The MORRIS SALESMAN'S MANUAL

1932

MORRIS EIGHT

Published by
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MORRIS
SALESMAN'S MANUAL

MORRIS EIGHT

(Ten h.p. Series)

Published by
MORRIS MOTORS LIMITED
COWLEY, OXFORD

To those who motor a great deal during the hours of darkness, adequacy of road illumination is of vital importance. The complete five-lamp equipment of the Morris Family Eight ensures an adequate amount of illumination on all occasions, the powerful headlamps in particular being of incalculable value on un-illuminated country roads.

In its equipment the Morris Family Eight is in every way complete, including as it does a speedometer, oil gauge, electric petrol gauge, automatic windscreen wiper, pressure chassis lubricating pump, license holder, tachometer and wings, driving mirror, single bumpers front and rear, progressive shock absorbers, electric horn, ammeter, coil indicator light, five-lamp equipment, festoon lamp for instrument illumination, five detachable wire wheels, five Dunlop cord tyres, spare wheel carrier, complete tool kit, jack and tyre pump; thus leaving the owner with nothing of a needful nature to buy. The catalogue price of the Morris Family Eight is an all-in price, including Triplex glass and chromium finish.

To the owner with restricted garage accommodation, the Morris Family Eight should appeal strongly and his attention should be drawn to the advantages of the rear safety petrol tank and the attractive body lines.

THE POWER OUTPUT OF THE MORRIS FAMILY EIGHT ENGINE

	Engine Revolutions Per Min.	Brake Horse-Power
MORRIS FAMILY EIGHT	1000	3·73
	1500	9·0
	2000	12
	2500	15
	3000	17·5
	4000	20

The Morris Family Eight

GENERAL DATA

Bore	57 mm.
Stroke	83 mm.
Bore/Stroke Ratio	1·4243
Cubic Capacity	847 c.c.
R.A.C. Rating	8·4/56
Compression Ratio	4·75–1
Firing Order	1, 3, 4, 2
Cooling System	Thermo-syphon
Valve Diameters	29 mm.
B.H.P./Revs.	See Table
Engine Sump Oil Capacity	4 pts.
Petrol Tank Capacity	5 galls.
Teeth on Pinion and Teeth on Flywheel	10–82
Starter Ratio	8·2–1
Gearbox Ratios	
1st	3·4–1
2nd	1·62–1
Top	1–1
Reverse	3·73–1
Back Axle Ratio	5·875–1
Teeth on Drive Gear	47
Teeth on Pinion	8
Driving Ratio	
1st	19·873–1
2nd	10·762–1
Top	5·875–1
Reverse	19·156–1
Cooling System Capacity	1 gal. 2 qts.

Carburetter Needle	S	W	R
S = Standard W = Weaker R = Richer	MR	MO	M

Gearbox Oil Capacity	1 pt.
Back Axle Oil Capacity	1 pt.

Wheel Size	19" × 4"
Tyre Size	Magna Type Wire 4·00–19

Tyre Pressures	(4.00 / 19) 24 F., 27 R.
Ground Clearance	6½"
Weight, Average	14 cwt. 3 qr.
Permissible Body Weight (ab Chassis)	5 cwt.
Track	4ft 1"
Wheelbase	7' 4½"
Length Overall	137"
Width Overall	55"
Height, Average	62"
Brake-drum Diameter	F. W. R. 9"
Steering Box Ratio	17.1
Turning Circle	R.H. 39' 3" L.H. 37' 9"

PRINCIPAL DIMENSIONS

DESCRIPTION	Morris Eight	
	Saloon	Sports Coupé
	in.	in.
Width at Front Doors	25½	25
Width at Rear Doors	24½	—
Floor to Roof	47	43
Front Seat Cushion to Roof	38	37
Rear Seat Cushion to Roof	36	34
Width Over Front Seats	46	38
Width Over Rear Seats	42	41
Height of Front Cushion	10	10
Height of Rear Cushion	17	12
Depth of Front Cushion	20	20
Depth of Rear Cushion	19	16
Height of Front Squab	18	18
Height of Rear Squab	21	19
Legroom (Front) Max.	41	41
Legroom (Front) Min.	33	33
Legroom (Rear)	34	34
Sliding Roof Opening Length	18½	17
Sliding Roof Opening Width	29	29½
Luggage Container Width	—	36
Luggage Container Depth	—	10½
Luggage Container Height	—	15
Overall Height	63	61
Overall Length	137	137
Overall Width	58	58
Unladen Weight of Car (in cwt. and qr.)	13-0	13-0

Running Costs

FIRST YEAR'S RUNNING (IN GREAT BRITAIN) 12,000 MILES

Actual Running Costs

	£ s. d.
Petrol @ 30 m.p.g.	29 12 9
Oil @ 1000 m.p.g.	3 8 0
Set of 4 tyres and tube	6 8 0
	£39 9 6

Total cost per mile—·0065d.

Standing Charges

	£ s. d.
Interest on Capital @ 3½%	7 12 6
Taxation	8 0 0
Insurance	11 3 0
Depreciation 1st half year @ 15%	22 17 6
,, 2nd ,, @ 12½%	19 1 3
Cleaning, Repairs and Overhaul	15 0 0
	£83 16 3

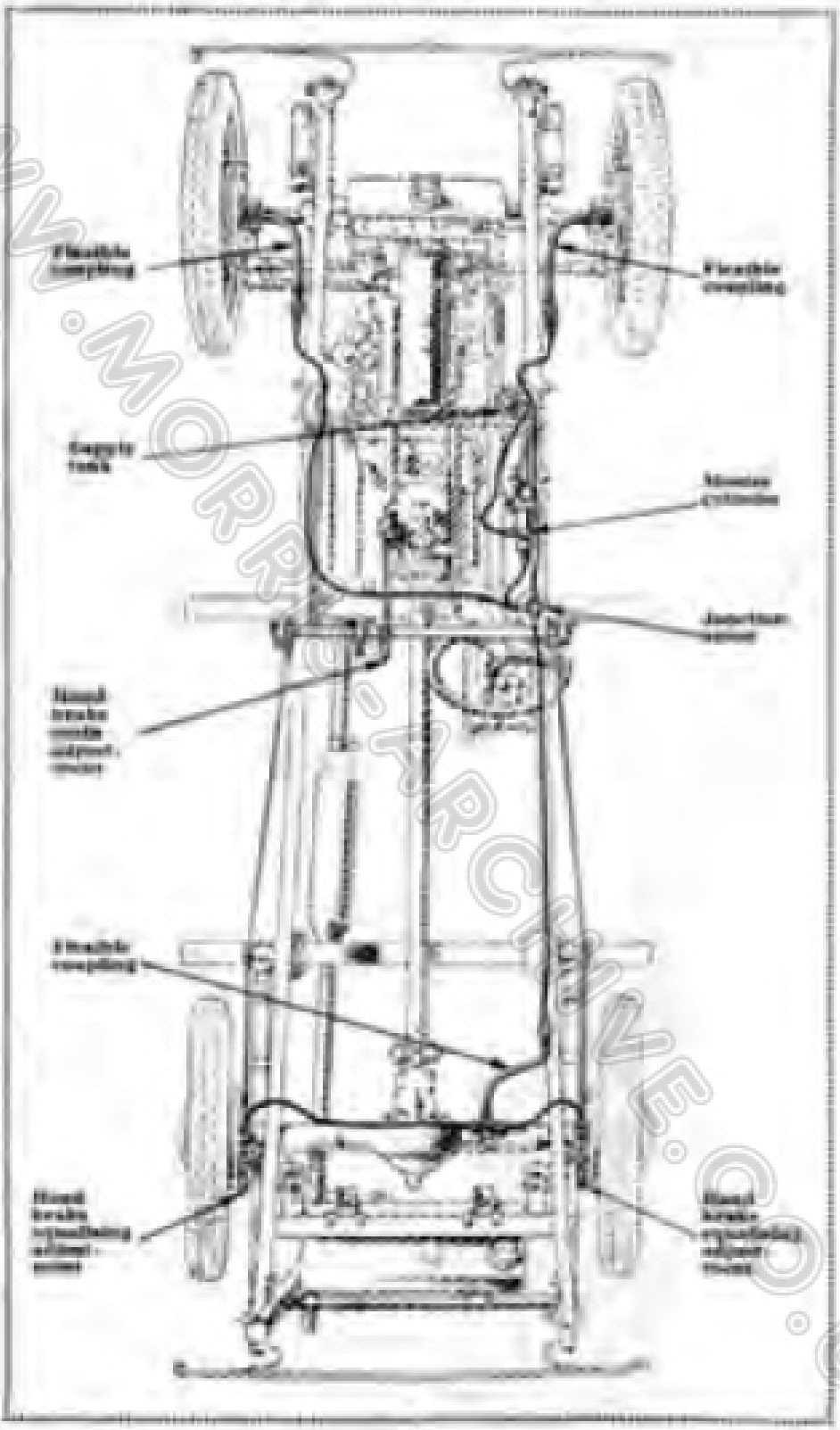
Total cost per mile—1·67d.

