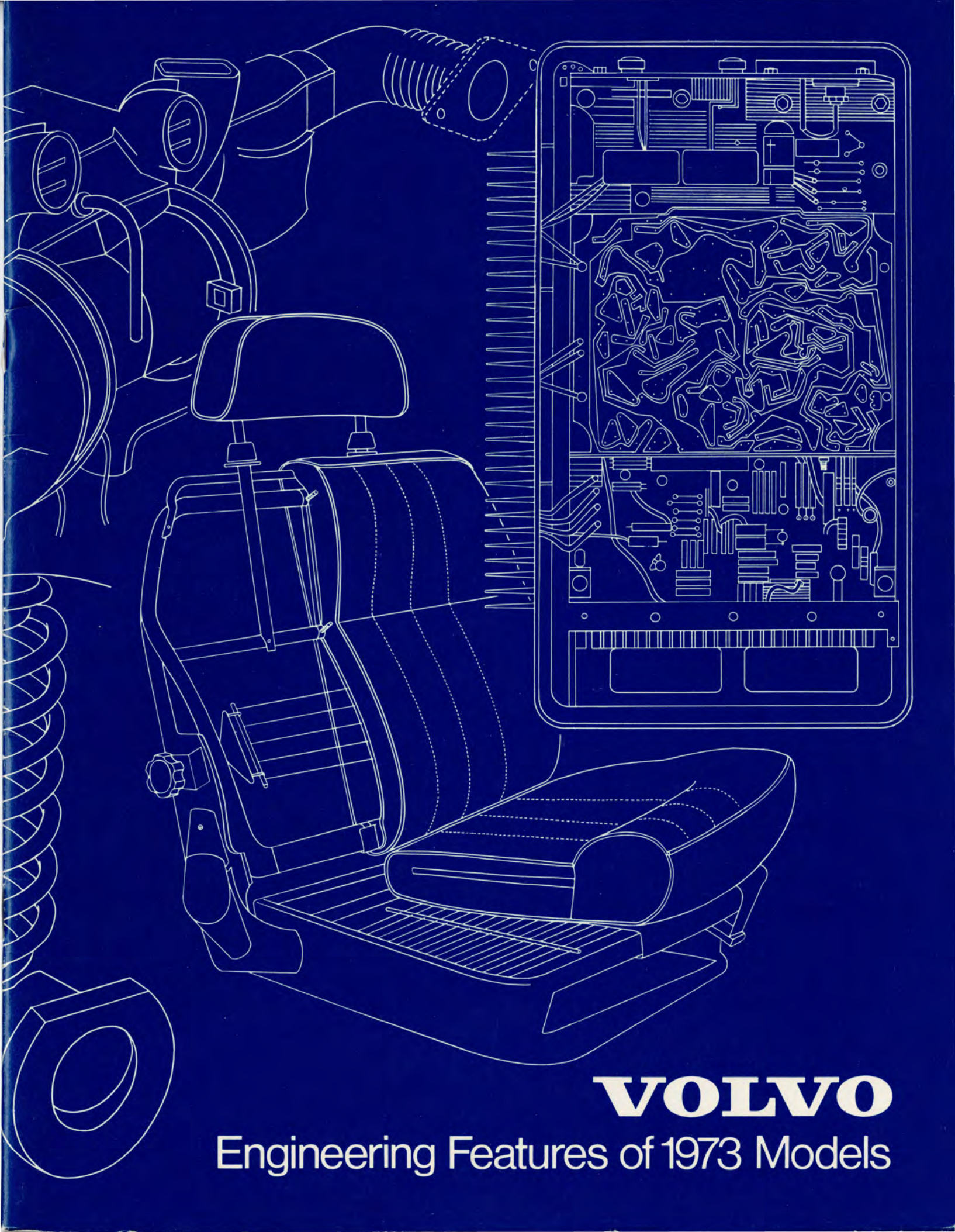


VOLVO

Engineering Features of 1973 Models

Volvo 164E

Volvo 144

Volvo 1800ES

This is the second edition of the 1973 Engineering Features Book. It was produced to give Volvo salesmen additional facts and information to answer technical questions and covers our product features more extensively than the sales brochures.

And because Volvo buyers are well above average in their interest in the development and engineering of their cars, the Engineering Features Book, even if it wasn't intended as promotional literature, has become a "best seller".

Which is the reason for this reprint.

This year Volvo expects a steady sales increase in America even with greater worldwide competition and more exacting Federal safety and emission control standards. This is due in part to steps taken in the course of many years to make sure the product we sell today meets the needs of Americans.

The 1973 Volvos embody the most extensive engineering changes since the introduction of the all-new 144 six years ago. We believe that these new features and product improvements, coming only a year after the many changes in the 1972 models—and combined with increased activities in the areas of service, parts and training of dealership personnel gives us a major advantage in this market.

The real key to our success, however, continues to be the Volvo buyer. In an era of increasingly sophisticated consumerism, our customers recognize the traditional Volvo virtues of high quality and durability—that we continue to provide safe, sound, *reliable* transportation, with ample and comfortable accommodations and superior mechanical performance, along with economy and convenience features designed to make driving a pleasure.

The 1973 Volvos will thus be equally well received by current and former owners, who will be gratified to find the same exacting standards of workmanship they have been accustomed to; and by first-time Volvo buyers, who cannot help being impressed by the comparison of Volvo's design and features to whatever automobile they have been driving.

For this reason it is worth remembering that far too often, salesmen are quick to point out the latest features, while at the same time they tend to neglect those essentials which created sales in the past. So this book will cover the many long-time features and engineering accomplishments found in all parts of the 140 Series and 164E, along with those considerable improvements in the 1973's. A special chapter will cover Volvo's 1800ES sports car.

EXTERIOR

For millions of Americans, styling remains one of the principal reasons for buying a new car, and they can be expected to select a particular make and model on the basis of "looks" rather than one that actually meets their needs. At the same time, however, there is a growing segment of knowledgeable American car buyers who have learned that their cars should be engineered, rather than just styled.

You can be sure that these people are going to be far more interested in features like the new shock absorbing bumpers and the improved windshield wipers than they are about the new front and rear styling of the 164E and 140 Series models. Equally important to them will be what they can't see under the shiny paint: Volvos continue to be assembled using a process of unitized construction which involves thousands of individual spots welds in each body. This means that the body panels and the frame are combined into a single unit designed to retain all of its strength and structural soundness throughout the life of the car.

To protect the body more than ever, Volvo now has a new system for primer application. After passing through a rigorous cleaning and phosphating process designed to etch the surface for better paint reception, the body/frame assembly is completely submerged in a special rustproofing bath charged with electric current. This electrolytic process ensures that a uniform primer coating clings to every part of the body surface, no matter how inaccessible.

This primer bath is so effective that it would have been possible for Volvo to have eliminated another costly rust prevention process: galvanizing the parts most prone to rust—the headlight surrounds and front end panels. Nevertheless this step—the thick layer of zinc which has self-healing properties to cover minor scratches—was retained, proof that we're building Volvos better than ever.

After rustproofing each Volvo body is dried for thirty minutes at a temperature of more than 300 degrees F. before the undercoat is applied. This step is followed by an intermediate coat and final color coats. Inbetween these operations there is an extensive preparation and inspection procedure and a final check-out to ensure a durable and flaw-free finish.

Volvo body protection, moreover, doesn't stop with the outside of the car. The underside is thoroughly coated with a special sealing compound (the familiar black goop) and followed by an anti-rust wax designed to resist the ravages of the salt used on roads during the winters.

Another specific example of Volvo's rugged engineering where it doesn't show is the center box-member post, just recently rediscovered by Detroit for its so-called "Pillared Hardtops." Volvo's centerposts are joined to similar box-members running along the roof and above the floor, as well as a transverse member under the front seats and across the top. There are two more box-members on each side at the windshield and at the rear, plus a fourth vertical support for the station wagon. This year Volvo has added even more protection: an anti-intrusion member welded into every door to ward off the effects of a lateral collision. You can't see it, but the extra protection is there. Something more visible, incidentally: the new child-proof door locks on the rear doors of the 164E and the 140 Series. Anyone who has occasion to carry small children will be immediately enthusiastic about them.

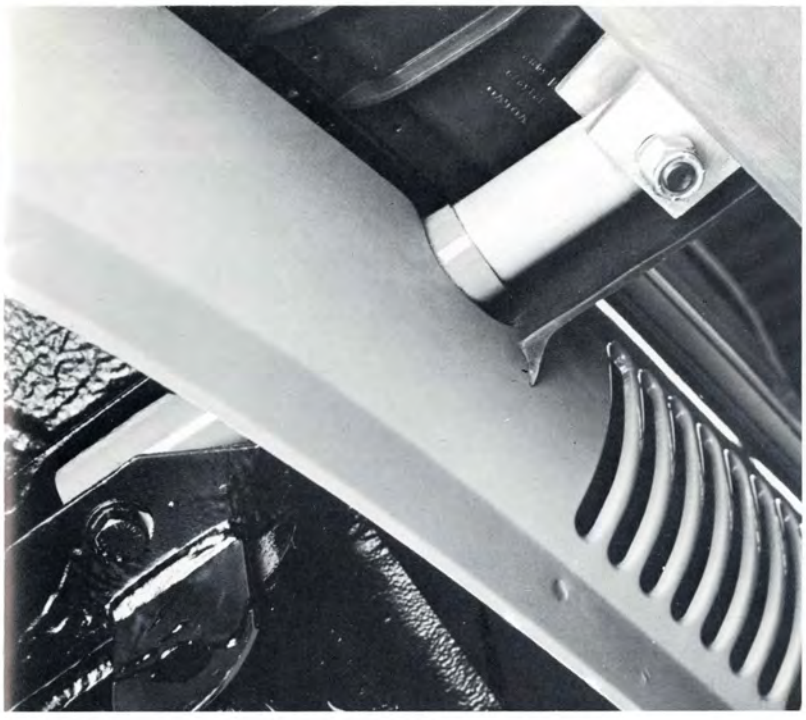
Continuing the trend to greater protection and safety, the bumpers of all Volvo models have now been engineered in accordance with Federal standards to withstand a frontal collision impact at a speed of 5-mph and a rearward collision impact at 2½-mph. This has been accomplished by a highly sophisticated system of specially designed shock absorbers filled with a gel which turns to liquid when compressed, and new, high strength aluminum alloy bumpers with full length replaceable rubber facings.

Another safety improvement is the new windshield wiper system, now cable driven for maximum sweep even at slow driving speeds. On the driver's side the wiper blade has been repositioned for improved visibility. A twin-jet washer has been relocated on the hood for a better spray pattern and a more effective wiping. Another refinement, small enough in itself but indicative of Volvo's thoroughness and attention to detail, is the new doorlock. It has better sealing and a new symmetrical key that makes unlocking a Volvo door or trunk a bit easier and more convenient, especially at night.

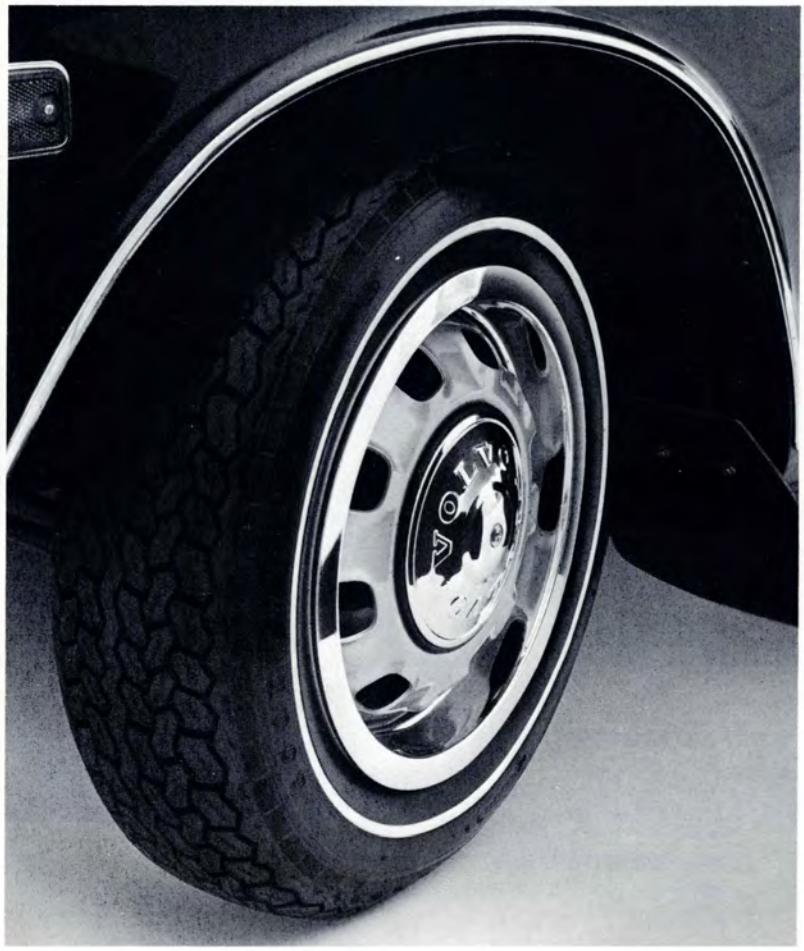
Traditional Volvo features which will continue to impress new buyers are the tinted high-impact window glass and the doors that open practically straight out. The tint is adequate to prevent the passage of ultra-violet rays that tend to fade upholstery, but still clear enough not to seriously reduce night driving visibility. The 90° opening doors make for easier entry, especially important for elderly passengers. At the same time there is an additional stop position useful in crowded parking lots.

Brushed aluminum impact absorbing bumpers are fitted on the 1973 164E (left) and 140 Series models. The bumpers, which extend from the body and are faced with hard rubber, are now the same height front and rear. New grilles are featured as well on 1973 models. The 140 Series has larger, wraparound front parking/turn signal lamps.

