

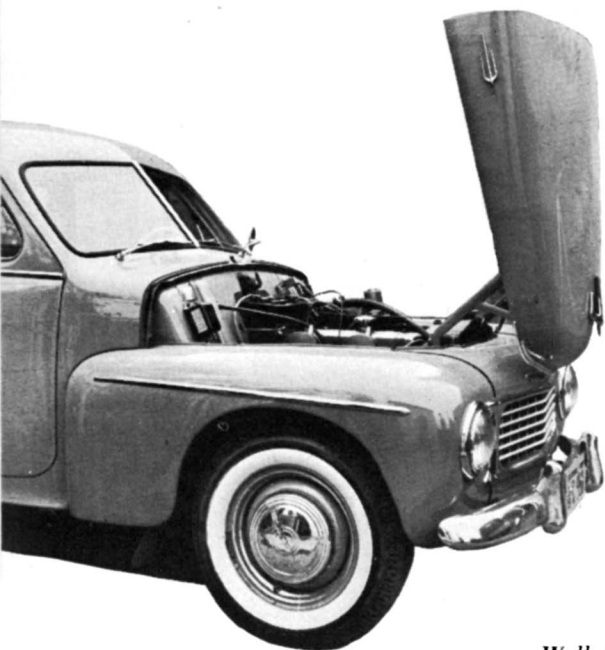
Swedish Invasion

SCI

ROAD

TEST:

PV 444



Well designed hood hinges lift hood high and away from engine compartment making repair work easier. Frontal pivoting offers safety feature if hood latch is left open.

ALTHOUGH SCI's masthead bristles with Scandinavian names, Christy, Ludvigsen and Borgeson have no burning torch to carry for the land of ancestors of a few generations back. But it would be foolish to say that our first contact with a Swedish automobile wasn't marked by unusually sharp curiosity. Testing the Volvo was a special sort of adventure for us and one that put extra emphasis on objectivity, just in case there might be a trace of squarehead chauvinism lurking somewhere around the shop.

Like the rank-and-file of U.S. enthusiasts, we had been aware for some time that certain obscure light cars were being built in Sweden, and that's about all the consideration we gave them. Then, less than a year ago, Auto Imports Inc. of Los Angeles, began to bring the Volvo 444 to this country. They chose to promote the car by racing it, and in four starts in under-1500 cc production competition, the Volvo, well

driven by Ron Pearson, easily ran away from the pack and won four firsts.

Here was a car really to be contended with. The citizenry was impressed and so were we. From its first appearance, the Volvo had set an entirely new standard for competition in its class. But it wasn't until we test-drove the Volvo briefly for SCI's July light-car survey that we began to realize how much automobile reposed beneath this car's disarming exterior. Now, after extended road testing of the \$1995 Volvo, we're prepared to state that this is the hottest light car you can touch within a thousand dollars of its price at this time. It may not win any *concours d'elegance* but on all grounds other than—in some case—esthetic ones, it can nail its competitors to the wall. Let's start with speed.

Our second Volvo, the one submitted to full-scale test, had just been driven back from the CSCC races at Bakersfield, California, and had over 3000 miles on its odometer. It had finished second there (Volvo's fifth race on the Coast) to an expensively-tuned, much more costly car. In spite of its accumulated mileage, this Volvo still felt tight and owners have assured us that these cars don't begin to really loosen up until after the first 10,000 miles or so. Yet with a mere 1.5-mile approach to our timing traps, we were able to clock a true 94.8 one way and 94.1 as a two-way average. This is nice going for a one-ton car with a displacement of just 1414 cc or 87 cu. ins.

It's remarkable. The Volvo is faster than the not fully broken-in Alfa Giulietta Sprint tested by SCI and its top speed is about equal to that of a typical MG "A" or Porsche 1500 Speedster. Kick that one around at your next bench race.

