

1801

BORGWARD

2.3

WITH AIR SUSPENSION

Only slightly larger in basic dimensions than the smaller-engined Isabella, the Grosse Borgward offers a much higher performance. It is luxuriously appointed and its air suspension contributes largely to good ride comfort and road manners



AIR suspension, with its acknowledged advantages of maintaining near-constant ride characteristics to suit the vehicle with the driver only aboard or when fully laden, was offered as optional equipment by most American manufacturers two years ago. Although we were not able to test a car so equipped, there were obviously deficiencies in the system as designed or engineered, for it has fallen from favour and is now available on the rear suspension of only one American car.

The Grosse Borgward—introduced at the Frankfurt Show in September, 1959, and later offered with air suspension as optional equipment at the Geneva Show last March—now has this system as a standard feature. The suspension units are of the rolling-pack mitten type, and are made in Germany under Firestone patents; the control and levelling valves are supplied by Bosch. The system is pressurized by an air pump, belt-driven from the front of the crankshaft, feeding a reservoir housed under the bonnet; this reservoir incorporates filters for cleaning the air, and for removing its water content.

It can be said at once that the air suspension on this car is very successful without being revolutionary in its behaviour. Some comparisons with the more widely known oleo-pneumatic suspension of the Citroen will not be out of place, for when the Citroen DS made its debut, its ride was, and still is, completely different from previously accepted standards. In certain road conditions the DS suspension is superb and unsurpassed, yet occasionally it can be caught out of step. The Borgward system does not offer a comparable breakthrough in any characteristic of ride; it is, however, outstandingly good in resisting roll on severe cornering, and this has a pronounced effect on handling properties; so much, in fact, that it seems to have overcome the shortcomings usually associated with a simple swing-axle rear suspension.

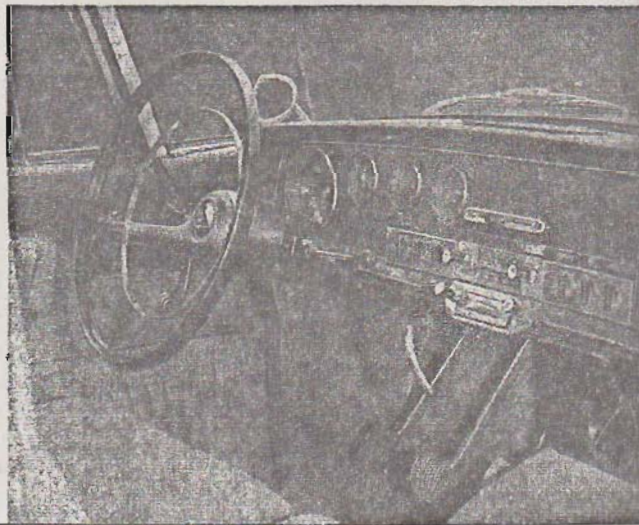
The Grosse Borgward is a roomy five-seater saloon. Six adults could be carried on occasion, but the individual front seats are designed primarily to carry two. Finish and appointments are of a high standard, the only extra being a radio to choice on the cars imported into this country (by Metcalfe and Mundy Ltd., 280, Old Brompton Road, London, S.W.5, to whom this road-test car was supplied by

the factory). The six-cylinder engine has the same size of bore and stroke as that of the 1½-litre Isabella and is, in effect, a larger version. Like the four-cylinder unit, it is surprisingly powerful, for the car achieved a top speed of 100 m.p.h.; at the same time it is also economical. The overall fuel consumption was 19.6 m.p.g. over 1,135 miles; during this period it was necessary to add two pints of oil to the sump.

First impressions of the car were deceptive in that it was not noticeably different initially in its suspension and ride characteristics from many others using more orthodox systems. In fact, the immediate impression was one of a well-designed car using steel springs. On main and secondary-class roads, at speeds up to 40 m.p.h., the ride with only the driver aboard tends to be firm but not harsh. At higher speeds, irrespective of the road surface, it becomes very much smoother and is constant in its characteristics whether lightly or fully laden. At high speeds on main roads the ride is level and comfortable, and the car keeps to a straight path without conscious effort from the driver to maintain a chosen course. Side winds have little effect on this inherent stability.

