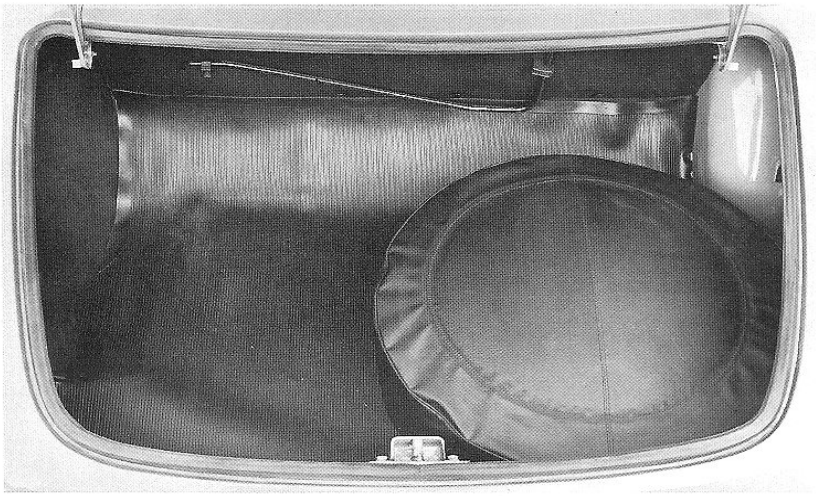
Locking center console and four-speed floor shift.

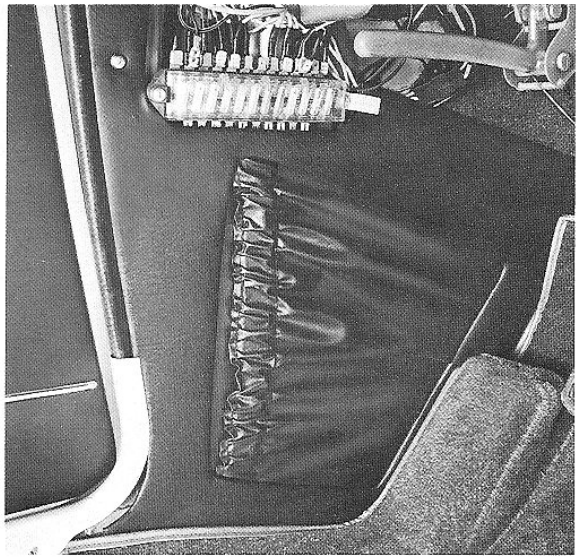




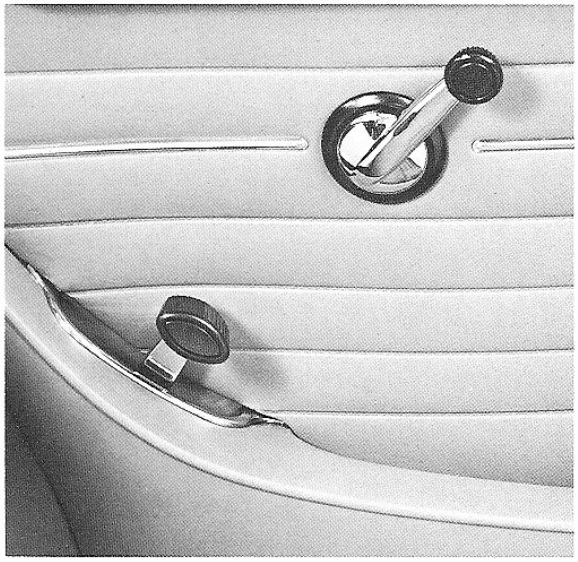
Rear storage area with fold down jump seat.

Luggage compartment with spare wheel cover.

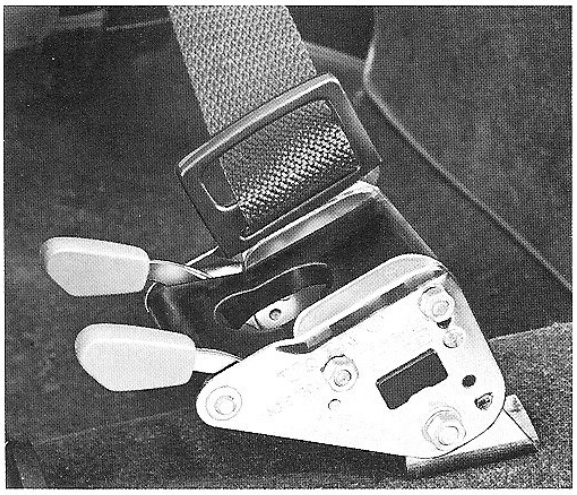




Expandable map pocket and fuse block.



Window regulator, door handle and armrest.



Three-point shoulder/lap safety belt center mount.

Both the front and rear of the seats may be raised or lowered with the snap-on cushion removed. Although ample legroom adjustment is provided (the back and forth adjuster gives eight full inches) an additional inch can be obtained for extra long-legged passengers by moving the entire seat frame to the rear.

In addition to a good sized trunk, the entire area behind the front seats also can be used for storage. The backrest of the occasional rear seat can be lowered, and leather straps are provided to secure luggage.

The trunk has fiber side padding with a removable rubber mat covering the floor. A vinyl spare tire cover also is supplied. Along with the body jack, mounted in the right corner, is a plastic tool pouch containing an adjustable wrench, pliers, spark plug wrench and two screwdrivers.