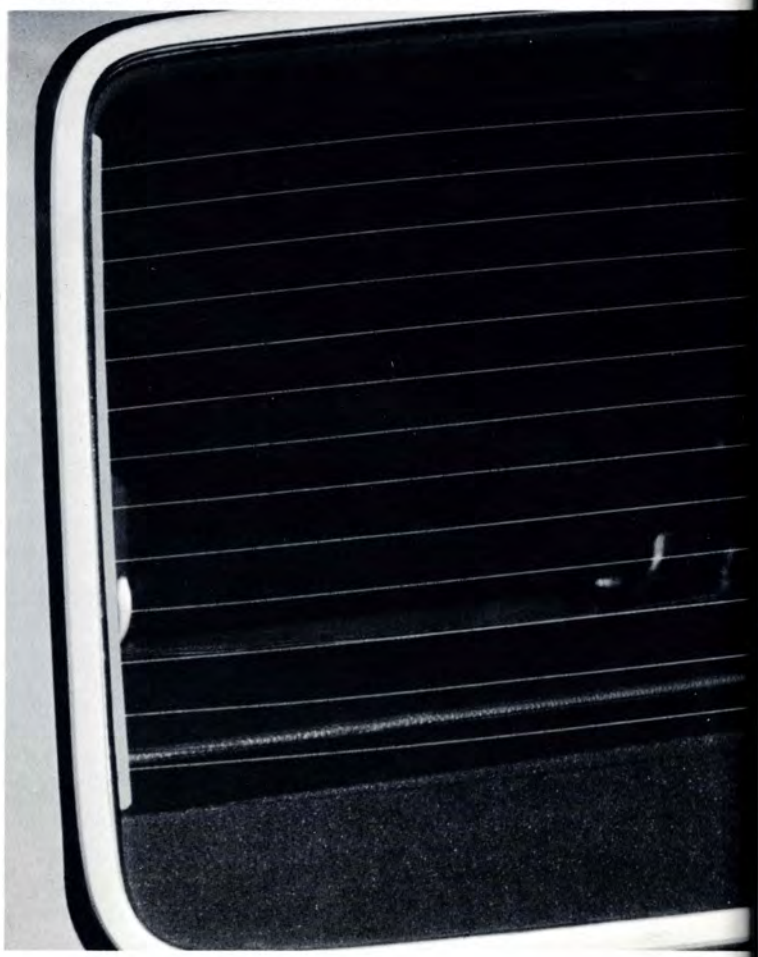
Special shock absorbers connecting the front bumpers to the frame are designed to absorb the impact of a five mile per hour collision. The shock fluid is a gel which turns to liquid when compressed and converts back to a gel after the impact.



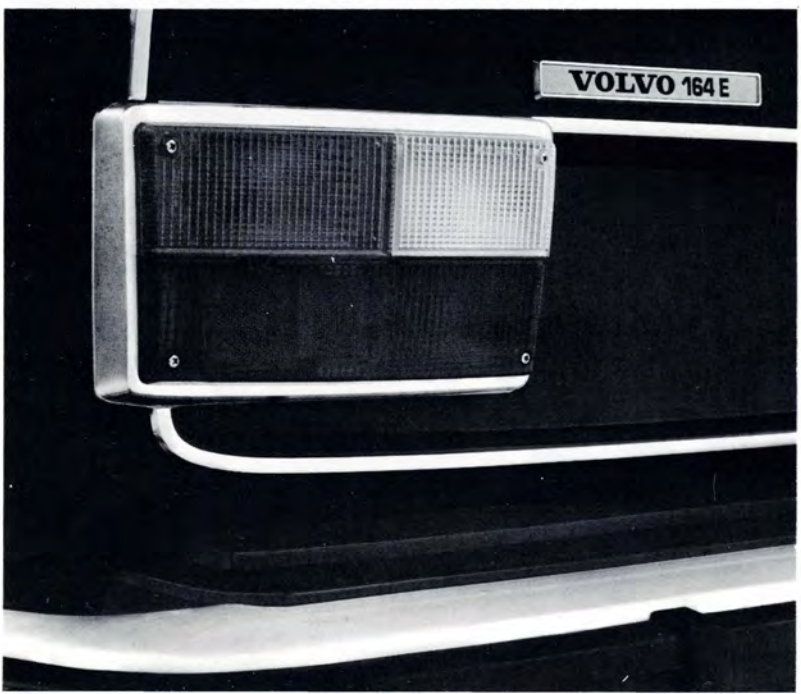
Whitewall radial ply tires are featured on the 164E and all 140 Series models. 164E also has stainless steel trim rings and distinctive fender molding.



Electric rear window defrosting is standard on all Volvos. Special electricity-conductive paint is applied to the inside of the glass. These "wires" will warm the window in seconds to dispel mist and are capable to heating the glass enough to melt ice.

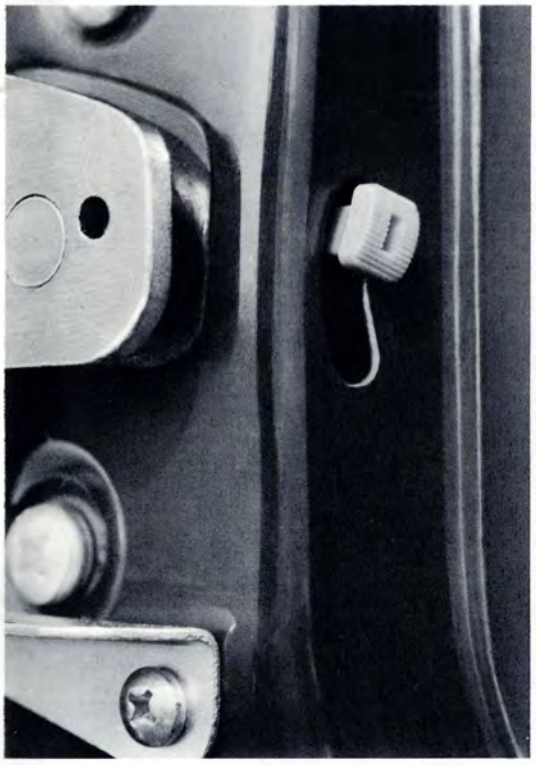


New rear lights are fitted on 1973 sedans. Clockwise from the upper left are the turn signal, backup, brake and tail light with reflector. A rubber spacer is fitted between the body and the rear bumper.



Front parking light and turn signal remain on the front bumper of the 164E. The wraparound design, along with an illuminated fender marker give good side lighting.

A childproof door lock now is provided for all Volvo rear doors. Pushing the catch down inactivates the regular locking button and the inside door handle but does not interfere with outside door opening operation.

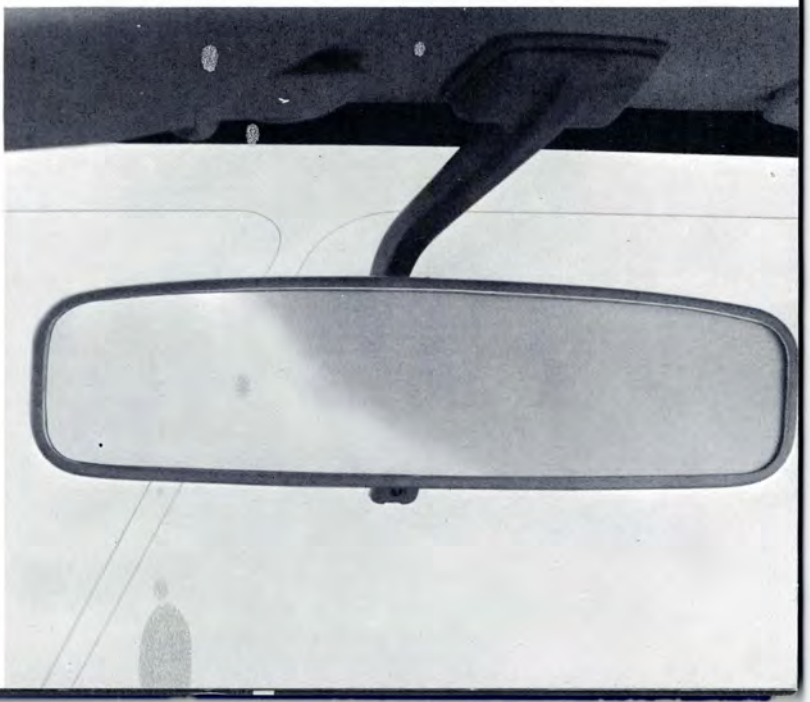


New, easier to use symmetrical ignition and door keys are featured on 1973 models. Door locks also are improved with more effective keyhole sealing.

View looking down through the rear window shows the interior (left) and exterior vents for Volvo's flow-through ventilation system. Inbetween is a one-way flap which prevents outside air from entering the car.

Station wagon's rear window features tinted glass, electric defrosting and an electric wiper and washer controlled by a switch located on the center console. Pressing the switch halfway operates both wiper and washer.

Another new 1973 feature is a radio antenna built into the windshield. The breakaway mirror has tinted glass and day/night positions. Padded sun visors extend almost to the center of the car.



INTERIOR

Volvo exteriors have tended to retain their characteristic styling and features over a number of years. Interiors, however, have undergone substantial modification in order to provide for greater passenger safety, comfort and convenience. Some of these improvements are readily apparent to old and new customers alike, others, like so much of Volvo's engineering, are not; you should be prepared to describe them in detail.

The major interior modification this year is the dashboard, which is an entirely new design. It reflects what has become an increasingly important concept in the past few years: that provisions for passenger comfort are almost as important as the driving controls themselves, at least from a sales viewpoint. Volvo's previous dashboard, while it was a model of simplicity designed for passenger safety, had no provision for face-level ventilation, when air conditioning was installed the glove compartment had to be sacrificed; the radio, which has certainly become an important addition, was inconvenient for the driver.

The new dashboard also has a number of other improvements. All gauges and warning lights are now located directly in front of the driver, and they are illuminated from above. Continuing a Volvo tradition, there's a six-digit odometer and a separate, push-button resettable mileage indicator for trips. A tachometer is standard on the 164E, and on the 140 Series the single-unit instrument panel can easily be removed to add an optional tachometer.

The remainder of the dashboard contains a centrally positioned, resettable clock, the illuminated, lockable glove compartment and four new air vents.

These vents are the visible components of a remarkably efficient new system for year-round, full interior passenger comfort. The core of the system is a powerful,vacuum-controlled

The entire dashboard has been completely redesigned for greater operating convenience and safety. Fully padded and glare-free, it features grouped instrument and controls layout for simplified reading and use.

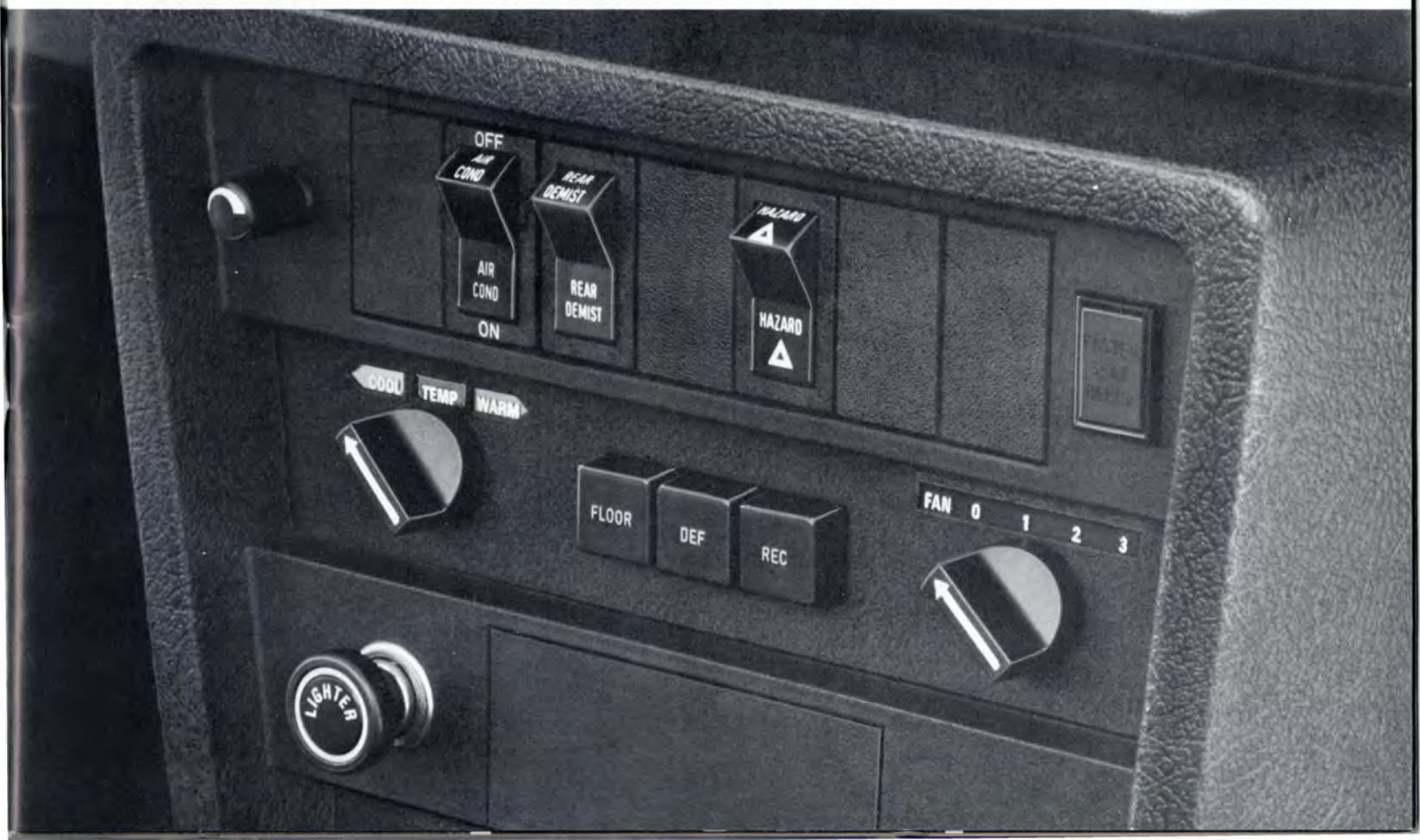
heating and ventilating unit—actually a highly sophisticated air pump. This unit provides a temperature-controlled airflow throughout the interior of the car under all weather conditions via the four fully adjustable dashboard vents, as well as by the vents located below the windshield and by front and rear floor outlets.