It is when cornering at high speeds that the air suspension really shows to the best advantage. Initial roll, which is arrested quickly, is small, and this not only has a pronounced effect on road-holding, particularly at the rear, but is appreciated also by the passengers. The resistance to roll is due to the functioning of the levelling valves, which seem to be almost instantaneous in their response. The result is that the lateral distance between the centre of gravity and the point of contact of the tyres with the road does not change greatly during cornering, so reducing considerably

Functions of the ficia switches are readily understood from the pictorial symbols above them. Heated or cool fresh air is regulated by the horizontal lever above the radio and distributed by the control knob on the heater unit mounted between the ficia and the transmission tunnel



the roll oversteer effect inherent in a swing-axle form of independent rear suspension. Thus the car can be cornered hard without any oversteering effect; in fact, basically it has understeer characteristics, but without them being too pronounced.

In consequence of this limitation of roll during cornering, wheel adhesion, particularly at the rear, is very good indeed. Even in very wet conditions, and seemingly irrespective of the road surface, it was very difficult to provoke sliding. At the limit of adhesion the rear wheels pattered slightly on a corner, but this behaviour was predictable and never disturbing. On very rough pavé, lightly or fully laden, the ride remained commendably level and the car was very controllable at speeds between 50 and 55 m.p.h. In these severe conditions, and also on a smooth road at speeds above 55 m.p.h., there was a tremor at the front of the car and at the steering wheel. It resulted from a natural resonance of the body structure, as distinct from steering kick.

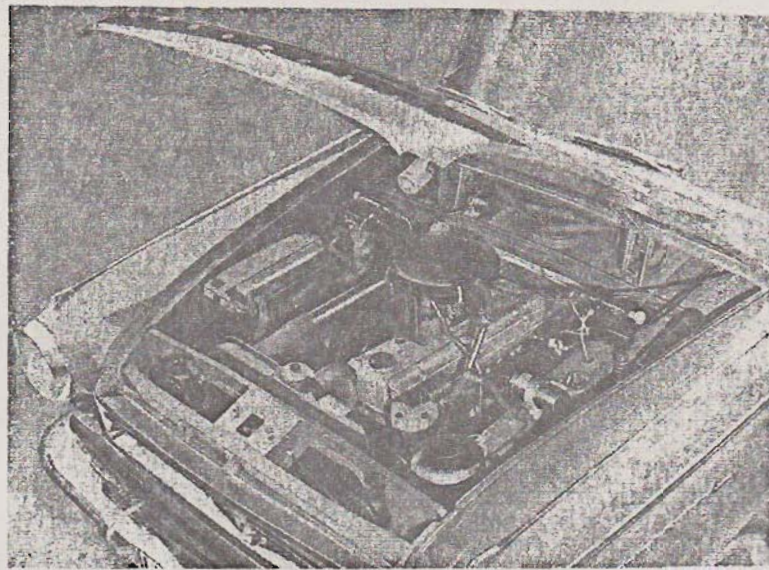
On an undulating surface, or one with a sudden change of contour such as a deep hollow or hump-backed bridge, the initial disturbance and consequent reversal of motion are quickly arrested. It would be an exaggeration to say they are not felt, but they are controlled without disturbance to the passengers, and any subsequent pitching resulting from them is almost entirely eliminated.

Good Turning Circle

Steering is quite precise without being outstanding, there being no noticeable amount of lost motion around the straight-ahead position. It is fairly heavy throughout its range and could, with advantage and without detriment, be provided with slightly lower gearing. Although four turns of the wheel are required from lock to lock, this must be related to the very good turning circle for a car of this size—under 33ft between kerbs.

Synchromesh is provided on each of the forward ratios of the gearbox and it is very efficient. Maximum speeds of 30, 54 and 85 m.p.h. are available in the indirect ratios, the spacing of these being well suited to the character of the car; third gives a very useful range for quick overtaking. The column control itself is not of such a high standard as the synchromesh mechanism. The movements of the lever are long, 15in. of travel being required between first and second, and third and top; the linkage is also noticeably springy. Operating loads, however, are quite light except occasionally when first gear is engaged from rest, which is a known feature of synchromesh in these conditions. Engagement loads, in fact, are so light that they could be increased considerably and a consequential reduction could be made in the long movements of the control lever. It is understood from the concessionaires that cars now being received from the factory have been modified on these lines.