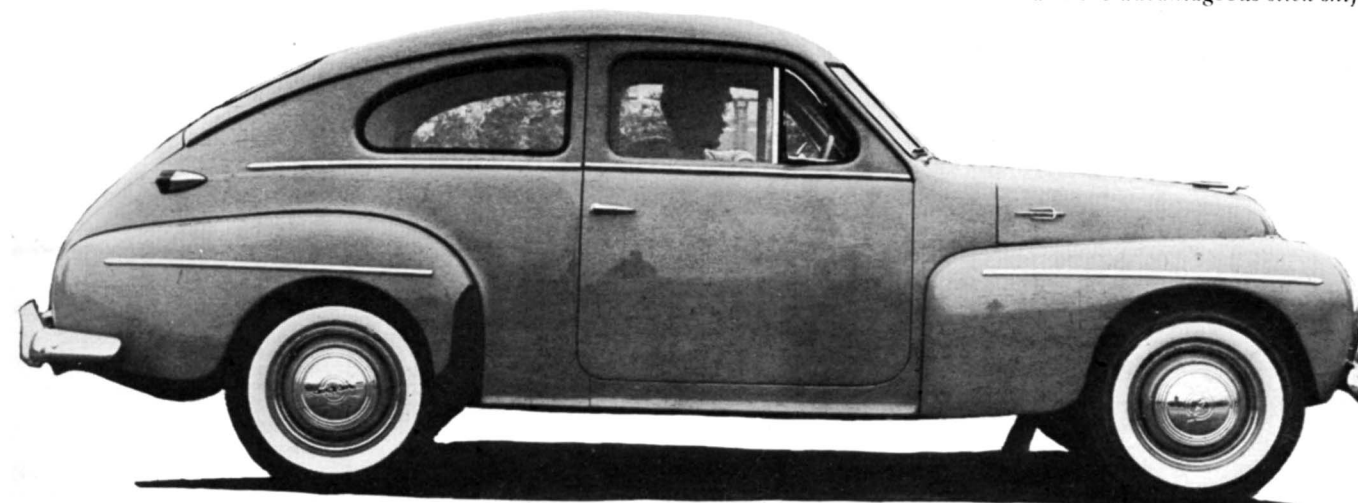
To get up to almost 95 mph in a pretty short distance, the Volvo has to be a good accelerating car. Actually, it's in a



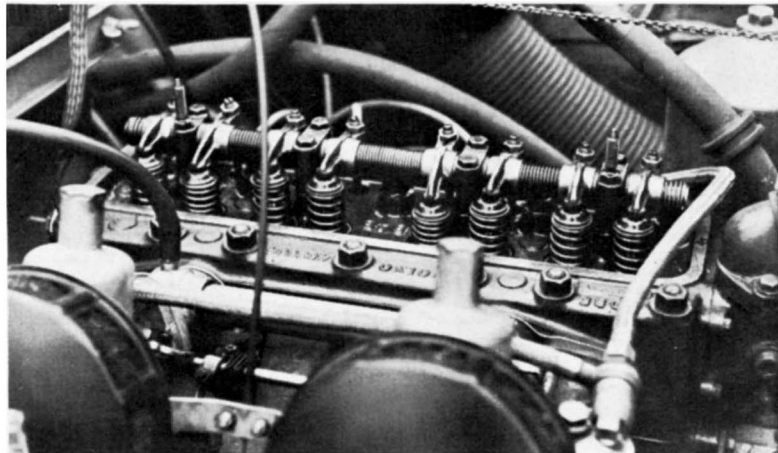
Looking at the Volvo head on from a low angle gives the car a high truck appearance. Actually height is 61.5 ins.



Interior view shows the roominess of driver's niche, the attractive finish, and the advantageous stick shift.



In profile, the Volvo might be a shortened '40 Ford, but there the similarity ends. The quality of the workmanship is unusually high, and the paint is rubbed to a glassy finish.



The twin SU carburetor fed engine with the rocker assembly exposed. Tips of the rocker arms are case hardened and springs pack 172 lb. pressure. Battery (not seen) is a six volt unit.