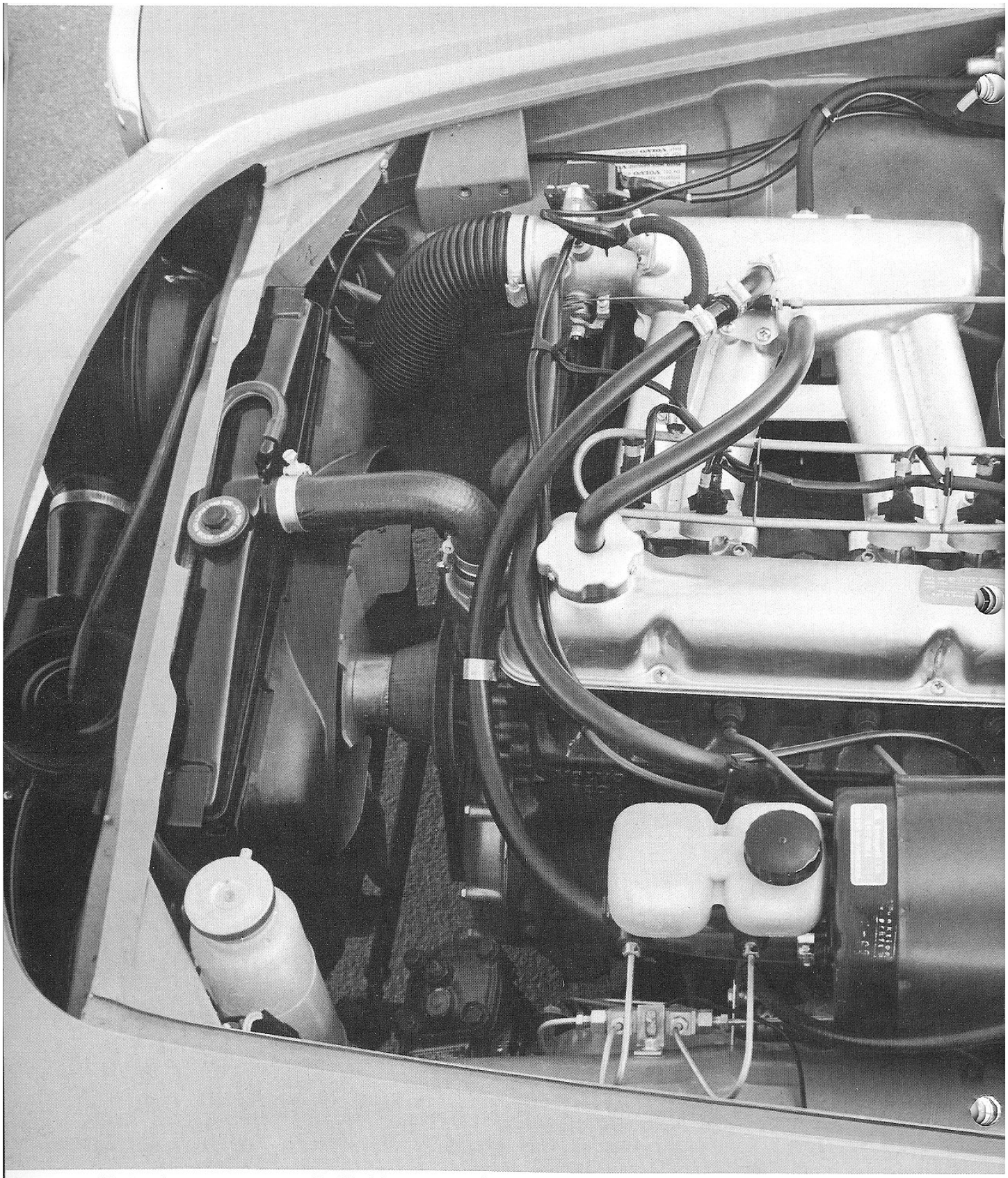
Another new interior feature on the 1800 E is a flow-through air ventilation system. Fresh air enters the car through an intake at the base of the windshield and through two underdash vents. Levers to open these outlets are located on either side of the car.

Grilles located behind the side windows draw stale air from the passenger compartment through ducts to the exterior vents on the rear fenders. A one-way rubber flap, which closes the system to outside air, is located behind the interior grille.

Adding to passenger comfort is the Volvo fresh air heating system. Powerful enough to heat a station wagon on the coldest day, it supplies so much heat that the two-speed fan normally isn't needed.

Controlling the interior temperature is a thermostat in the heater's air stream. Adjusting one of the three underdash controls sets the temperature to the desired level regardless of changes in outside temperature, engine temperature or the car's speed. The other two knobs distribute air flow to floor and windshield in varying amounts...from partial to full force.

Redesigned, optional Volvo air conditioning with improved temperature control is available for the 1800 E. This new unit has its temperature and three-speed blower controls and two fully adjustable outlets centered below the dash. The evaporator is tucked under the dash on the passenger side, where an additional fully adjustable outlet is located. Another adjustable outlet supplies cold air to the driver's floor.



