VOLVO

A Tradition of Engineering Excellence


N25018

Twenty years have now passed since we first imported Volvo's into the U.S. In 1955 only twenty-six were sold in America. Within three years the number had risen to 7,062 and by the end of the decade Volvos were selling here at the rate of more than 17,000 a year.

Since then there has been a steady, year-by-year expansion in Volvo sales. Last year they exceeded 25% of Volvo's total production.

In order to better meet the demands of the American market, Volvo has planned a new $140,000,000 manufacturing plant in Virginia. By the end of the 'seventies, it is expected to produce 100,000 American Volvos a year.

The expansion of sales is the direct result of a program of constant engineering improvements to the cars themselves and to the development of a widespread network of distributors and dealer facilities.

Unlike some of its competitors, Volvo did not burst upon the scene in a manner to excite the feature writers of the automotive press. No banners on the covers of *Time* and *Newsweek* ever proclaimed that "The Volvos are Coming." Some observers, in fact, were moved to wonder just what Volvo's marketing "secret" really was, while at the same time conceding their very practical merits.

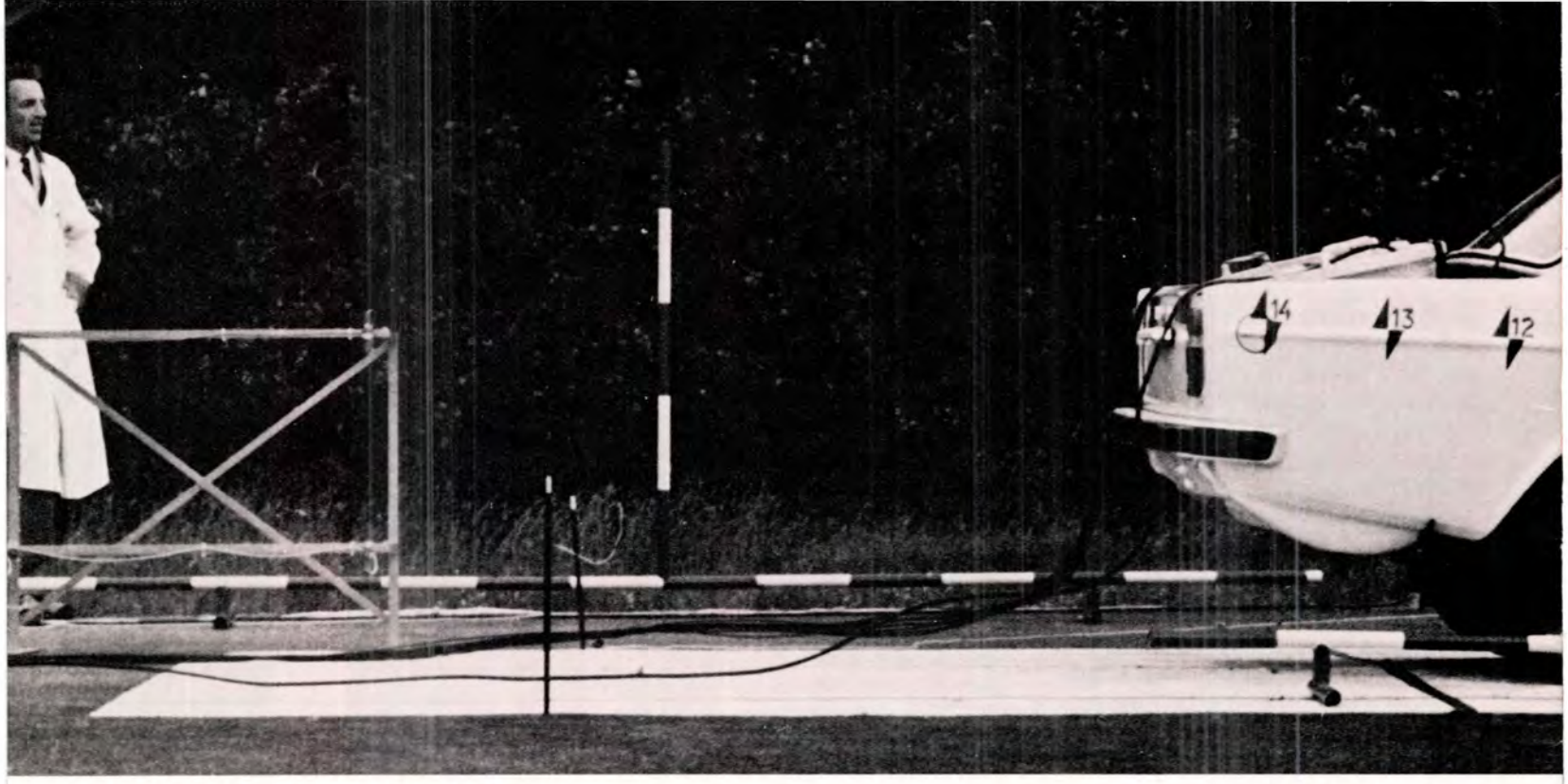
But, of course, there is no secret to Volvo's success. Taking each feature by itself there is virtually nothing about the car which cannot be found elsewhere. For example, two American luxury sedans now have four-wheel disc brakes.

It is true, however, that there have always been a number of Volvo features which are not immediately visible nor readily apparent to the casual observer. Many of them cannot always be adequately described in advertisements or sales brochures either. Nevertheless, we feel that the prospective buyer is entitled to know all about his car before he buys it. More particularly, he should be able to understand and appreciate why the Volvo is built the way it is and not some other way.

Why? Because part of Volvo's whole approach is that the driver is just as important a factor in the car's performance as are any of its mechanical components and systems. It is every bit as necessary for him to be in touch with his car as it is for him to be aware of the road and traffic conditions.

This does not necessarily mean that he must understand the mechanical design and operation of, say, the fuel pump, or that he must master the principles of steering geometry, but rather that he ought to be familiar with the design philosophy which underlies such features. For it is really the Volvo engineer's basic convictions that determine his response to environmental and mechanical challenges, and, over more than a decade, have made the Volvo what it is today — quite simply, we believe, one of the best production cars in the world.

The Volvo 444 began a tradition of rugged construction and reliable performance in the post-war years. Successive 544 and 122 models went on to win European Rally Championships, the toughest test for strength and endurance.
● The 1975 Volvo 244.



Crash tests to prove the strength of Volvo's safety bodies have been conducted for more than fifteen years. This 1966 test, above, was a successful demonstration of the then new 144's impact absorbing capabilities.

● Some automakers still do not believe that safety sells cars. Volvo knows it does. So do our owners. Volvo's inherent safety features are advertised the world over.

IT SHOULDN'T TAKE AN ACT OF CONGRESS TO MAKE CARS SAFE.

Volvo was committed to safety long before it became mandatory.

In 1956, for example, we installed padded dashboards: 12 years before the government insisted on them.

In 1959, Volvo became the first mass-produced car in the world with safety belts as standard equipment. Nine years later all cars had safety belts, inspired by Federal regulations.

We don't just settle for the legal minimum, either:

The law says all cars must have two brake circuits. Volvos have two *triangular* circuits, each controlling three wheels. So if one circuit fails, you still have about 80% of your braking power.

Volvos also have many safety features not required by law:

Like front and rear ends which absorb the impact of collisions. Four-wheel disc brakes with a pressure-proportioning valve to reduce the chances of rear-wheel lock-up. Child-proof rear doors. Rear window defrosters.

Now who would you rather buy a car from?

A company that builds a safe car because someone else made them do it?

Or a company that builds a safe car because their conscience made them do it?

VOLVO

Where Volvo Engineering Begins

Safety has always been the overriding consideration – almost the obsession – at Volvo. Safety is not something that is to be imposed by government edict or the pressures of consumer advocates. On the contrary, it is basic to the design of a passenger car.

This is why Volvo has consistently taken the lead in safety engineering by introducing padded dashboards, 3-point safety belts and dual brake circuits, features which later were made standard by the industry.

Comfort and convenience, and driver comfort especially, has been emphasized at Volvo because it has always been regarded as essentially an aspect of Safety.

In order to avoid accidents the driver must be fully alert to the demands of the traffic environment and fully responsive to the vehicle and the road. Under all conditions.

He can only be expected to fulfill this role if the effects of fatigue and distraction have been kept to an absolute minimum, even after a long and perhaps boring drive.

This emphasis on driver participation is, of course, also an emphasis on

Perhaps the simplest way to approach this complex subject is to state the criteria by which every design feature and engineering modification is ultimately evaluated by Volvo engineers: total safety followed by functional comfort and convenience.

accident avoidance rather than just *injury* avoidance. Both are descriptive of two distinct aspects of safety engineering: *Active Safety*, which seeks to prevent a collision in the first place, and *Passive Safety*, which must begin by assuming that the collision has occurred and then go on to prevent injury to the occupants.

In recent years there has certainly been a widespread concern for Passive Safety, as such mandatory measures as seat belts, headrests and safety glass indicate. But as the evolution of the Volvo demonstrates, both aspects of safety must be developed together. Avoiding an accident must involve such factors as road grip, steering response, well-balanced braking, good traction and visibility under *all* driving conditions.

Avoiding injury depends on a lot more than safety belts. Features like shock absorbing bumpers, energy absorbing body panels and collapsible steering columns are also important.

The simultaneous pursuit of both of these objectives is very much a matter of integrating, and in some cases reconciling, the design and function of a great many components and systems without unreasonable sacrifices to convenience and economy. This calls for some very sophisticated thinking, and there is some economic risk involved, but Volvo believes that it is the only way to build a passenger car.

Unitized Construction–
Volvo's Basic Approach to a Safe Body

If strength were all that was needed, a car body could be built like a tank. But since total performance must be considered, an automobile should not be any heavier than necessary.

Volvo's response to the basic need for a combination of strength and lightness is the "unitized" body. Instead of a heavy frame with a light chassis bolted to it, the components of both are spot-welded together to form a single shell. Loads and stresses can thus be spread over a larger area and critical points throughout the shell can be reinforced by heavier metal or by box-profile members.

Ever since their first appearance in this country, Volvos have attracted much favorable attention because of this superior method of construction. When the Volvo 122 appeared in 1960, at a time when most imports and many domestic cars tended to extremely cramped interiors, it was widely noted that the 122 had a generous amount of legroom – even though the car itself was scarcely higher in profile than the more stylish Detroit models.

This was because there were no massive frame members to take up space underneath.

At the same time there was widespread approval for two other Volvo characteristics – the lack of body squeaks and rattles and the absence of a tendency to rear end twist and shake, even on the roughest roads. Both of these traits are inherent to unitized construction.

But all these advantages, though certainly desirable, have never been the basis for Volvo's choice. The overriding consideration is simple – unitized body construction makes the car much safer.

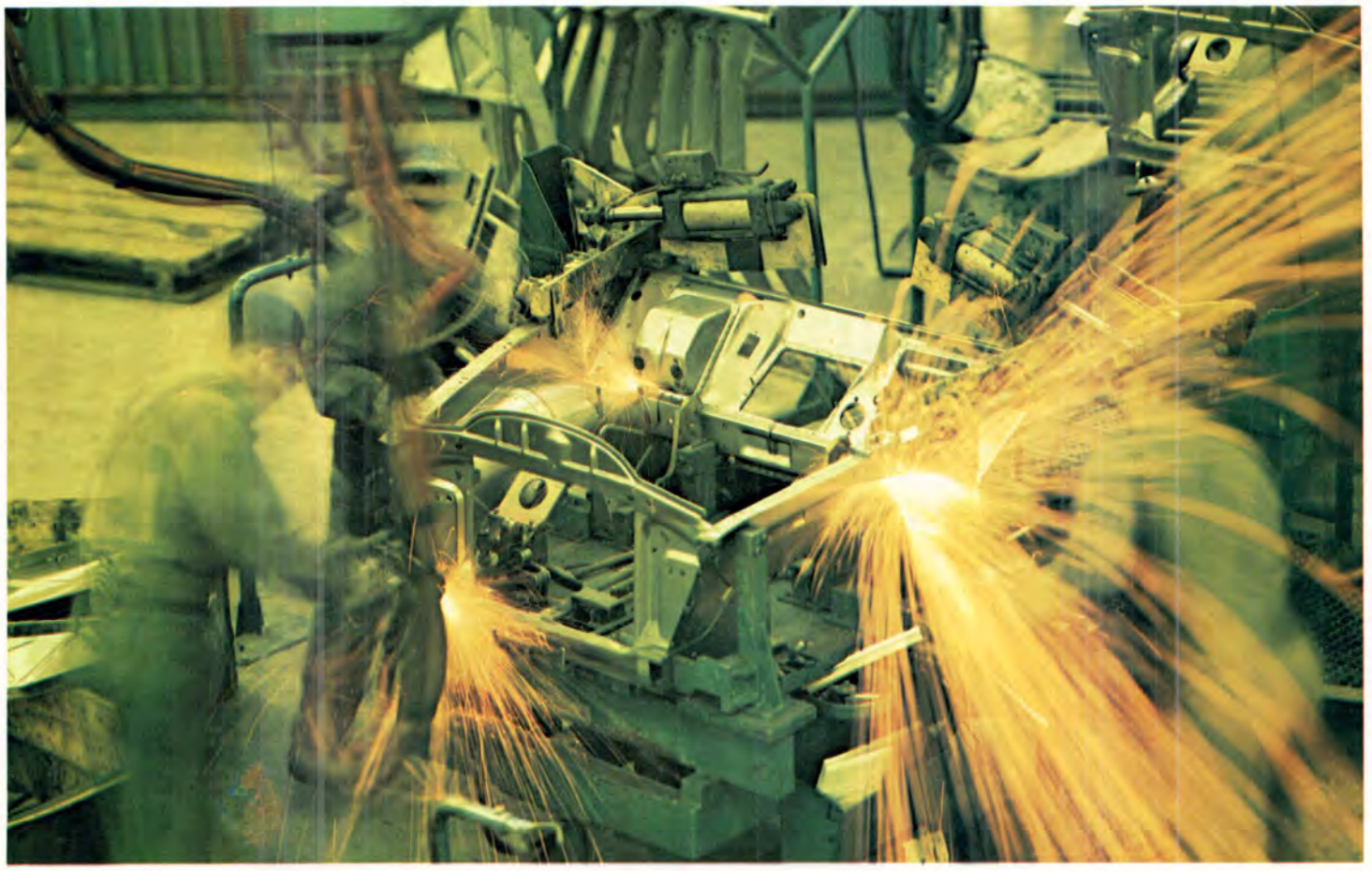
The Volvo point of view was recently expressed in a technical paper presented to the American Society of Automotive Engineers:

"The unitized body is capable of producing the desired torsional stiffness over the wheelbase to facilitate positive and effective vehicle handling in crash avoidance situations."

The same paper went on to cite "good driver fields of view and good seat anchorages," along with "excellent facilities for passenger protection within a rigidly constructed compartment."

The unitized principle was first adopted by Volvo in the nineteen forties. Volvo engineers have often stressed how much practical experience and testing has been involved in its subsequent development. For example, the various panels which go

Years ago, the complexity of unitized construction required extensive hand welding. Today, much of this work is automated, but hand welding is still used wherever it's needed. And hand inspection still is a feature of Volvo quality control programs.