On the Volvo 164E an evaporator and compressor unit have been added to provide a complete factory-installed air conditioning system. In the 140 Series, these additional components can be readily added, at extra cost, by your dealership. This means that "factory" air conditioning will be a popular option for the 140s.

Controls for the passenger comfort system are located on a newly-designed center console, which also houses the rocker switches for the electric rear window defroster and the 4-way flashers, along with the cigarette lighter and ashtray. The console's cover plate hinges at the top so that a radio or tape player can easily be installed. On top of the dashboard there are two wide defroster outlets and space for a radio speaker. This location will create an improved spread of sound because of the reflection off the curved windshield. Stereo speakers can still be fitted into the front door trim pads.

The steering wheel and steering column have also been redesigned this year in the interests of greater safety and convenience. The steering wheel itself is now an inch smaller in diameter in order to provide additional space for the driver's legs and permit easier entry; it also features a new padded horn assembly. The two-piece steering column, introduced in the Volvo 144 before required by law, is designed to separate or telescope, depending on the Volvo model. To this Volvo has added an additional safety feature this year: At the top of the column the attachment to the steering wheel has been redesigned so that in the event of a collision the wheel will automatically swivel to

Center console houses all the auxiliary controls not found on the steering column (except for the dashboard located headlight switch). The console is illuminated from the top and these lights and the dashboard instrument lights are controlled by a rheostat switch (upper left in the photo). Below the rocker switches on the upper panel are the heating controls; temperature, area selection and three-speed fan.



align itself with the driver's chest, thereby considerably reducing the effect of impact.

Controls essential to driving are incorporated in the steering column, so that the driver need never take his eyes off the road nor his hands off the wheel to operate them. A turn signal lever/headlight dimmer switch has been standard for a number of years; this year another lever—for the two-speed windshield wiper/washer—has been added to the right side of the steering column.

Volvo drivers will appreciate another new feature designed to enhance driving safety: the new suspended, rather than floor-mounted, accelerator pedal which cannot be forced past the full throttle position. The new design virtually eliminates the possibility of a jammed throttle or broken linkage.

Clutch operation has also been improved this year. The effort needed to depress the clutch pedal has been reduced by modifying the clutch linkage. This improvement complements the shorter, more easily handled gearshift lever introduced last year.

Volvo pioneered the use of 3-point shoulder/lap safety belts in 1959. Today its improved inertia reel seat belts, which are self-adjusting, are among the most advanced in the industry. Safety conscious buyers will recognize their superiority at once.

Concern for passenger safety extends throughout a Volvo's interior. The design of each component, as well as its location, is evidence of this. A specific example, one easily understandable to new customers, is the Volvo handbrake. On many other cars this feature is no more than a parking brake, virtually useless for slowing the car if the hydraulic brake system should fail. On all Volvos, however, the handbrake is still completely functional, and its convenient position alongside the driver's seat permits him to use it under all conditions, even though Volvo's superior dual hydraulic system makes its emergency use extremely unlikely.

Along with safety, Volvo's engineering stresses passenger comfort and convenience. It is evident that Volvo engineers have designed the car's interior with no waste space. Every feature has been carefully engineered with regard to its position and placement relative to other components. For example, when comparing legroom the height of a seat, the angles of cushion and backrest are just as important as straight line measurements; the positioning of the steering wheel, gearshift, and important operating controls is as critical as pedal placement.

This approach is possible because Volvo's product engineering, development and production departments, rather than "styling" determine what we make. At the same time, freed from the artificial pressures of cosmetic changes we are able to concentrate on the business of building a better automobile. The features we include, the number of different models we make, are determined by what we believe in and what we can fully control, rather than by what the competition is doing.

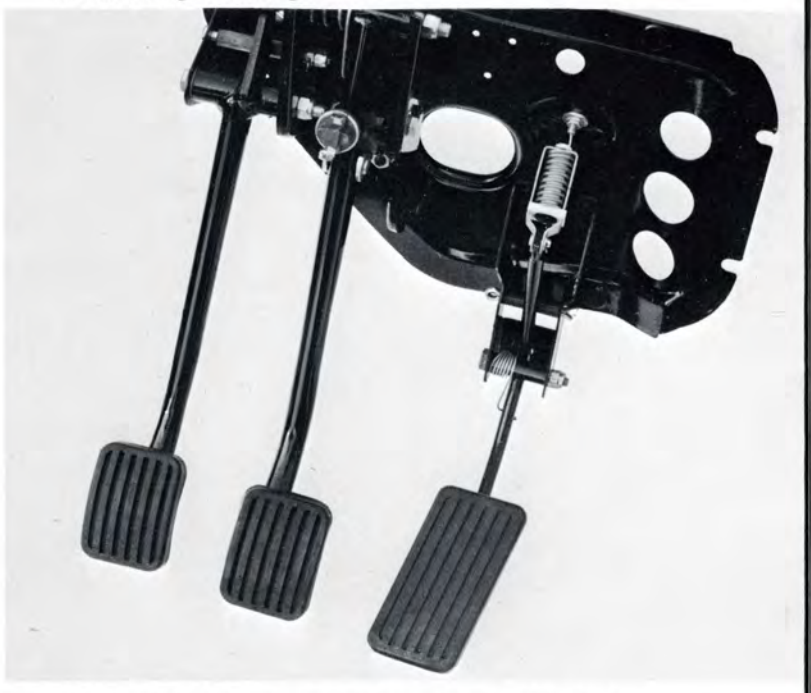
Windshield washer/wiper lever and overdrive lever are located on the right side of the steering column. On the column's left side is the combined lever for lane changing/turn signals and high beams.

The locking, illuminated glove compartment has been moved to the upper dash in front of the passenger's seat. The door opens flat to serve as a tray. Capacity of the compartment is 365 cubic inches.

Handbrake is conveniently placed next to the driver's seat. It operates a drum-type system on the rear wheels. A reminder light on the dashboard alerts drivers if the handbrake is engaged.

New non-glare safety steering wheel has a 1.2 inch smaller diameter to provide additional clearance between the rim and seat and to make steering easier. The wheel's padded center, which also is the horn ring, has been increased to lessen chances of chest injuries.

Pedal assembly with the brake power assist is installed as a single unit. The new pendant type acceleration pedal will bottom against the floor at full throttle to prevent overstressing the linkage.



Instrument cluster was designed as an easily replaced unit. Rheostat controlled illumination is from the top. The tachometer is standard on the 164E, optional on 140 Series models. Mileage is recorded to 999,999 and supplemented by a trip odometer with the reset button just below.

SEATS

One of the most visible and readily appreciated expressions of Volvo's exacting design philosophy is the seating. Front bucket seats are fitted to provide for separate adjusting. Each front seat is attached to the floor by four bolts. An additional set of attachment points provides for another inch of legroom, and, if necessary, the seat can be removed altogether.

The seats themselves, were designed with the aid of orthopedic surgeons—men who understand the importance of proper weight distribution for riding comfort. Cushion material is thus not packaged in a one-piece form but rather as a series of specially fabricated foam sections. The center of each seat cushion has a sandwich construction of firmer foam, while the sides and front, are made softer.

Underneath each front seat cushion is an arrangement of flexible parallel steel wires fastened to a spring-loaded steel frame. These wires are designed to flex and respond to the passenger's body movements in a manner similar to the more conventional system of coil springs and upholstery webbing.

There is a similar arrangement located in the backs of the front seats. This consists of five parallel steel wires in a spring-loaded frame. Turning a knob at the side of the backrest, "tunes" these wires to provide a softer or firmer backrest for proper lower back support.

Volvo considers its seats to be as much of a safety feature as any other interior component. A relaxed comfortable driver who can fully concentrate even after many hours behind the wheel will tend to operate his car in a safer manner. Seats also provide protection from collisions. The entire backrest is locked by a friction coupling so that it will slowly collapse in a controlled manner in the event of a rearward collision.

The same friction coupling permits the backrest to be adjusted to any angle the passenger desires. Another adjustable feature is the height adjustment, located below the seat, which enables the front and the rear of the seat to be raised or lowered. This means that a Volvo seat can really be adjusted to the proportions of any occupant. These provisions are especially important to a driver; if he should happen to have short arms and long legs, for example, he can raise the seat to gain extra legroom and at the same time move it forward to shorten the distance to the steering wheel.

This same attention to safety and convenience applies to the seat upholstery. Seats on the 142 and 144 models are covered with a new, softer fire-resistant material. It has two basic advantages—good wearing qualities and the fact that it breathes. It also responds to changes in temperature and does not retain summer heat or winter cold. Front cushions are removable for easy cleaning. Because of the hard use that station wagon seats are usually put to, the 145 is upholstered in heavy duty vinyl.

The 164E has durable leather covered seats, with sides and rear in matching vinyl. Although the basic design and construction of the seats in Volvo's different models is essentially the same, the 164E has an additional adjustment feature. The driver's seat has two levers: one controls fore-and-aft movement; the other, on a cam-type latch, is for raising and lowering the seat itself while at the same time providing for additional fore-and-aft movement.

Rear seat passengers have also not been forgotten. Shoulder room is nearly as much as the front, and the station wagon is no exception. Just as important, there is an exceptional amount of rear legroom. In this respect, Volvos are emphatically *not* compacts. Additional features are a fold-down armrest on sedans and net storage pockets on the back of the 164E front seats.

Easy to use self-adjusting 3-point safety belts are provided for front seat and outboard rear seat occupants. Front shoulder/lap belts are connected to an inertia reel mechanism in the door post, those in the rear to a similar inertia reel on the hat shelf. They unwind when pulled from their hangers and automatically retract when released from their mounts.

Seats in the Volvo 142 and 144 are upholstered in fire-resistant cloth with vinyl trim. The cushion's center area contains three layers of polyurethane foam with softer foam at the front and sides where less support is needed. Outer edges of the cushion and backrest are raised to provide lateral support.

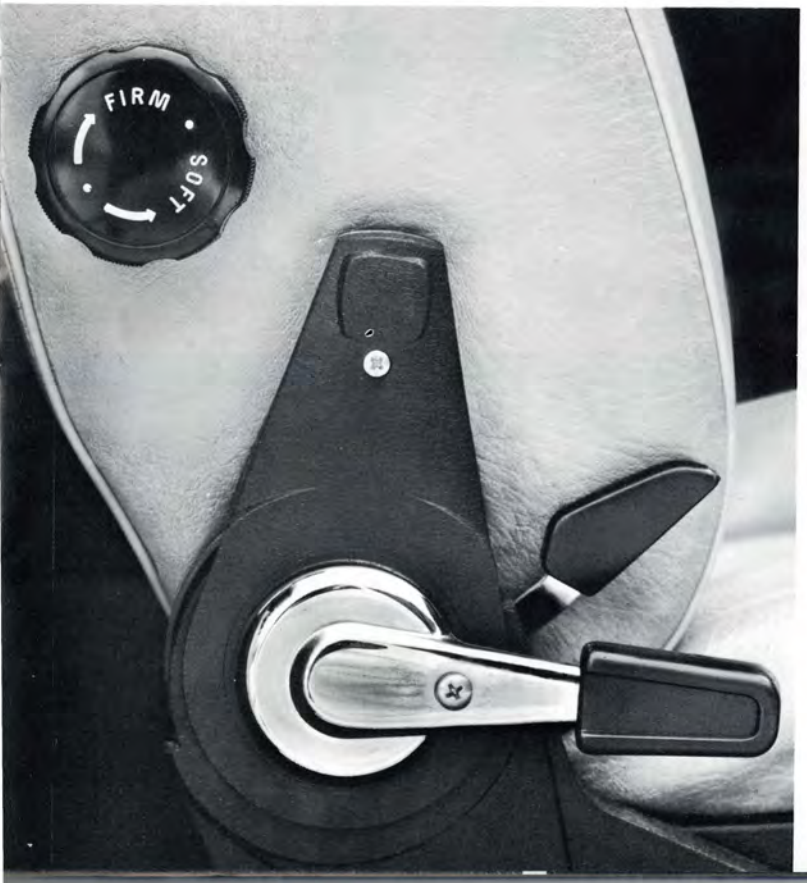
Volvo 142/144 seats are positioned to provide 40.7 inches of front legroom with a minimum rear seat knee clearance measurement of 4.0 inches. Fore and aft travel is 7.8 inches for both driver and passenger seats.

Leather-faced 164E rear seat, as those in the cloth upholstered 140 Series sedans, is equipped with two 3-point automatic adjusting safety belts, a center passenger lap-belt and a pull-down armrest.

Foam-filled head restraints are positioned for average height passengers but can be raised for taller occupants.

Heavy-duty vinyl covers the Volvo 145 station wagon seats. Available colors are blue, brown and black.

Variety of seat adjustments includes a lumbar support knob which turns to change the profile of the lower backrest. Raising the seatback adjusting lever will allow the backrest to be locked in any position. Two-door models have a spring-loaded safety catch (located above the seatback adjustment lever) to permit the seatback to be folded forward.



The Volvo 164E driver can adjust the height of his seat by lifting the lower lever to any of three positions. Lowering the seat also increases legroom 3.1 inches. The top lever is for fore and aft adjustment, providing another 6.4 inches of travel.

HEATING AND VENTILATION

This year a major engineering innovation in the 164E and 140 Series Volvos is the completely redesigned fresh air heating/circulating system. In this combined unit the same outlets and the same controls are used to circulate either warmed or ambient, or in the case of air conditioning, cool air.

Perhaps the best way to describe this system is in terms of its function, beginning with the airflow from the intake grille located just below the windshield. Ambient air is drawn into the central unit, which is basically a set of powerful blowers located under the dashboard directly behind the new instrument console. Here the air may be heated or cooled and then directed into a system of ten outlets located at strategic places throughout the car. The unit has three speeds–high, at 3800 rpm (a new speed to be used for maximum air conditioning), middle, more than 18% lower at 3100 rpm and a whisper-quiet low speed of 1900 rpm. At maximum speed air can be circulated through the passenger compartment at the rate of 318-cubic feet per minute, which is about 80% better than last year's system. (When air conditioning is included, the fan's output is only slightly reduced to about 300-cubic feet.) The heating part of the system has the same heating capacity as the unit which has been in use for the past few years. It is now controlled, however, by a newly designed vacuum switch which has a much faster reaction time to changes in the thermostat setting.