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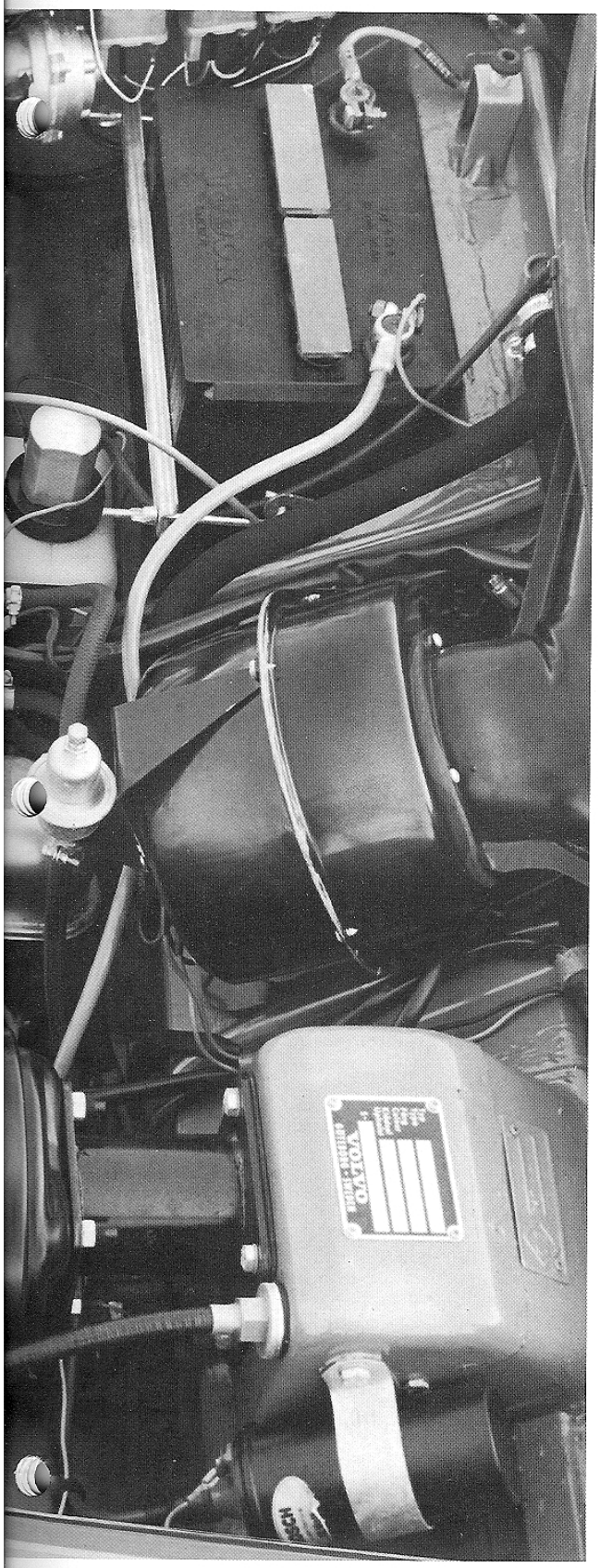


Performance has always been an important feature of the Volvo 1800. The original sports coupe was powered by a 100-horsepower twin carburetored engine that produced 0-60 times of 13 seconds. In 1963 the first of the "S" models boasted 108 horsepower and, three years later, the 115 horsepower version of the B18B engine was unwrapped. The 1969 models carried the first B20 engine, developing 118 horsepower.

For 1970, the fuel injected B20E engine, producing 130-horsepower, gives the 1800 E even better overall performance than Volvo's six-cylinder 164. *Sports Car Graphic* road tested the new 1800 E for their February, 1970 issue. They reported these performance figures: 0-60 – 9.6 seconds; 0-¼ mile – 16.8 seconds, 82.4 m.p.h.; top speed (estimated) – 122 m.p.h.

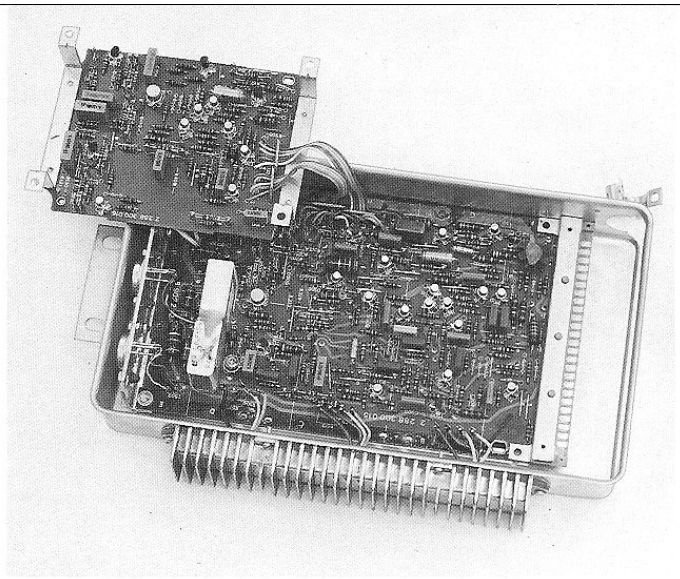
While fuel injection itself is not new, it's application for volume produced cars is a recent breakthrough. The fuel injection system on the 1800 E was developed for Volvo by the Robert Bosch Company of Germany. The system's principal features are electronic computer control and direct fuel injection to the valves. Other types of fuel injection use mechanical control and inject fuel into the combustion chambers.

The first use of the Bosch system was made by Volkswagen. Further refinements have now made it possible to make its successful installation possible on more powerful engines.