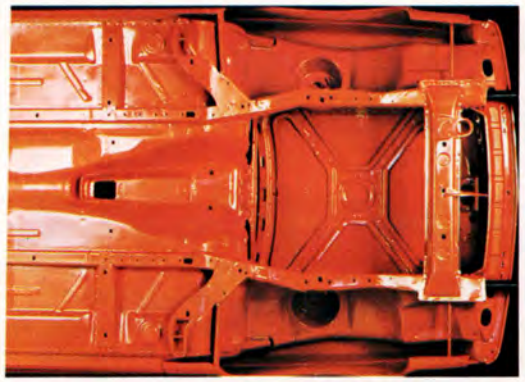


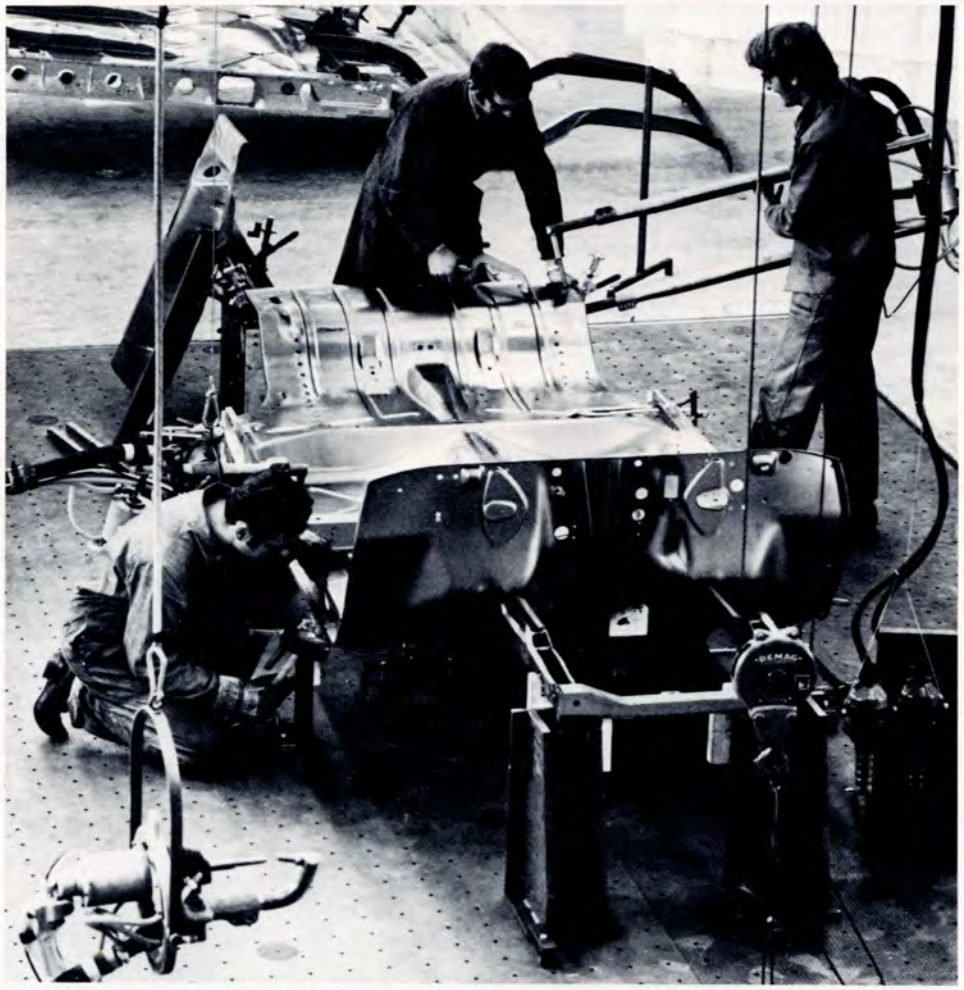
to make up the body must be reinforced at critical points by different types of box profiles. The weight, shape and operation of a variety of mechanical components and fittings must also be taken into account.

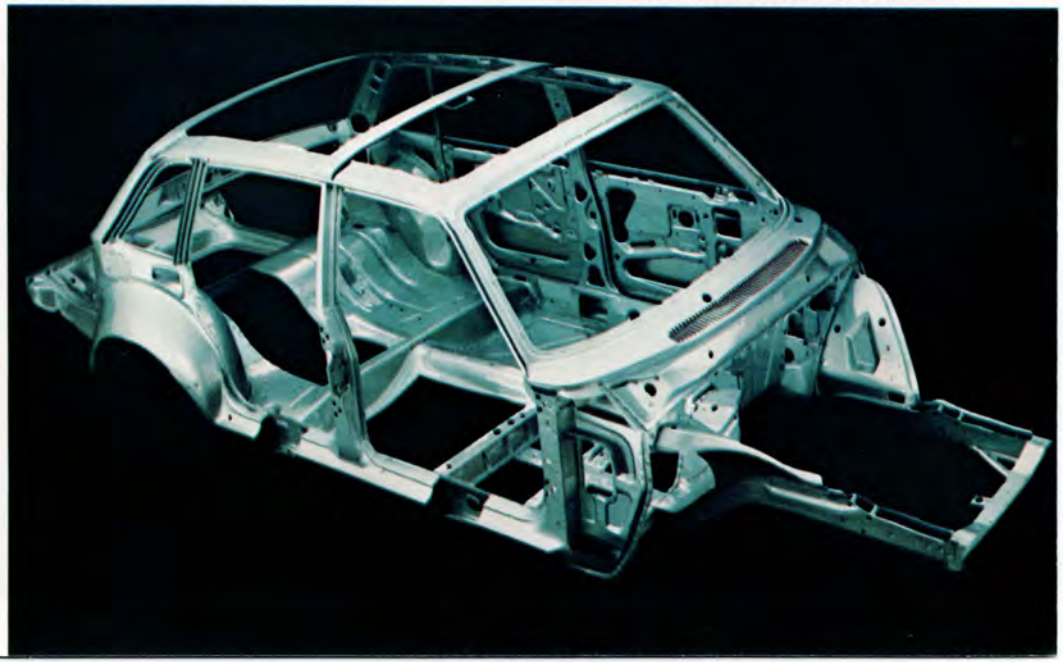
Moreover, there is a continuing requirement to improve the construction and functioning of the body itself. Over the years there has been a trend to fewer, and larger, panels, and consequently, to fewer joints. Reducing the number of joints, in turn, reduces fitting problems and makes the body stronger than ever.

As constant experience in the laboratory and on the road has added to Volvo's store of unitized construction data, an extensive program of refinement and modification has been carried out. The value of energy-absorbing front and rear sections has become increasingly apparent, and certain parts of the body have actually been redesigned to be "weaker" instead of stronger, so that in the event of a collision, they will collapse under impact to allow the body to "roll with the punch." On the other hand, heavier gauge metal has been adopted for a number of critical parts, and an increasing number of sections are now galvanized against rust to ensure structural strength.

Another example of Volvo's concern with the unitized body's safety characteristics is the way the tail panel on the sedans is made. From a strictly "convenience" point of view, the tail panel is just a bit too high. This makes it a little more difficult for some people to lift their luggage in and out of the trunk. In spite of the fact that Volvo's roomy luggage space is an important sales feature, engineers have resisted the temptation to lower the tail panel accordingly. Why? Because this would weaken the rear part of the body. Safety comes before mere convenience at Volvo.







"Frame" and "body" components are solidly welded together to be mutually supporting. Box profiles and shaping of sheet metal adds to overall rigidity and strength without adding unnecessary weight. ● In the methods laboratory, center, technicians build prototypes by hand to determine the most effective welding and assembly programs. ● Cutaway of a 144 sedan body shows the safety cage surrounding the passenger compartment. Each of the six vertical pillars is designed to support the weight of the entire car.

Body Protection: More Than Paint Alone

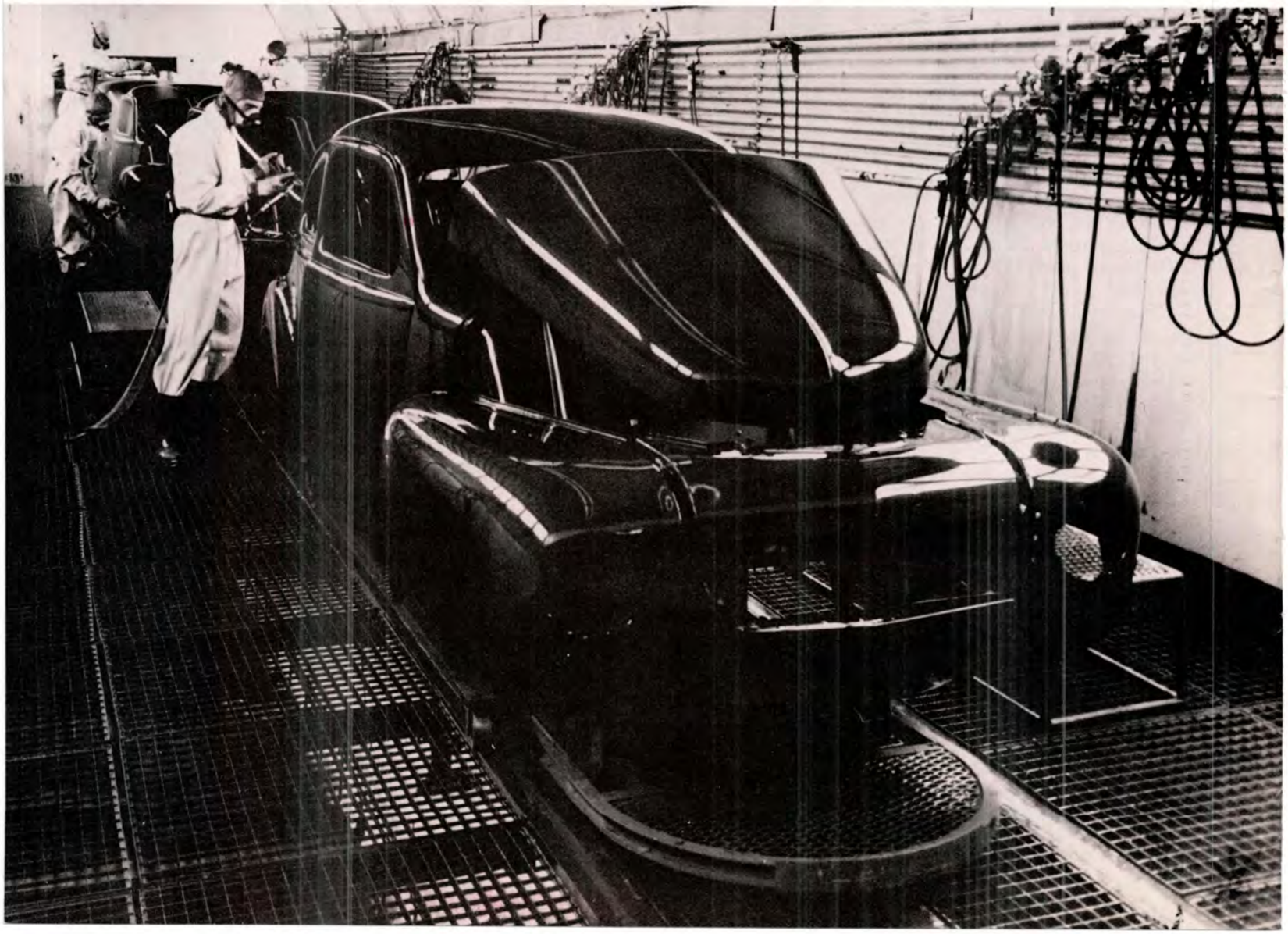
Paint and rustproofing cannot be considered as part of the Volvo's safety system, nor do they directly affect passenger comfort. But they do contribute to the life of the car. And since this is definitely a Volvo engineering consideration too, these operations must meet exacting standards.

Many of the exposed body parts are galvanized against rust, including those that serve as anchorage points for safety components. The outsides of the door sills are given a coating of tough polyester and, by means of an ingenious arrangement of drainage holes along the bottom, their insides are ventilated by the slipstream.

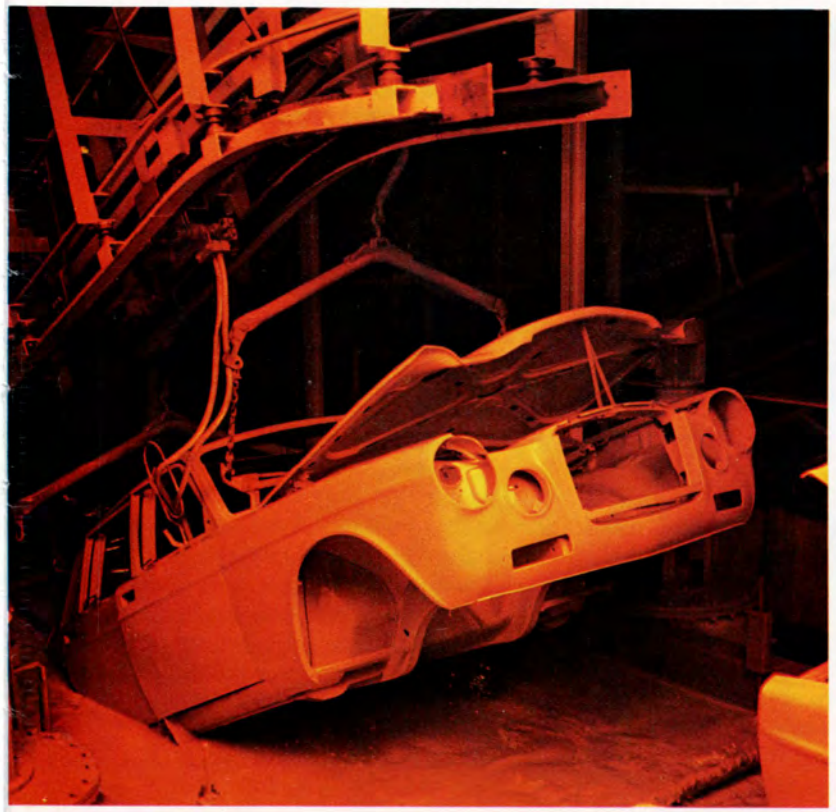
The painting operation itself is as carefully controlled as any other manufacturing process. As the body travels through the painting facility, it passes sixty-six work stations, where the surface is primed and given a filler coat. Top coats are then applied wet-on-wet in order to get just the right thickness.

