JAGUAR

MARK TEN & 'E' TYPE 4·2 LITRE MODELS

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Outwardly distinguished by small " 4·2 " name plates only, Jaguar's latest model incorporates a host of mechanical refinements

4·2 litres for Jaguar Mk.10

1965 MODELS

• Power Steering • Automatic Transmission
• All-synchromesh gearbox • Heating system

PRICES	Basic	Total (inc. P.T.)		
	£	£	s	d
4·2 Mk.10 saloon	1,783	2,156	0	5
" " " with overdrive	1,833	2,216	8	9
4·2 Mk.10 automatic	1,895	2,291	7	1
4·2 E-type open two-seater	1,568	1,896	4	7
4·2 E-type coupé	1,648	1,992	17	11

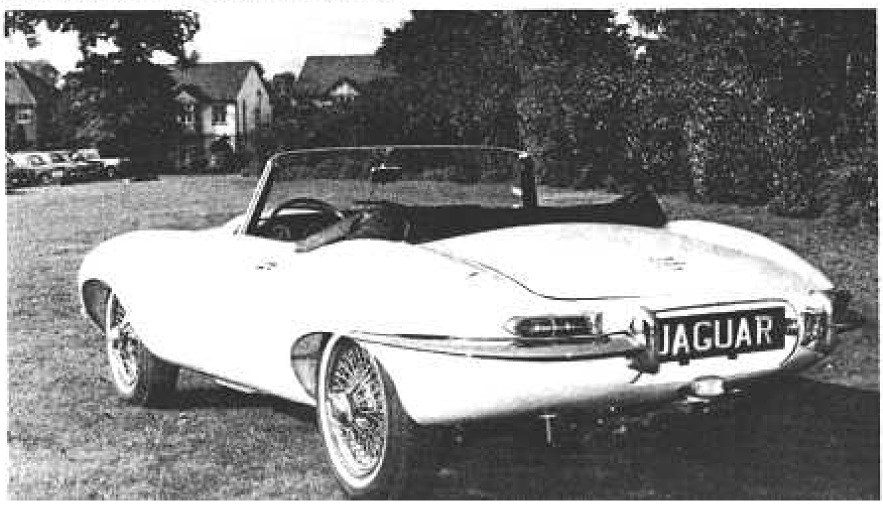
A TRULY international car must keep up with the international trend. This is particularly true so far as the important American market is concerned, and it has been an open secret for some time that the 3·8-litre Jaguar Mk. 10 has been somewhat left behind in the transatlantic horsepower race. The announcement of a larger, 4·2-litre engine for it, still developing 255 b.h.p. but much greater middle range torque, therefore comes as no surprise and should redress the balance. Concurrent with this engine option, which has entailed a complete redesign of the block, on 4·2 models come a large number of worthwhile improvements which, but for the unchanged exterior, would surely have warranted a new type number. Perhaps the most important of these innovations is the first-ever installation of Marles-Varamatic variable ratio power-steering. Jaguar enthusiasts who change their own gears will also welcome the long-awaited announcement of a new four-speed, all-synchromesh gearbox; it comes together with a high-rated a.c. generator and Laycock-Hausserman diaphragm spring clutch. On automatic transmission 4·2 models the Model 8 Borg-Warner replaces the older Type DG.

Double circuit brakes operated by a suspended vacuum servo, an improved engine cooling system and a more efficient heating system are other changes which go to justify a price increase of about £134 for the 4·2 Mk. 10, bringing the total for the automatic transmission model to £2,291. Mk. 10 3·8-litre models continue unchanged.

A new, additional version of the E-type will also be offered with the 4·2 engine and all-synchromesh gearbox. It will have all the engine features of the Mk. 10, but there is still no automatic transmission option on this model. Prices of the roadster and coupé, which include redesigned seats as one of a number of new features, are approximately £78 and £66 more than the equivalent 3·8 cars.

Faced with a piston speed of 3,500 feet per minute at maximum power, it was impracticable for Jaguar to enlarge the capacity of their six-cylinder overhead camshaft engine by increasing the stroke, without curtailing the maximum engine speed and risking the possibility of overloading the crankshaft. The extra capacity has been made possible by respacing the cylinder bore centres, moving the two end bores outwards and bringing the centres of the two middle cylinders closer together. The bores have been enlarged by 5mm. As a result it has been necessary to siamese all the bores to retain the existing external dimensions of the block. To ensure a flow of water round the top of the

The aluminized silencers of the 4·2 Mk. 10 and E-type are expected to give a 90 per cent increase in the life of the exhaust system



bores, on a level with the piston ring belt when the piston is at top dead centre, slots are milled through the vertical webs joining the cylinders at this point. This operation, first introduced on the 3·8 engine, which also has siamesed bores is carried out before the usual Jaguar chrome-iron liners are pressed in, and provides accurately dimensioned water passages between the webs at the hottest part of the cylinder.

As the power curves show, the net results of these changes has been to increase torque by 10 per cent at the bottom end of the speed range, and 9 per cent at 4,000 r.p.m. where the peak torque of 275 lb. ft. occurs. There is a general horsepower increase right through the engine speed range, from 5 per cent at the bottom end to 7·5 per