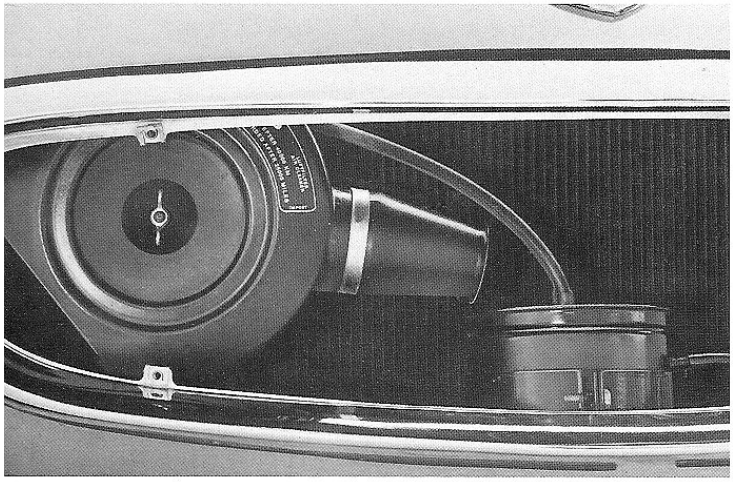
Basically, what fuel injection means is the absence of carburetors. Volvo engineers working with the Bosch Company found other advantages as well. These include increased fuel economy, cleaner exhaust, additional horsepower, improved warm-up and automatic compensation for changes in altitude, air temperature and humidity. Also important is the fact that reliability of fuel injection over carburetors is improved.

An easy way to describe how fuel injection can improve gas mileage is to compare what happens at low speed when a driver floors the gas pedal. With the throttle opened suddenly on a carburetored car great amounts of fuel are sucked into the engine at a rate that can't be used efficiently. This causes unburned gasses to pass into the exhaust system and excessive hydrocarbons to be released into the atmosphere. The electronic brain governing the injection system "knows" this and will not permit additional fuel to enter the engine until its speed has been sufficiently increased to explode the entire mixture.

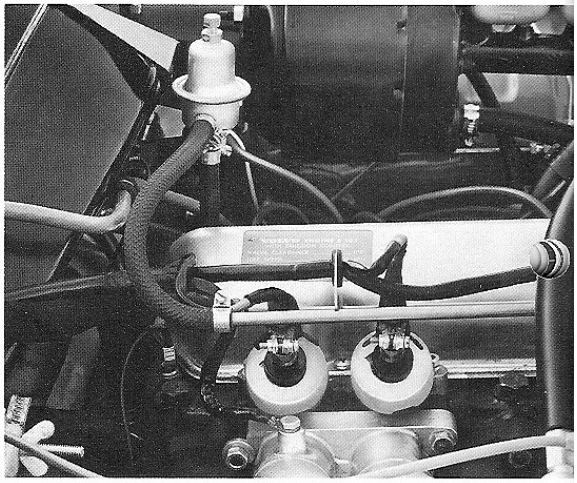
One important feature of this fuel injection system is that the injections stop as soon as the throttle is closed. When coasting down a long hill no unwanted gas is being delivered, allowing for maxi-



Fuel injection computer.



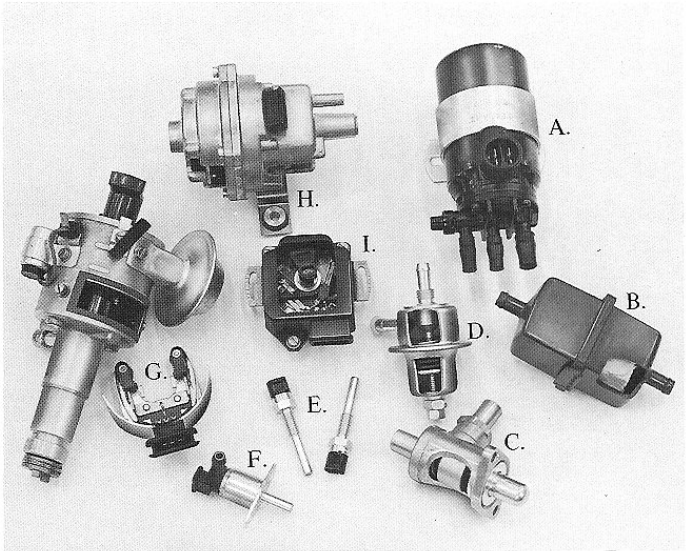
Intake air filter and evaporation control cannister.