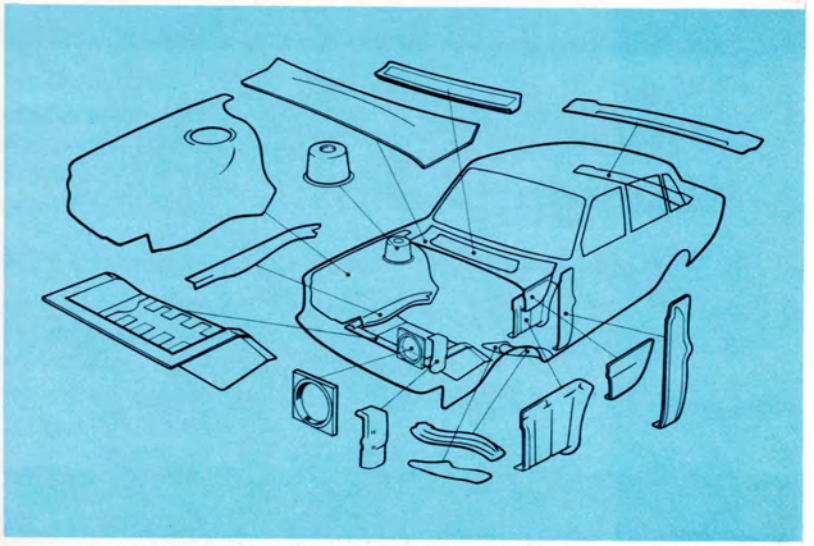
The underbody is also given a full treatment of bitumen coating to protect against rust and road dirt, and to act as a sound absorber. Other parts are also sprayed with a rustproofing gel which hardens into a tough, durable coating.

Much of this work is done by hand and repeatedly inspected. Perhaps it's a bit old-fashioned, but it's the best way to ensure protection for the Volvo body and give it a handsome finish.



Many 544's are still in service because of their paint and rust-proofing protection. Even today, hand spraying is part of Volvo's body sealing program to ensure a heavy coat.





Bodies are submerged in electrically-charged paint to coat outside and inside surfaces with an even layer of primer. Many exposed and critical parts are hot-dip galvanized, and the underbody gets two separate rust-preventative sealing coats.

Accident Avoidance: Braking

A 244 sedan demonstrates the power of four-wheel disc braking on Volvo's test track.

The Volvo unitized body has also served as a reliable platform for the evolution of the car's active safety systems – those which enable the driver to avoid a collision or, at least, to minimize its effects.

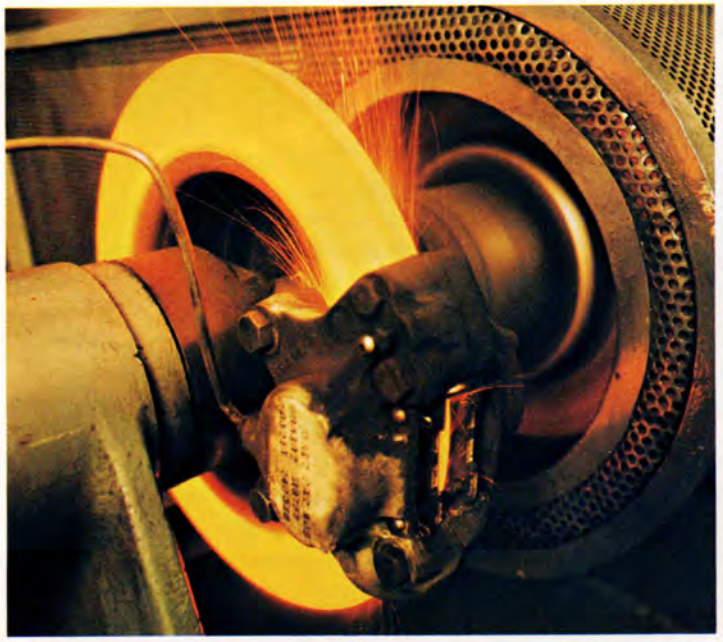
A driver has only two basic responses available to him in a critical situation – he can either steer around a threat or stop before he hits it. And, most likely, it's a combination of both. Therefore, active safety will involve the car's steering and braking systems.

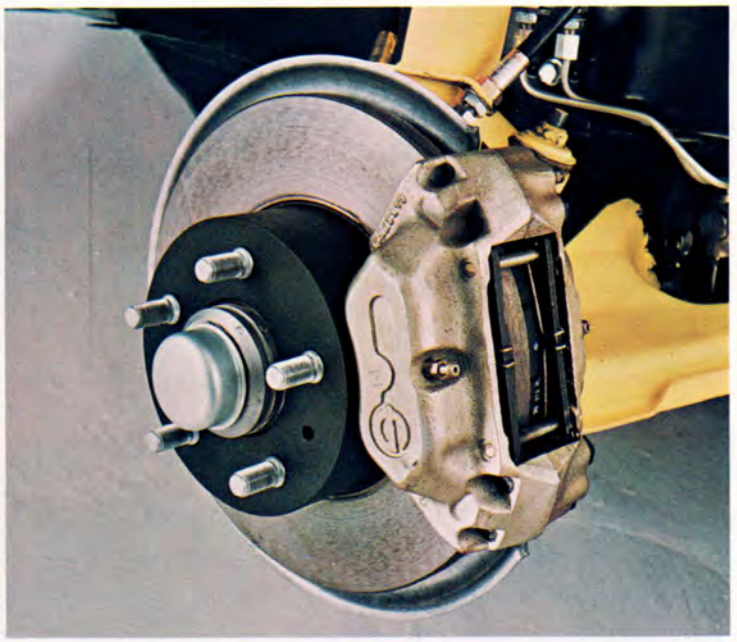
But there is a third factor which must be given equal consideration – the suspension.

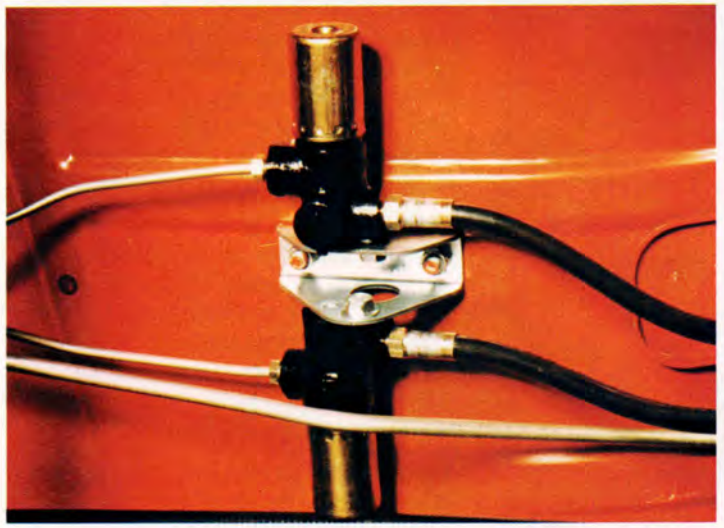
All three must be optimized with two objectives in mind. First, to make sure that the driver gets enough feedback to react properly, and second, that the car will carry out his commands. What this implies is that the driver must be able to actually *feel* what the car is doing and what the road surface is like.

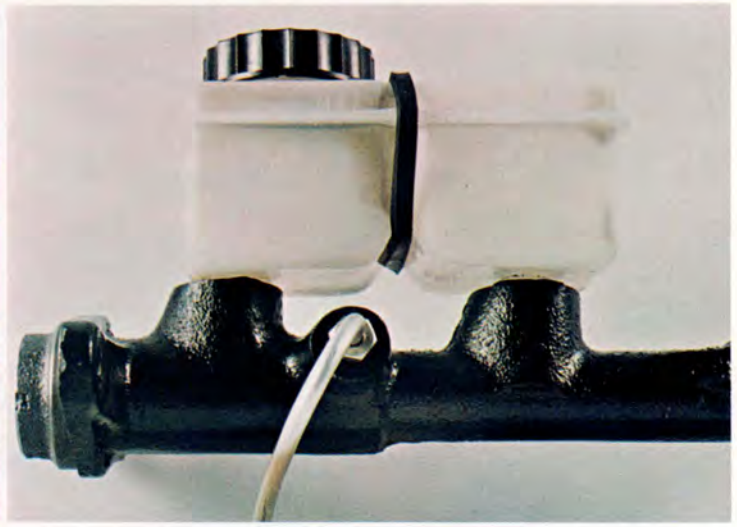
The basic engineering necessary to achieve this kind of responsiveness is not new, and it was not invented by Volvo. But what Volvo has done is to make the decision to adapt the largely proven systems once considered applicable only to race cars to the needs of what the experts have called the "95th percentile driver"– the person who does not race or follow the rally circuit, but who needs the same sophisticated engineering performance in an occasional critical situation.

This is what Volvo engineers have designed for, and they have main-









Automobile brakes work by converting mechanical energy into heat. Disc brakes can take care of larger amounts without losing efficiency because they have a greater mass and more cooling area. ● Newest Volvo discs, top right, produce braking forces of more than 700 horsepower! ● Brake proportioning valves, above left, act to distribute hydraulic pressure in both circuits (each circuit connects the front wheels with one rear wheel) between the front and rear wheels. The result is reduced braking power in the rear to avoid premature locking of the rear wheels — a prime cause of spin-outs. ● New stepped-bore master cylinder assures normal pedal pressure if one sub-system fails.

tained a superiority for decades. While some of the credit for this is due to the fact that science and programs development are critically important at Volvo, it's also due to the fact that the technical aspect of quality control and testing has received such prominence in the past few years.

One product of research and development is the Volvo braking system, approved for production two years before it was actually introduced on the 1967 Volvo 144. This four-wheel disc brake system, with dual hydraulic circuits that connect both front wheels to one rear wheel, was widely hailed at the time as the standard for all other automobile manufacturers to meet. One magazine described it as the "closest thing yet to a completely fail-safe system."

Nevertheless, Volvo's braking system has been continually modified and improved since then. Brake disc cooling has been improved, friction material for the pads can withstand higher temperatures, with less wear, and this year a unique master cylinder has been developed.

This new feature responds to the need for improved braking capability if one of the two hydraulic circuits should fail. Now, with a new system introduced on the 240 Series models, with only one of the dual circuits in operation you maintain about the same pedal pressure for the same stopping distance.

The need for similar incremental improvements led Volvo to the establishment of a 56-million dollar technical center and test facility designed to duplicate actual driving conditions anywhere in the world, and to provide reliable data for all phases of automobile safety as well as in such areas as emission control, fuel economy and servicing efficiency.

Active Safety: Integrated Steering and Suspension

One of the torture tests a Volvo suspension must pass. This 544 sedan set the standard for generations of Volvos. ● Shake machine can simulate the worst kind of road conditions and then some. A few days of this punishment is equal to years of actual driving.

In 1972, Volvo began development of the widely heralded Volvo Experimental Safety Car, or VESC. This was before the safety car "rage" became a topic of governmental and industry consideration. Volvo's reason was basic, the company decided to group all its various safety programs into a unified project and prototypes for testing and evaluating were needed.

Some of the VESC innovations are electronically-controlled anti-lock brakes, a rear suspension leveling system and various passenger protection devices – air bags and automatic safety belts. Some of the more basic features have already been incorporated on current production models, proof that the Volvo fleet of VESC prototypes has not only contributed to the development of new ideas, but to improved products you can buy today.

A prime example is the steering and suspension systems of the 240 Series. The net effect of these important modifications has been to make these cars hold the road more securely, corner with less sway and steer more precisely.

Merely enumerating such improvements, however, does not tell the whole story. What has happened, in effect, is that *all* the operating systems work together better – there is more feedback and more "feel," handling is smoother, control is more precise.

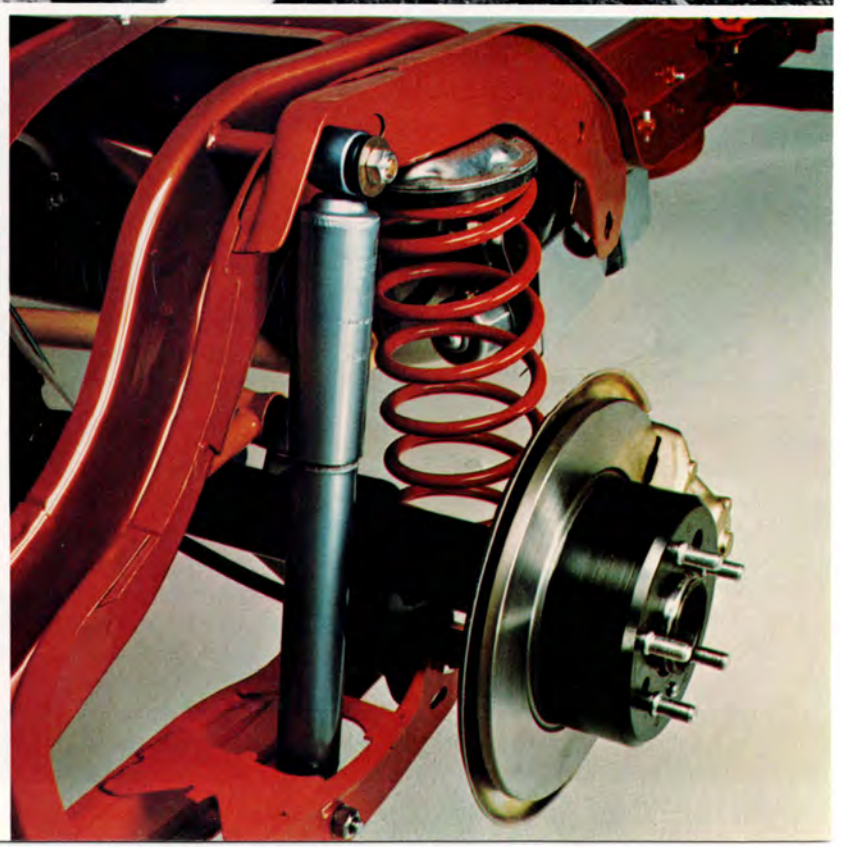
The way this has been accomplished can be described in not-too-technical terms. The new Volvos have a spring strut type front suspension which permits a generous amount of fore-and-aft movement of the wheels while closely controlling the amount of lateral sway and vertical travel.

The rear suspension makes use of the less complicated "live" axle, together with a system of separate components

to provide lateral and longitudinal support and to control wheel movement on rough roads, as well as during acceleration and braking.

On the 240 sedans there is also a rear stabilizer, or sway bar, which permits the front suspension to be somewhat stiffer than previously, but makes it possible to use softer springing in the entire suspension for a more comfortable ride. It also reduces the car's tendency to lean in the course of hard cornering.

The Volvo Experimental Safety Car on the Belgian block course in Volvo's new testing facility. The test track also features sixteen other road horrors, including washboard ripples, railroad ties and deep ruts. ● New front suspension system on the 240 Series features a compact spring strut arrangement. Rear suspension uses separate elements to control springing, damping and axle movement.



At Volvo's former testing facility, skid pad tests on a circular track developed steering and suspension interaction data.

From a functional standpoint, it is impossible to separate a vehicle's steering qualities from its suspension. The design of one must necessarily involve the other. So this year, Volvo's 240 Series also has an entirely new rack and pinion steering system, which was developed along with the new front suspension.

Rack and pinion steering in itself is not new, of course. Like most other automotive systems, it has certain advantages and limitations, depending on how well it can be integrated into the overall design.

Volvo's decision to adopt this approach was dictated by its primary consideration – safety. Because it uses a relatively small number of moving parts, rack and pinion is extremely direct-acting and precise. In view of Volvo's concern for the driver's interactions with the car, this is a very desirable characteristic.