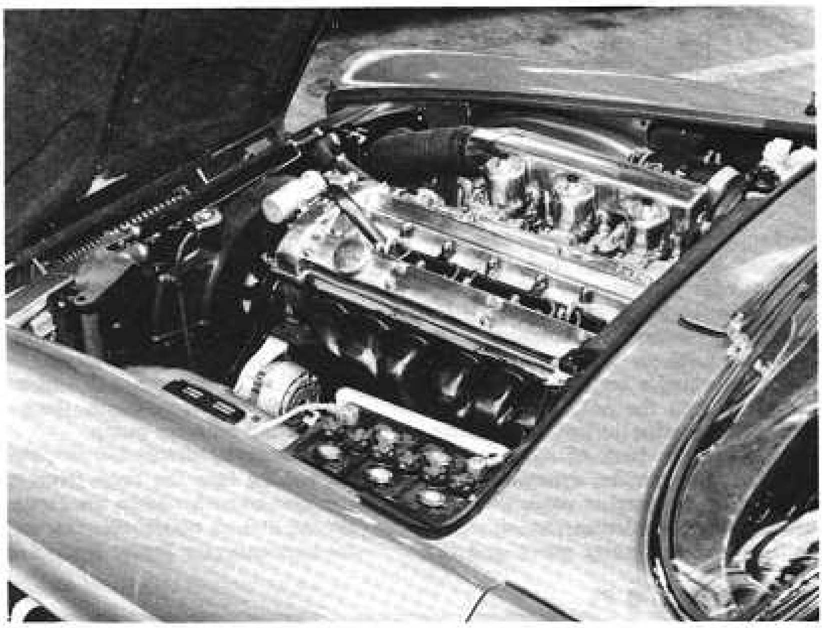
and E-type

Above: Driving compartment, showing individual heater controls on the parcels shelf ledge and diffuser vanes in the box-like heater outlets beneath the facia. Below: The alternator in the Mk. 10 provides full charging current at engine speeds as low as 900 r.p.m., and has a constant load rating of 45amps at 3,000 engine r.p.m. It revolves at twice engine speed

cent at 4,500 r.p.m. Maximum power, 255 b.h.p. gross, is developed at 5,400 r.p.m., compared with 5,500 r.p.m. for the 3·8-litre unit.

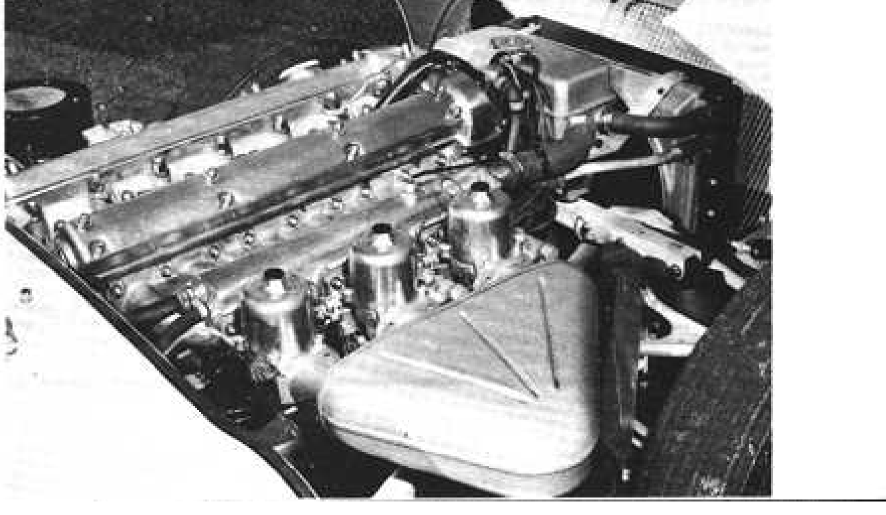
Since the basic unit was designed there have been big advances in bearing materials; thus the redisposition of the cylinder centres, which has resulted in narrower main bearings, has given the opportunity to redesign completely the crankshaft with thicker webs, considerably increasing its torsional stiffness. Main- and big-end bearings are all of the steel-backed type with indium-flashed, copper-lead bearing material. The connecting rods are unchanged, but the pistons now have chromium-plated top rings, tapered second rings and multi-rail oil control rings.

The cylinder head is common to the 3·8-litre unit, but to eliminate steam



E-type front seats hinge forward and have limited adjustment for rake

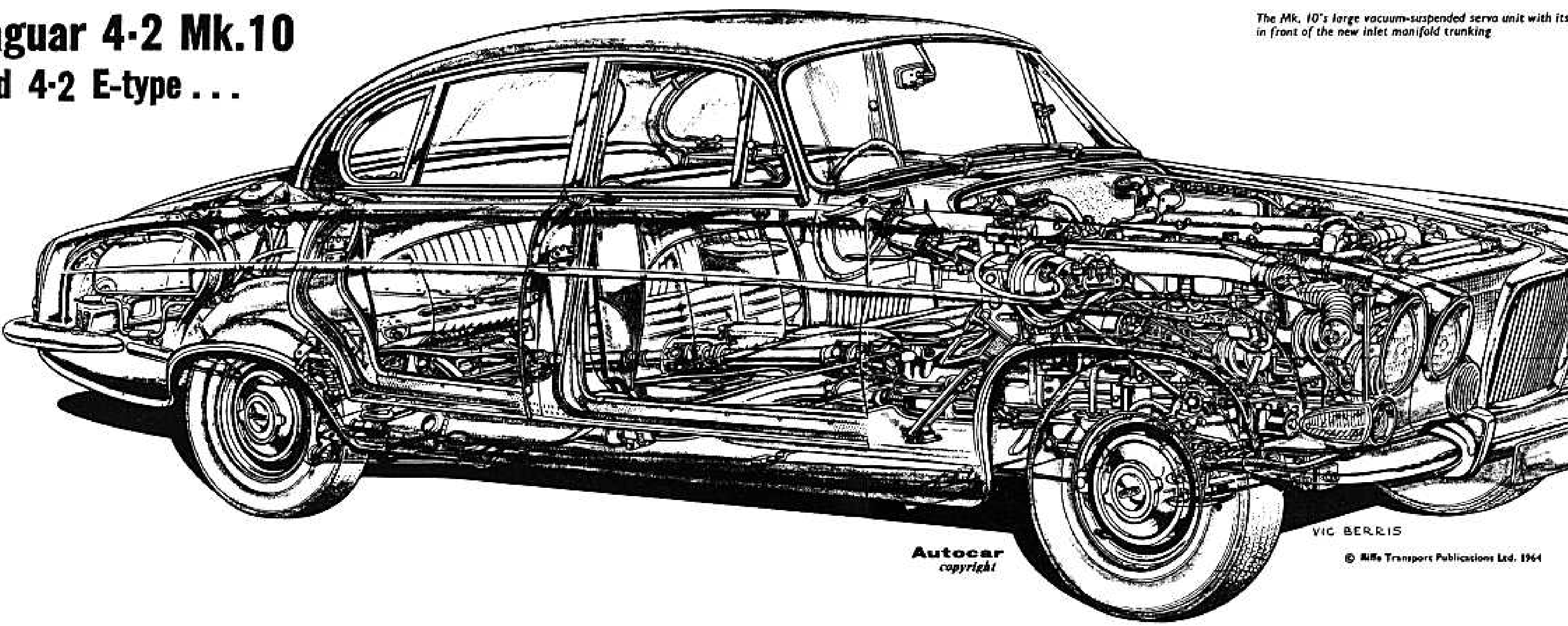
Underbonnet view of the 4.2 E-type, with the new one-piece cast inlet manifold. Compared with the 3.8 tracts have been straightened, and the hot water gallery designed to eliminate steam pockets