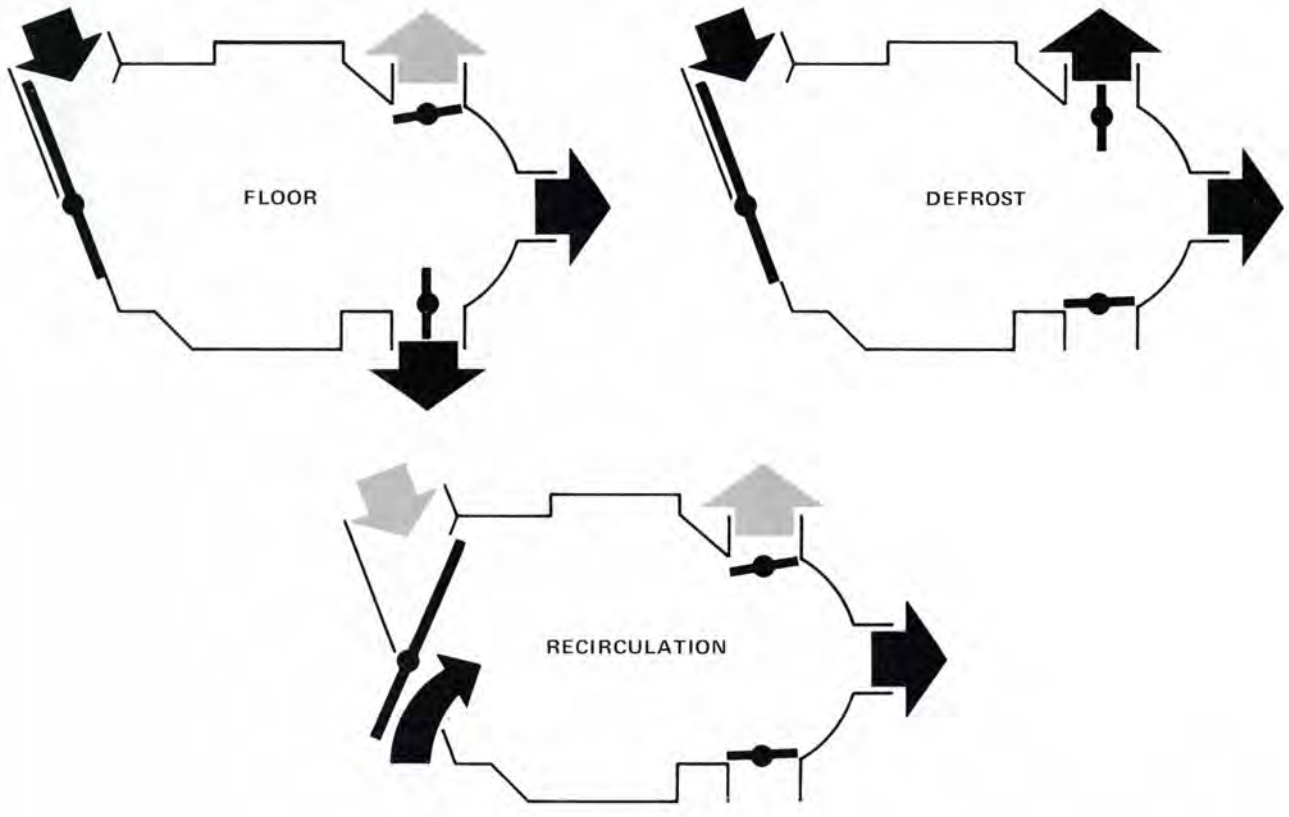
The four dashboard outlets can be completely adjusted from fully open to closed and angled in any direction. This will be particularly appreciated by front seat passengers, who are often more conscious on hot or cold air drafts than the driver is.

The quickest way to cool the passenger compartment is to shut off most of the intake of ambient air by switching to the new recirculation mode. This will result in an 80% reduction in the intake of outside air and consequently a re-use, or recirculation of the already cooled air inside the car. When the desired temperature is reached the "floor" and/or "defroster" modes should be selected in order to bring more fresh air into the compartment.

Best results, when maximum cooling is desired, is obtained by opening the dash outlets and closing the floor outlets. Reverse this procedure when maximum heat is wanted.

For most efficient defrosting, the floor and center dash outlets should be closed, the defroster mode selected and the outboard dash

Diagrams of Volvo's combined heating/air conditioning unit indicate air flow into the system and from the outlets in the different operating modes.



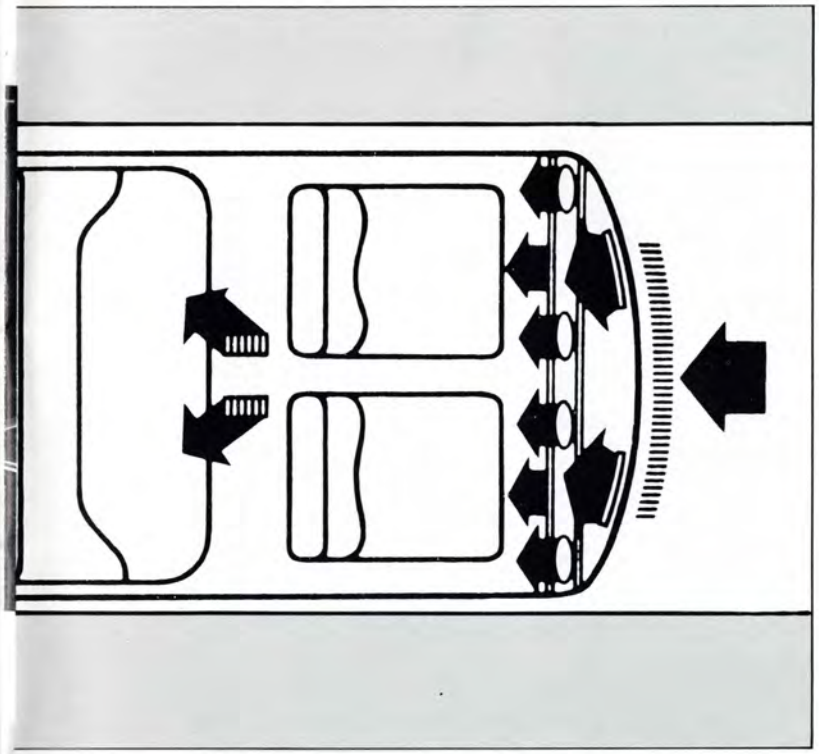
outlets opened halfway for demisting the side windows.

Regardless of whether the "floor" or "defroster" mode is in operation, there is little change in the amount of air flowing through the dashboard outlets. When the "floor" mode is selected, however, a small amount of air is directed to the windshield as well as to outlets located at the front and the rear of the floor.

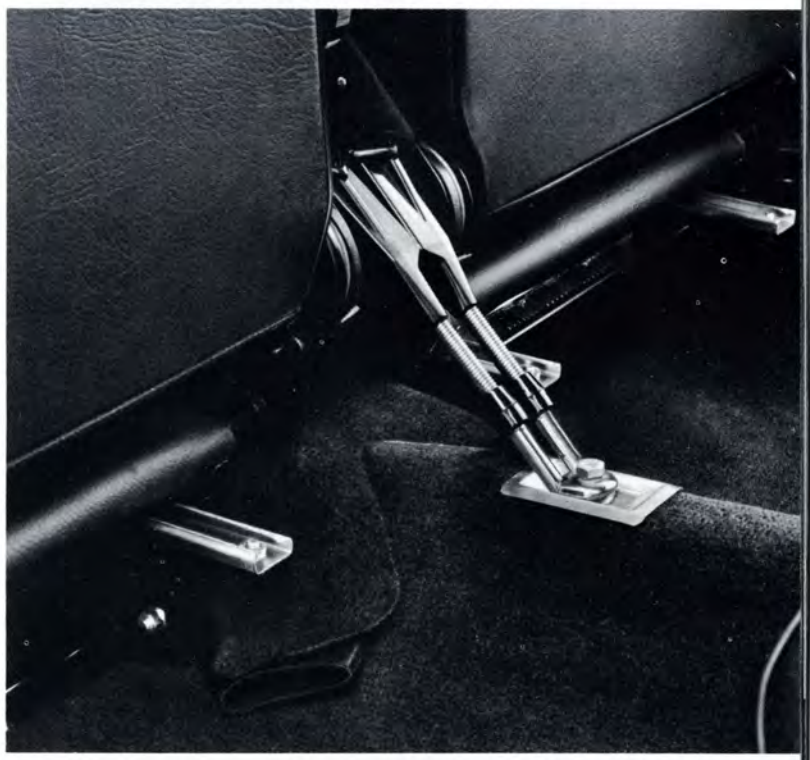
When the "defroster" mode is in operation, all incoming air to the floor is shut off. The "floor" mode thus assures a more even temperature for passengers in cold weather because warm air will always rise from the floor.

Components which make up the air conditioning part of this system are factory installed standard equipment in the 164E. In the 140 Series models these same components can be

New system has ten outlets which can be used for cooling, heating or fresh air ventilation. Air enters the Volvo below the windshield, not through the grille, to minimize intake of exhaust fumes.



Another special Volvo feature is ducting which can give rear seat passengers their own supply of heated or cooled air. This added air distribution helps to maintain a more even temperature throughout the car.



Dashboard outlets can be infinitely adjusted to allow the desired air intake and can be swiveled to direct the air flow to any angle. These outlets should be opened for maximum air conditioning and fresh air but closed when maximum heat is desired. Because warm air always rises above cold air, the floor outlets should be used to warm the car quickly.

Exposed view of Volvo's new combined unit was taken from the side so only one of the two fans is shown. The heating core is in the center next to the evaporator unit for air conditioning. Because air passes through the evaporator before entering the heater core, moisture can be removed on damp winter days and the air then heated.

installed at extra cost. Because the evaporator and its fittings are now simpler to install, the time to do this has been greatly reduced.

Customers who are not familiar with automobile air conditioning systems often think that they operate the same as room air conditioners. Actually they are very different. The inside of an automobile exposed to the sun can reach extremely high temperatures and the unit required to cool it must be a great deal more powerful than a single room home air conditioner.

The Volvo system has reduced the temperature to 72 degrees F. in 15 minutes in a test where the outside temperature was 90 degrees F. and the *inside* temperature 125 degrees F.

In another driving test, with the outside temperature 0 degrees F. the heating system brought the Volvo's inside temperature to 70 degrees F. in 14 minutes. This type of severe testing is typical of the way Volvo labors to prove out its components.

Another efficient system, flow-through ventilation, gets rid of the air inside a Volvo. Exit vents at the rear of the car are controlled by a set of one-way flap valves. When outside air is prevented from entering the car the flaps close to prevent the loss of heated air. Positive pressure caused by allowing fresh air to enter the car will reopen the exhaust valves.

Defrosting the rear window is still a separate function. Volvo has an electric system that heats horizontal wires applied to the inside of the rear window. Defogging takes place in seconds and ice that may have formed on the outside can be wiped away in a few minutes. Even when the defroster is left on a long time the glass will only get warm; it will never be hot to the touch.

Buyers who want a more complete system can add an optional sunroof for even better ventilation. It's available on the 142 and 164E. The Volvo sunroof is flush fitting steel opened by turning a fold-down handle. To eliminate excessive downdrafts a forward flap rises as the sunroof is opened.

LUGGAGE COMPARTMENT AND STATION WAGON

One of the easiest features to "economize" is a car's luggage compartment. Volvo's convenience-oriented styling, however, extends all the way to the trunk, and then some. The first consideration in any trunk is space. The Volvo trunk is a box-like structure that contains more than 23 cubic feet of useable storage space plus the spare tire which is placed upright (the Volvo owner need never be caught with the spare tire buried under layers of luggage). Volvo owners will also find that they can carry a lot more bulky items than they could in most "full-size" cars.

Within the trunk there are a number of features which exemplify Volvo's creative engineering. For example, the new license plate lights have been made to illuminate the interior of the trunk as well by extending the lamp into the rear panel of the trunk. A small touch, but one that will be appreciated.

Another "better idea," which Volvo has had for the last six years, and recently "introduced" in America by Ford, is the use of gas-filled springs to raise the trunk lid. The advantage to this arrangement, besides simply making it easier for, say, elderly women to raise the trunk lid, is that the raised lid can be positioned at a low angle to keep rain or snow out of the trunk when it is being loaded or unloaded. Another special feature is that the trunk lid can be left securely closed but still unlocked if desired.

Inside the trunk there is a well on each side. The spare tire fits in the one on the right. The other well is covered by the floor mat; it can be used as a "secret" storage area, or as a place to carry a specially fitted accessory gas can. The rubber floor mat can easily be removed for cleaning.

Like the sedans, the Volvo 145 station wagon has more usable storage space than comparable intermediate, or even many "full-size" wagons—67 fully carpeted cubic feet of it with the rear seat folded, without annoying projec-

Box-like trunk design means that luggage can be placed upright instead of being stacked. A removeable rubber mat covers a hidden compartment on the left side where valuables or an accessory gas can can be stored. Vertically mounted spare tire assures accessibility even with a fully loaded trunk.

tions and with nearly vertical sides all the way to the roof. The rear door opens up, assisted by a gas-filled cylinder, thereby eliminating the need for all the cumbersome and unreliable door linkages to enable the rear door to be opened either down or to one side. The rear seat backrest folds down by using *one* handle located on either side. The backrest bottom, as well as the wheel arches, is carpeted like the rest of the cargo area. The spare tire and wheel are positioned in the left rear quarter behind an easily removed cover. This means that, like the sedans, the 145 doesn't have to be unloaded if a tire has to be changed.

On the right side of the cargo area there's a reservoir for the rear window washer—another Volvo innovation. There's still more: the entire center of the wagon's cargo area opens to reveal another storage compartment containing 3.5 cubic feet of space for tools or whatever. There's also a domelight located just in front of the rear door with a 3-position switch.