Total cost of running car for 12,000 miles—0·285d. per mile.

Based on the following prices :—

	£ s. d.
Petrol (per gallon)	1 3½
Oil (per gallon)	5 6
Tyres (4·40—19) (each)	1 10 6
Tubes (4·40—19) (each)	7 6

The Brake Gear



Morris Family Eight Brakes

GENERAL DESCRIPTION

Brakes on all four wheels.

Foot-operated brakes act on all four wheels. Hand brake on rear wheels only.

Hand Brake Operating Mechanism. Hand lever, cross rocker shaft, adjustable cables, camshafts and levers.

Foot-operated Brakes.—Lockheed hydraulic on all four wheels.

Operating Mechanism.—Foot pedal, master pressure cylinder on chassis frame, copper pipe line to cylinder on each wheel.

Diameter of Axle Brake-drums. 9".

The Brake-drums are medium carbon steel pressings machined inside and fitted with steel bands on the outside.

Brake-shoes.—Special die cast aluminium alloy.

Brake-shoe Linings.—Wire-bound, die-pressed, bonded asbestos, secured to shoes with aluminium rivets.

Sizes: Front (two halves), $7\frac{13}{16}$" × 1½" × $\frac{3}{16}$" thick.
Rear (two halves), $7\frac{13}{16}$" × 1½" × $\frac{1}{4}$" thick.

Brake Cables.—Special rustproof multi-stranded steel. Tested to 2000 lb. pull.

Brake Rocker Cross Shaft.—Heavy gauge tube, underslung on chassis frame and secured on steel bushed brackets. One-piece brake cable levers brazed to tube.

Brake Cams and Shafts.—Solid steel of best quality mounted in bushed brackets supplied with Enots lubrication.

Hydraulic Pipe Line.—¼" outside diameter specially prepared and internally cleaned.

Pipe Unions.—Flared-end type.

Flexible Hose.—Lockheed patent non-expansive, tested to 6000 lb. per sq. in. pressure.

Advantages

The design of the Morris Family Eight brakes, whilst incorporating a more than ample margin of strength, represents the acme of simplicity and light weight. Acting on all four wheels, deceleration sufficient for every emergency is given. Furthermore, full use can be made of the power of acceleration of the engine. The minimum of attention to the brakes is required to ensure their efficiency at all times.

The six essentials of satisfactory brake gear are incorporated in the Lockheed brake.

Reliability, Simplicity, Automatic Equalisation, Efficiency, Ease of Control, and Longevity.

All brakes give equal retardation.

Light pedal pressure only required.

No equalising adjustments whatever necessary when once assembled.

Absence of any tendency to skid when brakes are applied.

No operating components to wear.

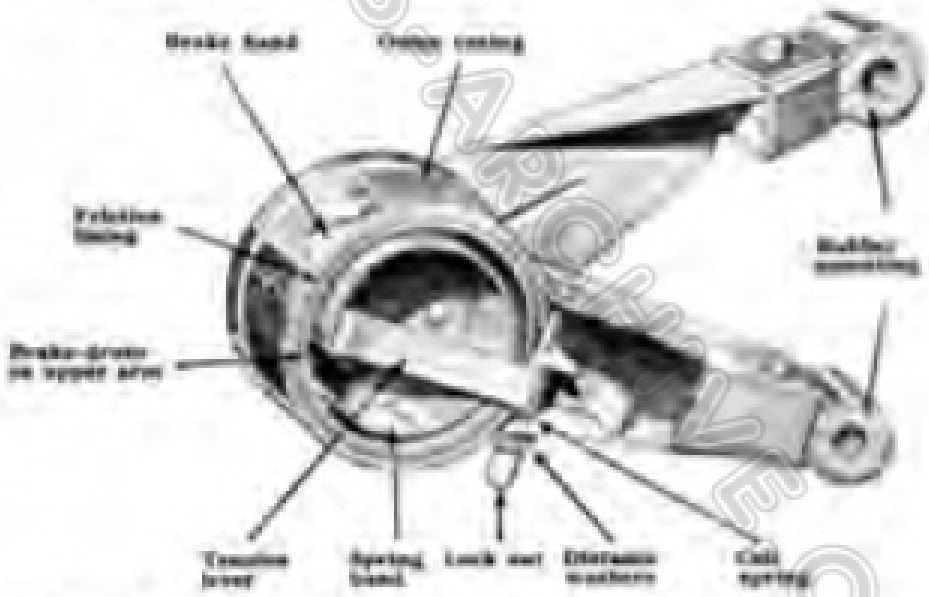
No complicated levers.

No lost motion.