AUTOCAR, 9 October 1964

Jaguar 4·2 Mk.10 and 4·2 E-type . . .

The Mk. 10's large vacuum-suspended servo unit with its tandem master cylinder can be seen in front of the new inlet manifold trunking



pockets a new, one-piece, cast aluminium inlet manifold has been designed with an integral balance pipe and a cast-in water gallery. S.U. HD carburettors supply the mixture.

Adoption of an alternator generator has necessitated a revision of the accessory drives on the Mk. 10 due to the difficulty of driving the hydraulic steering pump from the back of it, as is standard practice with d.c. dynamos. A separate steering pump is used, therefore, driven by triangulating the single-vee belt drive to the water pump and fan; a spring-loaded jockey pulley eliminates the need for adjustment of this belt. The alternator, which runs at twice engine speed, has its own single-vee belt drive running in a groove in the periphery of the crankshaft damper. On the E-type a double-vee belt drives the alternator and water pump, there being no steering pressure pump.

Unnecessary absorption of power by the cooling fans has been given special attention on both models, since tests have proved that, at maximum revs, with the car stationary, the Jaguar fan can absorb as much as 16 b.h.p. Consequently, Holset viscous clutches are now fitted in the fan centres of Mk. 10 models; they have the property of slipping when the torque loading reaches a preset figure, in this case approximately 2,500 r.p.m., when power absorption is approximately 2 b.h.p. These clutches have the additional advantage of protecting the fan drives from the inertia loadings which caused belt squeal on earlier models. On the E-type, the engine-driven fan with viscous clutch is replaced by a Smiths electrically driven unit, controlled by a thermostatic switch in the header tank.

By limiting the maximum speed or driving the fan electrically, it has been possible to speed up the water pump, with benefit to the cooling system, which also features a redesigned tube and corrugated fin crossflow radiator. Special attention has been given to the prevention of air pockets in the cooling system.

A final refinement to the engine, for those who operate their cars in sub-zero conditions, is the fitting of the Lucas pre-engaged starter.

The option of the new Jaguar four-speed, all-synchromesh gearbox or the Model 8 Borg-Warner automatic transmission makes a notable addition to the specification of the Mk. 10, although they are for the time being confined to 4·2-litre models; the 4·2 E-type only has the new gearbox.

New All-Synchromesh Gearbox

Main feature of this new Jaguar manual box, which is conventional in layout, is the inertia lock baulk-ring synchromesh, which positively prevents gear engagement before synchronization is complete. The synchronizing clutches have been stressed for present and future requirements. In the construction of the box, cast iron has been chosen for the main casing to provide mechanical rigidity and for its noise-absorbing properties. The input, or first-motion shaft, and the output shaft, run on large-diameter ball bearings and spigot together on a needle-roller race, while the layshaft and the constant-mesh gears run on caged needle-roller bearings. By giving the two pairs of

4·2 Mk.10

PERFORMANCE DATA

Top gear m.p.h. per 1,000 r.p.m. .... 21·4
Torque lb. ft per cu. in. engine capacity .... 1·1
Brake surface swept by linings .... 446 sq. in.
Weight distribution—F, 55 per cent; R, 45 per cent

ENGINE

No. of cylinders ...	Six
Bore	92·07mm (3·625in.)
Stroke	106mm (4·173in.)
Displacement ...	4,235 c.c. (258·4 cu. in.)
Valve operation ...	Overhead twin camshafts
Compression ratio	8 to 1 (optional 7 to 1 or 9 to 1)
Max. b.h.p. (gross)	255 at 5,400 r.p.m.
Max. b.m.e.p. (gross) ...	160 p.s.i. at 4,000 r.p.m.
Max. torque (gross)	275 lb. ft at 4,000 r.p.m.
Carburettors ...	Three S.U. HD8
Fuel pump ...	Two S.U. electric Type AUF.301
Tank capacity ...	20 Imp. gallons (91 litres)
Sump capacity (including filter) ...	12 pints (6·75 litres)
Oil filter	Tecalemit full-flow
Cooling system ...	Pump, fan and thermostat, pressurized
Battery	12 volt, 60 amp. hr.