By turning a recessed handle on either side of the car, the 145's rear seatback folds flush with the floor.

Underfloor compartment houses the one and one-half quart reservoir for the electric rear window washer.

Spare tire is conveniently located in station wagon's rear quarter behind easily removeable cover.

145 rear compartment holds up to 70 cubic feet of cargo with a twin-lid underfloor compartment. Fully carpeted flat floor has a maximum length of 74 inches. The rear door opens upward, assisted by a gas-filled cylinder. The left side brace is equipped with a safety latch.

1800ES SPORTS CAR

Volvo's top-of-the-line sports car was introduced in the United States in the spring of 1972 with an entirely new styling concept. It replaces the 1800E model, the first Volvo to be equipped with electronic fuel injection, power disc brakes, radial ply tires and electrically operated overdrive, along with a number of luxuries like leather upholstery. The 1800ES offers buyers the innovation of a fast back, combined with many of the advantages of a station wagon.

For 1973 the 1800ES has been further improved with stronger bumpers, new dashboard controls and improved windshield wipers. The wiper blades are two inches longer, in order to sweep out a 10% greater area. Inside, the lower dashboard to the left of the steering wheel now features illuminated rocker switches for the windshield wiper, washer, electric rear window defroster and heater fan.

Mechanically and structurally the 1800ES shares engineering principles and many major components with other Volvo models. Common features include the B20 fuel injection engine, power assisted 4-wheel disc brakes and the four-speed transmission with electrically-operated overdrive. (Or optional automatic at no extra cost.)

Instrumentation, operating controls and most interior fittings differ, along with the high capacity heating/ventilation system and the air conditioning.

Front bucket seats are identical in construction to those in the 164E except that the headrests are built into the backrests. From the front seat back the 1800ES converts to a station wagon with 36-cubic feet of storage space. This space is accessible from the swing-up rear window by folding the backrest of the rear seat flat into the rear floor. Even with the rear seat, which is primarily intended for children, in place, there is still substantial space for luggage. The 1800ES also has an underfloor compartment for concealing valuables.

Other interior features of interest include a locking center console and expandable pockets on the doors.

Unusually large cargo capacity of the 1800ES is 36 cubic feet. Even with the rear seat in place, there's more storage room in Volvo's sports car than in the sedans.

When folded, 1800ES rear seat with retracting lap belts is flat with the rear floor, not the cushion.

Built-in head restraints are the only difference between the 1800ES front buckets and those in the 164E.

Two additional underfloor compartments flank the spare tire well. Extra large rear window serves as a tailgate; held open by two gas-filled cylinders.

ENGINES AND TRANSMISSIONS

When Volvo engineers began their search for ways to control exhaust emissions the first thing they found was that the basic design of existing automobile engines would meet Federal requirements without the necessity for major internal modifications and without sacrificing performance.

The key feature for today's Volvo engines was the development of an electronic fuel injection system to better control the flow of fuel and air into the engine.

In 1968 Volvo engineers began testing an electronically-controlled fuel injection system for Volvo's four-cylinder engine. This new approach was to replace the time-tested automobile carburetor with something intrinsically better—something which would provide better road performance and at the same time, which would be even more serviceable and reliable.

The result of this program was the appearance, two years later, of the fuel injected 1800E and, the following year, of a fuel injection engine for the 142 sedan. The performance of both of these models has been so impressive that Volvo has now standardized the fuel injection system for every model, not only for the four-cylinder 1800ES and 140 Series, but for the six-cylinder 164E as well.

Two basic considerations have influenced Volvo's decision to adopt fuel injection. The first was simply the need to combine more power with a cleaner exhaust—without compromising the Volvo engine's proven reliability and long life. The second was the development of electronic control, which promised to eliminate the complicated problems of tuning and adjustment which had hitherto restricted the use of automotive fuel injection systems to high performance applications like racing.

Electronically-controlled fuel injection definitely offers better overall performance compared to carburetted Volvos. The basic reason for this is simple: it is more efficient to spray fuel directly into the engine than it is to squirt it more or less into the airstream—and then let it find its way into the engine. To oversimplify a bit, this is really what a carburetor—even the most sophisticated carburetor-actually does. To put it another way, all carburetors are basically simple, self-regulating *mechanical* devices. Where no great amount of feedback and control is required, they provide a satisfactory solution to the problem of mixing gasoline and air in the right proportions over a limited range, which is why they can be used on motors for lawnmowers, rowboats and even tiny model airplanes.

But when it comes to a multi-cylindered three or four thousand-pound automobile, which is driven day-in, day-out, in all kinds of weather, the task of mixing fuel and air becomes more and more demanding. The basically simple carburetor has become more and more complicated. Each refinement in design imposes an additional price in adjustment and maintenance. At the same time the options, in terms of overall performance, have tended to narrow. In effect, you can tune a carburetor for more speed, but this will be at the expense of fuel economy; or you can adjust it for smooth operation at low speeds, say, for city driving, but to do so you will have to sacrifice a measure of expressway performance, or lower combustion efficiency and in the process you will probably get a dirtier exhaust. Whatever compromise you accept, you will find that it is increasingly difficult to maintain it.

Built-in electronic control provides fuel in-

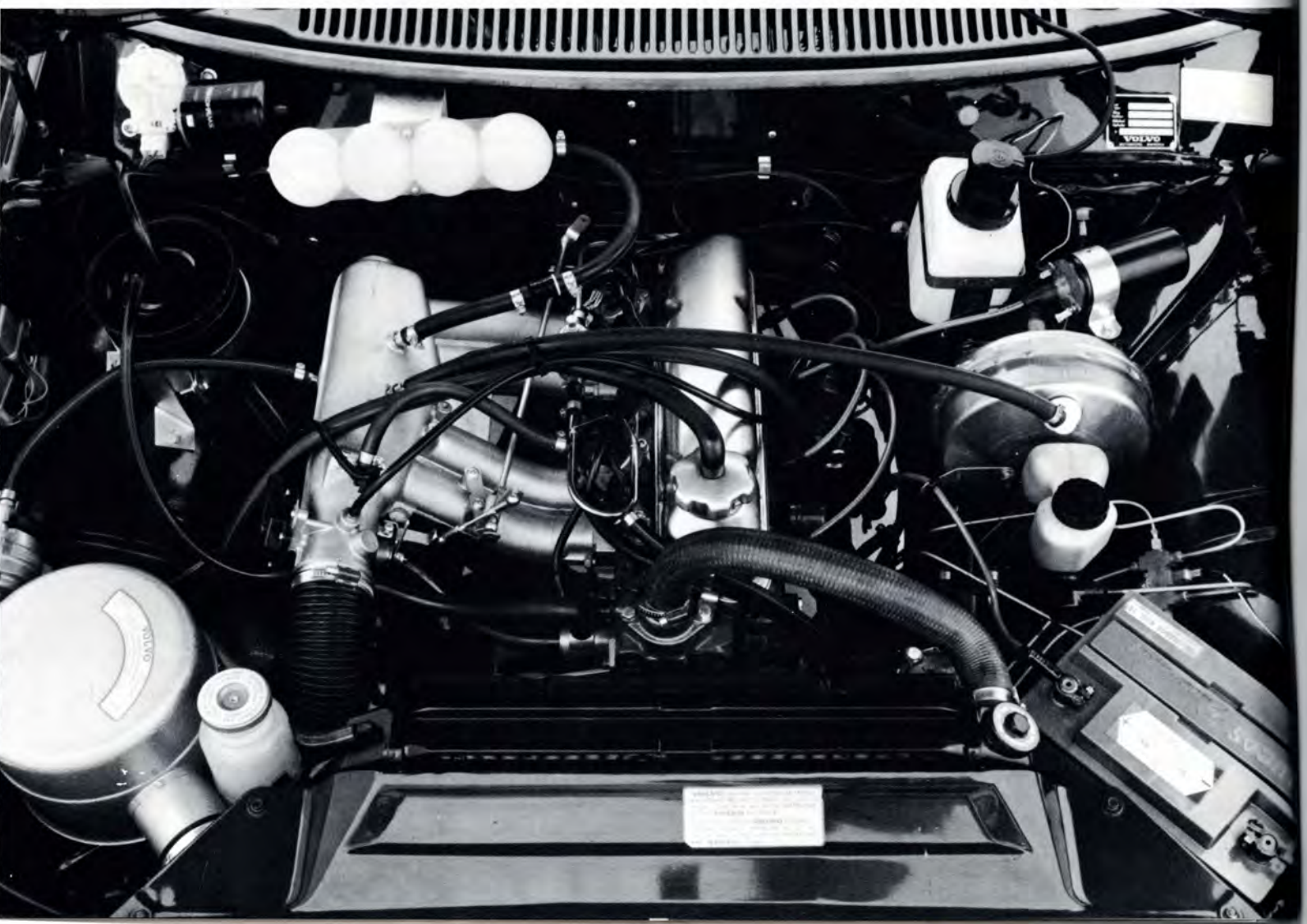
jection with the edge over carburetors. Electronic control can cope with a wider range of operating conditions. It makes possible a better compromise in road performance, fuel economy, and what is increasingly important, a cleaner exhaust. How? In two ways: By responding to a greater number of operating signals, and by delivering a more precisely controlled air/fuel mixture to each cylinder. Here's how it works:

Ambient air is drawn through the air cleaner, into the manifold, and then to the cylinders in the same way as it is in a carburetted engine. The amount of air coming in is regulated by a valve controlled by the accelerator pedal. (Strictly speaking, you don't give the engine "more gas," you give it "more air.")

Instead of passing through the mixing chamber of a carburetor, however, the incoming air now goes *directly* to each cylinder. At the same time fuel is fed under pressure to a set of injection valves, one located immediately before each cylinder's intake valve. An electronically controlled switch in each injector opens and shuts to let a measured amount of fuel spray (rather like an atomizer) into the cylinder, where it instantly mixes with the incoming air to become an explosive vapor.

The injectors are controlled by a small analog computer (similar to those used in aircraft automatic pilots) located in the passenger compartment. This computer control unit acts on the basis of signals received from the engine itself, from the driver, and—just as important—from the environment. Its purpose is to provide not only the proper amount of fuel, but also the proper *proportions* of fuel and air at all times. (Varying engine requirements like starting and accelerating require proportionately more fuel, while varying external factors like

Components in the engine compartment have been carefully located to provide for full servicing accessibility. New underhood features include the windshield wiper motor and vacuum system for controlled interior temperature (top left).



atmospheric pressure and temperature call for a change in the ratio either way.)

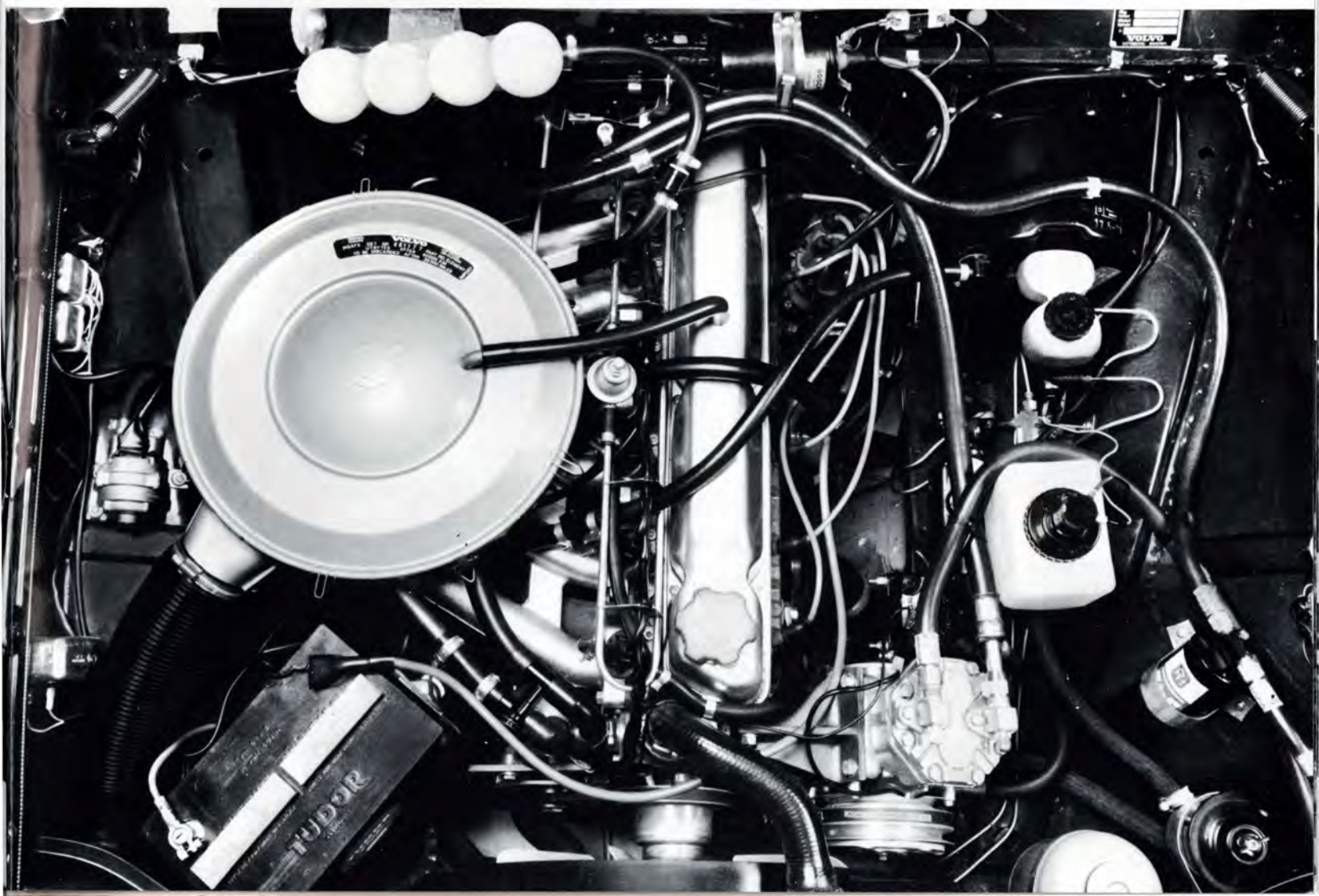
The process of sensing and responding to these conditions begins the moment you turn the ignition key. Information about engine and ambient air temperatures is received by the control unit from electronic sensors, located in the engine, in the form of electrical pulses. These are instantaneously transformed into operating signals for the injectors. At the same time, a thermostatically-controlled device regulates the flow of air coming into the engine.