The Armstrong Shock Absorbers

SPECIAL FEATURES

1. No lubrication required.
2. All working parts substantially made.
3. Action is progressive. That is to say, their resistance increases as the spring deflection increases.
4. The friction linings are of generous dimensions, thus ensuring longevity.
5. **Completely enclosed, and protected from weather, dust and dirt**—a valuable feature for efficient and consistent working.
6. **Adjustment is simple**—necessary to remove only one or more washers.
7. **Special flexible joint at end of each arm**—the moulded rubber bushes are detached easily. An efficient and silent method of mounting which is readily removable.
8. **Silent in operation.**



The Armstrong Shock Absorber cut away to show the disposition of its component

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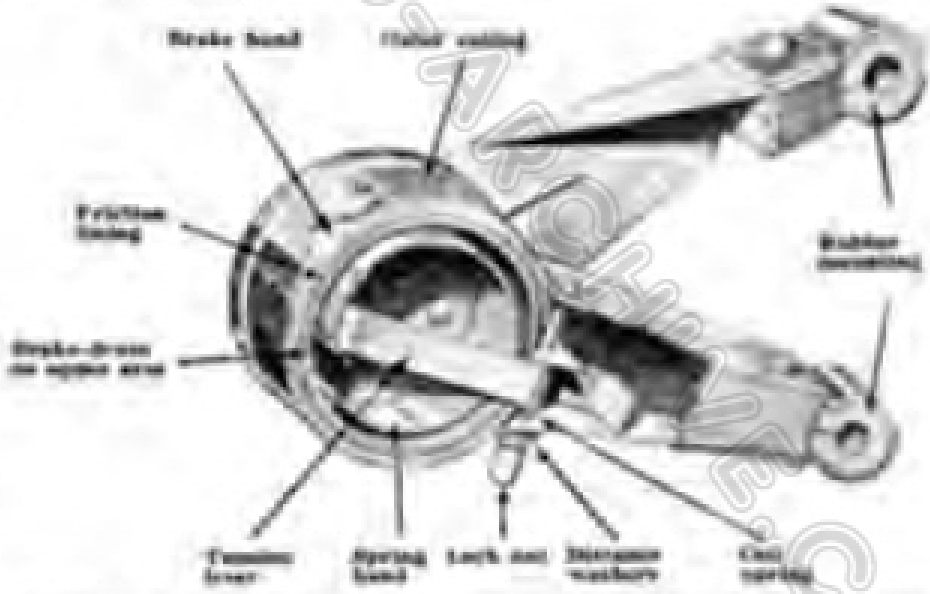


The drawing above shows the way to show the disposition of the components.

Electrical Equipment

LUCAS 6-VOLT EARTH RETURN

Ignition.—By coil and battery.

Coil.—Type 4C6.

Distributor.—Type DJ4 (anti-clockwise).

Lighting and Starting.

Dynamo.—Type DD53 (clockwise). Gives full or half output according to position of charging switch.

Starter.—Type M35A (anti-clockwise).

Battery.—Type 3TW13E. Capacity, 60 amp. hours.

Cut-out and Fuse.—Type C39.

Instrument Panel.—Type 409CA incorporating lighting, charging, and ignition switches, ammeter and coil ignition warning lamp. Panel illuminated by a festoon dashlamp.

Ignition Warning Lamp Bulb.—Lucas screw-cap type No. 222 M.E.S., 2·5 volts, 1·0 watts.

Headlamps.—Type RG63. Bulbs, No. 312 L.G.D., 32 watts.

Sidelamps.—Type L700. Bulbs, B.A.S. No. 88, 3 watts.

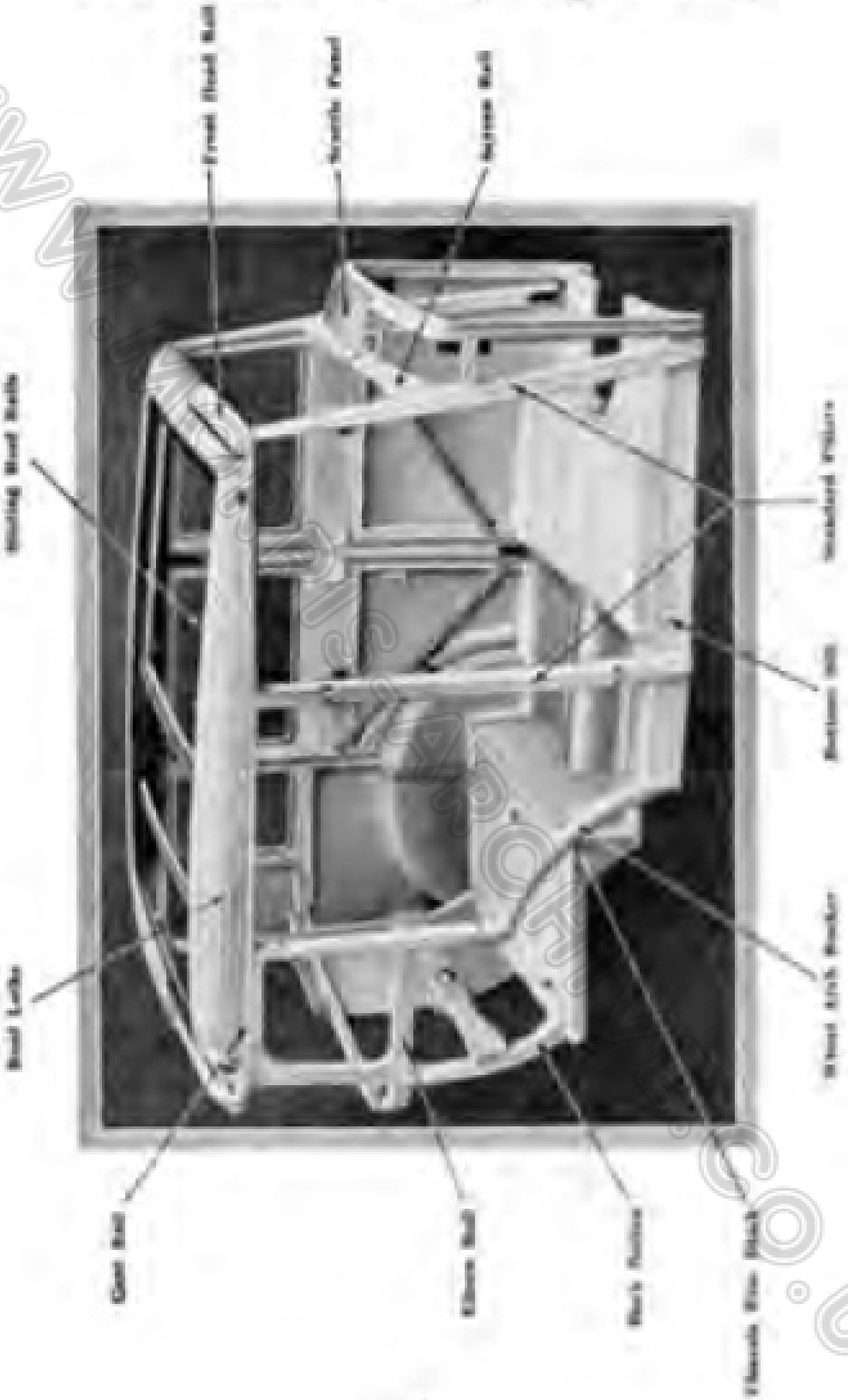
Tail-lamp.—Type T191. Bulb, B.A.S. No. 88, 3 watts.

Dashlamp.—Type D5. Bulb, B.A.S. No. 8/8 watts.

Electric Horn.—Type Mi1. Motor driven type.

Note.—The direction of rotation of machines is given as viewed from the driven end.

The Morris Family Eight Body



Morris Family Eight Body Construction

Body Framing

The timber from which the pillars and rails of the framing of the Morris Family Eight bodies are cut is ash, as this has been proved to be the most suitable wood known, owing to its resiliency, toughness, and ability to withstand the stresses set up by braking, acceleration, and frame twisting. The flooring is of birch plywood, having nine laminations. Parts which are not under stress are of whitewood or pine, to reduce the total weight.