TRANSMISSION

Clutch	Laycock-Hausserman diaphragm spring, 10in. dia.
Gearbox	Four-speed, all-synchromesh, central floor change

Overall gear ratios:

Manual ...			
	O.D. Top	2·93	—
	Top	3·77	3·54
	3rd	5·00	4·70
	2nd	7·44	6·98
	1st	11·46	10·76
	Reverse	13·16	12·36

Automatic ...	Direct 3·54–7·08; Intermediate 5·16–10·3; Low 8·5–17·0
Final drive ...	Hypoid bevel, 3·54 to 1 manual and automatic transmissions; 3·77 to 1 with overdrive

CHASSIS

Brakes	Dunlop bridge-type discs, self-adjusting, vacuum-servo assisted. Front, 10·9in. dia., rear 10·38in. dia.
Suspension: front	Independent, semi-trailing wishbones and coil springs, anti-roll bar
rear	Independent, coil springs, wishbones, fixed-length drive shafts and lower radius arms
Dampers	Girling hydraulic telescopic
Wheels	Pressed steel disc, 5·5in. wide rim
Tyre size	Dunlop SP41, 205 x 41, with tubes
Steering	Marles Varamatic Bendix power steering
Steering wheel ...	Two-spoke, 17in. dia.
Turns, lock to lock	2·75

DIMENSIONS

Wheelbase ...	10ft 0in. (305cm)
Track: front ...	4ft 10in. (147cm)
rear ...	4ft 10in. (147cm)
Overall length ...	16ft 10in. (513cm)
Overall width ...	6ft 4in. (193cm)
Overall height (unladen)	4ft 6in. (138cm)
Ground clearance (laden) ...	6·5in. (16·5cm)
Turning circle ...	37ft 0in. (11·28m)
Kerb weight (approx.) ...	35cwt-3,920lb (1,778kg)

. . . and 4·2 E-type

PERFORMANCE DATA

Top gear m.p.h. per 1,000 r.p.m. .... 24·7
Torque lb ft per cu in. engine capacity .... 1·1
Brake surface swept by linings .... 461 sq in.
Weight distribution—F, 50 per cent; R, 50 per cent

ENGINE

No. of cylinders	Six
Bore	92·07mm (3·625in.)
Stroke	106mm (4·173in.)
Displacement ...	4,235 c.c. (258·4 cu. in.)
Valve operation ...	Overhead, twin camshafts
Compression ratio	9 to 1 (optional 8 to 1)
Max. b.h.p. (gross)	265 at 5,400 r.p.m.
Max. b.m.e.p. (grs.)	169·5 p.s.i. at 4,000 r.p.m.
Max. torque (grs.)	283 lb. ft. at 4,000 r.p.m.
Carburettors ...	Three S.U. HD8
Fuel pump ...	S.U. electric, Type AUF 301
Tank capacity ...	14 Imp. gallons (63·6 litres)
Sump capacity (including filter)	15 pints (8·5 litres)
Oil filter	Tecalemit full-flow
Cooling system	Pump, electricfan and thermostat, pressurized
Battery	12 volt, 57 amp. hr.

TRANSMISSION

Clutch	Laycock-Haussermann diaphragm-spring, 10in. dia.
Gearbox	Four-speed, all-synchromesh, central floor change
Overall gear ratios	Top 3·07; 3rd 3·90; 2nd 5·34; 1st 8·23; reverse 9·45 to 1
Final drive ...	Hypoid bevel, ratio 3·07 to 1

CHASSIS

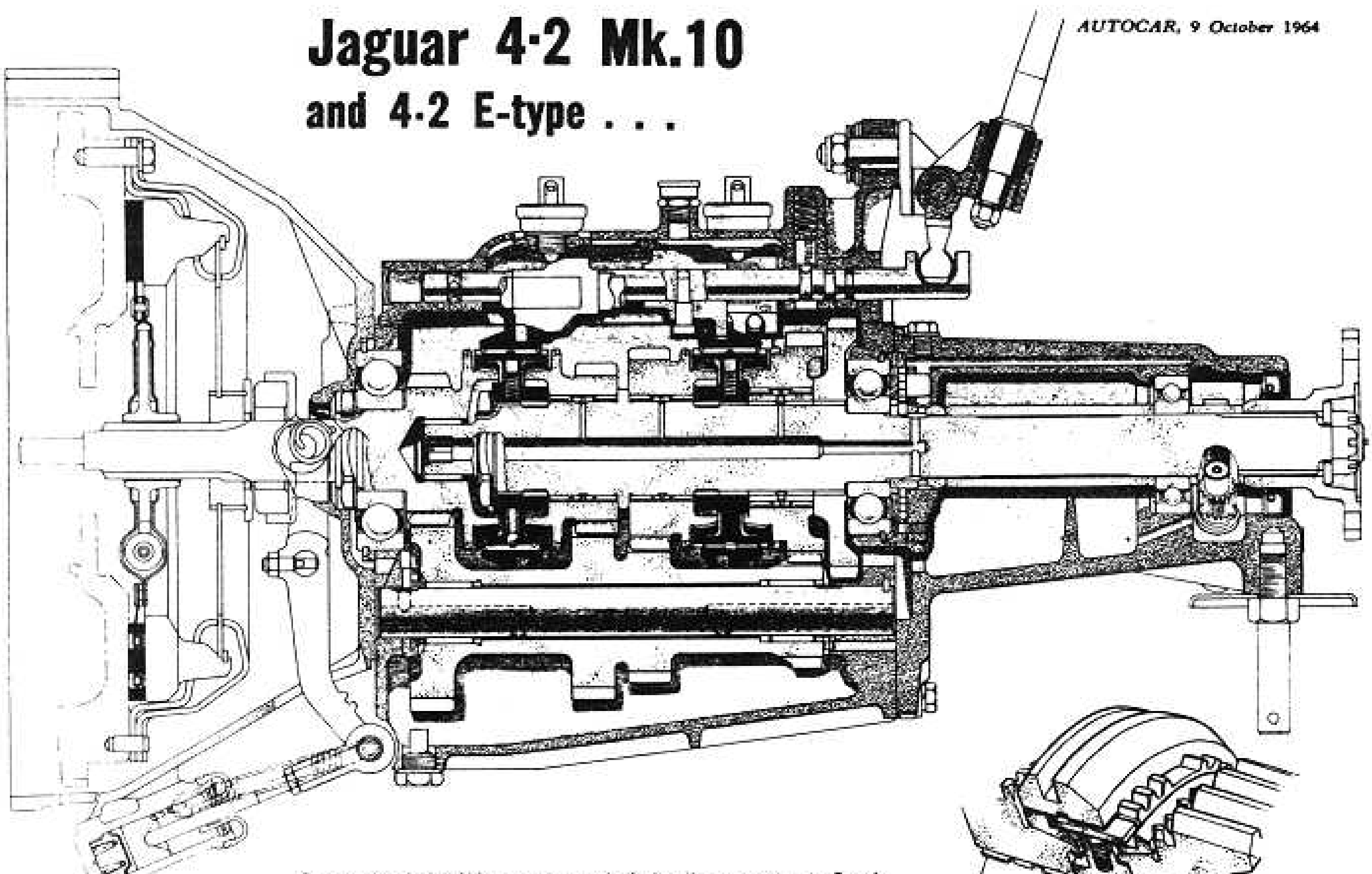
Brakes	Dunlop bridge type discs, self-adjusting, vacuum servo-assisted. Front, 11in. dia., rear 10in. dia.
Suspension: front	Independent, wishbones with torsion bars
rear	Independent, lower wishbones and fixed-length drive shafts, radius arms, anti-roll bar. Twin coil spring and damper units each side
Dampers	Girling hydraulic telescopic
Wheels	Centre-lock, wire-spoked, 5·0in. wide rim
Tyre size	6·40—15in. Dunlop RS5
Steering	Rack and pinion
Steering wheel ...	Three-spoke, 16in. dia.
Turns, lock to lock	2·5

