2.4-LITRE **HEALEY** 2.4-LITRE

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DONALD HEALEY MOTOR CO., LTD., The Cape, Warwick, ENGLAND

Looking in on the Healey

(*Reprinted from* MOTOR SPORT *January*. 1947)

The Editor and Cecil Clutton visit the factory where one of Britain's most outstanding High-Performance Cars is in production

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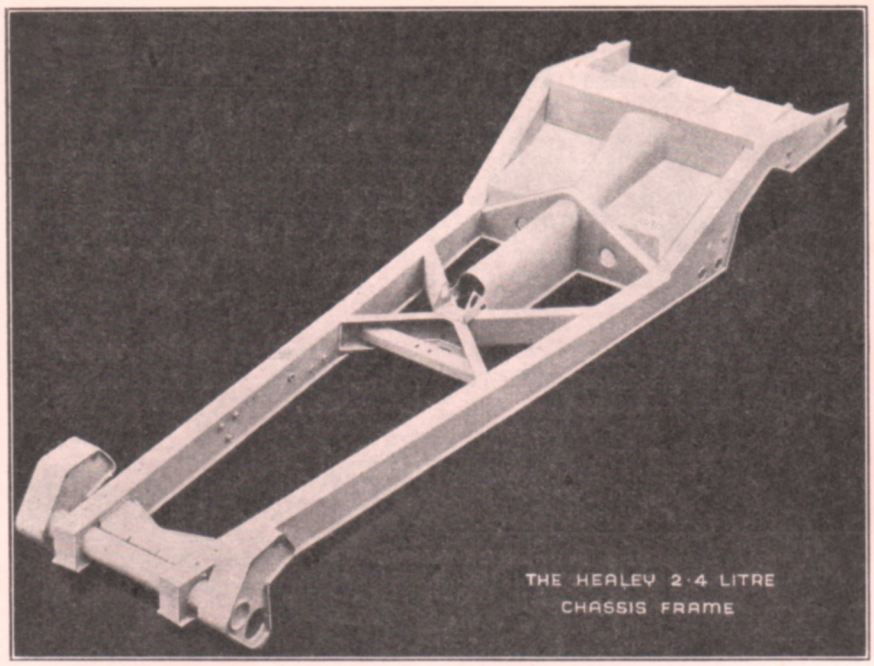
FROM its inception the 2.4-litre Healey has aroused widespread interest and a visit to the factory at Warwick to inspect it was high-priority on the Editorial agenda. When the Editor made this journey with Cecil Clutton, early last month, he had not seen actual performance figures relating to the car, but on his arrival Mr. James Watt, the Sales Director, was able to greet us with the news that the saloon Healey had been timed by the Automobile Club of Milano to do 104.65 m.p.h. over a flying ¼-mile on the Milan-Como Autostrada, and to have clocked 17.8 sec. for the standing start ¼-mile. It had also covered a kilometre at 106.56 m.p.h. These figures, in respect of which the Italian Club has issued a Certificate covering the deeds of car No. NX 199, engine number M 502, chassis number A 1502, were a fitting prelude to our inspection, because these performances by a closed car of 2.4 litres capacity are, frankly, momentous. The aerodynamic bodywork clearly pays big dividends, especially as the fuel consumption came out at well over 30 m.p.g. at 70 m.p.h. cruising. Donald Healey has convincingly realised one of his ambitions, to market a production saloon car able to exceed 100 m.p.h. That he has done this with a moderately-tuned, four-cylinder engine of but 2.4 litres capacity is all the more to his credit.

Mr. Watt told us of the origin of the Healey. Donald Healey, noted for his exploits with Triumph and Invicta cars, particularly in the Monte Carlo Rally, felt that it was about time Britain competed properly with Continental high-performance cars. So he set about evolving the Healey and each problem in respect of design was approached by considering first how much given components would weigh, afterwards, how much they would cost. His ideal was to build a car weighing just a ton and then to give it a 100-b.h.p. engine. He hasn't quite realised that ideal, but in view of the performance figures quoted above, there is no need to carp about that! Actually, the "Big Four" Riley engine selected gives 104 b.h.p. at 4,500 r.p.m. (it will run up to 5,000 r.p.m.), and the complete saloon weighs 22½ cwt. unladen.