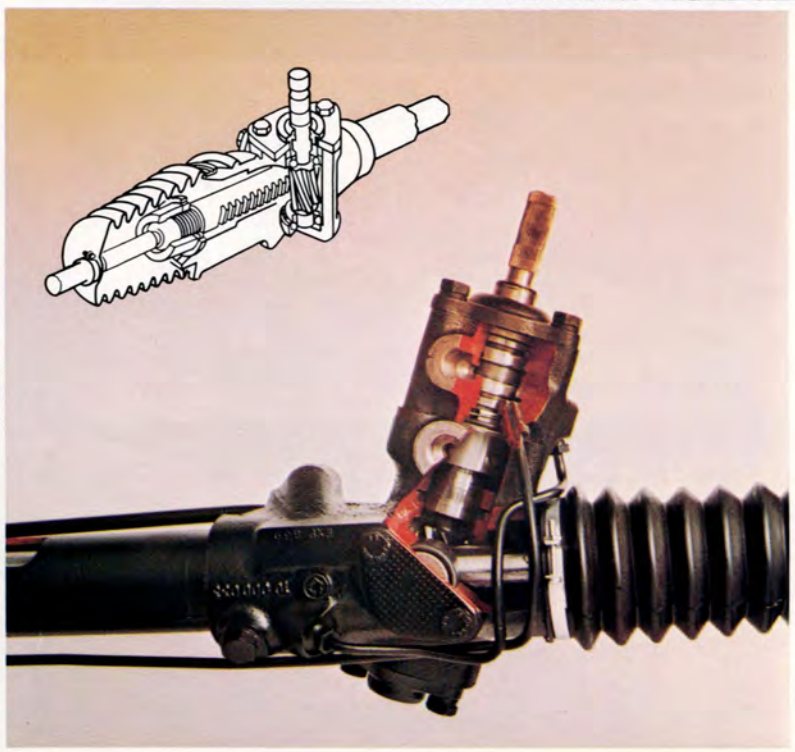
Fewer parts means less play in the steering linkage and less delay in feedback, so that the driver has more time in which to react. The difference may only be a matter of tenths or even hundredths of a second, but it is just this interval between reaction and response that is so vital in avoiding an accident.

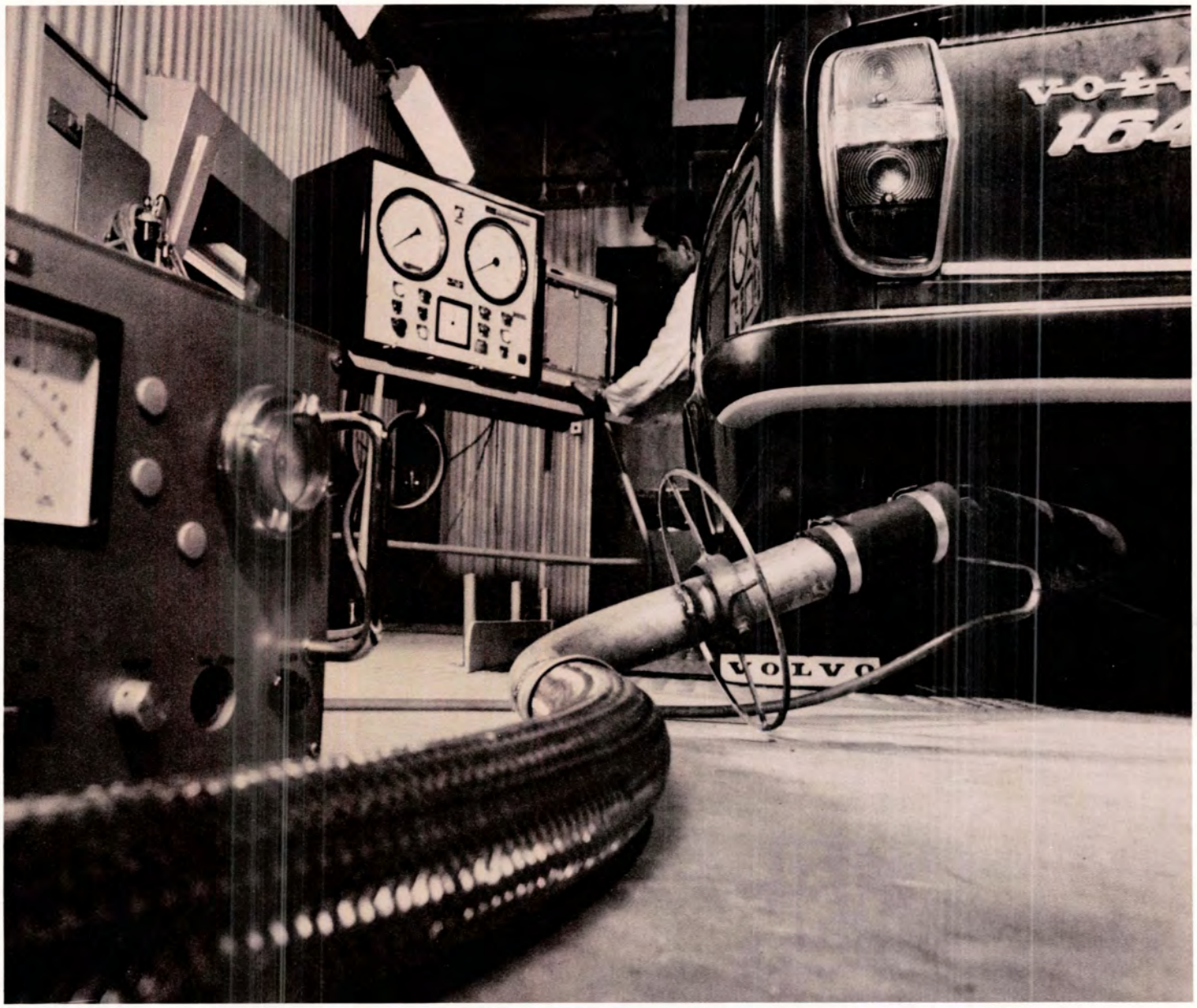
With the addition of power-assisted steering, assuring sufficient "feel" becomes even more critical. Since it is so important for the driver to retain a sense of the road, Volvo engineers have never believed in letting the power steering unit do all the work. Instead, steering ease is provided in proportion to the steering force required. This is done in such a way as to make the driver work a little harder as demands for steering power increase.

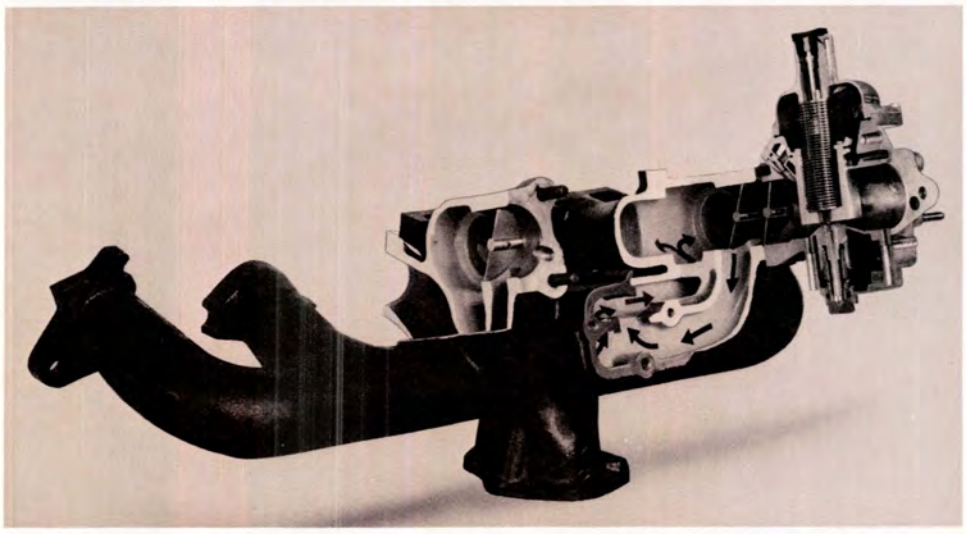
When the car is moving straight ahead the servo unit supplies no assistance at all. A moderate curve summons a moderate amount of assist, and, as the curve becomes more demanding, more assist is forthcoming. But at the same time, the driver must also make a greater effort to steer.

Optimum suspension and steering performance also dictates that the wheels must be *rounder*. The use of steel-belted radial tires has gone a long way towards this goal. This year, Volvo has gone even further with redesigned wheels centered on lathe-turned hubs, instead of the more conventional tapered wheel studs.

At Volvo's new test track, winter ice conditions are simulated by spraying water on a course surfaced with a low-friction plastic. Although the course is flat, a hill simulator machine can vary the terrain angles. ● The 240 Series hub design includes a flattened section so that the wheel can only be fitted one way. This results in a better balanced wheel assembly. ● Steel-belted radials have a wider footprint for better road holding. ● Rack and pinion steering unit works by the rack sliding horizontally in response to the turning pinion at the base of the steering column. The unit is sealed against weather and road dirt. ● The turning circle of a Volvo is no larger than that of a VW Dasher, even though the Volvo is more than fifteen inches longer.







Emission testing has long been an important part of Volvo's engine development program. Volvo's original anti-smog manifold was introduced in 1968. It was designed to pre-heat the air coming into the engine so that the fuel/air mixture would burn more completely.

Engines That Are Responsive and Responsible

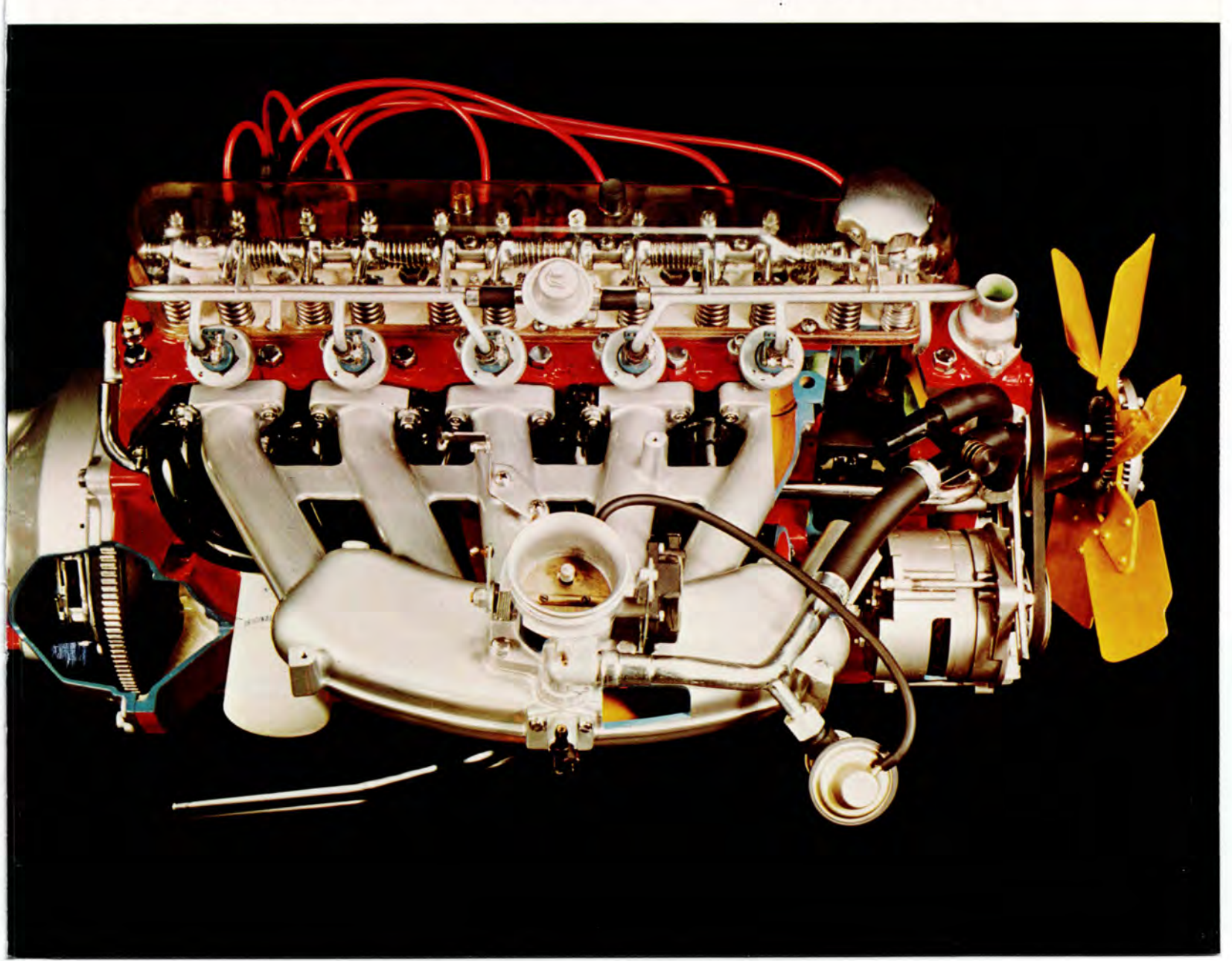
In common with other parts of the Volvo, there are many years of careful development and testing behind the present generation of engines. Beginning with the celebrated B4 and B16 engines that powered the 444 and early 544 models, the basic Volvo engine has been steadily improved to conform to the needs of newer Volvos.

Although many Volvos have been seen on the race and rally circuits in Europe and the U.S., there has never been a deliberate effort on the part of our engineers to produce a "muscle car." Instead, the aim has always been towards an engine that is most efficient in terms of power and acceleration across the range of normal or average driving speeds, and that is reliable and long-lasting under the most adverse driving conditions.

In 1964, after a generation of improvements, the B18 engine made its appearance as the powerplant for the 122 sedan and the 1800 sports coupe. This engine attracted considerable attention for its five oversize main bearings, which provided more bearing surface than the then current 283 cubic-inch Chevrolet V-8 engine.

Four years later, the B18 was in turn succeeded by the larger B20 and its six-cylinder version which was used in the new 164 sedan. Both engines continued the Volvo tradition for ruggedness and reliability, and when fuel injection was introduced, beginning in 1970, neither required extensive modifications for the new fuel/air induction systems.

A cutaway view of Volvo's largest engine. The fuel injectors can be seen at the top; below them is the six-branched air intake manifold designed for even and efficient airflow.



Fuel injection proved to be so successful that in 1973 it became standard equipment for all Volvos sold in America. Its basic principle is quite simple and logical: Instead of the fuel being mixed with air in a carburetor and the resulting vapor allowed to find its way into the individual cylinders (via the intake manifold), a measured amount of fuel is injected just before each cylinder. Mixture with the air takes place just prior to ignition. The result is more complete combustion, an advantage that is becoming more and more important in view of the stringent demands for exhaust emission controls.