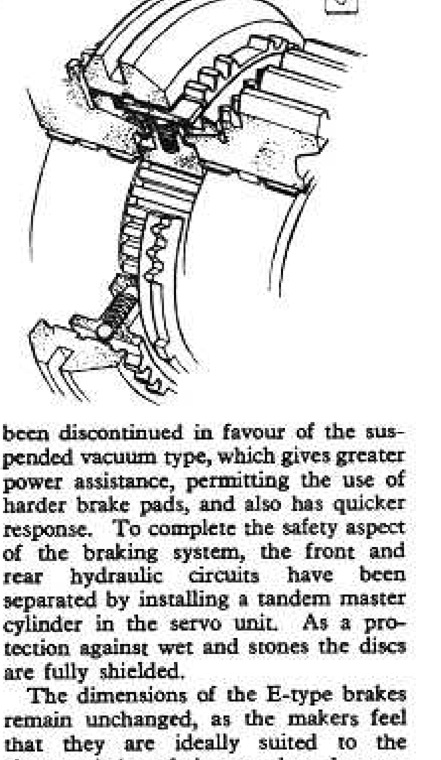
DIMENSIONS

Wheelbase ...	8ft 0in. (244 m)
Track: front ...	4ft 2in. (127cm)
rear ...	4ft 2in. (127cm)
Overall length ...	14ft 7·3in. (445cm)
Overall width ...	5ft 5·25in. (166cm)
Overall height (unladen)	4ft 0·1in. (122cm)
Ground clearance (laden) ...	5·5in. (14·0cm)
Turning circle ...	37ft 0in. (11·3m)
Kerb weight (approx.)	Fixed-head coupe 22·5cwt-2,520lb (1,143kg); Open two-seater 22cwt-2,464lb (1,117·7kg)

Jaguar 4·2 Mk.10

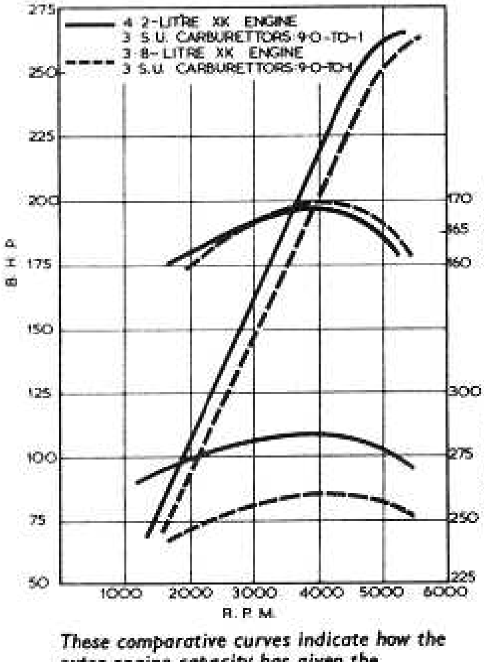
and 4·2 E-type . . .





Synchromesh by Warner inertia-lock baulk ring units is fitted to all four forward gears of the new Jaguar box. The gear lever end (top right) has a rubber bush to cut out sympathetic vibrations. Right: Section through one of the baulk ring synchromesh units

gear trains opposed helix angles, end thrust is reduced. The selector mechanism is built into the top cover of the box, the gearlever, mounted on the rear edge of the cover, operating directly on the selector pushrods. In conjunction with this gearbox a Laycock-Hausserman clutch will be standard equipment; it should give lighter pedal pressures and retain its balance throughout the life of the car.