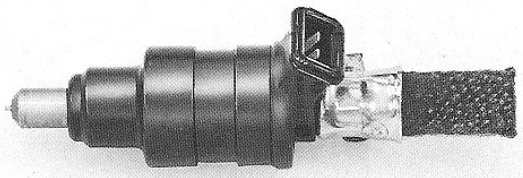


Fuel pressure regulator and fuel injectors

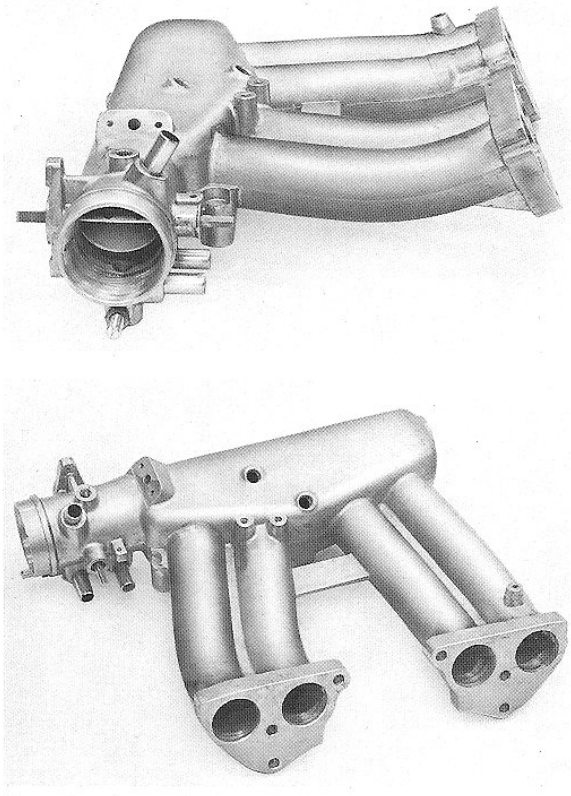
Fuel injection components

A. Electric fuel pump.
B. Fuel filter.
C. Auxiliary air regulator
D. Fuel pressure regulator
E. Temperature sensors
F. Cold start valve
G. Distributor and triggering contacts
H. Pressure sensor
I. Throttle valve switch





Electro-magnetic fuel injector.



Cast aluminum air intake duct.

mum engine braking and reduced hydrocarbons. When the engine speed falls to 1000 r.p.m. the fuel supply again is switched on to enable a smooth changeover to idling speed.

Volvo engineers' experience has shown them that the 10 percent power increase of the fuel injected, 121-cubic inch engine over the same displacement engine used in the 140 Series cars could easily have been obtained using carburetors. But with clean air a matter of international concern the excessive pollution caused by inefficient low speed combustion in high performane engines makes fuel injection practically a necessity. In fact, a recent report by the industry's spokesman, *Ward's Automotive Reports,* credits a fuel injection supplier as claiming that 1974 will find fuel injection on all cars made by Detroit's "Big Three."

The controlling computer, located under the dash on the passenger's side, is the heart of the two-litre Volvo engine. Inside it are 300 components including 37 transistors, 27 diodes and two power amplifiers. Information is fed into the computer from five sources in the form of electronic impulses. It includes air temperature, air pressure, water temperature, throttle pressure and engine speed. Also, the computer "learns" when the engine is being started or stopped.

The easiest way to describe the electronic fuel injection system is to trace the flow of both the gas and air.

The pressurized fuel delivery system starts at a separate filter and fuel pump located below the gas tank. This special electric pump is so powerful that it can empty the Volvo gas tank in less than a minute. Another feature of the pump is a by-pass valve that discharges any air that may be trapped in the fuel lines. When the ignition is turned off the valve closes the fuel line to maintain pressure for the next start.

From the pump, fuel is fed through the distribution line to the four injectors, one for each cylinder. Excess gas not required by the injectors passes to the pressure regulator which maintains a constant 28 p.s.i. pressure in the fuel system. When the pressure exceeds this figure a valve opens allowing gas to escape back to the gas tank.

Another important feature of the fuel system is a cold start valve that is triggered by the starter. Cold starting conditions (at engine coolant temperatures below 140°F.) require a richer mixture.

When the starter is operated under these conditions a needle valve sprays a stream of gas into the air intake duct. As soon as the engine fires, the valve automatically shuts off. To prevent flooding the engine, valve opening time is limited to ten seconds.

The air intake system is equally complex. Air flow is regulated by a butterfly valve in the cast aluminum duct. As engine speed increases this flap valve opens to allow an additional air supply to mix with the increased injections.

This valve is completely closed when starting or at idle. When idling, air enters a by-pass which signals the computer to adjust the injections for idling speed.

Under cold running conditions a varying amount of air enters the intake duct, also by-passing the throttle valve, through the auxiliary air regulator.

The four injectors are opened electrically in two sets, cylinders one and three, and cylinders two and four. This means that the intake valves of cylinders two and three will be closed when the injection occurs, storing the fuel for a small fraction of a second.

When the electro-magnetic injector is opened the pressurized fuel is sprayed over the valve and mixed with air as the flow enters the combustion chamber. On a carburetored car this mixing is done in the intake manifold.

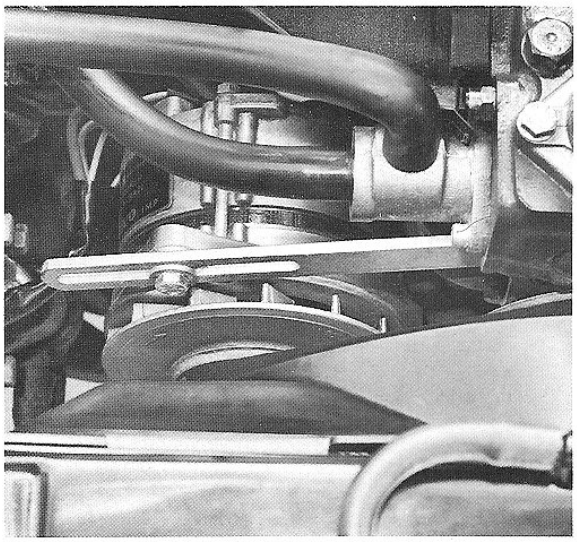
The length of time an injector stays open is minutely varied by the computer between two and twelve milleseconds, according to engine speed and load. The number of injections also are varied.