RATING FACTORS:

Bhp per cu. in.81
Bhp per sq. in. piston area	2.56
Torque (lb-ft) per cu. in.87
Pounds per bhp — test car	30.6
Piston speed @ 60 mph	1910 fpm
Piston speed @ max. bhp	2890 fpm
Brake lining area per ton (test car) ..	108.5

SPEEDOMETER CORRECTION:

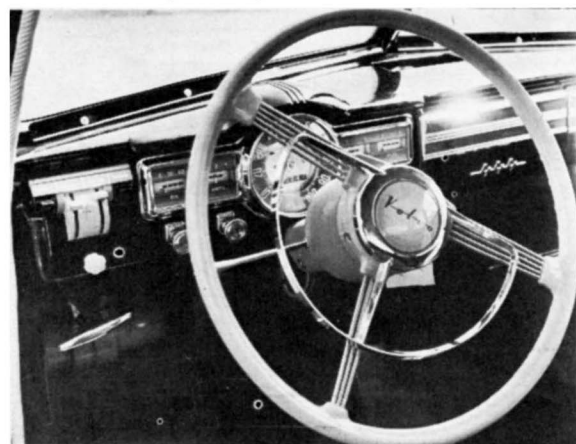
Indicated	Actual
30	28.0
40	38.0
50	48.5
60	58.5
70	69.3
80	80.0



Entering SCI test curve at 50 mph, car rode flat and steady. Some lean can be detected, however, in photo. Good cornering comes from its almost equal weight distribution, with 2 aboard.



Taking leave of the curve, the 444's attitude has understeer effect, tail out, nose into turn. With a back seat passenger or some trunk luggage, 50/50 distribution can be hit on nose.



Instrument panel consists of heat and vent controls at left and gauges at right. In first shipments, gauges had metric and Swedish markings. Latest exports have English readings.

class by itself. For our own information we made up a single chart containing the superimposed acceleration curves of all the cars covered in SCI's light-car survey. We found that the Volvo's curve bears no resemblance to all the others. It is steeper and higher and is more of a sports car than a typical light car.

The factory claims that the Volvo should move from zero to 60 mph in 19.6 seconds. Our capsule-test car, a well flogged race veteran and sales demonstrator, would yield no better than 21.5. But the second car sprang effortlessly from rest to an actual corrected 60 in just 17.3. In the eight car field the Volvo stands out as a real high performance vehicle. It represents a blending of good sports car qualities with the best of the light car's virtues.

There's a further combination in the Volvo of characteristics that usually are mutually exclusive and this cannot be expressed more neatly than it was in a test report in THE AUTOCAR (London). The Volvo 444, it stated, "combines the general comfort and convenience associated with a vehicle of transatlantic (Detroit) design with the handling qualities that are expected of a thoroughbred Continental car. Added to these qualities is a third, that of good general and detail finish and sound engineering."

The Volvo definitely reflects strong Detroit influence in its

body design, roominess and generous interior appointments. Also, it's equipped with a three-speed transmission, a concession to convenience as opposed to sporting requirements. This is or is not an advantage, depending upon your point of view. Had the Volvo been designed with heavier emphasis on sheer performance, a four-speed box certainly would have been specified. The car's acceleration times could be greatly improved by more closely related torque-multiplication factors, and corners could be approached at higher speeds if there was a cog between Second and High to drop into. But even so, the Volvo remains practically unbeatable in its displacement class and the star performer in its price bracket.

The floor-shift transmission is a delight to use because of the precision of its action and the infallibility of the synchro-mesh provided on the two top gears. Unlike most synchro boxes, with which it's necessary to allow a moment for gear speeds to become equalized during a shift, the Volvo's cogs can be popped back and forth in the upper ratios just as fast as you please, and there is never a trace of noise or clashing during this operation. The useful range of Second is remarkably broad and it's possible to wind right on out to 60 mph if you want to push the engine. Low is a noisy gear to get into a standstill unless you first pop the lever in High and then into Low, which then produces a completely silent change. Silent downshifting to Low is an exercise that calls for skillful double-clutch and throttle work.

While the Volvo can be driven just like any stick-shift American car, its road manners are drastically different. It can be paid no higher compliment than to say that it handles very much like a good Italian road machine. To understand why the Volvo behaves as it does, let's take a look at the market it originally was designed for.