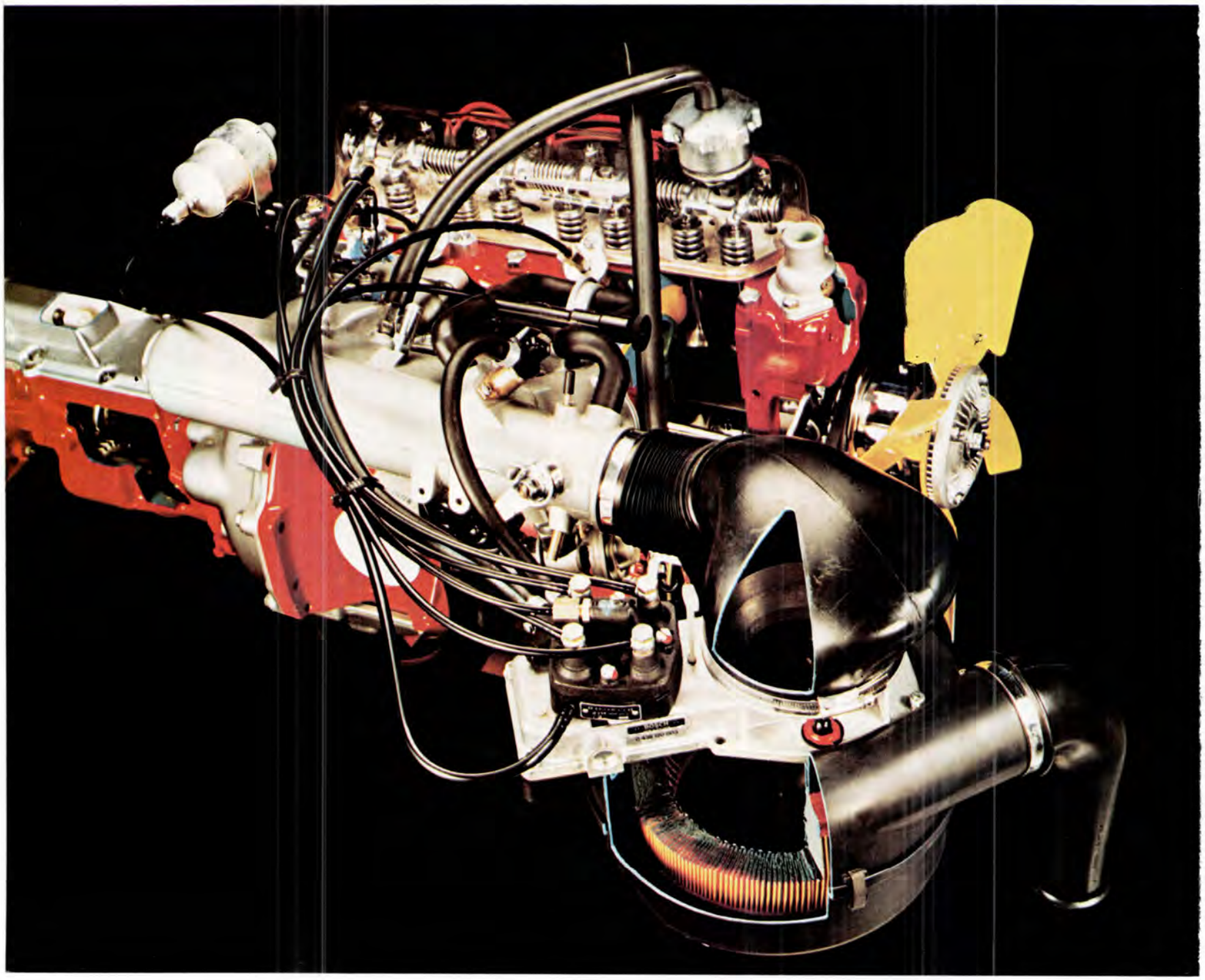
Volvo now uses two approaches to fuel injection. The 182 cubic-inch engine in the 164 has an electronically-controlled system in which the amount of fuel injected is determined by a small analog computer. This computer also monitors a number of performance variables, via sensors, in the engine compartment.

The 240 Series' 4-cylinder engine uses a somewhat simpler system in which the amount of fuel injected is determined by the amount of air being drawn into the engine – itself a function of throttle position and engine load.

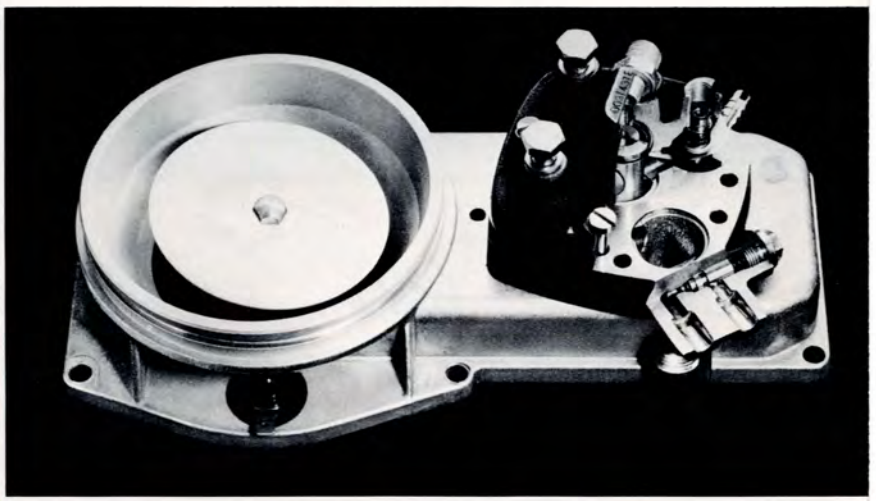
Both systems are due to Volvo engineers' having looked far enough ahead to realize that controlling emissions would mean changes in power and fuel enonomy. Today, these two factors are very much on everyone's mind, and so engine performance has been further improved by the addition of a new, solid-state electronic ignition system.

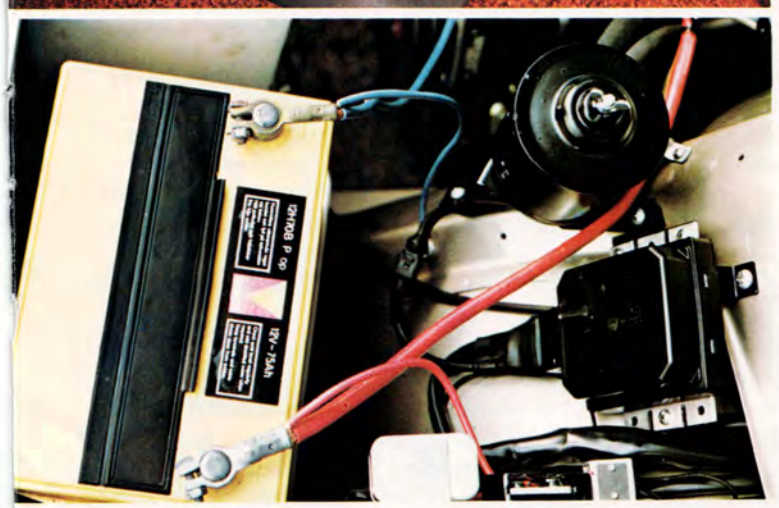
The benefits of this more reliable ignition are easy to appreciate. Instead of the traditional distributor, there is now an electronic control unit. This means that the inherently better fuel/air mixture provided by the fuel injection system now receives a more consistent and controlled ignition. The result is that fuel combustion is even better. It also means lower operating costs because there no longer are ignition points and condensers to replace.

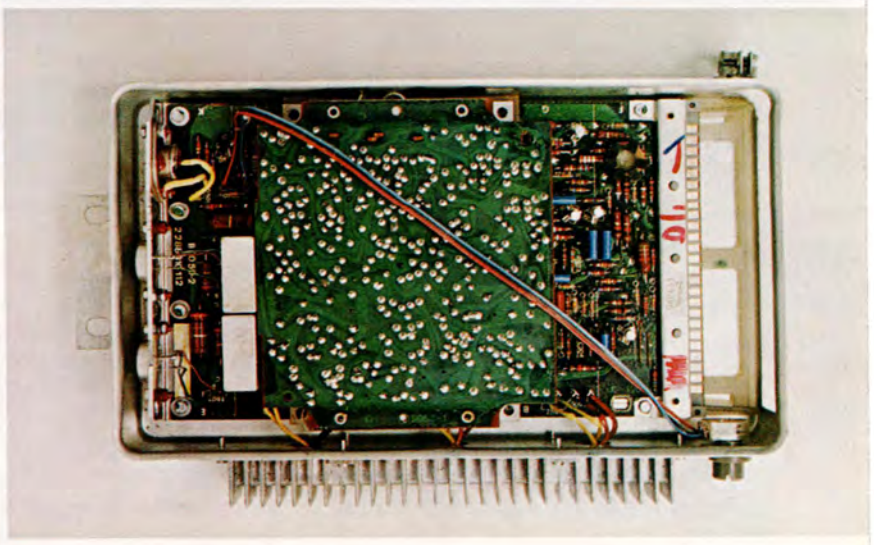
The continuous injection B20 engine used in the 240 Series. Air is drawn in through the snorkel at the lower right, then passes through the air cleaner into the air/fuel metering unit.

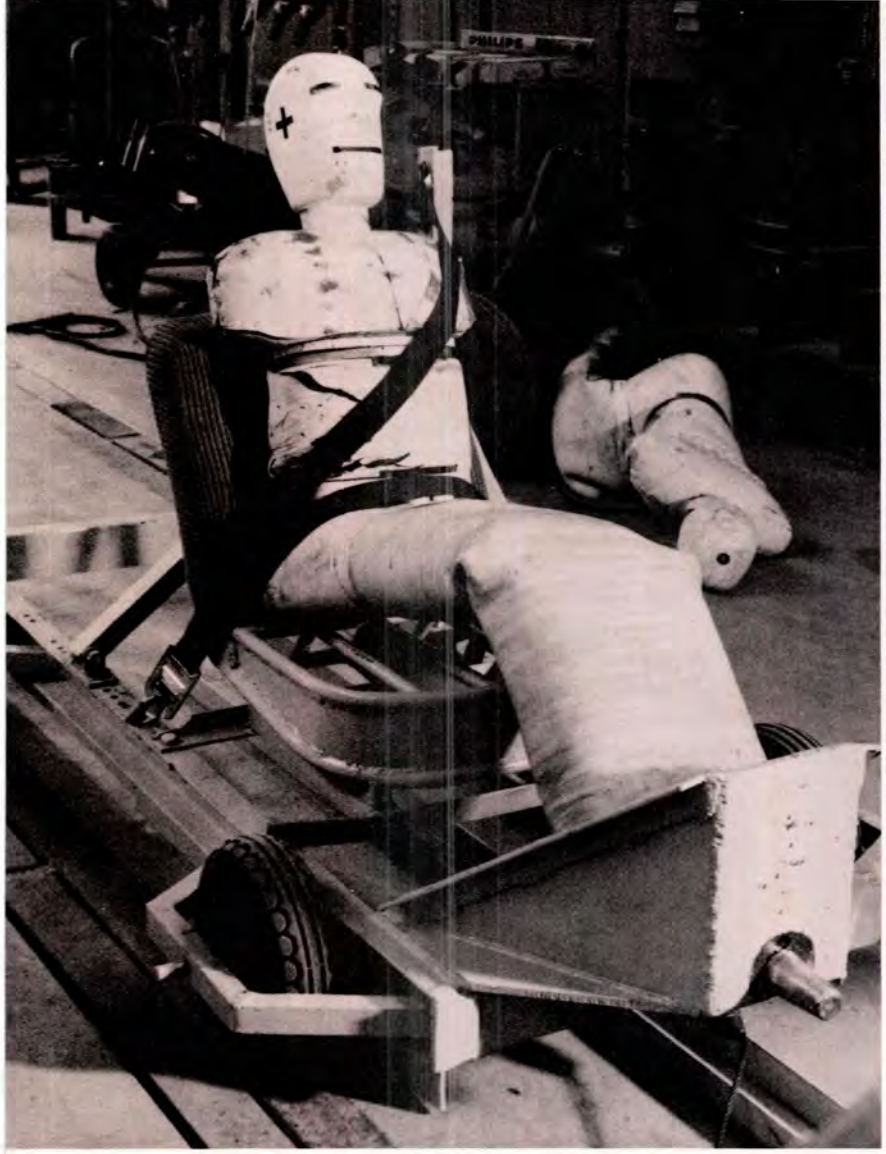


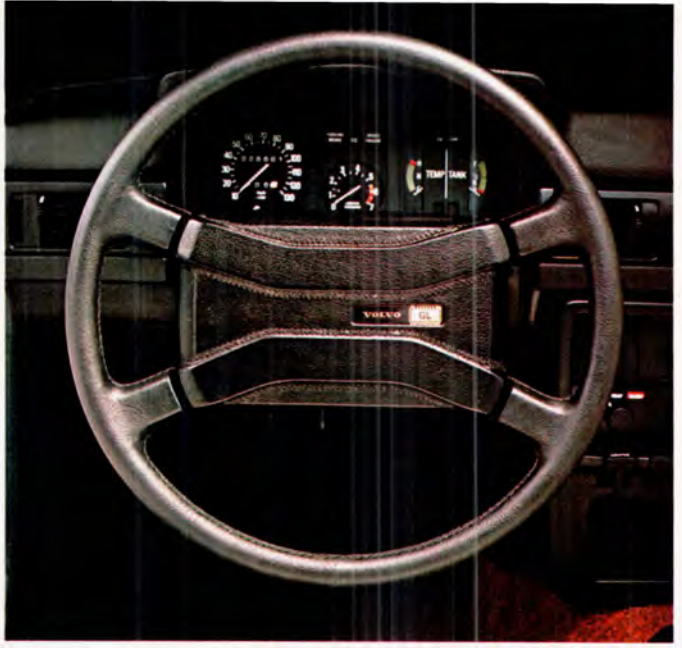
The heart of the Continuous Injection system, below. As air is sucked into the engine it raises the disc in the conical chamber. The disc is attached to a balance bar that simultaneously lifts a piston to allow an increased fuel supply to the injectors. The ratio of air and fuel is in perfect balance and varies depending on engine speed. ● Electronic fuel injection on the six-cylinder engine is controlled by a miniature computer that accumulates data from five sensors and orders the injectors to vary their time of opening. By regulating the air/fuel mixture electronically, the 164 engine will adjust quickly to altitude or temperature changes and to the whole spectrum of operating conditions — from idle to acceleration. ● Automatic transmission lever provides for fast shifts between Second and Drive speeds. Pressing the push-botton unlocks gates into other positions. ● A thumb-switch on the manual transmission lever lets you easily shift into or out of overdrive. ● Electronic ignition control unit, below the power steering fluid container, enhances fuel injection efficiency by providing a more reliable spark.