The constant impulses sent to and from the computer, and the resulting actions of valves and sensors, expansion of diaphragms and opening and closing of devices in the system can be boiled down to one feature...insuring the correct air/fuel mixture under any given conditions.

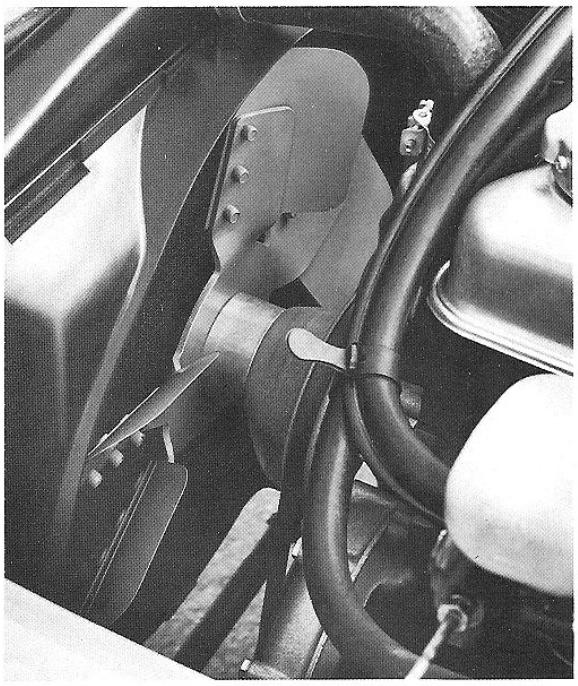
All of these components and many others with less important roles make up only a part of Volvo's complete engine story.

There are other differences between the four-cylinder B20E and the B20B engine used in the 140 Series cars. The cylinder head, with a higher 10.5:1 compression ratio is new. Larger 1.73 inch intake valves are used and a high performance camshaft has been added. Also new is the entire exhaust system for improved breathing. Maximum output of 130-horsepower occurs at 6000 r.p.m. Peak torque of 130-foot pounds is developed at 3500 r.p.m.

The engine's heart is an exceptionally strong five-main bearing crankshaft. This component is the only link with Volvo's former engine, the B18. The two-litre engine, introduced on 1969 models, otherwise is a complete redesign. Important factors like high capacity lubrication and cooling systems, valve operation, bearing material and connecting rods were improved for increased engine life. Also strengthened were the clutch and the flywheel.



35-amp alternator.



Asymetric fan with flexible steel blades

Constant evaluation and testing of the sealed cooling system in laboratories and over the road has resulted in a new shrouded radiator flex fan. The stainless steel blades of the fan flatten out at high speeds, when speed alone supplies sufficient cooling, to lower fan noise, increase water pump life and save horsepower.

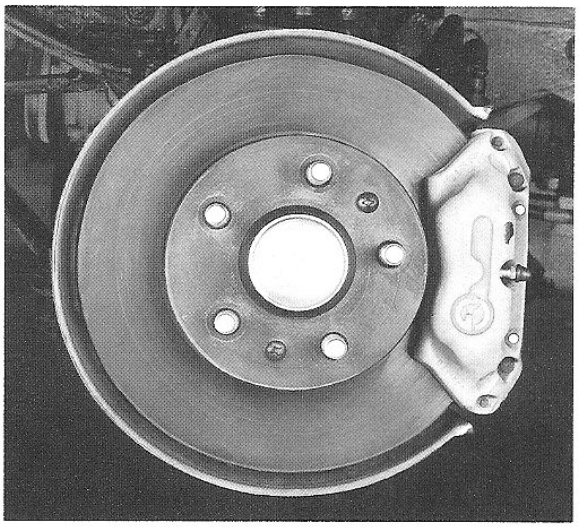
Another addition is gasoline evaporation control. Gas tank vapors collected and stored in a trunk container are pulled forward by the engine's normal suction action. The fumes enter a cannister containing charcoal granules located in back of the grille, are mixed with air entering the bottom of the cannister, and are then sucked into the engine to be burned. A styrofoam filter, that should be changed every 24,000 miles, is placed in the cannister's base to purify incoming air. Although required only by the State of California, this feature is standard equipment on all Volvos sold in America.

Even with the additional voltage required by the electronic computer, Volvo's high capacity electrical system has not been changed. That's because of a standard 60-amp hour battery and a 35-amp alternator. Also, Volvo uses a powerful one-horsepower starter to ensure quick winter starts without excessive cranking. The ignition system is protected against moisture with silicon rubber seals developed for Volvo-Penta marine engines.

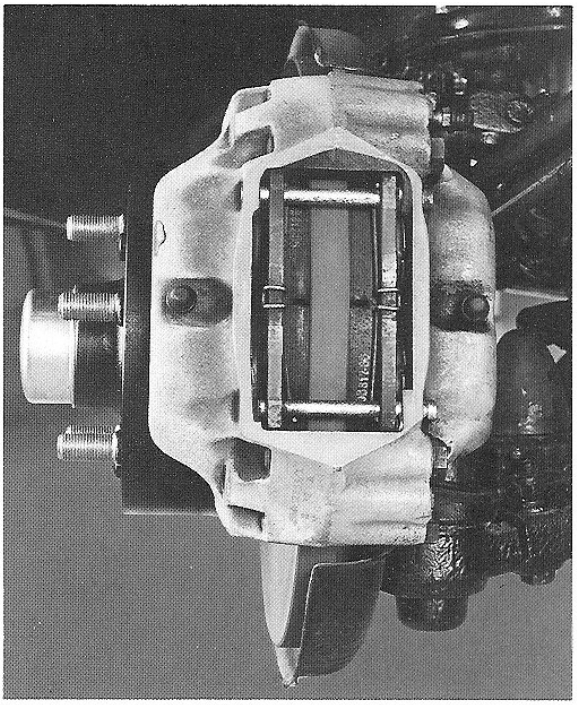
The four-speed fully synchronized transmission in the 1800 E is the same unit developed for the six-cylinder 164. Designed to handle high torque loads, this new M410 gearbox has powerful synchromesh and uses remote linkage to eliminate vibrations in the shift lever. The electric overdrive operates on fourth gear and results in an overall ratio of 3.44:1 for low engine speeds. The 1800 E will cruise at 60 m.p.h. at only 2800 r.p.m. in overdrive.