These comparative curves indicate how the extra engine capacity has given the 4·2-litre car even greater medium speed torque, and therefore potential acceleration

The Model 8 Borg-Warner transmission is virtually a scaled-up and more robust version of the Type 35 unit so far as its main features are concerned. It differs, however, in having a second drive setting, D2, which locks out the first gear train so that take-offs are made in intermediate gear, an advantage on slippery surfaces. It will be recalled that a special version of the Type 35, made for the Daimler 2·5-litre vee-8, also has this facility. The Model 8 transmission shares the lock-up feature of the Type 35; this permits immediate downward changes from top to intermediate gear by moving the selector lever into the L position. Special attention has been paid to keeping the mechanical linkage of the Jaguar installation as free from friction as possible, in view of the higher loads of the selector input at the box on this particular transmission unit. To keep the oil temperature inside the box at a reasonable level in arduous operating conditions, a heat exchanger is built into the cold return pipe of the cooling system.

Although the main performance improvement of the 4·2 Mk. 10 will be in acceleration and not maximum speed, any performance increase demands improved stopping power, and considerable attention has been paid to the braking system. Cast iron, instead of malleable iron, callipers of the Dunlop Series III type have been incorporated to cut down bending deflections, and larger, Mintex M59 pads give a total pad area of 38·4 sq. in. and a swept area of 446 sq. in. Equally important, the pedal booster type of brake servo has been discontinued in favour of the suspended vacuum type, which gives greater power assistance, permitting the use of harder brake pads, and also has quicker response. To complete the safety aspect of the braking system, the front and rear hydraulic circuits have been separated by installing a tandem master cylinder in the servo unit. As a protection against wet and stones the discs are fully shielded.

The dimensions of the E-type brakes remain unchanged, as the makers feel that they are ideally suited to the characteristics of the car, but the suspended vacuum type of servo and M59 linings have been adopted. The servo unit is remotely mounted from the pedal for ease of installation.

Heating Arrangements

Modifications to the Mk. 10 heating system have been made with the object of diffusing the flow of ventilation across the front compartment and to give a more precise control of the temperature of the incoming air. To these ends, guide vanes have been inserted in the rearward facing outlets under the parcels shelf and spread the heater output effectively across the front compartment. Warm or cool air can be directed towards the front passengers' feet or upwards to their bodies by manipulation of individual levers controlling cylindrical air valves in the outlets, but the temperature of incoming air is now controlled by mixing, by means of flap valves, cool air from atmosphere and hot air from the heater matrix, in two plenum chambers. Each has an individual control. The resultant mixtures are fed to the front compartment at a rate dependent on the speed settings of the two blower fans. Since the air supply to the rear compartment is bled off jointly from the two outlets, the air temperature is the mean of the two front compartment settings.

Although changes to the interior of the Mk. 10 are in detail only, modified front seats are a feature of the 4·2 E-type models. Their design should answer valid criticisms of the seats fitted to earlier versions of this car. The new seats have cushions shaped to give more support under the passengers' knees; upholstery is in moulded foam rubber trimmed with hide. An entirely new system is used for springing the squab. It consists of a diaphragm made up of rubber rings linked with wire clips and padded with soft foam rubber. Trim is in leather with plain pleated cushions and a roll round the edge of the squab to provide lateral location for the occupants.

New Steering Gear

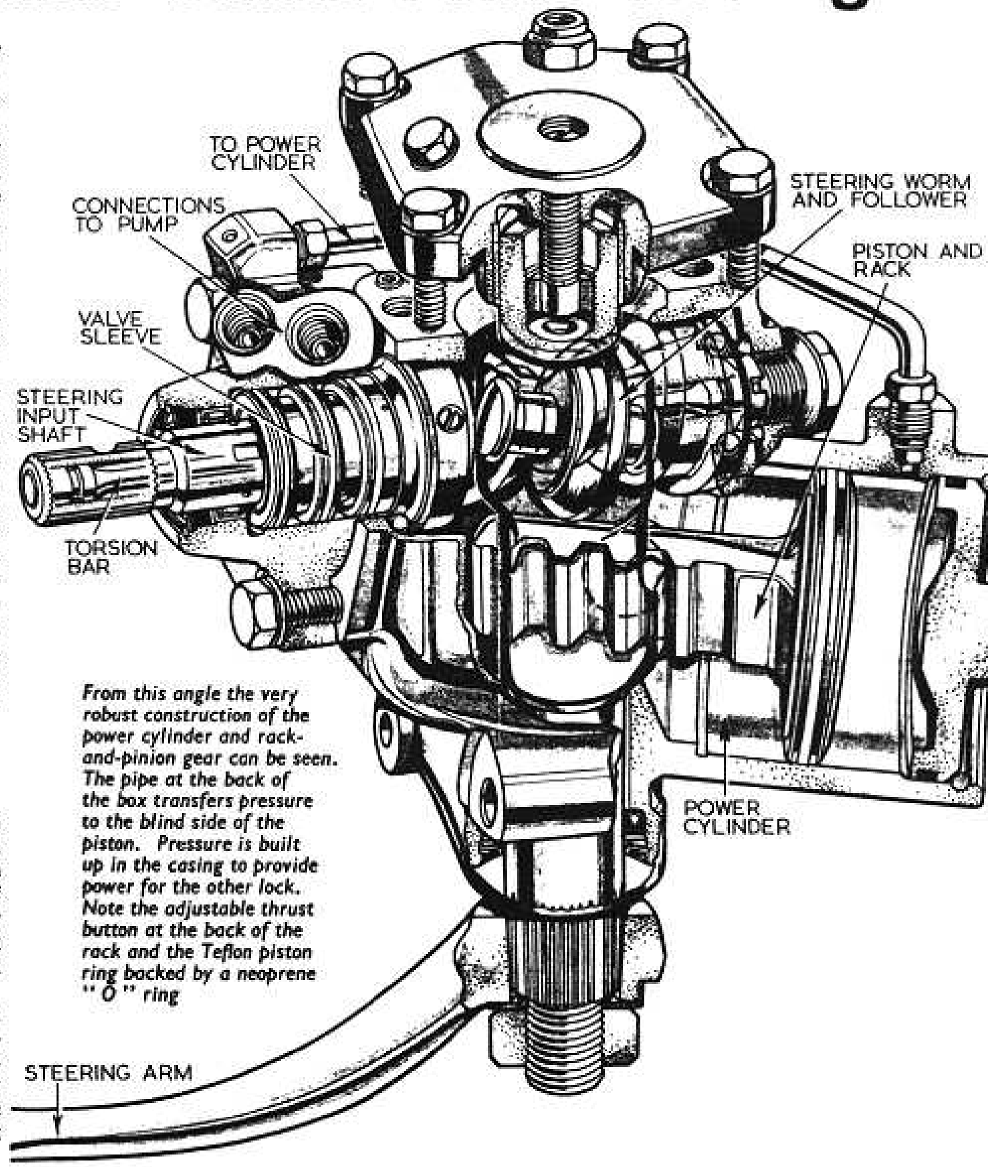
The variable-ratio steering merits, and has been given, a detailed description of its own. Its incorporation is an indication of the advanced nature of the specification with which Jaguar have endowed their most expensive model. Preliminary performance tests promise that the acceleration of the Jaguar 4·2 Mk. 10 will be quite the equal of that of the majority of American cars and the speed greater. It will also well satisfy continental European requirements for a high-performance luxury saloon.