The effectiveness of the brakes, which now have vacuum servo assistance as a standard fitting, matches the car's performance. They are rather fierce at light pedal pressures when cold, but once the drums have been warmed by a few

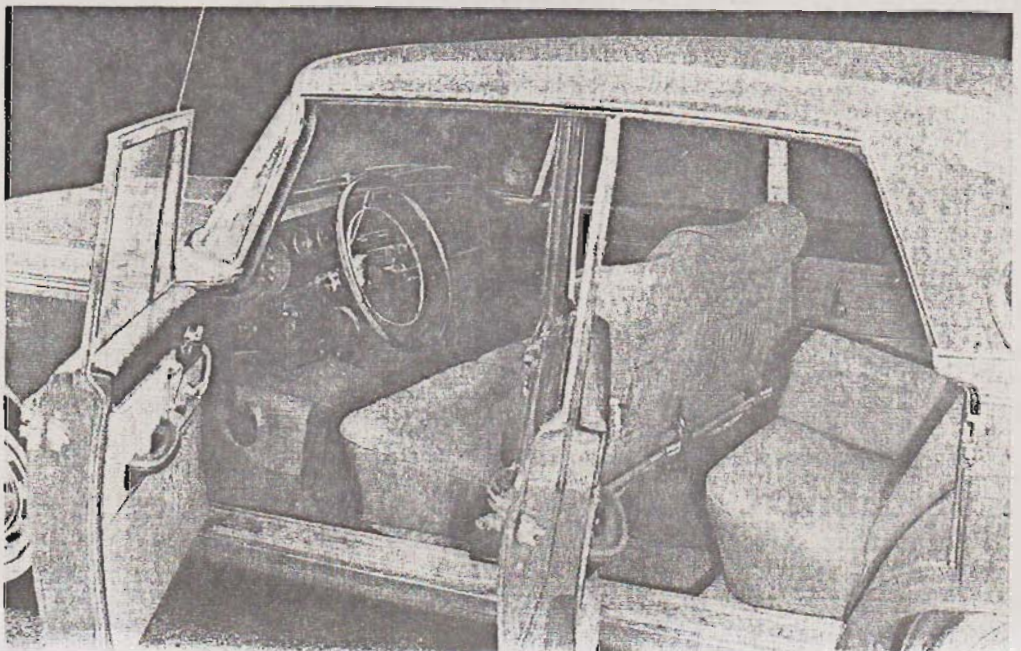


A single-cylinder compressor, belt-driven from the crankshaft, maintains pressure for the air suspension system. The two front levelling valves can be seen on each wing valance, forward of the scuttle

applications they become much more progressive. A maximum retardation of 0.95g was achieved with the relatively light pedal pressure of 75lb. Severe use resulted in increased pedal travel, but the operating load in these conditions did not become noticeably heavier. Fade could be induced by repeated stops, with little time for heat dissipation, from speeds of between 80 and 90 m.p.h., but recovery was quite rapid and the balance between wheels remained unimpaired. The hand brake, controlled by a twist-to-release umbrella-type handle beneath the dash, is powerful and light in operation. It held the car on a 1-in-4 incline, but failed to do so on a 1-in-3. It was possible to take-off from rest on the latter hill, provided the engine was given plenty of revs; the clutch did not object to this treatment.

Pendant pedals are used for clutch, brake and throttle operation, and they are well spaced. The clutch pedal is particularly light to use, requiring a pressure of only 20lb. It has a fairly long movement and needs to be fully depressed for clean engagement of the gears. In the abnormal conditions of take-off from rest when we were timing maximum performances it was smooth in operation and took up the drive quickly without undue slip. There was some rear wheel hop with this technique on a dry surface, but these circumstances are exceptional, and would not concern the average owner.