The base of the body is formed by two members known as sills or bottom sides running from front to back of the body and resting on the top flange of the chassis frame, to which they are bolted. The side pillars are attached to the sills. The front pillars, which slope backwards and to which the sides of the windscreen are fixed, are known as the front standard pillars, whilst the pillars on which the doors shut are known as the door standard pillars. The rear seat is formed of two side members, resting on the top of the rise of the chassis frame and forming a continuation of the bottom sills, a front rail to which the front will is fixed, and a rear cross rail to which the rear pillars, usually known as back battens, are attached.

The box construction carrying the front locker seat is built up as a separate unit and screwed to the bottom sills, on which its ends rest.

The roof, in the Saloon model, is composed of side members known as roof rails, into which the side pillars are tenoned, a front header rail over the windscreen, and a cross rail at the back of the body.

All models are fitted with the Pytchley sliding head of the semi-flush type.

All the parts of the body, such as the sides, doors, roof, etc., are built up in jigs and the completed parts are assembled together in jigs, to eliminate the risk of errors due to the human element.

Panels

The outside panels of the Morris Family Eight Saloon are of No. 20 I.W.G. steel. They are formed to shape in presses, completely finished and assembled into six main units, besides the pillar cover panels, etc., before fixing to the body frame. These units are :—The scuttle and windshield frame panel, the door panels and the tonneau panel. All the bolt mouldings and wheel housings are formed as part of the panels. Nuts are held in small retainers on the inside of the wheel housings so that the rear wings may be bolted in place or removed without disturbing the interior upholstery.

Painting

When the panels have been fixed to the frame, and the doors fitted, the body shell is sprayed with a *rustproof primer*, which is the locking coat for all the coats which are to follow. The woodwork inside is sprayed with lead colour and the flooring with black. These coats are dried hard by passing the body through a kiln, after which it receives a number of coats of filler, which are dried in the same way. The body is then rubbed down with wet quartz grit papers by hand until a perfectly smooth and level surface is arrived at, when the body is passed through another kiln to dry off all moisture and the first coats of cellulose colour are applied by spray. This again is dried in a kiln, after which the surface is "flatted" by rubbing down with very fine grit papers lubricated with a special rubbing compound dissolved in water. This process is known as "sanding." After this the body receives a mist coat of cellulose thinner, and is ready for polishing.

Upholstery

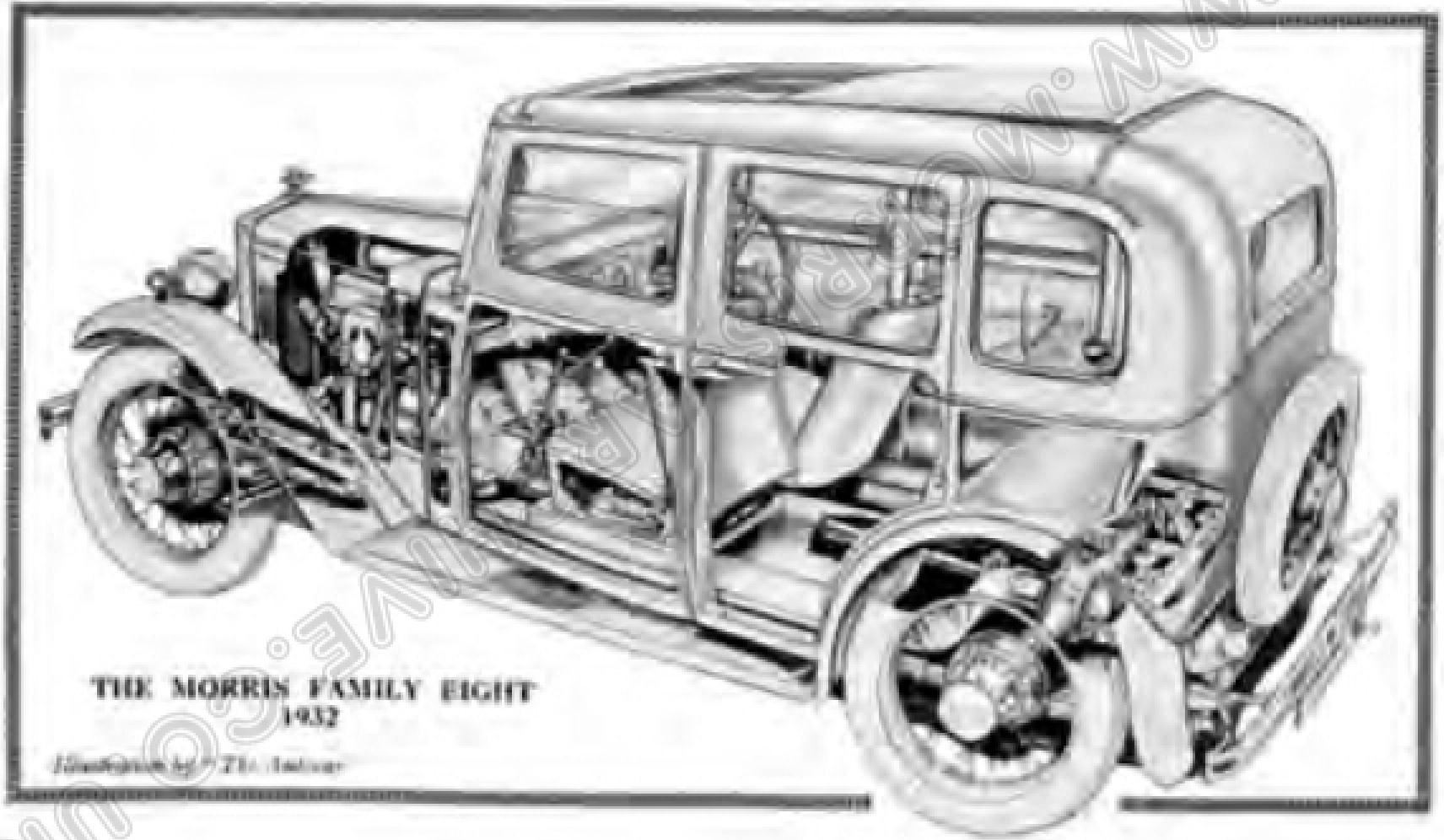
The interior of these bodies is upholstered in leathercloth. The cushions are built up on a spring frame which consists of rows of coppered steel springs held together by clips at the bottom and sides, and covered above by metal "lace" formed by coils of fine gauge tinned spring steel wire interlaced. This gives a firm, yet resilient, foundation for the horse-hair and felt with which the cushions are padded. The bucket seat backs are of sheet steel swaged to give stiffness and with the edges rolled over a heavy gauge wire. The insides of the doors and sides of the body are lined with plywood panels covered with leathercloth, and are immediately detachable by the removal of the fixing screws.

Fittings

The windscreens are built up from brass *plated* and tubular members chromium finished and glazed with ¼" Triplex safety glass which is bedded in rubber under pressure. The door and quarter glasses are ⅜" Triplex, and the door windows are raised or lowered by a quadrant type regulator and operated by the internal handle.

The Sliding Head

This is of the Pytchley type and consists of a sliding portion mounted in aluminium guide channels in which it is free to slide. It is held in any desired position by a hand-operated friction grip acting on a locking bar at the side of the roof opening.