Another new 1800 E feature is the four-wheel disc brake system, replacing the front wheel discs and rear drum brakes used on earlier models. These new brakes are identical with those used on the four-hundred pound heavier 164. For controlled emergency braking the 1800 E is equipped with a lesser reduction ratio of 1:2.7 for the power assist, compared to a 1:4 ratio for the 164. Also contributing to straight line braking are a pair of hydraulic pressure limiting valves in the rear brake lines. These valves eliminate the possibility of having the rear brakes lock before the fronts, the primary cause of loss of control during panic stops.

An additional feature is Volvo's exclusive dual brake system which has each circuit operating on three wheels, two front and one rear. The benefit of three-wheel braking, in addition to having more



Front disc brake



Front disc brake caliper.

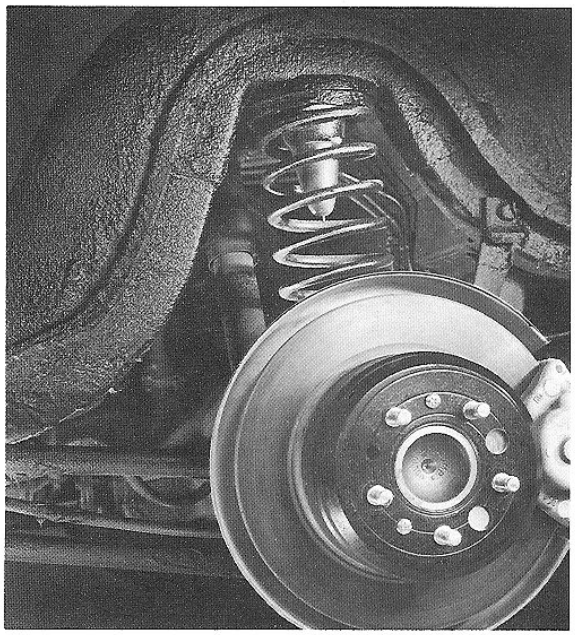
stopping power than a two-brake system, is that the single rear wheel that is free rolling supplies directional stability.

The 1800's responsive steering has a 15.5:1 reduction ratio. The cam and roller system has 3¼ turns lock to lock and the turning circle is only 29-feet 10-inches.

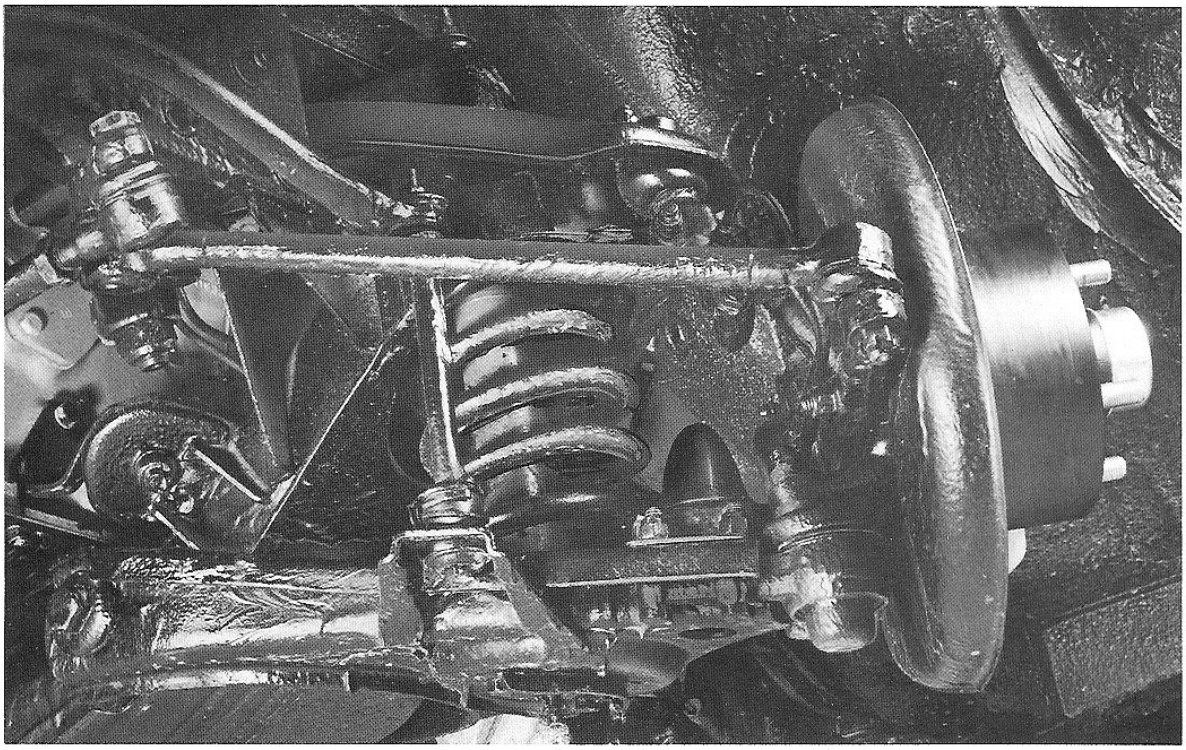
As all Volvos the 1800 E has basically neutral steering with slight understeering characteristics when driven hard. This arrangement means that correcting front end slip can be done by applying additional lock to the steering wheel.