Sweden has its share of primitive roads, plus a very cool climate with long, frigid winters, almost no spring at all, and short, tepid summers. In the northern part of the country the ground may be covered with snow for six or seven months out of the year. So the Volvo is a car designed, among other things, to cope as well as possible with road surfaces that are rough, rutted, frozen and slippery a great deal of the time.

The result is a vehicle with the go-anywhere abilities of a GMC Recon wagon plus authentic sports-car roadholding. It can be taken through turns at surprisingly high speeds without apparent body roll, without a murmur from the tires and with a minimum of effort on the part of the driver. It is a safe-cornering car, and feels like one. It can be drifted with confidence if you want to push it that hard and the rear tires can be slipped deliberately, although the Volvo is fundamentally a tracker, rather than a slider, in the turns. It has a very slight amount of understeer.

Much of the Volvo's good cornering stance is derived from its weight distribution. Unloaded, it is slightly nose-heavy. With two in the front seats, weight on the front and rear axles closely approaches equality. With a rear seat passenger or two or with some ballast in the luggage compartment, 50-50 can be hit on the nose.

Front wheel suspension is conveniently independent by coil springs and unequal-length wishbones. The solid rear axle also uses coil springs and is located fore and aft by a pair of husky, hat-section torque arms. Stiff anti-roll torsion bars are fitted at both front and rear. It's a well-knit, heavy-duty suspension layout, more ruggedly substantial than you'd expect to find on a light car.

Precise control of the car is abetted by ZF worm and two-stud lever (cam and lever) steering, as also fitted to the early 300SL's and to current Alfa Romeos. The just-over-three-turns from lock to lock provides as quick response as you are likely to need or want in a touring machine. There is no play in this steering and it is very light, even during parking

TEST CAR:

Volvo 444 sedan, "sports" engine. Over 3000 miles on odometer

TOP SPEED:

(1½ mile approach to ¼ mile trap)	
Two-way average	94.1 mph
Fastest one-way run	94.8 mph

ACCELERATION:

From zero to	Seconds
30 mph	4.9
40 mph	7.5
50 mph	11.6
60 mph	17.3
70 mph	22.9
80 mph	47.2
Standing ¼ mile	21.2
Speed at end of quarter	68 mph
Standing mile	57.4 secs.
Standing mile, average speed	54.2 mph

SPEED RANGES IN GEARS:

I	Zero to 28 mph
II	9 to 56 mph
III	19 to 94 mph

FUEL CONSUMPTION:

Hard driving	21 mpg
Average driving (under 60 mph)	29 mpg
In heavy traffic	23 mpg

BRAKING EFFICIENCY:

(5 successive emergency stops from 60 mph, just short of locking wheels):

	Percent
1st stop	70
2nd	70
3rd	70
4th	70
5th	68

POWER UNIT:

Type	In-line four (three main bearings)
Valve arrangement	Pushrod ohv
Bore & Stroke (Engl. & Met.)	2.95x3.15 ins. 75x80 mm
Bore/Stroke Ratio	1/1.07
Displacement (Engl. & Met.)	86.6 cu. ins. 1414 cc.
Compression Ratio	7.8 to one
Carburetion by	Two S.U.
Max. bhp @ rpm	70 at 5500
Max. Torque @ rpm	75.2 lbs.-ft. at 3000

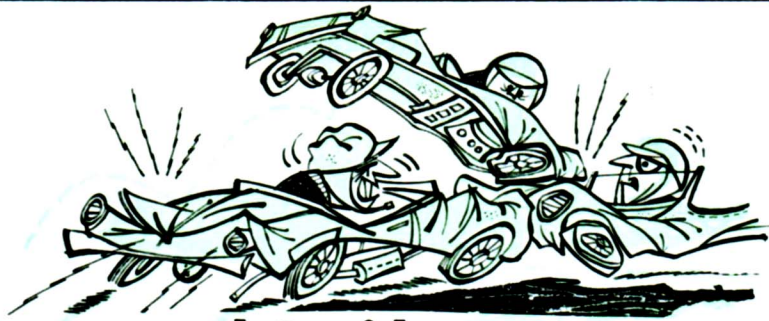
CHASSIS:

Wheelbase:	102.5 ins.
Front Tread	51 ins.
Rear Tread	51.5 ins.
Suspension, front	Independent, by coil springs and unequal-length A. arms. Anti-roll torsion bar
Suspension, rear	Coil springs, radius arms. Anti roll torsion bar
Shock absorbers	Double-acting hydraulic
Steering type	ZF cam and two-stud lever
Steering wheel turns	
L to L	3.25
Turning diameter	33.5 ft.
Brake type	Hydraulic, leading and trailing shoes F & R

GENERAL:

Length	177 ins.
Width	62.5 ins.
Height	61.5 ins.
Weight, test car	2140 with full fuel tank
Weight distribution, F/R	52.4/47.6
Weight distribution, F/R, with driver	51.8/48.2
Fuel capacity — U.S. gallons	9.5
Ground clearance	8 ins.

(Continued on page 54)



Phenomenal Avider

ALTHOUGH he drives as Tybalt fought duels, "by the book of arithmetic," Stirling Moss has used up more than a cat's ration of lives in his nine years' racing. Not counting the certified wildmen of the game, few front-end drivers in Europe today have so picturesque a record of what Sammy Davis calls phenomenal avoidances.

Most of these have resulted from mechanical failures or malfunctions, several from chance proximity to ham handlers in their moments of aberration, some from spins on unforeseeable oil spillings, and a few, as Stirling would admit, from his own momentary misreadings of the book of arithmetic.

Twice in his first year in Continental racing, 1950, when he was on the late John Heath's H.W.M. team, Moss's car broke a front stub axle at over 100 and lurched to a standstill on the brake drum. The second time this happened, during the Circuit of Lake Garda, Italy, H.W.M. pulled in another of their team cars for Stirling to take over. Mechanics were manhandling it into position, empty, when this one too shed the corresponding wheel.

1952 wasn't exactly humdrum, either. In the Formula III Grand Prix of Brussels this son of a London dentist arrived too early and too fast on the scene of an entanglement involving five other cars. Four more promptly piled into the debris, to which Moss' Kieft, a complete wreck, had already added some 500 pounds of scrap metal. Then at Monaco, Stirling spun his C-Jaguar into an *hors de combat* Aston Martin that had collided on spilled oil with a Ferrari. Next, at Spa in the Belgian G.P., Moss went off the road in flames after the experimental G-type E.R.A. he was driving had thrown a rod through the crank chamber, and wound up with a sickening crash into a trackside rock.

Finally, back home on a British course — Fairwood airfield, in Wales, there was a peculiar episode in which Moss and his 500 Kieft were assaulted from ahead and astern almost simultaneously. Another Kieft which was leading him spun through 180 degrees and rammed him head-on. A split second later an upcoming Arnott clambered up the tail of Stirling's car, aviated over the cockpit and came down like the hubs of hell on the front end. The base of the Arnott's engine scored weals in Moss' helmet.

Although he doesn't go all the way on rabbit's-foot philosophy, Stirling can't quite make himself laugh superstition off, either. He, therefore, compromises by taking a miniature horseshoe along with him on races. In particular, the Mille Miglia country has been a constant proving ground for this talisman.

His very first reconnaissance of the M.M. itinerary, in an XK Jaguar prior to the '51 race, ended in a head-on shunt with a truck that was overtaking on a blind curve. Moss and companion stepped out unhurt.

In the race itself that year, he arabesqued on spilled oil within minutes of the start and slammed a stationary Fiat — off which Alberto Ascari had just ricocheted, killing a spectator. Moss never got a scratch.

While training again for the fateful Mille Miglia of 1955, in which he was to break a 17-year spell of continuous victories by Italian drivers, his Mercedes went full smack into a truck carrying unexploded bombs. And didn't explode them.

Finally, in this year's marathon his Maserati went amok near Rome, bouncing from a wall into a tree. The car wound up teetering precariously over the edge of a 200-foot precipice. Undamaged, Stirling and his famous bearded disciple, Denis Jenkinson, scrambled back up to the road and out of the race.