THE MORRIS FAMILY EIGHT
1932

Equipment

MORRIS FAMILY EIGHT COACHBUILT SALOON

Two headlamps. Two sidelamps. One tail-lamp. One instrument panel light.
Single-panel windscreen—Triplex. Can be fixed in five different positions and locked in the closed position.
Four winding windows in Triplex glass.
Pytchley sliding head.
Polished instrument board.
Four doors with safety catches.
Lucas rear vision mirror.
Speedometer.
Oil gauge and ammeter. Ignition warning light. Summer and Winter charging switch.
Dash reading electric petrol gauge.
Jet control. Slow-running control. Ignition timing control.
Electric horn with push-button under steering wheel combined with dimming switch.
Screen wiper, suction operated.
Safety rear petrol tank with automatic Petrolift.
Spare wheel at rear of car.
Pressure chassis lubricating oilgun.
Double bumpers—full width of car, fore and aft.
Armstrong shock absorbers for front and rear axles.
Calormeter engine temperature indicator with mascot wings.
Licence holder.
Chromium finish on all external bright parts.
Two independent front bucket seats.
Complete tool kit, tyre pump and jack.
Carpet mats for front and rear compartments.
Remote control rear blind.
Magna type rear wheels.

MORRIS FAMILY EIGHT SPORTS COUPÉ

Two headlamps. Two sidelamps. One tail-lamp. One instrument panel light.
Single-panel windscreen—Triplex. Can be fixed in five different positions and locked in the closed position.
Two winding windows in Triplex glass, with louvres.
Polished instrument board with cubby-holes each side.
Two doors with safety catches and remote control.
Door pulls.
Lucas rear vision mirror.
Celstra leather upholstery.

Speedometer.
Oil gauge and ammeter. Ignition warning light. Summer and Winter charging switch.
Dash reading electric petrol gauge.
Jet control. Slow-running control. Ignition timing control.
Electric horn with push-button under steering wheel combined with dimming switch.
Screen wiper (electric).
Inbuilt luggage container.
Safety rear petrol tank with automatic Petrolift.
Spare wheel at rear of car.
Pressure chassis lubricating nipples.
Double bumpers—full width of car, fore and aft.
Armstrong shock absorbers for front and rear axles.
Calorimeter engine temperature indicator with magnet rings.
Licence holder.
Chromium finish on all external bright parts.
Two independent front bucket seats.
Float-on-air cushions for rear seats.
Complete tool kit, tyre pump and jack.
Pile carpets for front and rear compartments.
Pockets in doors.
Rear blind with remote control.
Roof-light.
Pedal rubbers.
Arm rests for rear seats. Hand grips.
Magna type wire wheels.

MORRIS FAMILY EIGHT CHASSIS

Four springs. Spare wheel, complete with tyre. Running-boards.
Instrument panel, complete with speedometer. Oil gauge and ammeter.
Ignition warning light. Summer and Winter charging switch.
Electric petrol gauge.
Jet control. Slow-running control. Ignition timing control.
Electric horn with push-button under steering wheel combined with headlamp dimming switch.
Double bumpers full width of car, fore and aft.
Armstrong shock absorbers for front and rear axles.
Plymax cloth. Dash shroud. Screen frame from cowl to hood with hood rear fixed. Splasher.
Two headlamps. Two sidelamps. One tail-lamp.
Battery.
Bonnet lodge.
Front and rear number-plates.
Full kit of tools, tyre pump and jack.
Carburetter with wings.
Bonnet fixed to chassis, complete with fasteners.
Pressure chassis lubricating system.

The Power Unit

GENERAL DESCRIPTION

The Engine Unit.—Four-cylinder water-cooled engine (thermo-syphon), overhead valves operated by overhead camshaft, driven from the forward end of the crankshaft by means of spiral bevel gears through the medium of the dynamo spindle, this being vertically placed.

Bore 2·2455", Stroke 3·268", 31·68 cubic in.
„ 57 mm. „ 83 mm., 517·1 c.c.

R.A.C. rating, 9·05. B.H.P. at 1000 r.p.m.—5·75. B.H.P. at 2000 r.p.m.—12. B.H.P. at 4000 r.p.m.—30.

Compression ratio, 4·75-1.

Sump capacity, 4 pts.

Valve timing with tappet clearance ·002", inlet opens 9° after T.D.C. Inlet closes 35° after B.D.C. Exhaust opens 40° before B.D.C. Exhaust closes 7° after T.D.C.

Ignition—coil, 2½° before T.D.C. Full advance 6-volt

Flywheel circumference, 31". 11·6° per in. of circumference.

Cooling system, thermo-syphon. Radiator capacity, 8½ pts. Water capacity of block, 5½ pts. Total in system, 1 gal. 2 pts.

Forced feed to all white-metal bearings.

Weight of engine, including clutch and four gearbox, 290 lb.

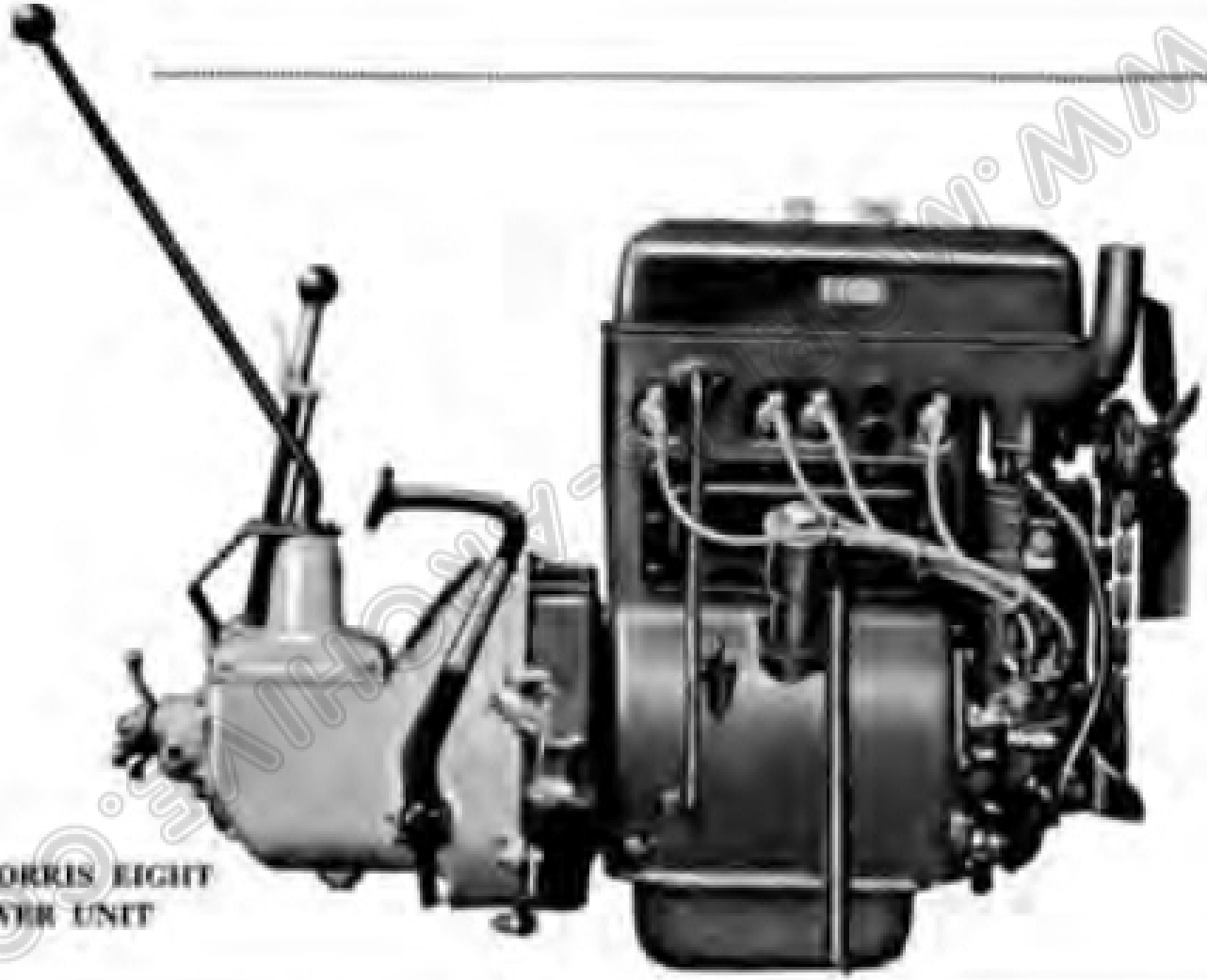
Cylinder Block.—Combined crankcase and cylinders of cast iron. Bores honed finish. Graded by ·0005", Z being greatest, Y normal and X small.