As for the E-type, it has stood out on its own as the best sports car buy in the world; the installation of the 4·2-litre power unit and the incorporation of other significant improvements go to make this an even greater truth.

Marles Varamatic Bendix Power Steering

UNIQUE to the 4·2-litre Jaguar Mk. 10 is a significant advance in power-assisted steering mechanisms, fitted as a standard item. It is an American system designed by an Australian, Arthur Bishop, developed by the Bendix Corporation in the U.S.A., and here by Jaguar and Adwest Engineering Ltd., Reading, the makers. The latest Jaguar has the first application in the world of this mechanism to a production car; the operating principles are new and the characteristics very desirable.

Basically the Marles Varamatic Bendix power steering gear (to give it the correct full title) provides a low-geared steering ratio in the straight-ahead position, becoming higher progressively towards the full-lock positions to eliminate the excessive number of wheel turns which would otherwise be necessary. However, unlike other types of variable-ratio steering, the progression of ratio itself depends on a closely controlled and pre-determined curve in which the ratio reduces rapidly from the straight-ahead position and then levels out completely by the mid-turn.



From this angle the very robust construction of the power cylinder and rack-and-pinion gear can be seen. The pipe at the back of the box transfers pressure to the blind side of the piston. Pressure is built up in the casing to provide power for the other lock. Note the adjustable thrust button at the back of the rack and the Teflon piston ring backed by a neoprene "O" ring

Wide Variation in Ratio

On the Jaguar the straight-ahead ratio corresponds to 4·25 turns lock-to-lock, whereas by the time the front wheels have turned through 16deg (about half full-lock) this has been reduced to only 2·1 turns. The overall ratio gives just under 3 turns lock-to-lock, compared with the previous system's 3·7.

Experimental cars have been built in the States fitted with even more ambitious versions of the device, in some cases the control operating most satisfactorily by means of two twist grips on the dashboard with only 90deg movement each way.

Early on in the development programme Cornell Aeronautical Laboratories published a report on the Bishop variable steering box for automobiles —derived, incidentally, from an aircraft nosewheel gear. Two years later, in 1958, Bendix decided to take up the design as a production part, although they have now had to go outside the U.S.A. to find a customer.

During their analysis of the Bishop gear, Cornell measured, over a wide range of forward speeds, the amount of deflection a steered wheel can withstand before skidding. A graph of the results is shown here, and it is interesting to note that only a 3deg deflection at 70 m.p.h. is equivalent to an 8deg deflection at 30 m.p.h. and a 30deg deflection at 15 m.p.h. in terms of the slip angle produced. It follows from these findings that a similarly shaped curve of steering ratio against angular deflection of the wheel will give an excellent sense of "feel" to the driver at all speeds, and this is just what the Bishop system achieves.

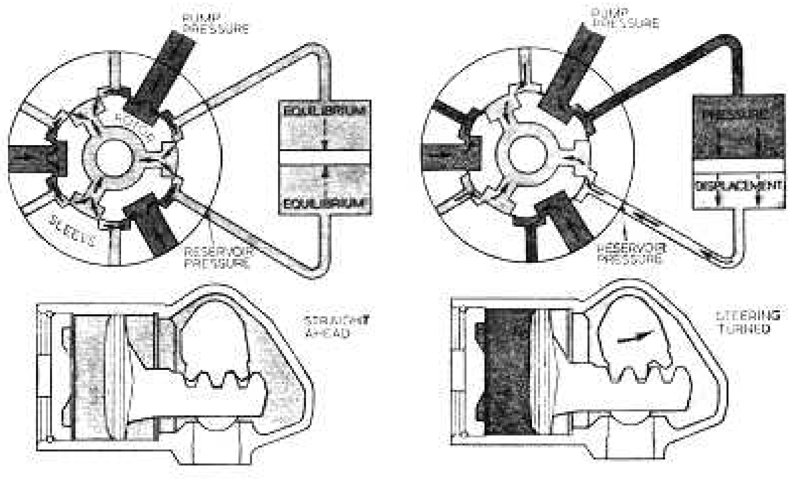
With a heavy car on large-section tyres the parking loads can be considerable (for a pair of 7·50-14in. tyres on a typical car the self-aligning torque is 50lb. ft. per deg), making power-assistance almost essential for manœuvring in confined spaces. In the Varamatic unit the power cylinder is integral with the steering box, a rack formed on the piston rod transmitting the power to a piston on the output shaft. The box is fully pressurized and acts as a pressure chamber for one side of the power piston. Hydraulic energy is provided by a pump belt-driven by the engine.