Morgue cheating runs in the family. Over 30 years ago, when Stirling's father was practising for the first of his two Indianapolis drives, he blew out a front tire on his borrowed Fronty-Ford. Somebody who knew the car's background better than he did, took a casual look and said: "Well, no wonder — those tires haven't been changed since Chevrolet won here with this car two years ago."

Dennis May

Volvo

(Continued from page 19)

maneuvers, yet steering feel is good at all speeds. No road shock is telegraphed up the steering column.

The Volvo has an honest, unaffected character and the job it undertakes it does with craftsmanlike thoroughness. The ride and general tautness of the chassis, for example, never let you down. The car feels solid and secure at 40 mph and feels no different at top speed. There's no body shake or driveline vibration to give you the feeling at high velocities that things are beginning to come unglued.

The chassis' shock-absorbing ability is up to good modern practice on average road surfaces. But when you hit bad roads in the Volvo you find its reaction hard to believe. You can charge at 50 mph through horrible ruts and chuckholes that would shatter the running gear and occupants of most cars. Yet you feel scarcely a ripple in the Volvo, and this statement is meant *literally*, not figuratively.

Scarcely any engine vibration is felt inside the car at any speed and the engine is quiet except at idle, when it emits a pleasant tic-tic that sounds like a chronometric tach digesting rpm. As soon as a load is put on the engine, its sound changes to a quiet hum and it remains smooth up to the peak-rev range, when the rocker box naturally begins to make itself heard.

Extreme reliability is claimed for this short-stroke four, and the factory, usually conservative in its statements, says that it is not unusual for a Volvo to go for more than 120,000 miles before the first rebore. Many pains have been taken to build this durability into the engine, including hardened surfaces on all bearings of the three-main crankshaft, porous-chrome piston rings, lead-bronze bearing inserts, case-hardened rocker arms, and spectacularly machined cam followers.

The engine's designer obviously has a passion for control of internal temperatures, and so much water jacketing is provided around the cylinders and in the head that the fan is almost entirely unnecessary. The cooling of plugs, combustion chambers, exhaust valves and cylinder bores should never be a problem. We understand that large numbers of Volvos are sold in North Africa and the Near East, and that in the most torrid climates they are never known to overheat, which is easy to believe.

Such is the extent of this emphasis on engine cooling that a warmup blind is

provided in front of the radiator, operated from the instrument panel by means of a chain control. This arrangement lacks the automatic convenience of a thermostat, but it does permit the driver to select any operating temperature that he may choose. In an atmospheric temperature of 70 degrees F. we made a 40-mile run with the blind all the way down. This included a final burst of 90 mph for several miles. Upon stopping, you could rest your hand on the top tank of the radiator and feel no discomfort.

For rapid warmup the blind can be raised all the way, then lowered partially to maintain a reasonable operating temperature. It's all too easy, we found, to forget to lower the blind from fully-raised and then note that the needle on the water-temperature gauge has shot all the way out of sight. This happened to us on two occasions, proving what slaves we've become to automatic controls. But we lowered the blind, kept going at a moderate speed, and within a minute, the needle was back in the permissible range.

The performance factors (see tables) relating to engine efficiency are very good when judged by light car and even by production sports car standards. One of the main contributing elements to this good performance is the excellent breathing of the Volvo sports engine, achieved by means of dual side-draft

carbs, over-sized valves and ports, the intake ports being polished, beefed-up valve springs, and a cam that packs a mildly warm grind. The lag you'd expect in bottom-gear getaway from rest with an engine of this size is there all right, but it's briefer than you might expect, and the pistons begin pumping very effectively at low revs. Most of the engine's components likely to require replacement in time are popular U.S., English, and German parts, widely available here. A six-volt electrical system is used.

Returning to the Volvo 444, this combination sports-family vehicle loses points on very few grounds. Its brakes appear to be its most serious mechanical shortcoming. Their lining area per ton factor is rather average and their performance is not up to the high standard set by all of the car's other mechanical elements. This definitely

does not mean that the brakes are bad; in fact, they're a shade better than the Detroit average. But they do fade noticeably and during our ten-stop test registered a big decrease in efficiency, although still retaining highly effective stopping power.