To revert to the prototype car, this commenced to take form in 1942 and the completed components were assembled in about a fortnight by Donald Healey in person, working under extremely trying conditions, partly in the open amongst cement-mixers dumped outside a friendly factory. That was in 1943-45, and Watt came home from India to see the chassis, only to be posted abroad again before he could help with it—he was a S/Ldr. in Coastal Command during the war and associated with Hudsons and, later, heavier metal, such as the York.

All that had to be done to the Riley engine to make it suitable for Healey's purpose was to replace the down-draught carburetter with two S.U.s and fit an easy-flow exhaust system. The latter gave some five additional b.h.p. We understand that each engine is supplied by Rileys with a power curve, and that they use the same modifications for the engine in the new 90-h.p. 2½-litre Riley car. The Healey's compression-ratio is 6.5 to 1 but this may be increased to 6.8 to 1 when pump fuel improves in quality. The engine in the prototype has apparently done 100,000 miles without mishap. Sam Clutton asked about piston velocity in relation to road-speed, in view of the 120-mm. stroke, and we discovered that 2,500 f.p.m. at the pistons equals 69 m.p.h., although Watt said that going up to the Edinburgh Cavalcade, for instance, he held 75 m.p.h. without concern.



The chassis frame of the Healey—light yet rigid.

It has been said that "All you need know about the radiator of the Healey is that it is a 'Serck'," but we propose to add to this—an interesting innovation is the use of pressure cooling. The release-valve in the overflow pipe of the sealed system is set to open at 15 lb./sq. in., quite a high pressure. This puts the boiling point up to 228½°F., and it is possible to use bottom gear for appreciable periods up long Continental hill-climbs without fear of overheating. Water is the coolant at present, but glycol may be used later, still further raising the boiling point. The filler cap is sealed with a rubber washer, enabling the radiator to be topped-up in the normal way.

The chassis frame is made of 18 gauge sheet steel of "top-hat" section, with a closing plate at the base. The interior of the "top-hat" section is rust-proofed and the whole frame is given a corrosion-resisting coating of a tar-like substance by Dockers. The side-members are straight, because curves weaken a structure, and the photograph shows the construction. A very rigid chassis results, yet one that is astonishingly light. Either end can be picked up with ease and, with all fittings, body brackets, engine and spring-mountings, rear platform, etc., but less tank, the weight is a mere 160 lb. So stiff is this chassis that the jack lifts centrally and keep-cables hold the front wheels clear of the ground as the suspension goes slack. Very flexible i.f.s. in the modern manner was decided upon and a fine trailing arm layout was designed. For this, and much of the rest of the chassis, A. C. Sampietro, who was with Railton when Cobb's 370 m.p.h. car was designed, was largely responsible. The suspension arms look heavy; actually they are of R.R.56 alloy and very light. Their length makes possible a wheel deflexion of 7½ in. while employing normal coil springs in the suspension units. These springs work in conjunction with built-in hydraulic dampers. The trailing arms pivot on needle-roller bearings carried in boxes on the chassis frame. These bearings are packed with grease on assembly and require a mere couple of strokes with a grease-gun every 15,000 miles. At the rear, in the interests of weight-reduction, a normal axle is used, with coil-spring suspension of lower periodicity than at the front, the wheel movement here being 3½ in. A Panhard rod locates the axle and two stays, also adopted for the 90-h.p. Riley, run forward from the extremities of the axle to the transmission torque-tube, to steady the axle under hard application of the brakes.

The steering layout is most ingenious, the motion from the non-reaction steering box to the wheels being via a swivelling plate and link-members. This plate is attached beneath the chassis on a light-alloy mounting and it pivots on ball and roller bearings. These bearings are packed with grease to combat condensation, but no further lubrication is required during the life of the car. While on this subject, there are twelve lubrication points in all on the steering and i.f.s. assembly, and the swivel-pins have oil reservoirs at the base which require replenishment every 1,000 miles. Rubber covers keep the lubricant where it should be on the steering joints. The steering plate provides proper Ackerman angles at the wheels, by reason of the points at which the links are attached to it, and the whole steering gear has been designed expressly to eliminate kick-back at the steering wheel. The column rake is adjustable and if clients require further adjustment they can either be individually measured for their cars, or dished spring-wheels can be fitted. The castor-action is easily adjusted through 3°, but cars are sent out with neutral castor.

The gearbox is the normal Riley unit, but by using a 3.5-to-1 axle ratio indirects of 4.96, 7.54 and 12.76 to 1 are obtained, light-weight construction and streamlined bodywork permitting these high ratios in spite of the engine's 2,443 c.c. The arrangement was finally decided upon in preference to an over-drive top. At 1,000 r.p.m. in top gear the engine is doing 22 m.p.h.