While the engine is tractable, frequent use needs to be



Seats are deeply upholstered and amply proportioned. The front ones are designed primarily for two, with individually adjustable and fully reclining backrests, but three adults can be accommodated when desired

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Large window areas contribute to good all-round vision. There are separate parking lamps at each side and both rear lamp clusters include a reversing lamp

made of the gearbox to obtain good acceleration, maximum torque occurring at the relatively low speed (for these days) of 2,000 r.p.m. The maximum speeds in the indirect ratios that we list correspond to approximately 6,000 r.p.m., peak power of the engine being developed at 5,100 r.p.m. These figures are higher than would be used normally on the road, but they are still below valve crash point; this takes place at 6,500 r.p.m. There is, however, no object in going beyond the figures quoted, for power falls off quickly after this point. At these speeds the engine remained smooth, but there was a fair amount of noise from the carburettor air intakes, possibly combined with other noise from the compressor for the suspension system.

Internally, the Grosse Borgward is roomy, well appointed, and luxuriously equipped. The individual front seats have softly upholstered cushions and squabs; the former are broad and long, and the latter well curved and high, each seat back having a padded roll at the top. These seats are adjustable individually; their cushions are unsymmetrical and meet above the transmission tunnel, so that a third person can be accommodated on this portion. A soft-faced nap cloth was used for the trimming of the test car, but leather can be specified. The steering wheel is of rather large diameter, and although the upper part of the rim does not intrude into the line of vision, the lower part is close to the knees unless the driving seat is set well back.

Efficient Screen Wipers

Vision is very good to all quarters. Owing to the proportions of the screen and its degree of curvature, combined with the position and length of the windscreen wiper blades, visibility in wet or muddy conditions is less affected than it is on most other cars in similar circumstances. The wipers are particularly powerful, quiet and consistent in operation; they are of the two-speed self-parking type, and really do park at the base of the screen. A completely separate control operates the wipers and two continuously running washer jets simultaneously, but because of this continuously running feature it was found that the small plastic reservoir was exhausted quickly; its capacity could be increased with advantage. These two rotary-control wiper switches, together with the lamp selector, are to the left of the facia centre. In matching positions on the other side are controls for the parking lamps, heater fan and fog lamps; all are provided with readily understood functional symbols.

There are four circular instruments, a large diameter speedometer and three smaller matching dials; a combined one for coolant temperature and fuel contents, one for the suspension system air pressure and a clock. The first of these three was very difficult to read with the car in motion, because the scales were too small.

Two controls are provided on the steering column. The gear-change lever points towards the centre of the car, and on the other side there is a multi-purpose stalk. With the latter, a radial movement is used for operating the self-

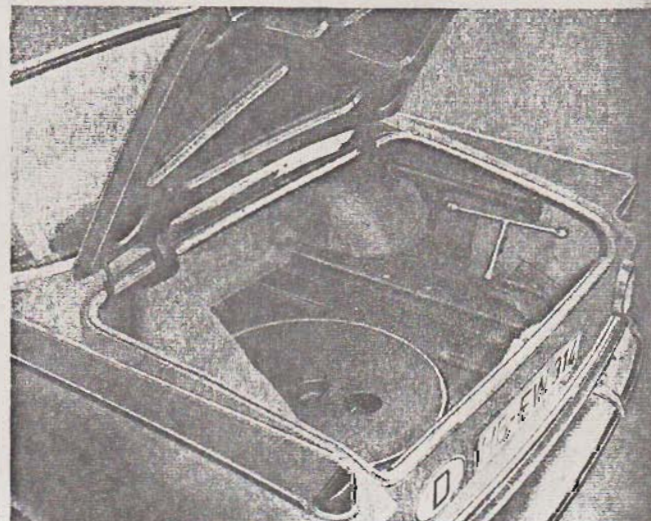
cancelling turn indicators, while downward pressure selects main beam; pulling it towards the wheel against spring pressure operates a thermal switch which flashes the headlamps in controlled sequence for signalling. The ignition key is adjacent to the steering column and operates a device to give half or fully locked steering. Beneath this switch is a press-button for engaging the starter.

Included in the standard equipment is a very comprehensive and efficient heating and ventilating system of the fresh-air type, mounted above the transmission tunnel and below the facia. It has two controls, one on the facia for selecting the degree of heat, and one on the unit itself, for air distribution. By means of this second control, the air can be directed entirely to the screen or to the car, or split between the two. There is a switch for boosting the air flow in two ways. One switch position is for augmenting the normal circulation in the orthodox manner, while the second position brings into action a rear-window fan which recirculates the air inside the car. Although this was helpful in balancing the flow throughout the interior, it was not very successful in demisting the rear window, even when the heat was almost overpowering. It cleared the glass in a series of four streaks and would be much more effective if the flow were concentrated in a narrower band around the centre of the window in line with the rear-view mirror.