Designed specifically for safe winter driving and bad road conditions the 1800 E suspension uses double acting telescopic shock absorbers and coil springs on all four wheels. The cores of the shock absorbers contain Freon gas for improved cooling. The gas eliminates weakening of shock absorber action by preventing foaming of the hydraulic fluid.

Unequal length wishbones for the independent front suspension are used with an anti-sway bar. The rear axle is rigid, accurately positioned by longitudinal control arms and torque rods. With rubber mounted components the suspension absorbs extreme punishment on rough roads while permitting turnpike touring comfort. Contributing to good high speed handling are 165R15 radial ply tires mounted on new five-inch wheels. These 15-inch wheels have a steel outer safety rim welded to a cast aluminum alloy center. Stainless steel wheel trim rings also are fitted.



Rear suspension.



Independent front suspension.

Specifications

Engine

Type B20E. Water cooled, four-cylinder in line, cast iron block and head, five-main bearing crankshaft. Pushrod operated overhead valves with gear driven three-bearing camshaft. Bore: 3.50 inches. Stroke: 3.15 inches. Displacement: 121 cubic inches (1986 cc.) Maximum horsepower: 130 b.h.p. at 6000 r.p.m. Maximum torque: 130 foot pounds at 3500 r.p.m. Specific power output: .93 b.h.p. per cubic inch displacement. Power to weight ratio: 19.5:1. Compression ratio: 10.5:1. Oil filter: Full Flow. Oil capacity: 4 1/8 quarts including filter.

Clutch

Diaphragm spring type, single dry plate - 8¼ inch.

Cooling system

Sealed, 50% anti-freeze coolant circulated by engine driven water pump. Transparent expansion tank. Capacity: 10.0 quarts. Engine driven fan equipped with asymetric flexible stainless steel blades.

Fuel system

Pressurized electronic controlled fuel injection with electric fuel pump. Tank capacity: 11.75 gallons. Evaporation control. Fuel required: Premium.

Transmission

Manual four-speed, fully synchronized with floor mounted, remote linkage. Electric overdrive operating on fourth gear.

	Ratios	Overall
1st	3.14:1	14.50
2nd	1.97:1	8.47
3rd	1.34:1	5.76
4th	1.00:1	4.30
Overdrive	0.80:1	3.44
Reverse	3.54:1	15.22

Rear axle
Hypoid type. Ratio: 4.30:1

Electrical system

Voltage: 12. Battery capacity: 60 amp hour. Alternator rating: 35 amps. Starter motor output: 1 h.p.

Gauges and equipment

Tachometer, speedometer, oil pressure, oil temperature, water temperature and fuel gauges. Alternator, headlight beam, directional signal, hand brake and overdrive warning lights. Two-speed 100-watt electric blower. Two-position rear window defroster. Two-speed electric windshield wipers plus electric windshield washers. Automatic backup light. Clock. Variable instrument lighting. Hazard warning flashers. Interior courtesy lights. Map light. Cigarette lighter.

Brake system

Power assisted, self-adjusting four-wheel disc brakes. Twin circuit hydraulic system, each circuit operating on both front wheels and one rear wheel. Each circuit alone provides 80% of total four-wheel braking effectiveness. Two pressure relief valves operate on rear wheels.

Front: 10.7 inch discs. Pad area: 27.0 square inches.
Rear: 11.6 inch discs. Pad area: 14.4 square inches.
Hydraulic power assist ratio: 1:2.7
Handbrake: Mechanical drum brakes acting on both rear wheels.
Lining area: 27 square inches. Dashboard warning light.

Suspension

Front: Independent with rubber mounted control arms. Steering knuckles supported by ball joints. Stabilizer bar. Coil springs with double acting telescopic shock absorbers. Permanently lubricated.

Rear: Solid rear axle carried by longitudinal, rubber mounted control arms and torque rods. Transverse location by rubber mounted track rod. Coil springs with double acting telescopic shock absorbers.

Balanced combination alloy and steel wheels.
Wheels and tires: Size: 5Jx15 inches. Tires 165R15 radial ply.

Steering

Cam and roller with 3¼ turns lock to lock. Turning circle: 29 feet 10 inches. Steering ratio: 15.5:1.

Interior dimensions

Width, hip height	48.4 inches
Width, shoulder height	53.5
Seat width	19.7
Seat depth	19.3
Backrest height	22.8
Headroom	35.4
Seat cushion to floor	11.0
Steering wheel to backrest	15.4

Exterior dimensions

Length	171.4 inches
Wheelbase	96.5
Width	67.0
Height	50.5
Track, front and rear	51.7
Ground clearance	6.1
Curb Weight	2529 pounds