The Volvo's body matches or surpasses Detroit standards of finish and solid construction; it forms a unit with the frame and is Bonderized for rust-

resistance. Its paint is glass-smooth. It is one of the extremely rare bodies in the light car field that the average U.S. motorist can enter for the first time and feel quite at home in. It has all the familiar conveniences: cigarette lighter, three ash receivers, conventional (and legal) turn indicators; dome lights, seats that are well, well off the floorboards. It's a five passenger car and the seats can be folded to make a roomy bed. The rake of the front seat-backs is adjustable.

Like the early VW's, the first shipments of Volvos lacked some export refinements. Recent shipments are finished to a fine turn. Interiors, instrument calibration and labelling, and bumpers are all now competitive with Detroit. It appears obvious that Sweden is willing to do its best for the Yankee dollar.

In a nutshell, the Volvo 444 is a short wheelbase car, but is not a small car. It has the fuel economy and nimbleness of a light car, but is free of the performance limitations and claustrophobic disadvantages of many of these. It

has a great deal of the zip and agility of a light production sports car, yet it's a family-sized machine. It's a skillful combination of good things from both sides of the Atlantic and as such is in a class apart.

Griff Borgeson

SAAB

(Continued from page 23)

dicular to the longitudinal axis of the car. Mounted close to the wheels, at the end of the U-section, are the coil springs. Under normal driving conditions on straight paths, they compress an amount equal to that of the vertical movement of the wheels in relation to the body. The shock absorbers, however, are placed midway on the U-section. This puts them approximately halfway between the hub of the wheel and the central bearing. Again under normal driving, shock absorber action is then about half that of the wheels, and a soft pleasant ride is thereby attained. But when a rolling action occurs, then the shock absorber movement is about 80 percent of the wheel movement. This immediately sets up a high resistance to the pitching motion, and the car rides flat. Augmenting this action is the tendency of the whole axle structure to act as a torsion anti-roll bar.

The torque produced upon this U-shaped axle when braking causes it to twist downward through an arc at the central bearing. Since it is firmly attached to the body at this point, it tends to pull the rear of the car through the arc with it. As a result,

there is no rear end lift when the Lockheed hydraulics take hold. The car never lurches or dips, a refinement in this small car that is markedly absent in many larger ones bearing a more fearsome price tag.

The SAAB 93 is an outgrowth of its predecessor, the SAAB 92, which was designed and used extensively as an experimental machine. A prototype machine was completed in 1946, but it wasn't until 1949 that the SAAB Aircraft Company entered the automobile market with the SAAB 92. This early model was a four seater powered by a 25 hp two-stroke engine, and employed the monobuilt body and frame. While plans for the 93 were being conceived and committed to the drawing boards, the 92 was out working up a reputation on the many and various roads of Europe. Satisfied that they had learned from the errors incorporated in the first-born, the SAAB Aircraft Company transferred notions from paper to practice with the gratifying result — the SAAB 93.

And so came to life the second Swedish automobile to hit American shores. Throughout the entire four days that we had the car, we didn't once tire of driving or riding in it. In it Parkway traffic ceased to be a hateful purgatory. We would merely spot an opening and jump into it,

moving through the creeping cars to the nearest exit, pop a second shift, and hasten away from the pokey pace.

And when we say hasten, we mean just that. In the acceleration department, the SAAB is no slouch, especially through first and second gears. It is really in third gear after the 40 mph mark has been reached that the pulling power begins to taper off. A look at the graph shows an almost steady diagonal line reaching to 40 mph. At this point the shift was packed into third and from then on the line begins to flatten noticeably. From a dead start in first, the 93 jumps off the waiting line in a fit of ambition.

Considering the ridiculous power-to-weight ratio of this car, one horsepower per forty-seven pounds, the 93 doesn't do too badly at all: Praise for such phenomenal pulling power is accredited to the rather high output of the small displacement three cylinder two-stroke engine. Originally, the 92 had a two cylinder two-stroke engine whose output was considerably lower, and whose efficiency lurked somewhere in the dismal depths. The problem was to raise the power output without increasing the displacement (and therefore, European licensing costs), hence, a reduction in bore size and the addition of the third piston.

(Continued on page 56) 55