Swivelling quarter vents are fitted to each front door. They are controlled by a plastic-covered hand wheel operating a worm-and-nut mechanism, which ensures that they can be locked safely and set finely to any intermediate position. A great deal of padding is provided at vulnerable points such as the top and bottom edges of the facia, the central bar of the horn ring, and the roof cantrails. Each door is fitted with an armrest, and there is a plastic grab handle above each door except the driver's. For stowage of small parcels there is a capacious locker on the facia, an elastic pocket in each front door, and another in the rear squab of each front seat.

Rear seats are well raked and the squabs slightly shaped for comfort, but a rather unusual fitting was the provision of a loose bolster as a substitute for a central armrest. Headroom, back and front, is such that a hat can be worn by a person of average height. Entry to the rear seats is very good indeed and there is no intrusion from the wheel arches. Matching the internal appointments, the car is well

The boot, illuminated when opened at night, is sensibly proportioned and quite cavernous. It is fully trimmed, the carpet having been rolled back to expose the location for the spare wheel beneath the circular cover



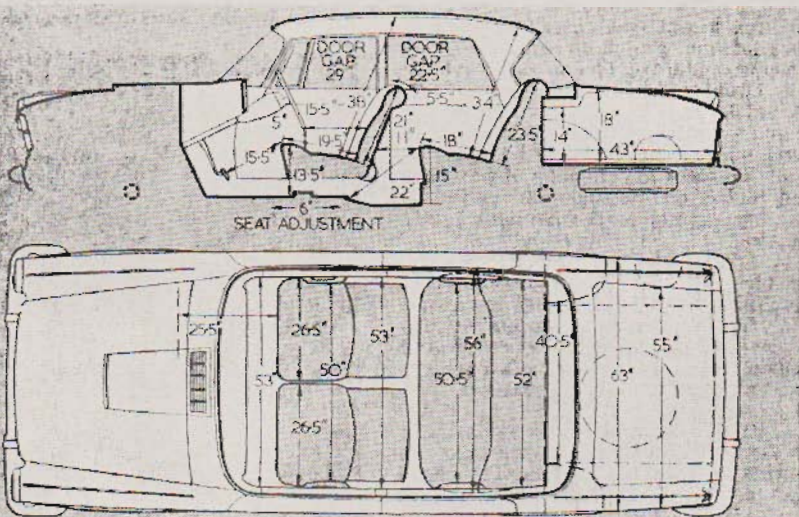
insulated from road noise, with deep underlays beneath all carpets. A slight vibration from the transmission could be felt at the rear passengers' feet. At speed there is little disturbance from wind noise, so that long journeys can be undertaken without fatigue.

A 14-gallon fuel tank ensures that 300 miles can be covered between replenishments if the cruising speed is limited to 80 m.p.h., at which speed the car seems particularly restful. There are 14 greasing points which the makers recommend should receive attention at intervals of 2,000 kilometres (1,500 miles). In the unlikely event of failure of the air compressor, it is claimed that the reservoir has a considerable surplus capacity, but even when this is ex-

hausted the car can be driven slowly in complete safety with the suspension against its rubber bump stops.

The Grosse Borgward was introduced to meet the requirements of the medium-to-higher price market, as opposed to the luxury market, in its native Germany. In the United Kingdom, where right-hand-drive versions are now available, it is relatively expensive, but nevertheless will attract buyers by virtue of its performance, particularly by the characteristics associated with its air suspension. It is our impression that this system has many advantages and no snags if well applied. Moreover, the Borgward proves that it can be fitted without a disproportionate increase in cost over that of orthodox designs.

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Scale 1/4 in. to 1 ft. Driving seat in central position. Cushions uncompressed.