The wheels are bolt-on discs carrying 5.75 by 15-in. tyres. The smallest possible wheels were chosen, to reduce unsprung weight, and when Clutton asked if small wheels did not drop into holes in the road, Watt said they did, but look at the spring deflections that looked after your comfort in a Healey. We queried why centre-lock hubs are not used and were told that a check had been taken on comparative weights. Apparently the saving in *unsprung* weight on four wheels by using bolt-on wheels is 25 lb., but, quite honestly, Watt said that the question of cost and availability of supplies would have decided that point anyway.

The brakes are Lockheed hydraulic and because of the small wheels the drums are fairly small—10 in. dia. at the front and 11 in. dia. at the rear. This has been found satisfactory, and the difference in drum size is intentional, to put 68 per cent. of the braking force on the front of the car as, from the viewpoint of comfortable riding, there is more weight aft than forward. The front drums contain two leading-shoes, but the rear brakes have normal shoe mounting, to give effective braking in reverse.

Throughout the chassis one notices the care given to detail work. The pedals are in R.R.56 and extremely light, and they are mounted on "Oilite" bushes, while the linkage to brake-cylinder and clutch-arm incorporates these bushes and proper pins throughout. The propeller shaft has double Hardy-Spicer universals, more nearly to obtain true constant-velocity joints, and the engine mounting angle humours the transmission line. The universal-joint trunnions and Panhard-rod joint are rubber bushed and the torque tube which encloses the rear end of the propeller-shaft is located on a rubber-mounted anchorage on the chassis. Simmonds lock-nuts are used throughout and where a component is attached to the side-members a rod is run across the chassis and the joints welded. The throttle-pedal is of piston type, conveying motion through an enclosed push-cable. Two Burgess silencers are mounted in tandem on the near side of the frame, a very nice exhaust manifold and steel pipe leading into them, while, again to reduce weight, the tail-pipe is of three per cent. magnesium alloy.

The aerodynamic bodies for the Healey were the subject of wind-tunnel tests with ⅛th scale models, in the wind-tunnel of Armstrong-Whitworth Ltd. Much experimentation was engaged in before the final form was settled. The saloon has ample head room and a large screen area. The wind-up windows are Perspex, treated against abrasion, as such windows were in R.A.F. aircraft. The rigid, streamlined wings weigh 8½ lb. each. Very satisfactory bucket seats, leather upholstered, have been evolved, and the body width of both models is approximately 3 ft. 8 in. at the front seat. The

bodies are panelled in magnesium alloy, and the bonnet hinges up from the rear to give very good accessibility. The saloon costs £1,597 19s. 5d. with purchase tax, the roadster £1,566 0s. 7d. The chassis comes out at £900 exclusive of tax. At present orders are flowing in, many for export, but delivery takes some time, as delay occurs unavoidably at the coach-builders. However, some 30 persons are turning out three chassis a week and a few of these can be delivered immediately to anyone wishing to market a special-bodied car or to have a body built privately. Endowed with a shell-body, which would not take so long to build, the Healey would have a staggering performance and many people will doubtless be interested to pursue this line of thought. The firm does not intend to race, but will give every encouragement to private entrants in events such as the T.T.

Whichever way you look at it, the over-100 m.p.h. maximum of the Healey, coupled with tremendous acceleration (it goes from rest to 60 m.p.h. in about 12½ sec.) is a most outstanding show by a 2.4-litre saloon basically priced at £1,250 today. It qualifies our enthusiastic remarks as to the quality and capabilities of present British high-performance cars with which we prefaced the "Show"-supplement in MOTOR SPORT last November. And it fully justifies aerodynamic bodywork. After we had thus critically examined this breath-taking newcomer, Watt produced a roadster for an excursion around Warwick and we hand over to Cecil Clutton, the well-known car critic, for a report on the trip.