As the engine begins to build up speed, another sensor is activated to monitor the pressure of the air being drawn into the cylinders. This, in turn, provides the control unit with an indication of the engine's load, while engine speed is being "sensed" and relayed by the trigger points in the distributor. This information is used to further regulate the injectors in two ways—by varying the frequency at which the injector valves open and by varying the length of time they remain open (thereby, of course, regulating precisely the amount of fuel entering the cylinder.)

The next source of information is the driver himself. As he depresses the accelerator, he opens the air intake valve wider and in the process sends more signals to the control unit. The effect of this, logically enough, is to cause more fuel to be injected into the cylinders as more speed and power is called for.

All of these sensors continue to function as long as the engine is running. The combination of signals they relay to the control unit will continue to activate the injectors according to a predetermined program. In this manner Volvo engines are made to respond to the entire spectrum of operating conditions at the moment they occur, rather than operating mechanically

The addition of electronic fuel injection, air conditioning, power brakes and power steering give a space-age look to the 164E's engine compartment but all the electrical and serviceable components are fully accessible.



in one of several broadly established modes like "idling," "running" or "accelerating."

The "starting" mode on a Volvo fuel-injection engine, incidentally, is taken care of by a special device that goes into action as soon as the engine starts to turn over. It is called the "cold start valve" and it's not designed just to start in cold weather; activated automatically by a thermo-timer, this valve enriches the incoming airstream with an extra measure of fuel whenever the engine temperature is less than 95 degrees F.

What does Electronic Fuel Injection actually mean to the Volvo driver and owner? It means, for example, that in hot weather his engine will automatically get a different mixture than it will in cold weather; when he drives from, say, the mountains to the seashore, or, for that matter, from his heated garage to his snow-covered driveway, his engine will respond by burning a little more fuel.

He will find that this new sensitivity has a number of advantages. Response to climate is one, driving demands is another. His Volvo will be able to fully cope with the restrictions of city driving—lots of stops and starts from low speeds along with higher engine temperatures from excessive idling in traffic. At the same time, he will get full performance on the expressway—fast, confident acceleration, plenty of power on hills and under heavy loads, and reliable engine braking.

The same flexibility that distinguishes engine operation and performance applies to Volvo's routine servicing and maintenance procedures over the life of the engine. Since the system's basic operation can be checked by advanced electronic equipment the engine is no longer subject to the tune-up uncertainties that are common to carburetted engines. In a word, the engine needs less "fussing."

The only major engine modification this year is found on models equipped with automatic transmissions. To reduce exhaust emissions at low engine speeds, Volvo has installed an exhaust recirculation system in which the exhaust pipe is now connected to the air intake manifold. This arrangement makes it possible to reburn a portion of the unburned fuel/air vapor present in the engine exhaust at low speeds, thereby increasing the engine's efficiency and—more important—significantly purifying the exhaust. Controlling this system is a replaceable valve which closes the recirculation pipe when the engine speed rises above a certain minimum.

Volvo dealers in nearly all major urban population centers have found that there is an increasingly greater demand for automatic transmissions. In less congested areas, however, Volvos equipped with manual transmissions, and particularly those models with overdrive, still sell better.

The six-cylinder B30F engine, shown with its air cleaner removed, has air centrally and evenly distributed to each of the cylinders. Fuel pressure valve (right center) maintains a constant 28 p.s.i. in the system.

Factory installed air conditioning now is standard on the 164E and the same system is optional on 140 Series models. The compressor is fitted above the power steering pump, the receiver/dryer unit on the inner fender.

Overdrive was popular for many years on domestic cars; Volvo is now one of the few automakers still offering this feature. Overdrive is standard equipment on the 164E and 1800ES, and optional on the 142. Attached to the rear of the manual transmission and operated electrically by a switch on the steering column, the Volvo overdrive unit in effect provides the driver with a fifth gear. Engine speed is lowered 21% below fourth gear—for the same road speed—to reduce engine stress, improve gas mileage and to permit quieter running.

There are two Volvo four-speed manual transmissions, one for the four-cylinder 140 Series and for the 1800ES, and the other for the six-cylinder 164E. Both are rugged, fully synchronized designs built to handle far more power than the engines actually develop.

Linkage in all models is the remote type, so that the shift lever can be exactly positioned. This remote linkage also makes shifting easier and more precise.

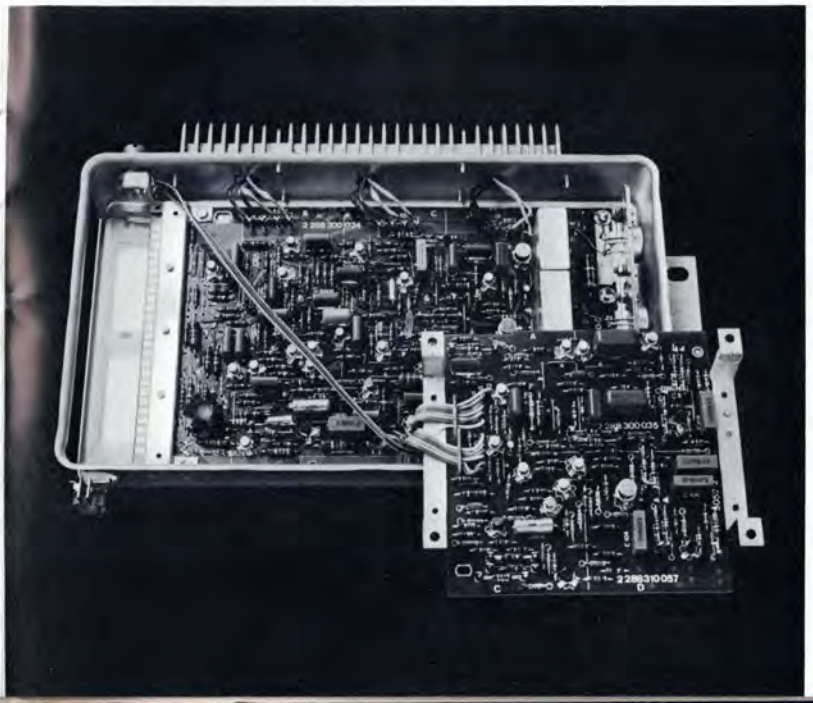
An important—and often overlooked—transmission feature is the gearing. The more gears a transmission unit contains, the better it can utilize the engine's power. Heavy trucks and racing cars, for example, require specialized and complex transmissions with close gear ratios in order to make efficient use of engine speeds.

Transmission gearing for passenger cars must embody a compromise between the load-carrying needs of trucks and the speed and acceleration requirements of racing cars. With this in mind, Volvo engineers have opted for evenly spaced gears, so that when shifting from a higher gear at peak engine speed, the resulting drop in engine rpms will never be lower than the point of maximum torque. This means that there is no need, for example, to maintain high engine speeds when climbing a steep hill; a higher gear will give equal performance.

Volvo's torque converter automatic transmission is a three-speed unit featuring part throttle kick down for passing acceleration. This transmission is matched to the different engines. Automatic "up-shifts" provide good performance. A new floor-mounted shift lever was introduced in 1972 to improve the transmission's flexibility. Drivers can thus select first speed only, second speed linked only with the first, and drive speed with automatic shifting between all three speeds. A push-button control on the shift lever prevents incorrect or inadvertant shifting.

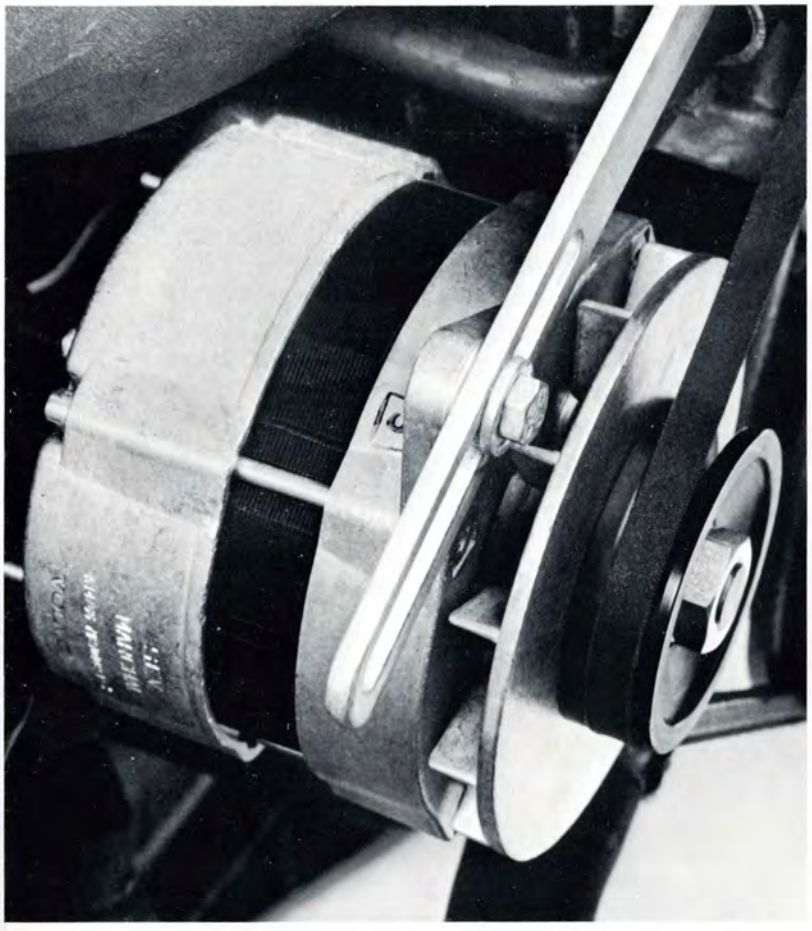
Because heat build-up can be excessive in automatic transmissions, Volvos are equipped with a transmission oil cooler housed in the base of the engine radiator.

Electronic brain controlling the Volvo engine receives signals from five sensors to regulate and control the length of time the fuel injectors remain open. The sealed computer is stored under the passenger seat.



A fuel injector sprays a thin stream into each intake valve port. The injector valve may open from two to twelve thousandths of a second, depending on operating conditions sensed by the computer.

All Volvos are equipped with a heavy duty 55 amp alternator which has the ability to charge even at idle speed with the air conditioner in operation.



For positive gear changing, the short-throw shift lever for manual transmission Volvos is connected to the gearbox by remote linkage.

Volvo's automatic transmission features an illuminated floor-mounted shift quadrant with a push-button selector lever. The push-button virtually eliminates incorrect shifting from any of the six positions on the quadrant.

NO NEED TO DEPRESS BUTTON	DEPRESS BUTTON HALFWAY	DEPRESS BUTTON ALL THE WAY
P	P	P
R	R	R
N	N	N
D	D	D
2	2	2
1	1	1

BRAKES

When the 144 was first introduced, its four-wheel power-assisted disc brake system was internationally acclaimed for its advanced safety provisions. Even without any substantial modifications this year it can be a powerful selling point to new and old buyers alike.

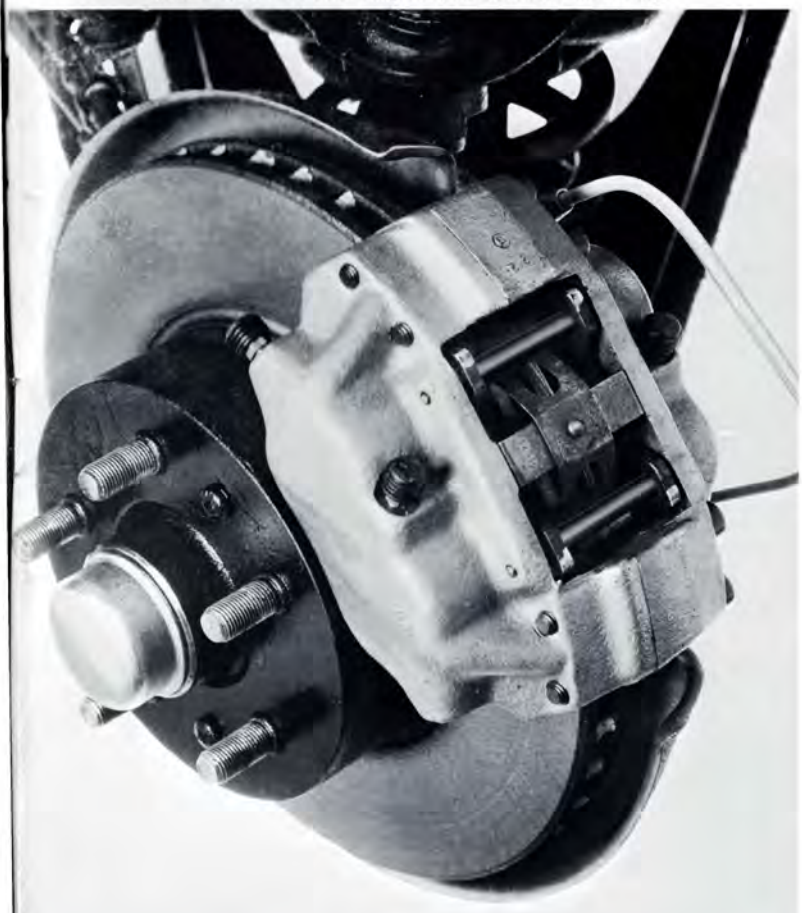
Why is Volvo's system so impressive? The true value of good brakes, after all, is not really evident in the course of normal day-to-day driving and they are rarely appreciated even in emergencies. Today all cars have hydraulic brake systems which use a fluid with a high boiling point and which have fittings and brake lines designed to withstand high pressures. Federal regulations, moreover, require dual hydraulic systems to ensure partial braking response if one circuit should fail. In addition, many American cars have now switched to disc brakes for the front wheels; nearly all automakers now offer power assist as standard or optional equipment.