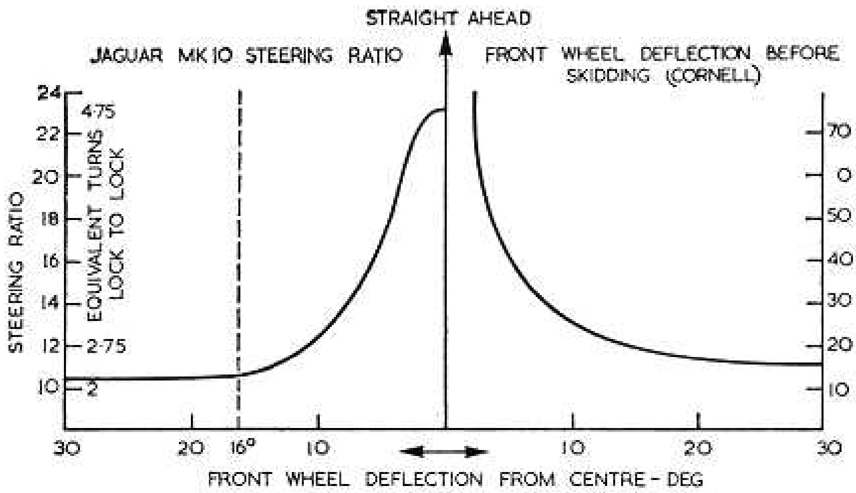
Mechanically the steering is of the hourglass worm-and-follower type, with the pitch of the worm increasing outwards symmetrically from the waist. Hydraulic assistance is metered by a sleeve valve concentric with the input shaft which forms the inner rotor. To provide the relative movement between the input shaft and the sleeve of the valve, which is pegged to the steering-worm, there is a loose-fitting spline (acting also as a fail-safe device) with 14deg of free axial movement. To centre the valve and regulate the amount of power assistance, a light torsion bar is splined between the output shaft and the end of the hollow worm.

As the diagram shows, the design of the rotor valve is relatively simple, although its manufacture calls for close tolerances. The lips of the ports are ground to a precise profile with a logarithmic curve to produce linear flow through the ports. Only 3deg of angular movement exists between the open and closed positions and the entire gear has been designed to have minimum hysteresis in its mechanical parts and valve elements.

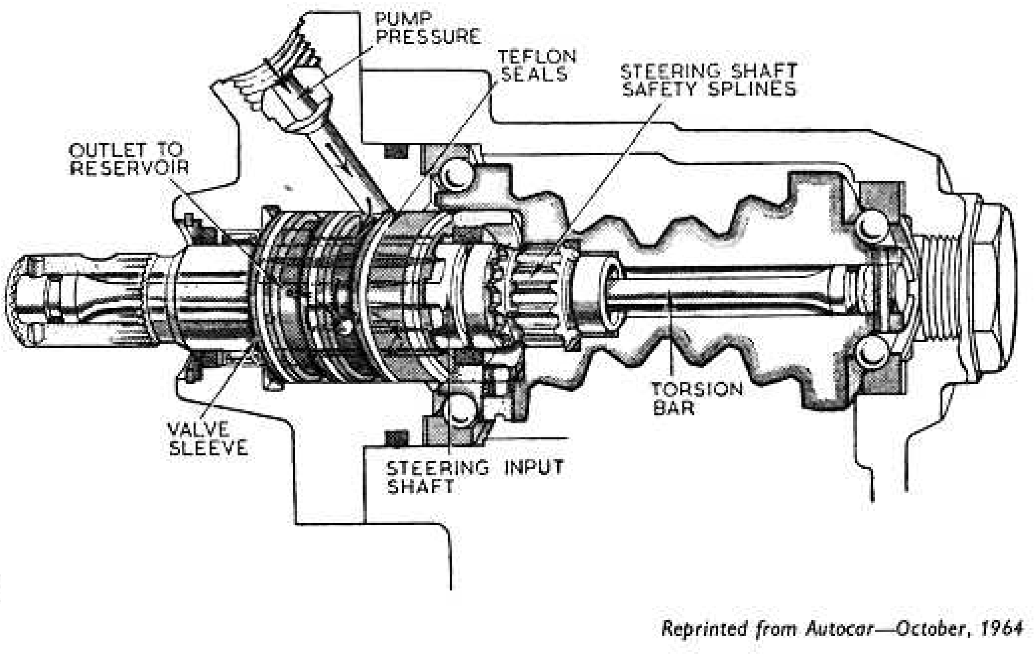
With further development of the system, the time is not far away when the whole concept of steering, especially in large cars, could be changed. Steering wheels would grow smaller and less of an obstruction to seating positions, possibly becoming like the aircraft type of control column, calling for little physical effort, yet retailing all the sensitivity of a linear mechanical installation.

Operating diagram of the rotor valve. The rotor is formed on the input shaft and the sleeve is attached to the worm. The two sections of the valve are connected by a torsion bar which centres the rotor when there is no load on the steering wheel, and also determines the percentage of power assistance





Dual graph showing how the ratio curve for the Varamatic steering box is matched to a maximum front wheel deflection curve before skidding at various speeds. This is really two halves of two symmetrical graphs



To allow relative movement between the two halves of the valve, a torsion bar connects the shaft and steering worm. In the unlikely event of power failure, safety splines take up the drive after about 7deg movement either side of centre