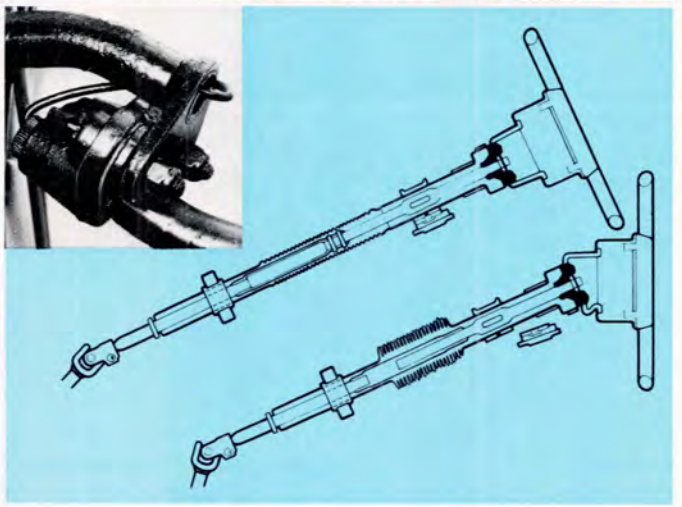












To Safety and Comfort, Add Ergonomics

Use of test dummies, first to design and prove safety equipment, now extends to the development of nearly all interior features. ● A heavily padded steering wheel is the first line of defense from the crash effects of the steering column. ● Original steering column breakaway joint was introduced eight years ago. ● Latest version of the steering column has four more safety features to protect the driver.

Just as many of the Volvo active safety features can only be fully appreciated in an emergency, there are a number of passive safety, or injury-preventing features which are not obvious to the casual observer. However, a closer examination of the Volvo interior can provide a good indication of our commitment to passenger protection as well as comfort and convenience.

The design of the steering wheel and column demonstrates this commitment in a number of ways. It is well known that the steering column represents the greatest threat to the driver's safety – even in a relatively minor impact.

Tests made under actual crash conditions reveal that the menace stems from tendency for the column to be forced rearward. At the same time, inertial forces throw the driver forward with such force that even the safety belt may not be able to prevent injury.

In response to this possibility, Volvo introduced a safety steering column in 1967. It featured a simple breakaway joint designed to cause the upper and lower halves to separate under severe impact, thus preventing the steering wheel and hub from being driven into the passenger compartment.

This feature was a distinct improvement, and it went a long way towards eliminating the worst threat to the driver. Volvo engineers, however, continued to study and modify the basic design. The result of this program was to provide for several stages of impact, instead of just one. This was accomplished by adding a telescoping section – in addition to the breakaway joint, by heavily padding the hub and making the hub collapsible under impact. This year, with the adoption of rack and pinion steering, the original breakaway joint has been replaced by a new design which serves the same purpose by permitting the steering column to fold like a jackknife.

Next to the steering column, probably the most important passive safety feature is the dashboard. As far back as 1963, Volvo has featured crash padding on the dashboard and sun visors. Since then it has been

made more effective by increasing the thickness of the padding and by recessing or redesigning controls.

In 1973, an additional controls console was centered below the dash to provide space for the less frequently used switches and operating controls.

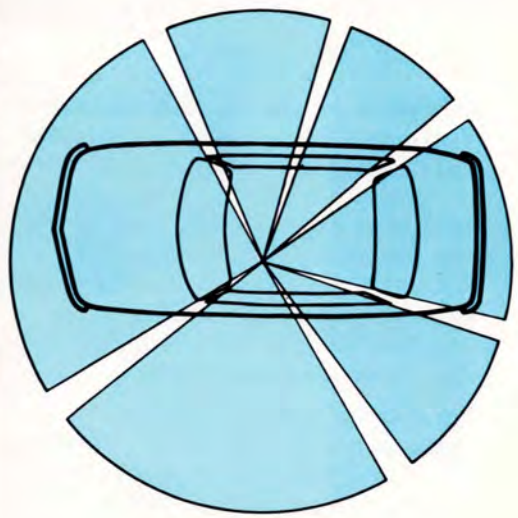
A padded dashboard and a recessed instrument panel is an obvious enhancement to driver safety. Less evident is the fact that the design and placement of instruments and operating controls is also an important factor in driver safety. As Volvo engineers have become increasingly aware of this over the years they have devoted considerable attention to research in the science of ergonomics.

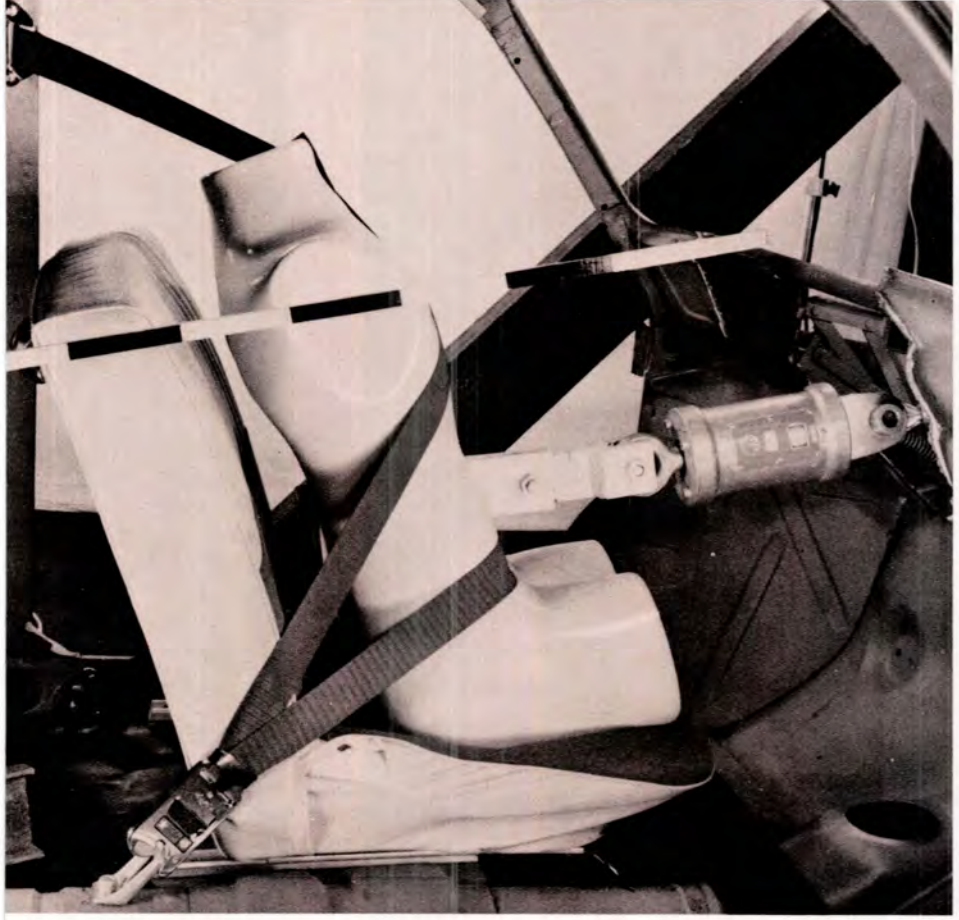
The goal of ergonomics is to create an environment for the driver which will enable him to drive with maximum effectiveness. This means that controls must be easily reached, that wherever possible similar functions be combined in the same control — as with the windshield wiper/washer lever, that controls are well marked and positioned so that they cannot be mistaken for one another.

All of these considerations are designed into the Volvo operating control system. Frequently used levers are placed close to the steering wheel in a logical arrangement. Instruments are positioned so that the driver never needs to turn his head to read them, and warning lights are designed to attract attention and provide vital information. An additional benefit is that a person who has never driven a Volvo before can easily operate the car with a minimum of instruction.

Closely related to instrument and controls placement is the driver's overall view of the traffic environment. Volvo engineers are uncompromising in their insistence upon as near to a 360 degree field of view as structural requirements allow. As a result, all Volvos are designed so the roof pillars take up no more than ten percent of the total field of view without sacrificing structural integrity.

Dashboard and center console are designed to provide impact protection. Gauges and warning lights are easy to read and can't be mistaken for one another. ● Drivers have excellent all-around visibility because roof pillars block less than 10% of the total field of view. ● Electric rear window defroster is a Volvo standard. It can melt a sheet of ice or clear misting in minutes.





Although 3-point shoulder/lap safety belts cannot be expected to provide total accident protection, their value as part of the overall passive safety system is unquestioned, particularly for preventing the occupants from being thrown about the car, or thrown from the car altogether. Volvo first installed them in 1959, long before they were required by law.

In order to make its belts as comfortable and as easy to use as possible, all Volvos have been equipped with the more sophisticated inertia-reel safety belts since 1971. And while shoulder/lap safety belts for front seat passengers are now part of every car, Volvo provides the 3-point self-adjusting type for rear seat passengers as well.

Volvo is thoroughly convinced of the benefits of 3-point belts because of their extensive research into investigations of Volvo accidents in Sweden.

In fact, this data has enabled Volvo to document the different types of accidents and their severity to an astonishing degree. One early objection to wearing safety belts was decisively overcome by Volvo's 28,000 accident study, that it's best to be thrown from the car rather than stay with it. Quite the opposite is true.

The latest study indicates that use of a 3-point safety belt reduces the possibility of injury by 32% for the Volvo driver and by 36% for the front seat passenger. This is positive proof of their value.

Rigorous testing has resulted in constant improvements to Volvo safety belts over the years. For 1975, safety belt locks are illuminated and placed in an easy-access console along with the handbrake.

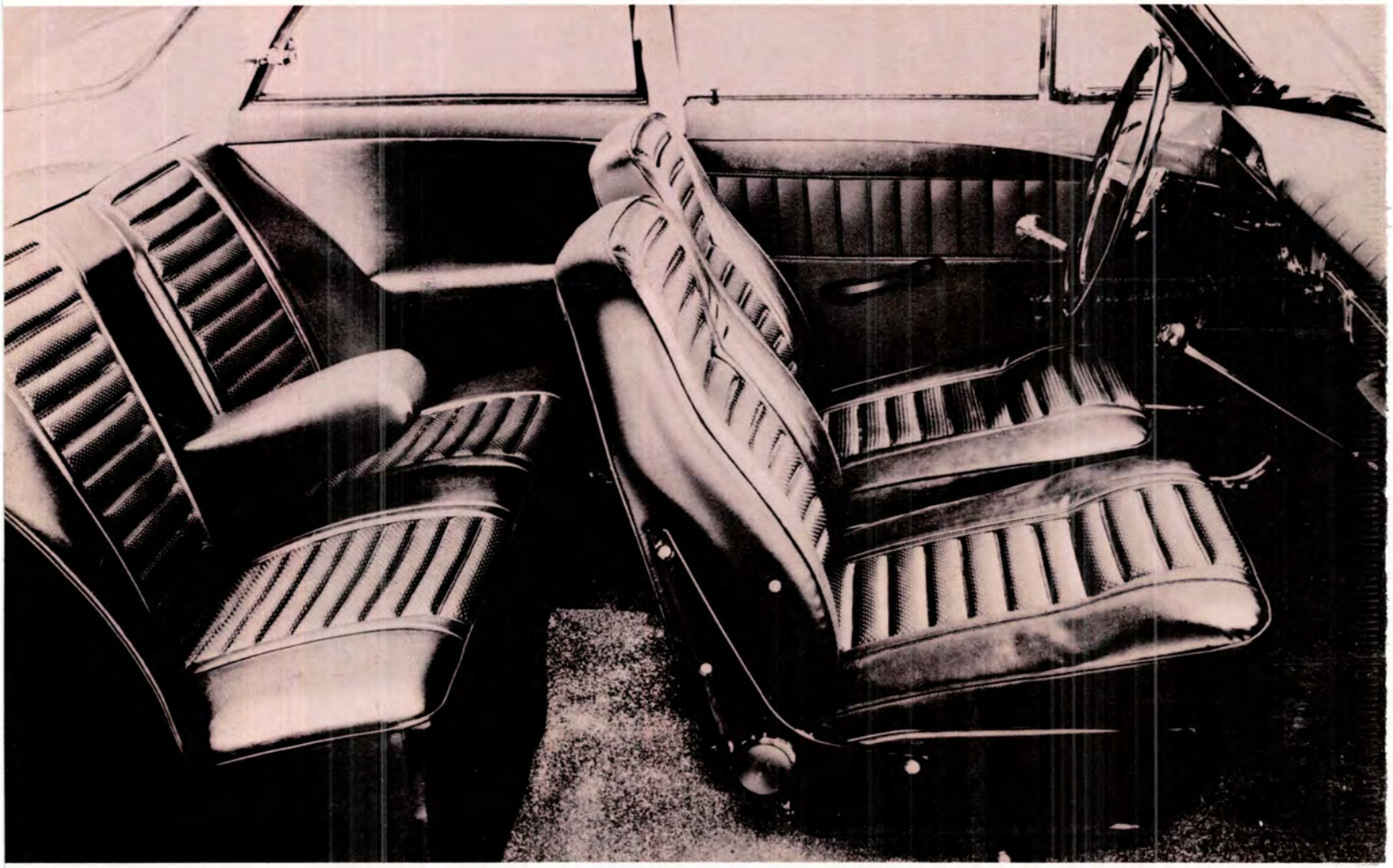
A Seat That's Built Even Better Than It Looks!

Since the appearance of the 144 sedan in 1967, the quality and comfort of Volvo seating has been one of our major features. It is no exaggeration to say that we have gone to extremes to try and make the best seats of any production car sold in the U.S.

The basic reason for this total concern is — once again — safety. Volvo engineers are convinced that in order to drive safely the driver must be fully alert at all times. The only way to assure this is to make him as comfortable as possible. Under all driving conditions, on long trips as well as short ones.

To this end Volvo has enlisted the aid of orthopedic surgeons to carry out a research program that includes a great deal of measurement of the forces acting on the human body when it is in a seated position. On the basis of this ergonomic research, Volvo engineers have determined that the normal strain on the back muscles can be considerably reduced by providing a firmer, rather than a softer, lumbar support, and by increasing the angle of the seat back.

However, since no two drivers have the same physical characteristics, neither of these factors can be used to advantage unless the seat is made fully and easily adjustable. This means that there must be provisions for more than just the conventional fore-and-aft movement of the seat. It must also be provided with a measure of up-and-down movement combined with a means for varying the angle of the seat back to suit the driver's measurements. At the same time, there must be provisions for changing the relative firmness of the backrest in accordance with the driver's weight.



Volvo brought out its first version of the adjustable lumbar support seat ten years ago on the 122 sedan. ● 1975 bucket seats feature see-through head restraints, come with four different types of upholstery -- cloth (shown here), vinyl, velour or leather.

The seat must also meet a further requirement – it must be able to withstand the impact forces of either a forward or rearward collision without either collapsing or transferring the shock to the passenger.