Cecil Clutton's Impressions of the Healey

I have often written in MOTOR SPORT that the very best modern motor-cars have all the handling qualities of the vintage era, and more besides. But in practice, I am bound to confess that this commendable theory is seldom borne out. Although there are some modern sports-cars whose handling qualities are beyond reproach, the result is often achieved in a spongy, indefinite sort of way which, although it may be perfectly satisfactory, contributes nothing, either to the confidence or pleasure of the driver. The best of them seem to be those which have fairly stiff springing, somewhat in the vintage tradition when, of course, the problems of independent suspension and gyroscopic effect are considerably reduced. One front-line modern-to-the-minute sports-car, which unquestionably holds the road as few others, is notorious for a back end which floats about in the most *degage* manner, and this is by no means conducive to the driver's peace of mind. Other cars cling, leech-like, to the road until the moment of break-away, when the controls seem to go soggy, as on a stalled aeroplane, and produce just about as much effect—a horrid feeling. Some American machines have ultra-low-rate suspension which works well at low and medium speeds over rough surfaces, but at high speeds the whole car works up a low-rate wallow, which can easily lead to hedge-hopping and other aerobatic activities for which the wing-loading is altogether inadequate. Added to which, they roll madly.

The Healey car does none of these things.

In praising it, it is difficult to know where to start, since it has all those qualities which attach, in theory, to soft suspension, but which are so seldom achieved. And the suspension of the Healey is very soft indeed. When stationary, the car can be rocked from side to side with only a light hand-pressure. With a high centre of gravity, the Healey would roll outrageously; that is one of the points on which the Americans fail so conspicuously. But the Healey is exceptionally low built, and it is entirely free from any tendency to roll, even though it has none of the fashionable anti-rolling expedients. The chassis is also conspicuously rigid, although so light, and unsprung weight has been studied meticulously. As a result of these two factors, the wheels follow the road-surface whatever happens, and the rest of the car remains rock-steady, even when travelling at ridiculous speeds over "colonial sections," or when one wheel is wantonly driven over a kerb. A passenger might never know it had been done.

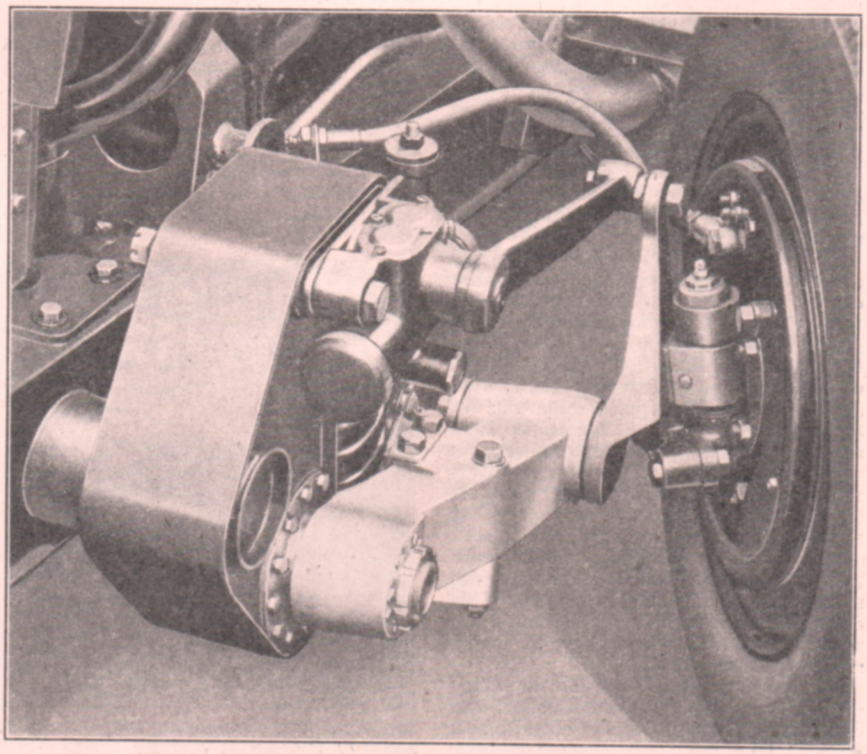
The Healey therefore satisfies the three absolute necessities of soft springing—low centre of gravity, stiff chassis, low unsprung weight. I venture that there is no production-car today which conforms more closely to all three requirements.

The practical gains are the obvious ones of outstanding passenger comfort, freedom from wheelspin, and maximum resistance to side-slip when cornering.