Nevertheless, the brakes on Volvo's production cars are still among the most effective on the road, and they should remain so for sometime to come. Here's why we can make this claim:

Volvos have disc brakes not just on the front wheels, but on all four wheels. These discs have passed laboratory tests that require, among other things, a stop from 60 mph in less than four seconds. They have also withstood temperature buildups as high as 900 degrees F.

Since a disc brake system works by forcing easily replaced stationary brake pads against a spinning disc mounted on each wheel, there are four critical factors to be considered in its design: the size of each disc, which must be large enough in diameter to effectively dissipate the intense heat generated by each braking before the next braking contact begins; the composition of the replaceable pad, which must be made of a metalized composition material with good wearing qualities; the size of the pad, which must provide a sufficient contact area, as well as good heat absorbtion qualities; and the hydraulic pressures involved, which must be

Front brake discs on the 164E are slotted to provide for greater cooling through air circulation. One advantage of disc brakes is their easy inspection and servicing.



Balanced brake design places smaller pads on the rear discs although the discs actually are larger. A separate handbrake system is incorporated inside the drum.

powerful enough to force the pad against the disc within a critical time period and be extremely responsive and easily regulated.

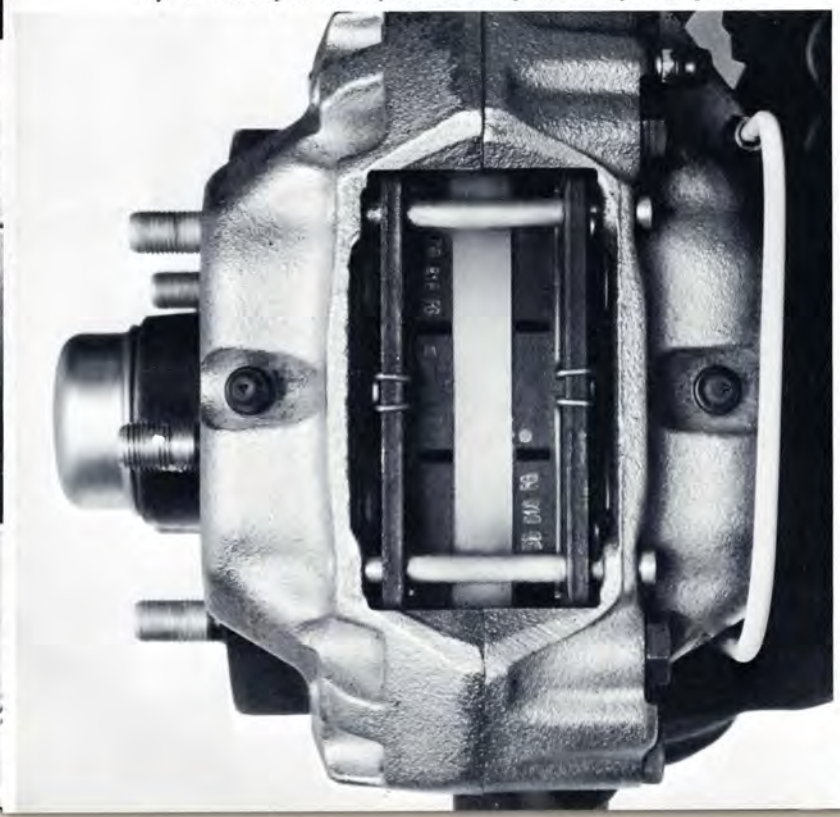
All of these factors were carefully balanced in the course of designing the Volvo brake system since, to perform optimally under all driving conditions brakes have to do more than simply "stop on a dime." Fast stopping ability, actually, may not be as important as directional stability and control. For example, since the 164E sedan is heavier in front than the 140 Series sedans, it has been equipped with ventilated front discs to take care of the increased heat dissipation requirements, and the power-assist, which multiplies the effect of brake pedal pressure, has been increased from 3:1 in the 140 Series to 4:1.

Another example of Volvo's superior design is the way the dual hydraulic circuits have been arranged. Rather than following the conventional practice of separate circuits for the front and rear wheels, Volvo ties one rear wheel to each of the *two* front wheels. In this way even if one circuit should fail entirely, the driver will still have about 80% of the system's braking power at his disposal, and he will have sufficient directional stability left to minimize the possibility of a skid or other loss of control.

Each of these brake circuits, moreover, has a relief valve in the brake line to the rear wheel. The purpose of these relief valves is to assure that the brake pressure on all four wheels is consistent with the changes in the car's weight distribution under all kinds of braking conditions. (The harder the brakes are applied, the more weight there is on the front wheels.) The valves regulate the hydraulic pressure to the rear wheels so that under hard braking conditions they receive a smaller proportion of braking effort, thus preventing premature wheel lockup in emergencies.

There is also an auxiliary handbrake system with a brake drum in each rear wheel. This system has been designed to ensure full handbrake effect even if the linkage is not in perfect adjustment. Another example of the process of constant improvement and refinement which makes Volvo's brake system something that you can take seriously.

End view of the front disc brake caliper shows accessibility of the replaceable pads held in position by steel pins.



Hydraulic brake fluid level in the translucent twin reservoir can be inspected without removing the cap.

STEERING AND SUSPENSION

Owners of early 140 Series models will be in for a pleasant surprise when they test drive a new 140 Series model. The smaller steering wheel will be noticable but the improved handling and directional stability and lighter steering reaction are because of changes made to the steering and suspension components. (When parking, 20% less effort is needed at full wheel lock.)

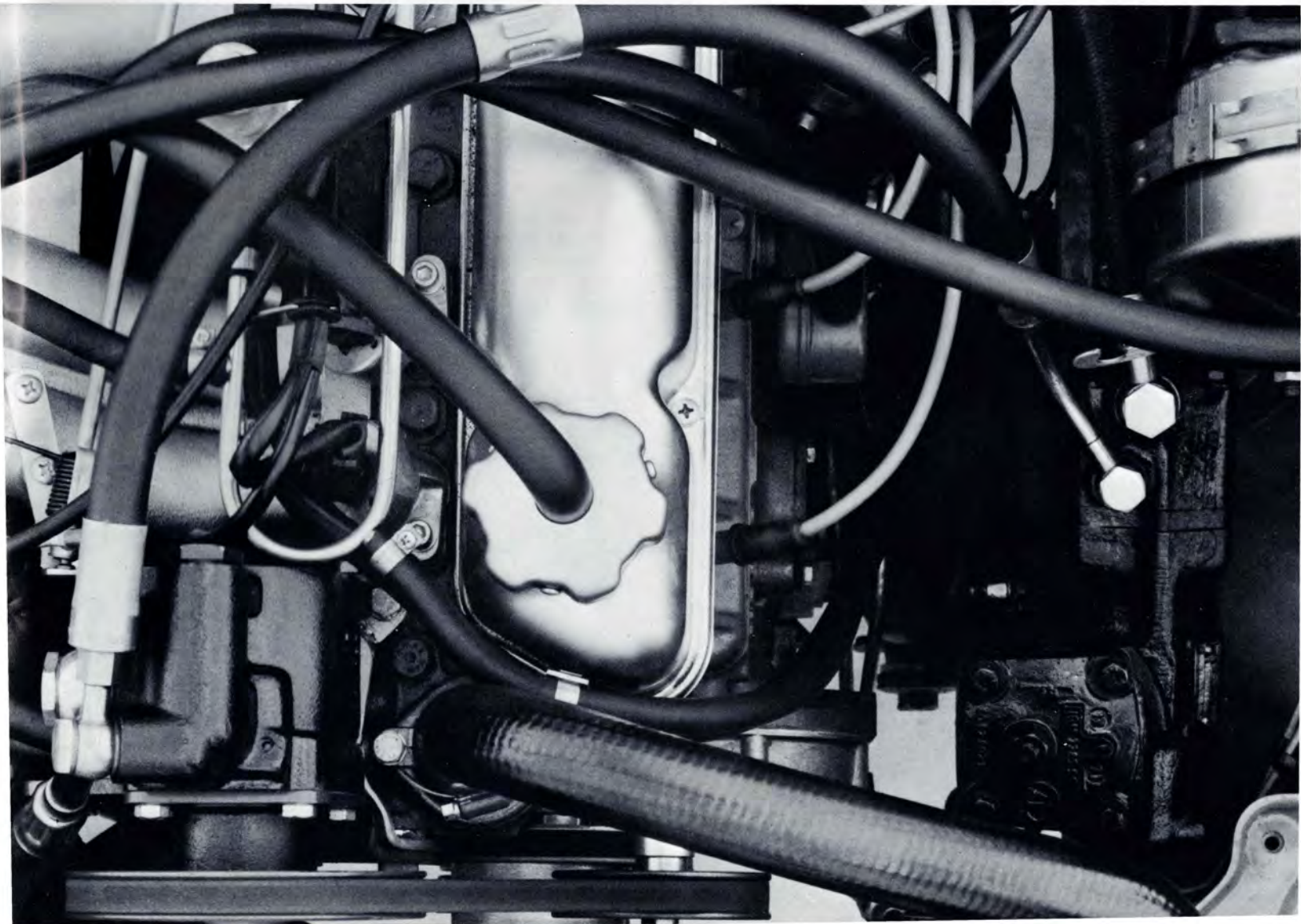
Furthermore, Volvo has recently added power steering to all 140 Series models equipped with automatic transmission. As with the 164E power steering, this unit also is ZF designed. Early production 1973 automatic transmission models have the same improved steering as cars equipped with the four-speed manual transmission.

All 164E models have had power steering standard since its introduction. This system effectively provides the kind of responsiveness that is lacking in many power assists, and it makes steering and parking a matter of ease and precision.

With far less weight up front than the larger 164E, the new 140 Series unit was carefully calibrated to avoid the sponginess and lack of road feel associated with too powerful an assist.

Because winters in northern countries can last six months or more, Volvo builds cars that can cope with bad weather and bad roads. This had led to an extensive research program for suspension systems and components, and to the adoption of a suspension system which is matched to the design of the car itself. This means rugged coil spring suspension and double-acting tubular shock absorbers on all

A brand new feature on 140 Series models is highly responsive power steering on cars equipped with automatic transmission. This recirculating ball and nut assist is similar to that used on the 164E but the lighter weight 140 Series models do not require as strong a boosting effect. The belt-driven pump is located over the alternator on the left side of the engine; on the 164E it's placed on the right side.



four wheels in combination with extremely accurate control of the rear axle. Longitudinal movement of the solid and "live" rear axle is controlled by two rubber-mounted support arms; lateral movement is controlled by a track rod. Two more torque rods prevent the axle from turning during acceleration and braking.

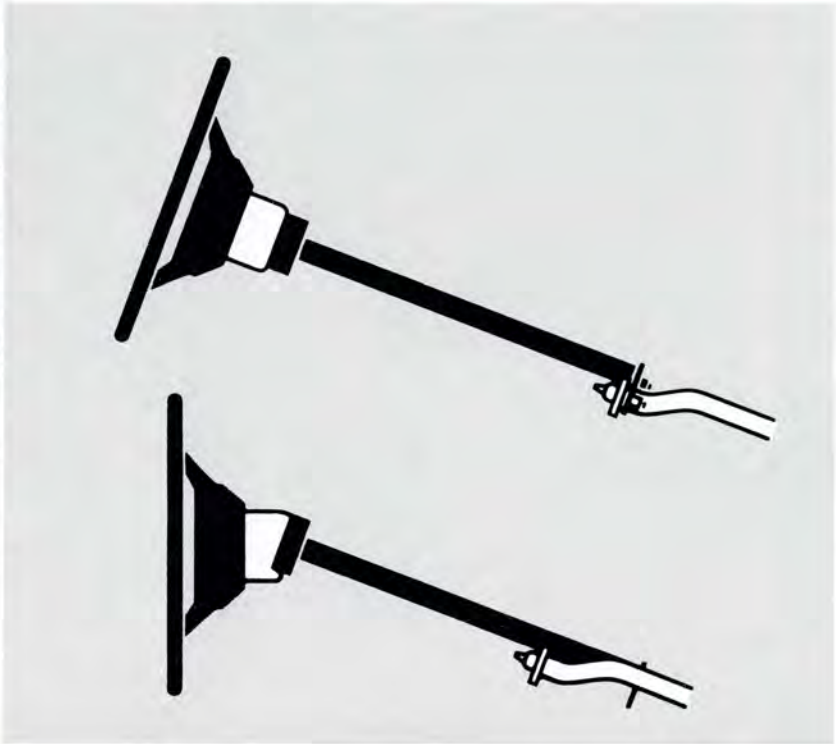
Since each of the system's functions—springing, control of axle movements and shock absorbing—is performed by a separate set of components, the suspension as a whole can be balanced so that it matches the design characteristics of the car. The result: a firm ride with unusually good control in the event of sudden swerves and other emergencies, as well as a smooth riding experience under more optimum conditions. This is in marked contrast to the soft and generally unresponsive ride of many domestic cars. All models have specially designed rear wheel bearings which absorb lateral stress during cornering. To increase bearing life, stress is absorbed on both sides of the bearing and on each side of the car.

Individual Volvo models, moreover, possess special features keyed to their particular riding characteristics. The rear springs of the 145 station wagon are thus supplemented by a set of hollow rubber snubbers which are designed to limit vertical travel of the rear axle under heavy loads.

All Volvos now are equipped with radial ply tires which industry tests show have distinct advantages over conventional cross-ply tires because the sidewall of a radial tire flexes, putting more rubber on the road in fast turns and when stopping. This "give" is taken up in the Volvo's suspension, which was modified when radials were first introduced on the sedans in 1971.

The 145 station wagon was equipped with cross-ply tires because of needed higher load ratings, but for 1973 a new, stronger radial ply tire is standard equipment on the wagon.