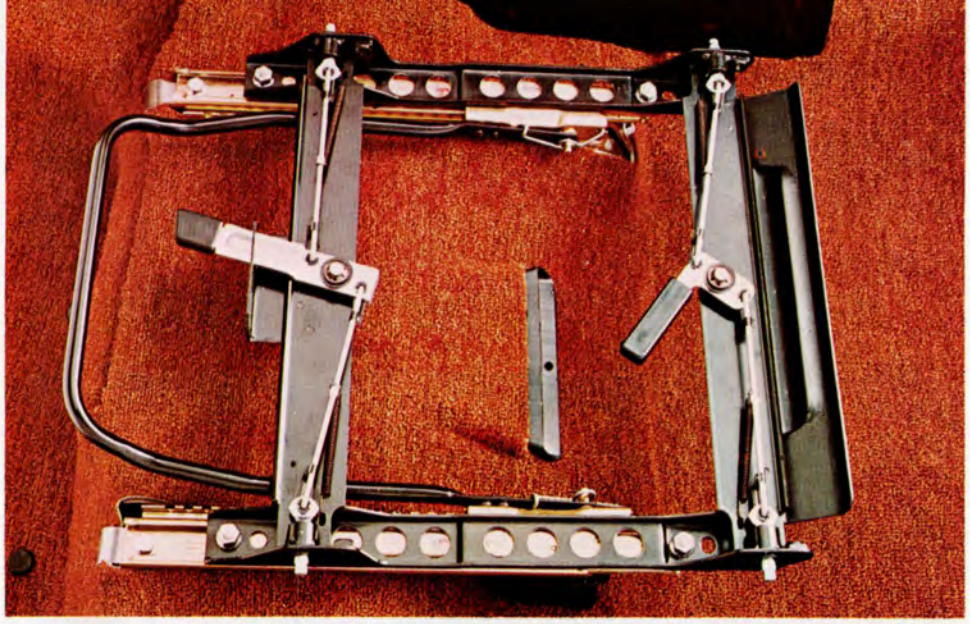
All of these engineering and adjustment features have been embodied in Volvo's front seats since the advent of the 140 Series. Instead of the conventional four to six inches of fore-and-aft movement, Volvo seats have eight inches. For more legroom, seat cushion angle can be changed by as much as 2.8 inches if you raise the front and lower the rear. Seat back angle is controlled by one knob on the side of the frame, firmness by another on the backrest.

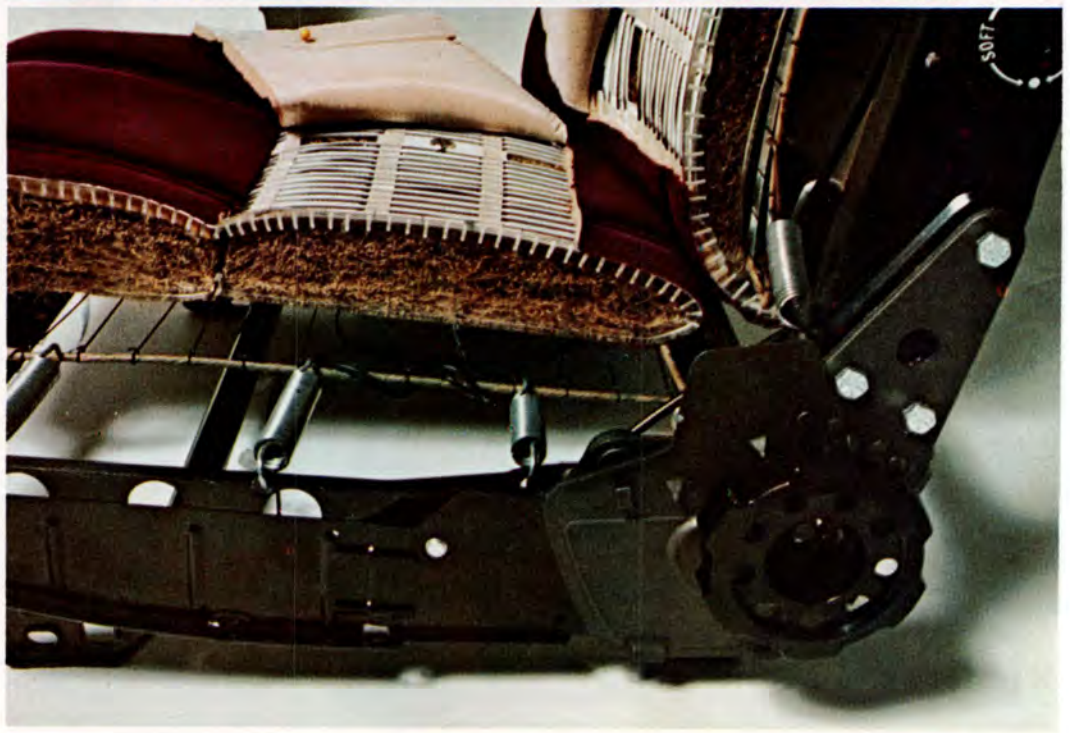
In the eight years since its first appearance, the front seat has been subject to considerable modification in the lumbar support system as well as in the frame and padding design.

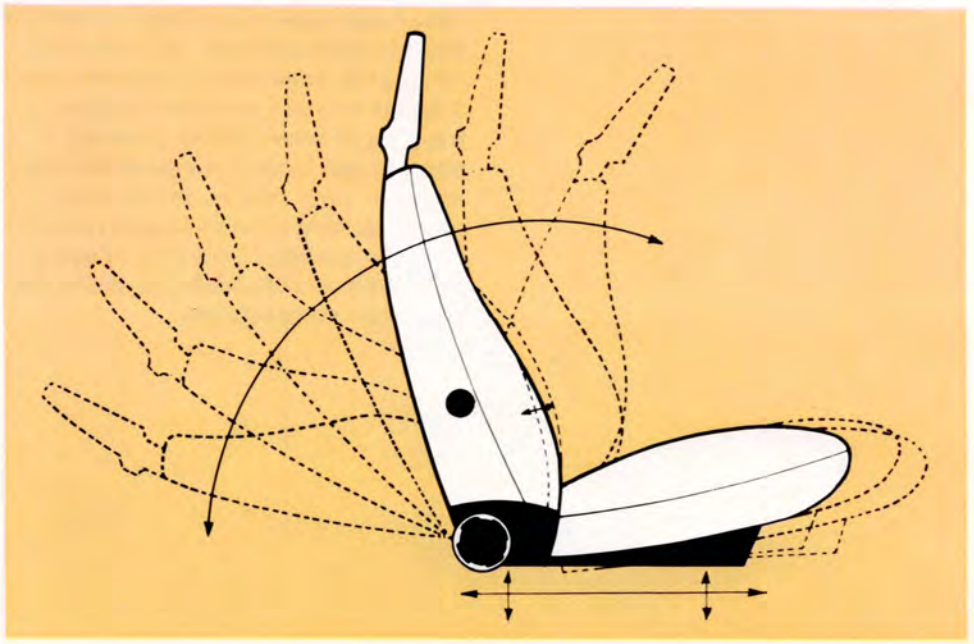
This has not come about because the original design was inadequate – most of its basic features have yet to appear on even luxury domestic models – but because ways were found to do the job a little better. The latest modification almost amounts to a complete redesign, and the entire seat from the floor pan up has been made considerably stronger and easier to adjust in every way.

After considerable experimenting, Volvo designers have concluded that the best all-around material for padding the seats consists of natural fibres bonded with a film of plastic foam, rather than plastic foam material alone.

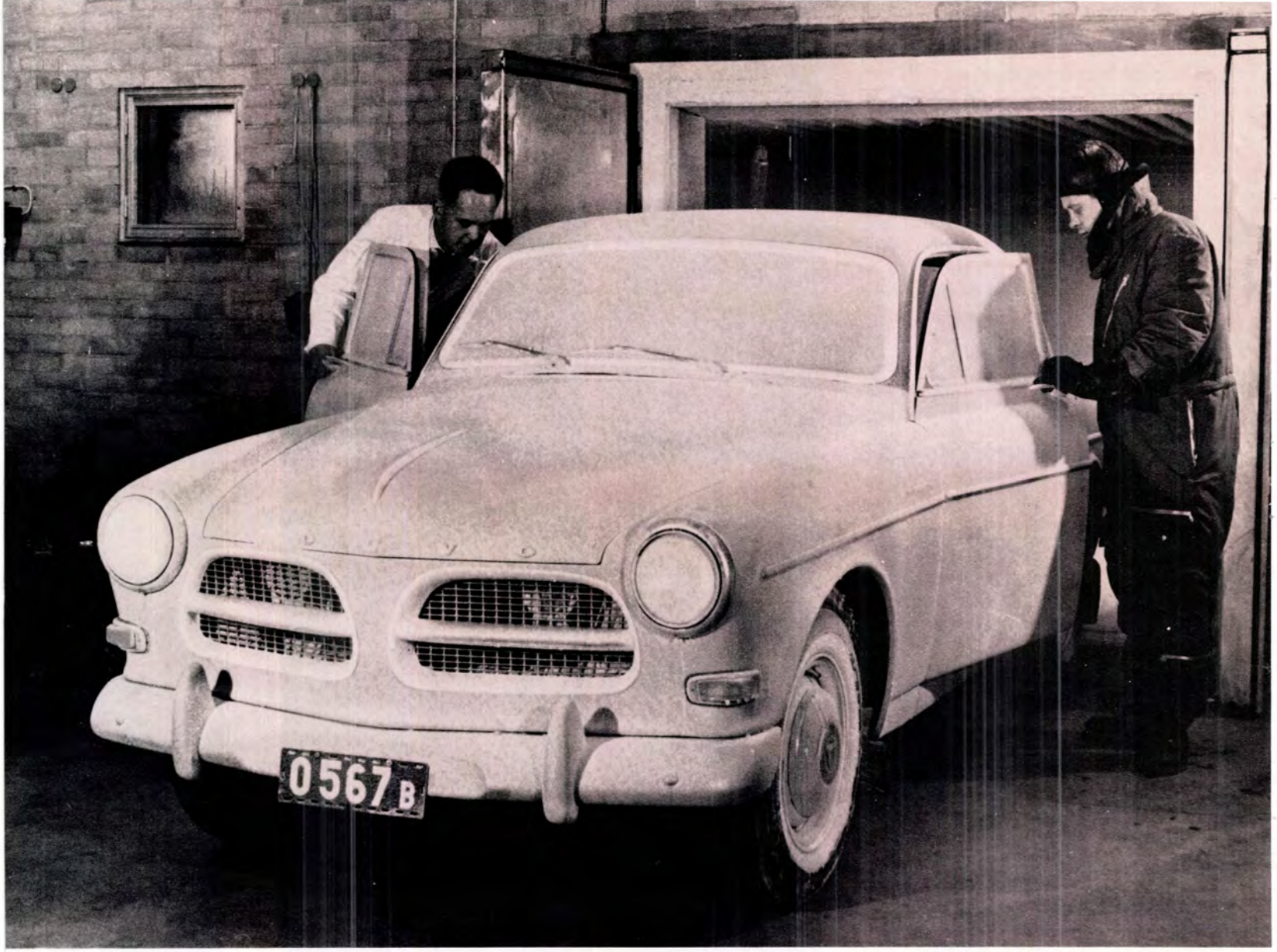
This construction forms a highly flexible cushion that holds its shape and provides excellent springing and damping qualities. The same type of resilient foam is used on the rear seat.



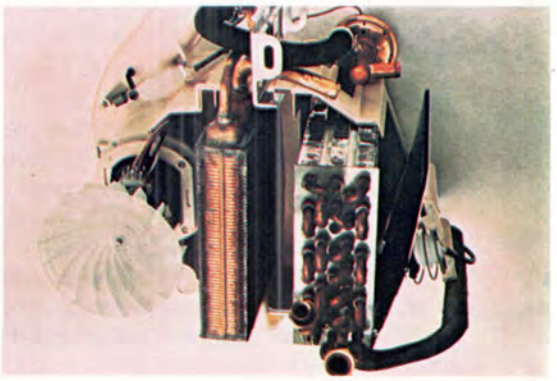


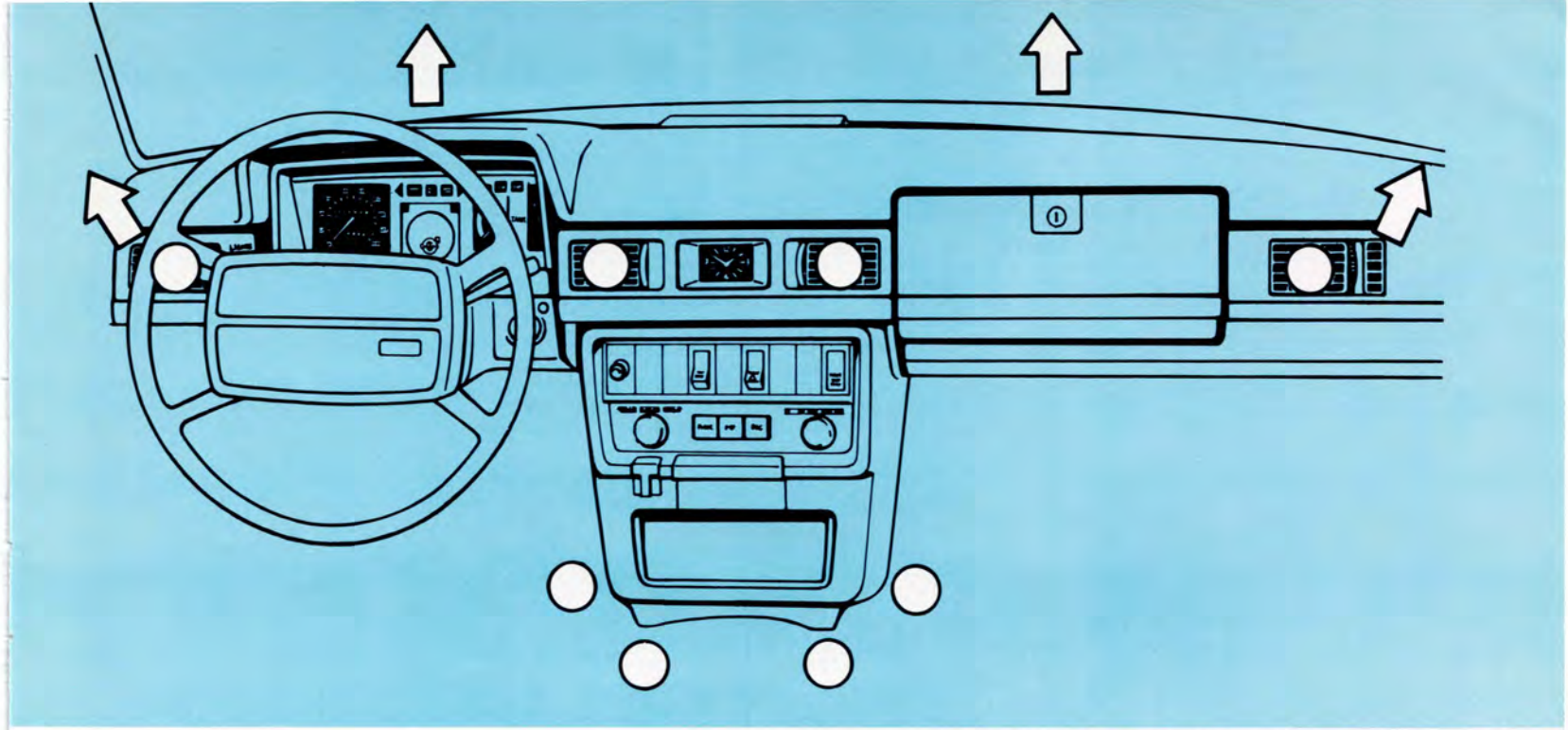


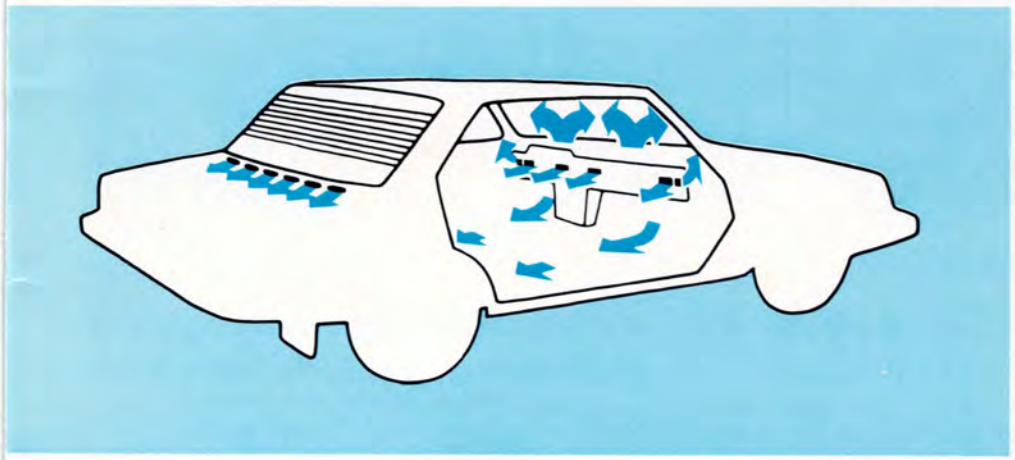
Engineering of Volvo seats starts from the floor up and the inside out. Seat lifters are designed so that the front or back can be raised independently. Note the heating outlet for rear passengers. ● Seat cushion is built up over a frame of spring-tensioned steel wires with layers of rubberized fibres and plastic foam. ● Five separate adjustable features, including lumbar support, are built into every Volvo front seat.