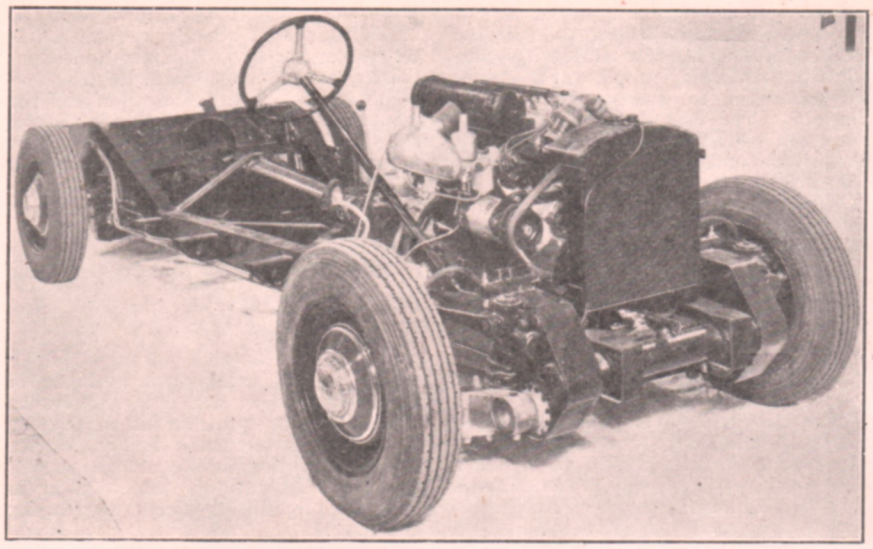
Every form of i.f.s. involves certain compromises, but it is widely held that the trailing-link arrangement gives the best result, and the most pleasant from the point of view of "feel," which is so important to the driver. The Aston-Martin "Atom" prototype quite converted me to this way of thinking, and the Healey confirmed my opinion. At the same time, it is difficult to obtain any large range of travel and, therefore, a low spring-rate, with trailing links, but this difficulty has been overcome entirely on the Healey by the layout which has already been described, in conjunction with very long trailing arms. These, of course, are subject to high lateral stresses when cornering quickly, but the Healey apparatus has obviously been made with this difficulty kept well in mind, since it is exceptionally rigid, while weight is kept down by the use of light, high-tensile alloys.

In so many fast cars one becomes rather painfully conscious of the back axle at high speed. The exceptional rigidity of the Healey layout, both laterally and in twist, aided by the light unsprung weight, contributes to a back-end which is entirely self-effacing; one never gives it a thought.

The steering gear itself is light and positive in action, trouble having been taken to screw the steering box firmly on to the chassis; an elementary precaution which so many designers seem to overlook. It is reasonably high-geared, but some people might prefer it even higher. This point of view might be justified for the reason that the driver's right elbow is somewhat cramped, and large arm movements are not easily made.



How Healey's do it—The trailing-link independent front suspension.



How it is done—the 2.4-litre "Big Four" 104 b.h.p. Riley engine in the softly-sprung, lightweight chassis of the 8ft. 6in. wheelbase Healey high-performance car.

Particularly is this the case since the steering wheel (although possessing reasonable adjustment for rake) comes very snug into the driver's lap. With low build and streamlined coachwork it is difficult to see how this can be overcome. The low build necessitates a substantial tunnel to contain the transmission arrangements, and the seats (splendid ones, incidentally, rock-solid and perfectly gripping the shoulders) are necessarily set on each side of the tunnel. In a non-streamlined open car (it was the open Healey I drove) the side of the body comes inside the driver's right elbow, which thus has the freedom so desirable in fast cornering. But a streamlined body has to be pretty well the full width of the car, and high, so that the elbow cannot be hung outside. It is difficult to see how this can be overcome in rear-wheel-drive cars, except those with independent or de Dion layout, when the prop. shaft tunnel can be very much reduced in size. My high-built saloon Bugatti, although two or three inches narrower than the Healey, affords considerably more living room for the driver.

The engine is luxuriously cushioned and smooth for its type, but you cannot expect completely to smother up a big four-cylinder unit, burning 600 c.c. of gas at each explosion, and showing no less than 125 b.m.e.p. at its peak revs. of 4,500 per minute, when the piston speed is also the considerable one of 3,600 feet per minute. The engine is in no sense rough; indeed, its balance is obviously splendid; but you know it is working away. Anyway, the outfit is avowedly a sports-car. It somewhat upsets preconceived notions about piston speed, since 2,500 f.p.m. gives only 70 m.p.h. and the car will definitely cruise effortlessly at anything up to 80. This does not mean that accepted tenets are wrong, but that they may be overridden in special cases.