Cylinder Head.—Cast iron. The shape of the head is such as to promote turbulence. The waterways lead in from the cylinder, through the gasket to cylinder head, cooling surfaces being provided for combustion heads and valve pockets. Cylinder head gasket is of copper, brass and asbestos.

Both inlet and exhaust valves are mounted in the cylinder head. The angle of the valve seats is 30°.

Pistons.—Copper aluminium alloy, ground finish. Graded for weight and size. The pistons are ground parallel and relieved for 30° round each gudgeon pin boss and for a distance of ⅝" below the gudgeon pin centre line and ⅛" above. The grading of the pistons and cylinders is such as to give ·002" working clearance on diameter.

Weight of the three steel-jointed rings, i.e. two pressure and one scraper, plus one gudgeon pin—1 oz. 14 dr. to 2 oz.



THE MORRIS EIGHT
POWER UNIT

Gudgeon Pins.—Case-hardening steel. Nickel steel. Tensile, 38 to 40 tons per sq. in. max. $\frac{5}{8}$" × .0005 dia.
.0001 "
Ground and lapped. Weight, 1 oz. 6 dr.
Held in connecting rod by $\frac{1}{4}$" diam. $\frac{3}{8}$" nickel pinch bolt.

Crankshaft.—0·30% carbon steel. Tensile, 45 to 50 tons per sq. in. Weight, 11 lb. 12 oz. Dynamically balanced. Ground on journals and pins.

The valve operating mechanism of the Morris Family Eight engine.

Front journal—B. & M. ventilum ball.
Bearing type M.J. 1¼. (3¼" × 1¼" × ⅝")
Rear journal white metal bearing.

Camshaft.—Case-hardening steel. Tensile, 30 tons per sq. in. max.
Ground finish with 3 bearings.
Valve lift, $\frac{3}{16}$". Weight, 22 oz. Running in white-metal liners with forced feed lubrication.

Connecting Rods.—Duralumin.
Separate liners.
Full ring butted type bearing.
Forced feed lubrication through drilled crankshaft.
Balance is effected by grading rods to weights by increments of four drams from 18 oz. to 14 oz.

Connecting Rod Bolts.—[illegible] nickel steel. Tensile, 30 tons per sq. in.

Valves.—[illegible] case-hardening nickel steel. Ground. [illegible]

Fret potash hardened in pot and quenched.

Valve Spring.—Spring steel. Rate, 31 lb. per in.

Valve Rockers.—Cast iron with chilled surfaces. Forced feed lubrication.

The gear type oil pump with its cover removed and body partly broken away to show the oil relief valve. The construction of the large external oil filter is also clearly shown.

Camshaft and Auxiliary Drives.—A spiral bevel gear is fitted on the front end of the crankshaft, which drives the dynamo. This, in turn, drives the camshaft through a second pair of bevel gears. The two-to-one reduction is carried out between the upper bevels.

The distributor and oil pump are both driven through a diagonal shaft, carried in the crankshaft front housing by means of bevel gears.

Bevel gears, [illegible] case-hardening nickel steel. Tensile, [illegible] tons per sq. in.

Fan.—Steel sheet blades on cast-iron centre mounted on [illegible] roller bearings.

Induction System.—Combined inlet and exhaust manifold incorporating "hot spot."

Lubricating System.—Full pressure system from gear pump to crankshaft rear journals and crankpin bearings. Pressure feed to camshaft bearings and valve rockers via rocker-shafts. Splash lubrication by overflow from crankshaft to pistons and gudgeon pins. Other mechanism lubricated either by splash or by oil returning to engine base.

Oil Base.—Mild steel pressing. Langite joint between oil base and crankcase. Joints in oil system Rapps or Vellumoid.

Oil capacity, 4 pts.

Starter.—Ratio, 8·9 to 1.

Teeth on flywheel, 88. Teeth on starter pinion, 10.

GEARBOX

General Description.—Unit construction with engine. Three forward speeds and one reverse. Central change speed and hand-operated transmission brake. Weight of gearbox complete (with clutch withdrawal mechanism and pedals), 35 lb.

Gears.—3% case-hardening nickel steel. Tensile, 50-60 tons per sq. in. Teeth generated by grinding.

Bearings.—First motion shaft bearing, R. & M. ballless ball bearing L.J. 35 (72 × 35 × 17 mm.).

Mainshaft spigot bearing, R. & M. roller bush B. 118 (¾" × ⅝").

Mainshaft rear bearing, R. & M. ballless ball bearing M.J. ½" (2½" × ½" × ¾").

Bushes for layshaft gears (2), ½" dia. × 1" grooved gunmetal.

Bushes for reverse gear (2), ½" dia. × ¾" grooved gunmetal.

Spigot bearing in crankshaft flange, R. & M. ballless bearing type L.J. ½" (1½" × ½" × ⅝").

Mainshaft.—Four-spline type, ⅞" O.D. × ¾" bore diam. Material, case-hardening steel. Tensile, 80 tons per sq. in. min.

First Motion Shaft.—Carries a six-spline for engagement in clutch plate centre. Material, case-hardening steel. Tensile, 80 tons per sq. in. min.

Dog Clutch.—For direct drive carries five dogs bevelled to facilitate engagement.

Speedometer Gears.—Spiral gears, 8 driven 14. Material, case-hardening steel. Tensile, 80 tons per sq. in. min. Driven gear carried in gunmetal bearing screwed for attachment of speedometer cable.

Oil Capacity.—One pint.

Gearbox Ratios.—1st, 9·4-1. 2nd, 4·958-1. 3rd, direct. Reverse, 9·75-1.

Universal Joint.—Fabric disc.