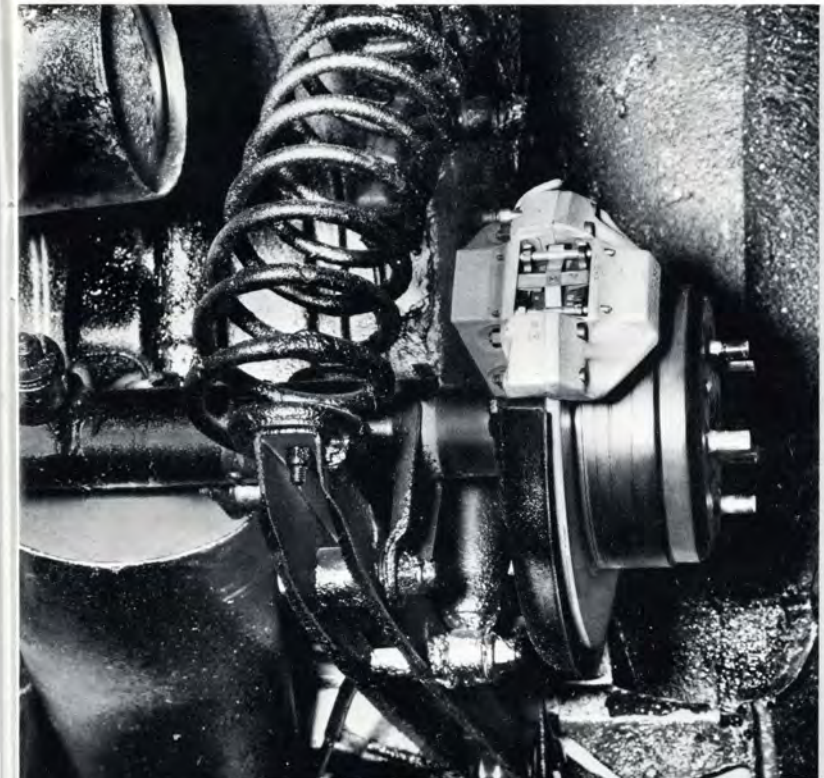
Another new safety feature is an attachment between the steering wheel and hub which will deform in an accident to align the wheel toward the driver. The two-piece steering column will sheer in a frontal collision (Volvos with power steering utilize a telescoping column).



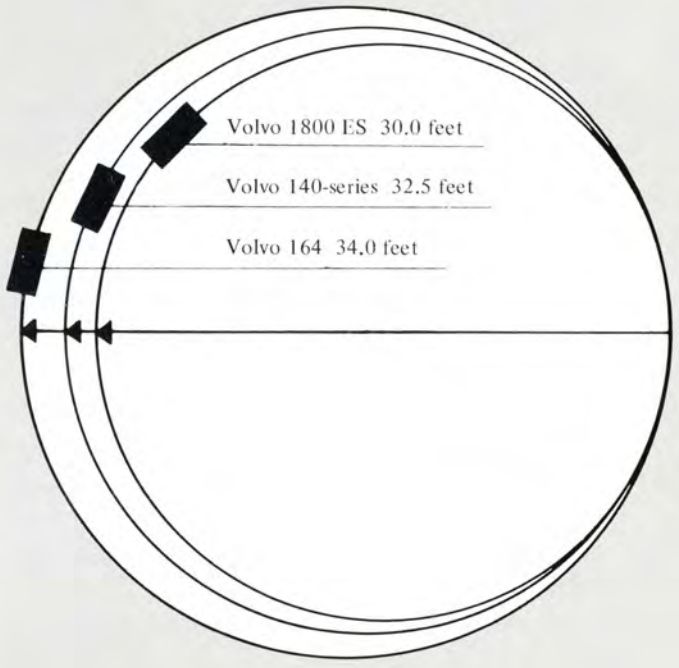
New ignition and steering column lock has been moved to the dashboard on 1973 models. Repositioning of the lock makes it more convenient and adds to Volvo's theft proof value.

Modified steering and suspension components on 140 Series models give even better directional stability and reduced steering effort (20% less force is required at full wheel lock). Improved handling and road feel are especially noticeable in fast turns or on rough roads.

Coil springs and telescopic shock absorbers are fitted at each corner of a Volvo. Solid rear axle is positioned by longitudinal rubber-mounted control arms and torque rods, transversely located by a track rod.



Short turning circle means a Volvo is more easily fitted into a tight parking space than some so-called compacts, and more easily done with power assisted steering on the 164E and 140 models with automatic transmission.



SPECIFICATIONS – 1973 VOLVO MODELS

Engine:

164E – Type B30F. Water cooled, six-cylinder, in-line, cast iron block and head, seven-main-bearing crankshaft. Pushrod operated overhead valves with gear driven four-bearing camshaft. Pressurized electronic controlled Bosch fuel injection with electric fuel pump. Bore: 3.50 inches. Stroke: 3.15 inches. Displacement: 182 cubic inches (2979cc). Maximum horsepower: 138 SAE net at 5,500 rpm. Maximum torque: 154 foot pounds SAE net at 3,500 rpm. Compression ratio: 8.7:1. Oil Capacity: 6.3 quarts including filter.

140 Series and 1800ES – Type B20F. 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. Pressurized electronic controlled Bosch fuel injection with electric fuel pump. Bore: 3.50 inches. Stroke: 3.15 inches. Displacement: 121 cubic inches (1986cc). Maximum horsepower: 112 SAE net at 6,000 rpm. Maximum torque: 115 foot pounds SAE net at 3,500 rpm. Compression ratio: 8.7:1. Oil capacity: 4 quarts including filter.

Clutch:
Diaphragm spring type, single dry plate – 9½ inch on 164E, 8½ inch on 140 Series and 1800ES.

Electrical System:
Voltage: 12. Battery capacity: 60 amp hours. Starter output: 1 hp. Alternator rating: 55 amps.

Cooling System:
Sealed, anti-freeze coolant circulated by engine driven pump. Transparent expansion tank. Capacity: 164E – 13.0 quarts; 140 Series – 10.5 quarts; 1800ES – 10.0 quarts.

Fuel System:
Sealed system with evaporation control. Tank capacities: 1800ES – 11.9 gallons; all other models – 15.5 gallons.

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.

Wheels and Tires:
164E – pressed steel wheels, rim size 5J x 15 inches. Whitewall radial ply 175SR15 or 165SR15 tires.
140 Series – pressed steel wheels, rim size 5J x 15 inches. Whitewall radial ply 165SR15 tires except on 145 which has whitewall radial ply 175SR15 tires.
1800ES – pressed steel wheels, rim size 5½J x 15 inches. Radial ply 185/70HR15 tires.

Steering:
164E – Cam and roller type with recirculating ball and nut power assist. 3.7 turns lock to lock. Turning circle: 34 feet. Steering ratio: 15.7:1.
140 Series – Cam and roller type with 4.4 turns lock to lock. Turning circle: 31.5 feet. Steering ratio: 17.5:1. Models with automatic transmissions are equipped with recirculating ball and nut power assist. Turning circle: 32.5 feet (left), 34 feet (right).
1800ES – Cam and roller type with 3¼ turns lock to lock. Turning circle: 30 feet. Steering ratio: 15.5:1.

Transmissions:
Manual: Four-speed, fully-synchronized with floor-mounted remote shift lever. Ratios:

	140 Series	1800ES	164E
First	3.41:1	3.41:1	3.54:1
Second	1.99:1	1.99:1	2.12:1
Third	1.36:1	1.36:1	1.34:1
Fourth	1.00:1	1.00:1	1.00:1
Reverse	3.25:1	3.25:1	3.54:1

Manual with Overdrive: Standard equipment on 1800ES and 164E, optional on the 142, operates electrically on fourth gear. Reduction ratio: 0.80:1.
Automatic: Optional on all models. Hydraulic three-speed with torque converter and part throttle kick-down. Floor-mounted illuminated gear selector with standard PRND21 quadrant. Ratios:

First	2.39:1
Second	1.45:1
Third	1.00:1
Reverse	2.09:1

Rear Axle:
Typoid type. Ratios:

	Manual	Manual with Overdrive	Automatic
142	4.10	4.30	4.10
144/145	4.10	—	4.10
164E	—	3.73	3.31
1800ES	—	4.30	3.91

Brakes:
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.

Rear: 11.6 inch discs.

Handbrake: Mechanical drum brakes acting on both rear wheels. Lining area: 27 square inches. Dashboard warning light.
Hydraulic power assist ratio: 164E – 1:4; 140 Series – 1.3; 1800ES – 1:2.7.

Gauges and Equipment:
Fuel and water temperature gauges, speedometer. Alternator, oil pressure, headlight beam, directional signal, handbrake and footbrake warning lights. Three-speed electric blower. Electric rear window defroster. Two-speed electric windshield wipers plus electric windshield washers. Electric clock. Rear window wiper and washer on the 145. Automatic backup lights. Variable instrument lighting. Illuminated glove compartment on 164E and 140 Series. Interior courtesy lights. Cigarette lighter. 164E and 1800ES have tachometer. 1800ES also has oil pressure and oil temperature gauges.

Exterior Dimensions:

	142/144	145	164E	1800ES
Length	188.0	188.0	192.3	176.6
Wheelbase	103.0	103.0	107.0	96.5
Width	67.1	67.1	67.1	67.0
Height	56.5	56.1	56.5	50.4
Track, front/rear	53.1	53.1	53.1	51.6
Ground clearance	7.1	7.1	7.1	4.3
Curb weight	2635-2725	2767-2798	2999-3034	2589-2595

Interior Dimensions:

	142/144	145	164E	1800ES
Front seat width, hip height	55.8/56.3	56.3	56.3	54.0
Front seat width shoulder height	54.3/54.7	54.7	54.7	49.2
Rear seat width, hip height	53.5/56.3	56.3	56.3	40.2
Rear seat width, shoulder height	53.5/54.7	53.1	54.7	48.8
Front seat width	22.4	22.4	22.4	19.7
Front seat depth	19.3	19.3	19.3	19.3
Rear seat depth	18.5	18.5	18.5	13.0
Headroom front seat	37.9	37.9	36.7	35.8
Headroom, rear seat	36.3	37.0	36.5	—

Luggage Compartment Dimensions:

	142/144	145	164E	1800ES
Cargo Loading Height	—	23.2	—	30.7
Maximum Width	61.0	53.1	61.0	48.8
Tailgate Opening Height	—	30.7	—	15.8
Cargo Area Length Maximum	47.6	74.0	47.6	59.8
Cargo Area Length Minimum	—	44.5	—	32.7

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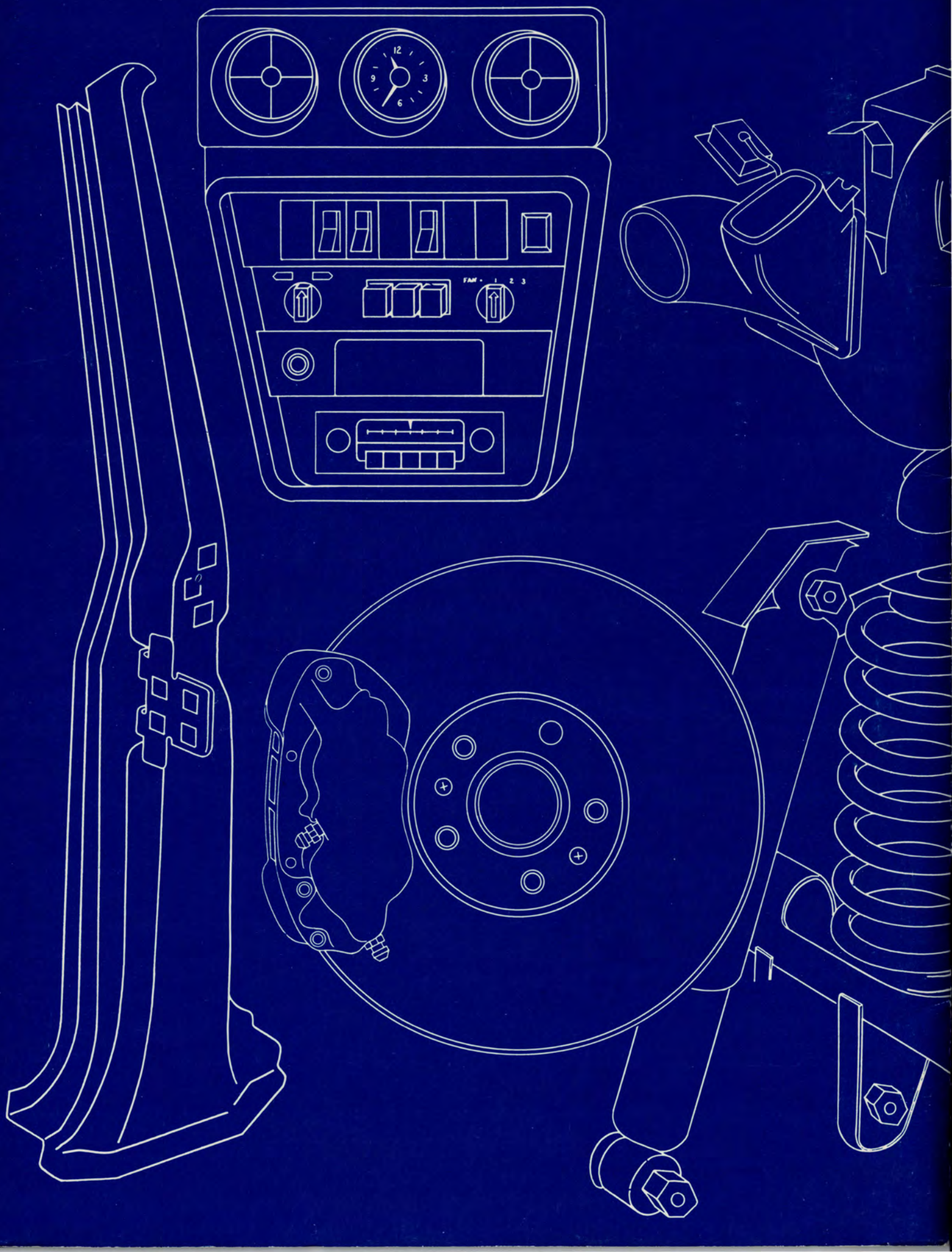
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