In the first place, the Healey-Riley engine and crankshaft are both short and exceptionally rigid. In the second place, even at 80 m.p.h., only a small throttle opening is called for, so that the engine is working quite lazily. These factors evidently more than offset the high frictional losses concomitant with high piston speed, as is shown by the startling fuel economy at high road speeds recently obtained by the *Motor* (31.2 m.p.g. at 70 m.p.h. and 24.8 m.p.g. at 80 m.p.h.). The low fuel consumption is also a tribute to the good aerodynamic qualities of the coachwork.

The power curve is, I should guess, something between the flat-topped variety popular in America, and the straight-line pattern of the high-revving, short-stroke engine, like the V12 Lagonda.

The gear ratios are well suited to the power-curve, being only moderately closely spaced. A change from top to third demands a 30 per cent. increase in engine speed, and from third to second 33 per cent. The engine will pull smoothly at less than 1,000 r.p.m. in top (about 22 m.p.h.), and pulls away well from that speed if the throttle is opened gradually. But it is from 60 m.p.h. that top really comes into its own, and this speed is easily attained in third, when the engine is turning at only 3,800 r.p.m. (the safe limit is 5,000 r.p.m., which gives 80 m.p.h. in third and 53 m.p.h. in second). Obviously, therefore, the ratios are spaced out to the best possible advantage, and the free use of them is facilitated by good synchromesh arrangements and dog engagements. The clutch itself is light to operate and smooth in action, it being perfectly easy to get away from rest in third with a minimum of clutch slip. The particularly effective output of the engine is contributed to largely by the excellent ingurgitation through twin S.U. carburetters, and unimpeded expectoration through the beautiful four-pipe, Bugatti-like exhaust manifold.

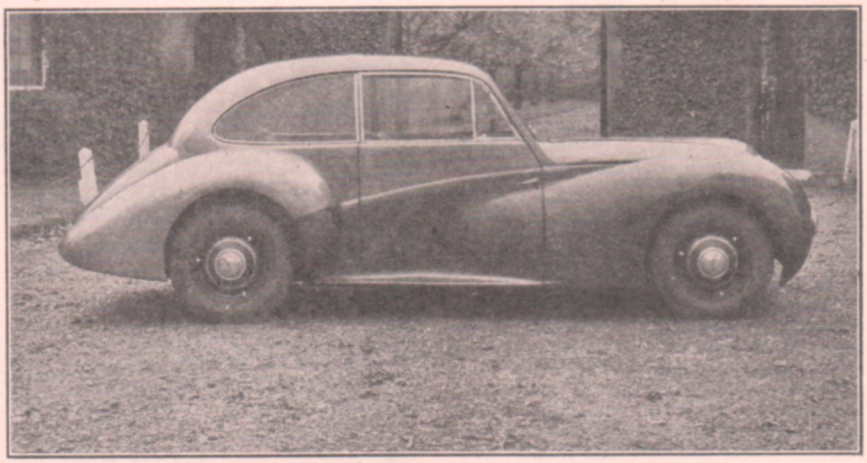
And then, the car as a whole?

Immediately on taking over control the driver has every feeling of confidence. At once, the car is put through fast open bends at speeds which would even embarrass most Bugattis. The steering is sufficiently sensitive for the driver to be able to judge exactly what is going on at each corner of the car, and it is always the right thing which is happening. The car is free from over or understeering bias, but in extremity, the breakaway is at the back end, which is where it should be. There is not a trace of roll and the bonnet remains rock-steady, like the very best racing cars. The Healey must, one feels, be very much like the German G.P. cars. Although the steering is so accurate there is very little reaction, thanks, no doubt, to the geometry of the linkage.

The driver sits well up and has a good view forward and of both mudguards. The screen pillars are narrow. The brakes, too, are well up to the performance and produce none of the peculiar effects one might expect with 68 per cent. of the effort on the front wheels, together with the long trailing links.

Actual performance figures remain to be taken in the near future, when the car is submitted to the full MOTOR SPORT road-test curriculum. The foregoing remarks are the results of a short drive, undertaken to afford no more than some general impressions.

And the impression afforded is that of a very fine motor-car indeed, of which England may well be proud.



The 2.4-litre Healey saloon, which, timed by the Automobile Club of Milano to do a mean speed of 104 m.p.h. over the two-way-quarter mile, with other performance qualities to match, proved itself one of the most outstanding high-performance cars of to-day.

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