Refrigerated lab is a vital testing area for Volvo. In the new Technical Center, desert and sub-tropical heat conditions also can be duplicated. ● Combined heating/air conditioning unit uses dual 3-speed fans and operates in either fresh air or recirculating mode by opening and closing the air intake vent at upper right (shown in the open position). Recirculation feature is used for faster cooling on hot days by using 85% of the already cooled air inside the passenger compartment.







Temperature Controlled Environment

It is worth noting that although the front seat's primary function is to keep the driver alert and in full control of the car, the same comfort and convenience features are also provided for the front seat passenger. This is because comfort is a very close second to safety at Volvo, and it is approached with much the same concern.

A prime example of how comfort is taken seriously is the Volvo heating and ventilation system. It has been designed specifically to meet the realities of the American environment, where people tend to drive longer distances in greater extremes of weather and traffic than most Europeans do.

The system embodies two basic qualities, fast action and even air distribution throughout the front and rear of the passenger compartment. To achieve this there are twin three-speed fans and various types of outlets at several locations. Stale air is exhausted through a set of vents below the rear window, so that a constant stream of fresh air flows through the car at all times.

The outlets are designed to provide a maximum directional variability to the incoming fresh air, which has been either heated or cooled as conditions dictate. And because the incoming air flow passes through the cooling part of the system before it reaches the heating core, it's possible to heat the dehumidified, air-conditioned air — an ideal benefit in cold, muggy weather.

Four outlets on the dashboard can be adjusted individually, two more beneath the windshield provide for quick defrosting, two ducts are directed to the front floor and two others under the front seat supply fresh air to the rear seat passengers.

A new refinement this year on the 240 Series is an additional pair of outlets at the ends of the dashboard. They are directed at the side windows to prevent misting.

Distribution of ambient, heated or cooled air is easily done with side-by-side controls on the center console and with four fully-adjustable dashboard outlets. ● To keep the side windows clear of misting, outboard dash outlets are fitted on the 240 Series.

The Engineered Interior

The same careful engineering that went into the heating/ventilating system has been applied to a number of other features in the passenger compartment. Individually, many of them may be of minor importance – for example, this year the cigarette lighter has been recessed into the center console. A small detail, but logical just the same, because now the lighter cannot be mistaken for a control knob.

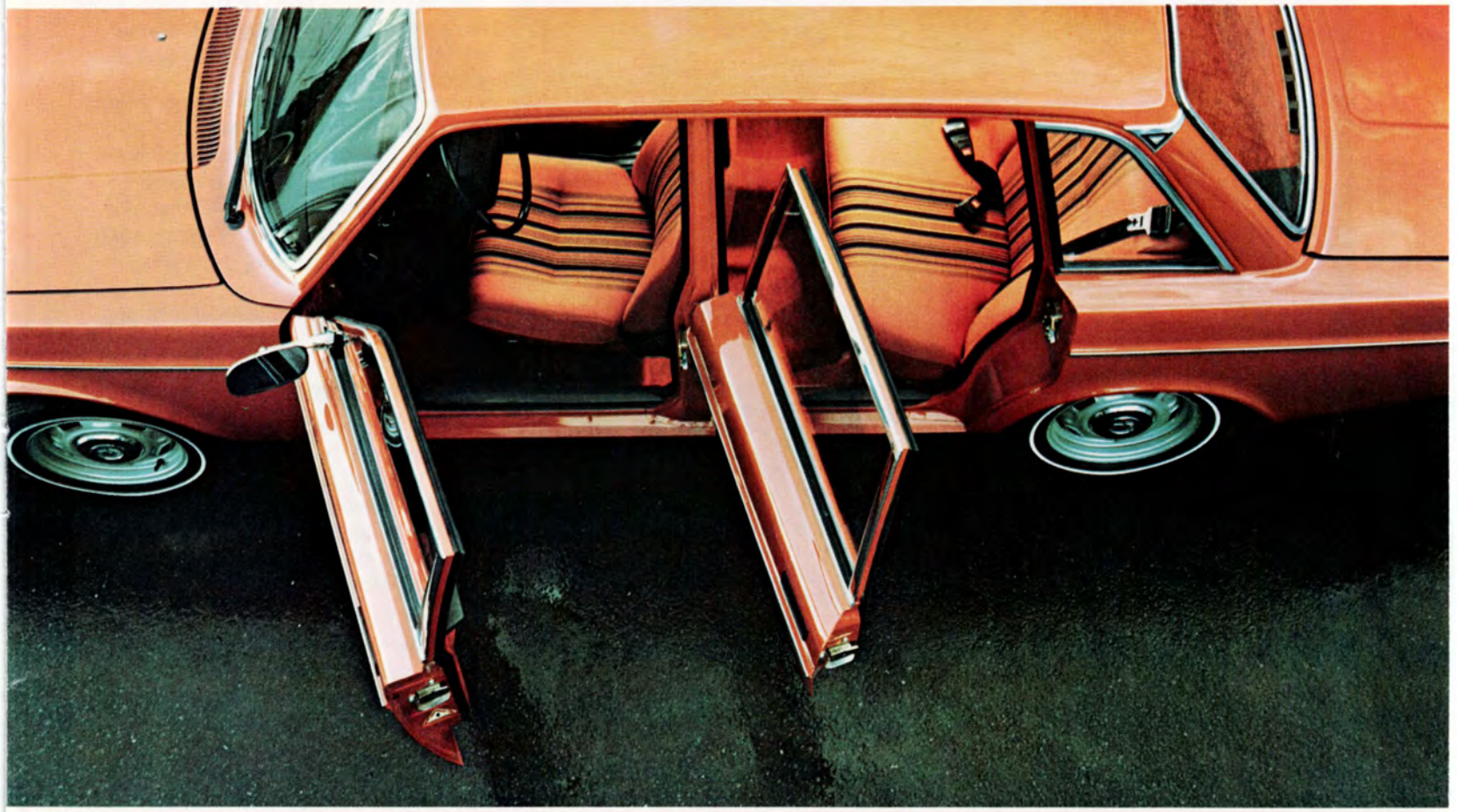
Or take another knob – the one on top of the gear shift lever. In common with many European cars, Volvo's shift lever has displayed a diagram of the shift pattern for a number of years. This year something new has been added, the overdrive switch.

The Volvo owner who is trading in a model several years old will be quick to notice these newest refinements, new owners can notice a lot more – details that have been lacking in their old cars. One feature which will be a pleasant surprise to both, however, is the heated driver seat in the 164 and 242/244GL models.

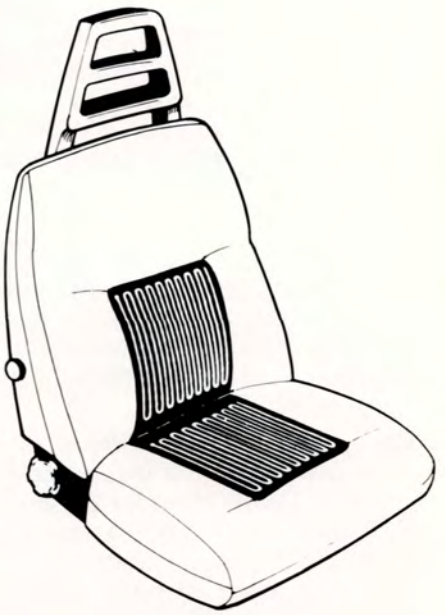
In contrast to most other imports of the late 'fifties, the 544 sedan was definitely a family car for full-sized people.

Volvo's heated driver's seat can only be justified on the basis of luxury. Introduced in 1974, the thermostatically-controlled heating wires imbedded in the cushion and backrest will maintain a temperature of 79 degrees whenever the inside temperature drops below 57 degrees. The system goes into operation the moment the ignition is switched on and it reaches full operating efficiency in less than three minutes.

Another example of attention to detail is the Volvo handbrake. For years this feature was placed to the left of the driver's seat and could be easily hand operated, the way vintage-car brakes were used. But the new Volvo seat required a new handbrake location, and our engineers resisted the idea of making the handbrake foot operated, only suited for "parking," and moved it to a console it shares with the safety belt locks and a rear seat ashtray and courtesy light.



High doors that open almost 80 degrees make getting in and out easier. ● Padded sun visors fold up flush into recesses in the one-piece molded headliner. ● Heated driver's seat is an added luxury on the 164 and GL models. Thermostatic control turns it on whenever the temperature drops below 57°.



The understated lines of the Volvo 1800 sports coupe made headlines when it was introduced in 1959 until it was discontinued in 1972.

Functional Innovations for Quality-Conscious Owners

There are certainly as many refinements in the rest of the Volvo as there are in the passenger compartment. The headlights, for example, on the 240 Series are now designed so they can be adjusted from the front, on the 164 you turn knurled knobs under the hood. Improved insulation to reduce the effects of both heat and noise has been provided in the engine compartment and at a number of critical points on the underbody. Windshield wipers are non-reflective to reduce glare. Tanks for the hydraulic fluid, radiator overflow and the windshield washer are made of translucent plastic to visually check fluid levels.

The advantages of such features may not be immediately apparent, but taken together they go to make servicing and maintenance easier, thereby enhancing the car's life and resale value.

The many safety and comfort features embodied in a Volvo are certainly sufficient justification for the car's style just as it stands. There are undoubtedly many purists who feel that any further attempts at styling per se would simply be gilding the lily. However, even the most dedicated engineers agree that there is no reason why a safe, comfortable and practical car cannot also be a handsome – even elegant – car as well.

There is also the argument that it is not enough just to build a fine car, there is also the matter of making one that will appeal to quality conscious buyers. With both of these considerations in mind, Volvo devotes a great deal of care and attention to making cars that are notable for their quiet good looks and for their unique combination of both European and American fine car features.

The outward expression of this approach is immediately noticeable to anyone who so much as passes a Volvo on the highway. Both the 164 and the 240 Series are beautifully proportioned machines whose lines are determined as much by what is not there as by what is. The body panels are free of those extraneous bulges, creases and other fantasies so characteristic of "committee" styling by companies where the sales department outweighs the engineering department.

Details – the headlight housings, parking and directional signal lamps, taillights and even the recessed door handles are equally simple and extremely functional. Where true luxury is concerned however, it is made standard equipment. All Volvos, for example, come from the factory with tinted glass all around, even the mirrors. All Volvos have a built in radio antenna in the windshield and a defrosting grid in the rear window. The 245 station wagon has a rear window wiper and washer as well.

And all Volvos come with steel-belted radial tires – hardly a luxury in 1975, true, although only the top-of-the-line domestics provided them as standard equipment in 1974. Volvo's radials, moreover, have white sidewalls as standard.

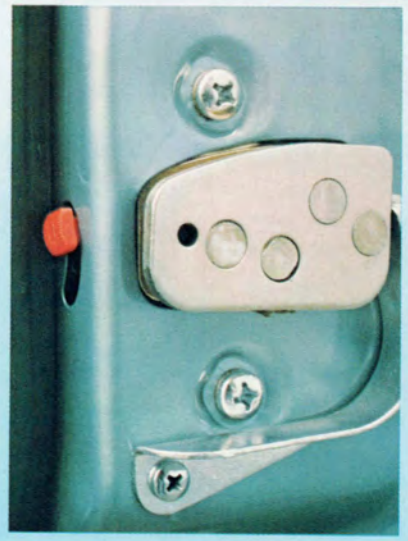
A more complete description of Volvo features is found in our sales brochures, along with all the details concerning the wide choice of models. It should be remembered, however, that in the final analysis the true measure of a fine car is much more than the sum of its features, no matter how impressive they are taken one by one. There is first of all the very complex matter of how effectively all of the car's operating systems actually work together. There is also the very simple matter of the quality of workmanship – how honestly the car is put together in the first place, and how thoroughly the intentions of its engineers and designers are carried out.

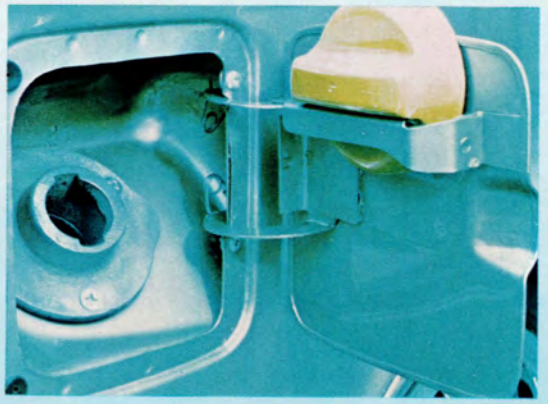
Added to these considerations, of course, is the matter of Volvo's reputation, which is totally committed to building nothing but fine cars for a relatively small number of highly critical buyers.

But when all this has been said, there is still one important question left to be answered: How do you assure yourself that the Volvo is all that it claims to be, and how do you decide that with all of its advantages it is the right choice for you?

The answer is very simple. Examine a Volvo for yourself. Test drive it, open its hood and the trunk, read and compare its specifications. Ask the questions which may have occurred to you in the course of reading this booklet. The answers are all there. There may be surprises in your Volvo, but there are no secrets.

On the new 240 Series, headlights are recessed and turn indicator/parking lights are faired into the corners of the fenders. Bumpers are anodized aluminum. ● Rear doors are fitted with child-proof locks. ● Gas cap fits in a specially designed recess in the cover when the tank is being filled. ● The full line of Volvos for 1975.





VOLVO

The factory reserves the right to make changes at any time, without notice, in prices, colors, materials, equipment, specifications and models and also to discontinue models.

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