PERFORMANCE

ACCELERATION TIMES (mean):
Speed range, Gear Ratios and Time in Sec.

m.p.h.	3-90	5-31	8-38	15-05
	to 1	to 1	to 1	to 1
10-30	7.1	4.4	—	—
20-40	10.5	7.1	4.5	—
30-50	10.4	7.4	5.3	—
40-60	11.8	8.1	—	—
50-70	12.0	9.0	—	—
60-80	14.1	12.0	—	—
70-90	20.2	—	—	—

From rest through gears to:

30 m.p.h.	4-1 sec.
40 "	6.9 "
50 "	9.7 "
60 "	14.8 "
70 "	20.2 "
80 "	28.6 "
90 "	40.1 "

Standing quarter mile 19.8 sec.

MAXIMUM SPEEDS ON GEARS:

Gear	(mean)	m.p.h.	k.p.h.
Top	(best)	99.3	160.6
		101	162.5
3rd		81	130
2nd		51	82
1st		28	45

TRACTIVE EFFORT (by Tapley meter):

	Pull	Equivalent
	(lb per ton)	gradient
Top	220	1 in 10.1
Third	310	1 in 7.1
Second	470	1 in 4.7

SPEEDOMETER CORRECTION: m.p.h.

Car speedometer	10	20	30	40	50	60	70	80	90	100
True speed	10	20	31	41	52	62	71	81	90	100

BRAKES (at 30 m.p.h. in neutral):

Pedal load in lb	Retardation	Equiv. stopping distance in ft
25	0.20g	151
50	0.55g	55
75	0.95g	31.8

FUEL CONSUMPTION (at steady speeds in top gear):

30 m.p.h.	33.4 m.p.g.
40 "	32.3 "
50 "	29.8 "
60 "	25.5 "
70 "	21.6 "
80 "	17.4 "
90 "	14.5 "

Overall fuel consumption for 1,135 miles, 19.6 m.p.g. (14.4 litres per 100 km.).
Approximate normal range 16-26 m.p.g. (17.6-10.8 litres per 100 km.).
Fuel: Premium grade.

TEST CONDITIONS: Weather: Gusty 10-30 m.p.h. head wind, damp road surface. Air temperature, 52 deg. F.

STEERING: Turning circle: Between kerbs, R, 32ft 0in.; L, 32ft 7in. Between walls, R, 34ft 10in.; L, 35ft 5in. Turns of steering wheel from lock to lock, 4.

DATA

PRICE (basic), with saloon body (including heating and ventilation system), £1,690. British purchase tax, £705 5s 10d. Total (in Great Britain), £2,395 5s 10d. Extras: Radio to choice.

ENGINE: Capacity, 2,240 c.c. (136.6 cu. in.). Number of cylinders, 6. Bore and stroke, 75 x 84.5mm (2.70 x 3.92in.). Valve gear, overhead in-line with pushrods. Compression ratio, 8.7 to 1. B.h.p. 100 (net) at 5,100 r.p.m. (b.h.p. per ton laden, 70). Torque, 116lb ft at 2,000 r.p.m. M.p.h. per 1,000 r.p.m. in top gear, 18.3.

WEIGHT (with 5 gal fuel): 25.6 cwt (2,862lb). Weight distribution (per cent): F, 56; R, 44. Laden as tested, 28.6 cwt (3,198lb). Lb per c.c. (laden), 1.43.

BRAKES: Type, A.T.E. Method of operation, hydraulic, with vacuum-servo assistance. Drum dimensions: F and R, 9in. diameter; 2in. wide. Swept area (total): 226 sq. in. (158 sq. in. per ton laden).

TYRES: 6.40-13in. Dunlop D7. Pressures (p.s.i.): F, 26; R, 28 (normal); F, 28; R, 30 (fast driving).

TANK CAPACITY: 14.3 Imperial gallons. Oil sump, 8.5 pints. Cooling system, 15 pints (including heater).

DIMENSIONS: Wheelbase, 8ft 8.38in. Track: F, 4ft 5.5in.; R, 4ft 5.8in. Length (overall), 15ft 5.25in. Width, 5ft 8.38in. Height, 4ft 8in. Ground clearance, 6.63in.

ELECTRICAL SYSTEM: 12-volt; 52 ampère-hour battery. Headlamps, 45-40 watt bulbs.

SUSPENSION: Front, double wishbones, air suspension units with levelling valves, telescopic dampers. Rear, swinging half-axes, air suspension units with levelling valve, telescopic dampers.