CLUTCH

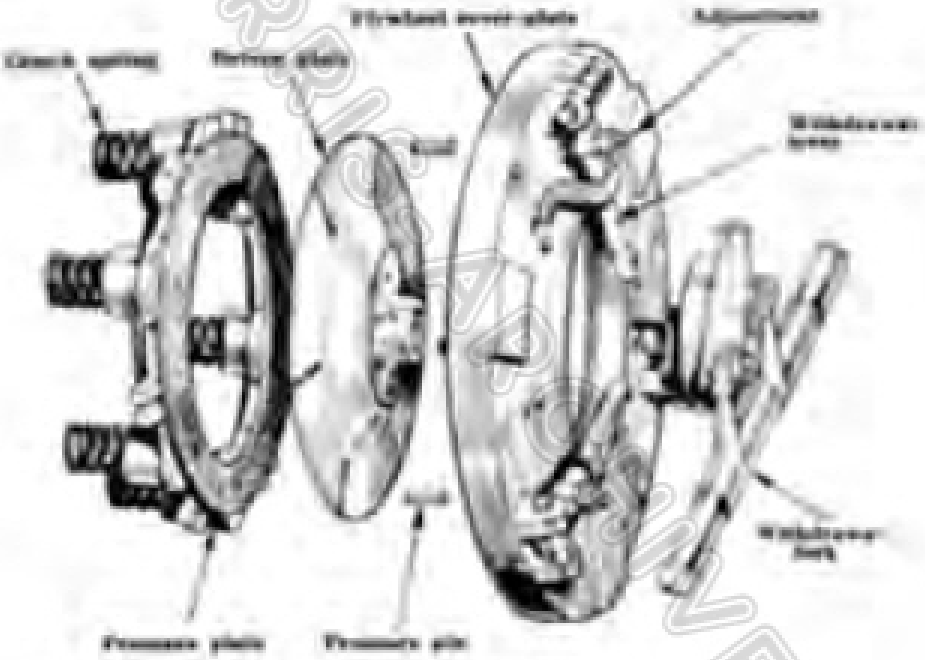
General Description.—Single dry plate loaded with three helical springs circumferentially placed and withdrawn by three toggle levers operated by means of a pedal through a withdrawal bearing carried on first motion shaft.

Bearing, 2¾" × 1¾" × 400". R. & M. double-purpose bearing. E.N.J.T. 1¼".

Note.—Clutch cover assembly is statically balanced.

The ratio of travel between pedal and pressure plate is 6 to 1.

Load on clutch pedal required to depress the clutch, 14 lb.



The component parts of the Morris Family Eight clutch assembly in sheet metal construction.

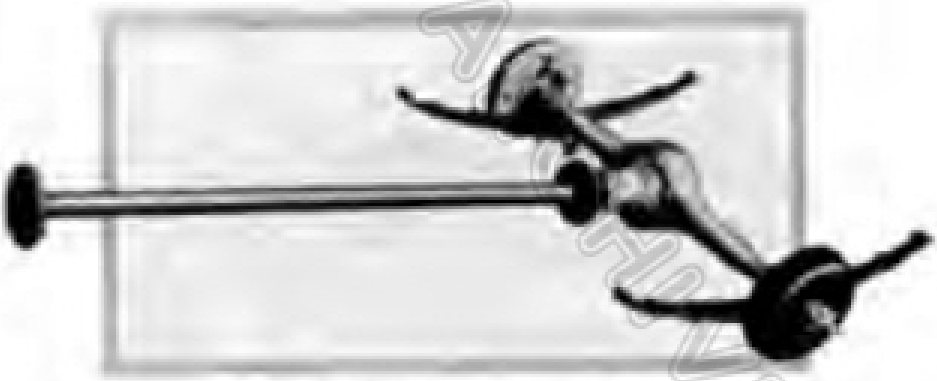
The Transmission

GEARBOX TO ROAD

Transmission.—On this model the drive is transmitted from the gearbox to the back axle through the medium of a tubular propeller shaft and two fabric disc universal joints. This lay-out is favoured on a small car by reason of its extreme simplicity, accessibility, and the fact that it requires no attention in the matter of lubrication.

The back axle casing is formed of two stout steel pressings, into the ends of which are pegged and welded solid-drawn steel tubes.

The spiral bevel drive gear and pinion are easily adjusted for mesh by the provision of shims behind the bevel bearing cups and locating lock nuts on either end of the differential carrier.



The Morris Family Eight rear axle assembly

Propeller Shaft.—High tensile carbon steel tube. 1¼" O.D. × 18 S.W.G.

Bevel Pinion and Gear.—5", case-hardening nickel steel. Tensile 50-60 tons per sq. in. Ratio, 5.875-1. 8 teeth on pinion, 47 teeth on wheel.

Pinion Bearings.—Front, R. & M. ratchless type ball bearing M.J. 25 (62 × 25 × 17 mm.). Rear, R. & M. roller bearing M.R.J. 25 (62 × 25 × 17 mm.).

Differential Bearings.—Double-purpose R. & M. L.J.T. 35 (72 × 35 × 17 mm.).

Hub Bearings.—R. & M. ratchless ball bearing L.J. 40 (80 × 40 × 18 mm.).

The rear axle with cover removed, showing the final drive and differential mechanism.

Differential Shaft.—[illegible] nickel steel. Tensile, 60 tons per sq. in. 1" dia. B.S.S. 903-402.

Rear Axle Casing.—Solid-drawn tube [illegible] carbon steel. Tensile, 60 tons per sq. in.

Oil Capacity.—1 pt.

Springs.—Material, Silico-manganese alloy.
Five main leaves, two reboundl leaves.
Length of spring between eyes, 36".
Width of leaf, 1·25".
Offset, none.

Wheels.—19" × 4" Magna type wire.

Tyre Size.—27"—4·00" (1·00"—19").

The Front Axle

Beam.—I-section centre with oval section ends.
Material, 0·4% carbon steel—ultimate tensile, 40 tons per sq. in. min. B.S. 3063/200 specification. Load, 35 ft.-lb. Steering centres, 21½".

Knuckle Pins.—3% case-hardening nickel steel. Tensile 53 tons per sq. in. ¾" dia. Load, 40 ft.-lb.

Knuckle Pin Bushes.—Hard phosphor-bronze cloth cast bar.

Steering Knuckles.—3½% nickel steel. Ultimate tensile, 60 tons per sq. in. Load, 30 ft.-lb. B.S. 3063/402.

Steering Ball Pins.—3% case-hardening nickel steel. Tensile 55 tons per sq. in. Load, 40 ft.-lb.

The front axle assembly of the Morris Eight.

Wheel Bearings.—R. & M. ratchless type ball bearing M.J. 39 (52 × 20 × 15 mm.) and L.J. 23 (52 × 23 × 15 mm.).

Springs.—Material, silico-manganese steel. Tensile 85 tons per sq. in. min.
Five main leaves, two rebound leaves.
Length of spring between eyes, 23·875".
Width of leaf, 1·25".
Offset, 1·25".

Turning Circle.—R.H., 30' 2". L.H., 32' 0".
Tyre size, 27" × 4·00" (4·00"—19"). Wheel size, 19" × 3" Magnum wire.

The Steering Gear

Type.—Worm and worm wheel type in aluminium alloy steering box.

Worm.—Three starts. Material, case-hardening steel. Tensile, 52 tons per sq. in. min. Izod, 40 ft.-lb. min.

Wheel.—Twenty-three teeth. Material, 3% case-hardening nickel steel. Tensile, 42 tons per sq. in. Izod, 40 ft.-lb. min.

Drop Arm.—Steel stamping. 3½% nickel steel. Tensile, 60 tons per sq. in. Izod, 50 ft.-lb. B.S. 3063/802.

The steering column and steering gear assembly of the Morris Family Eight.

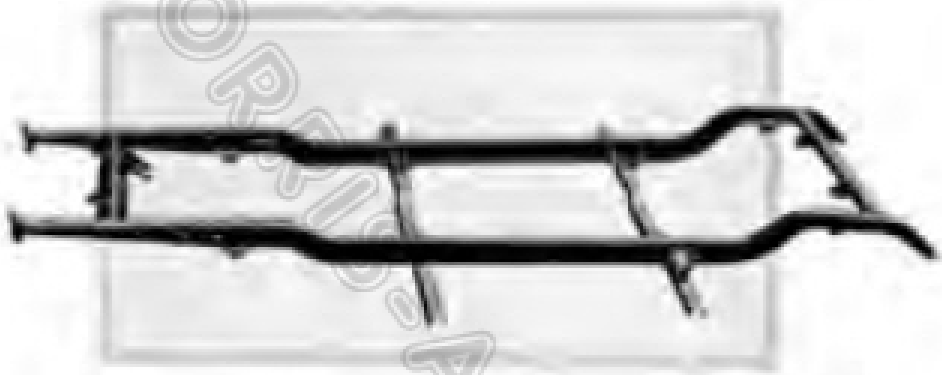
Bearings.—Steering column top, twenty-three ¼" balls, double-purpose bearing. Steering column worm bearing, cast iron bush, ¾" bore. Steering worm wheel and steering box bushes, phosphor-bronze, ¾" bore.

Chassis Frame and Road Springs

CHASSIS FRAME

Description.—Pressed steel channel. 20" carbon steel. Tensile 28 tons per sq. in. B.S. 500/213 specification.

Dimensions.—Maximum depth, 4". Average width, 1¼". Thickness of plate, ·128".



The sturdy drop-forged chassis frame of the Morris Family Eight.

ROAD SPRINGS

Rear (half-elliptic).
Length under load of 350 lb., 36".
Width, 1¾".
Offset, nil.
Number of leaves, five and two reinforced plates.
Material, silico-manganese steel. Tensile, 90/85 tons per sq. in. max.

Front (half-elliptic).
Free length, 20".
Width, 1¾".
Offset, 1¾".
Number of leaves, five and two reinforced plates.
Material, silico-manganese steel. Tensile, 90/85 tons per sq. in. max.

Morris Family Eight Engines on Test

Morris Family Eight Production

In the production of the Morris Family Eight, every branch of manufacture is under the control of specialists, and the machine shops are divided into units—one unit producing, assembling, and testing engines; a second producing and testing front axles; a third rear axles; a fourth steering, and so on.

The illustration on page 34 is a general view showing some of the engine-test plant.

The illustration below is a close-up view of a Morris Family Eight engine on the production "Froude" water brake. The "Froude" water brake shaft is surrounded by a casing which is filled with water; on the shaft is mounted a "Froude" rotor, which consists of a kind of flywheel in the sides of which are formed specially shaped pockets separated from each other by means of oblique vanes.

A Morris Family Eight engine coupled to the "Froude" hydraulic brake.

The vanes in the rotor face similar vanes which are fixed to the interior of the casing and do not rotate with the shaft; when the engine is started up, the brake shaft naturally rotates at the same speed, and a considerable amount of hydraulic interaction thus takes place between the rotor vanes and the casing vanes.

By this hydraulic action the whole of the engine power is absorbed, but the actual load imposed on the engine by the hydraulic brake can be regulated between very wide limits by rotating a handwheel fixed on the outside of the casing. Movement of this handwheel

causes a corresponding movement of thin bronze plates which are interposed between the vanes of the rotor and the vanes in the casing, and when these are in the fully closed position, communication between rotor vanes and casing vanes is entirely cut off. In this condition the brake load is at a minimum, and if the engine throttle is fully opened it will speed up to its maximum. When the bronze plates are in the fully opened position there is full communication between rotor and casing vanes, and the brake load is at a maximum; even with the engine throttle fully opened, this results in a very low engine speed, and by adopting intermediate positions of the handwheel the engine can be tested over its full range of speed.

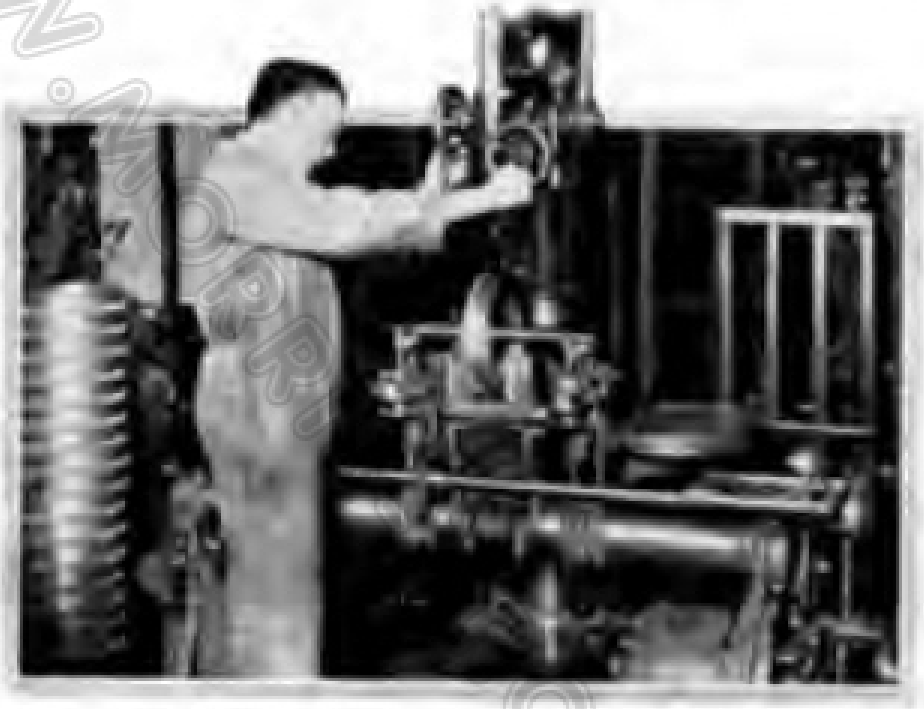
A Morris Family Eight engine undergoing test on the special electrical dynamometer.

The absorption of the engine power by the hydraulic action naturally causes the water to become heated; fresh water is, therefore, constantly led into the casing and allowed to escape through an outlet valve in order to carry away this heat.

Before dispatch from the makers' Works, the brakes are fully tested and calibrated; the calibration is effected by a scale showing the movement of the handwheel, the scale being marked in various positions, one of which shows the setting of the bronze plates to give a brake load corresponding with a predetermined maximum engine output at a certain speed.

In the Morris Family Eight engine test shop every engine must be capable of attaining this speed with the brutest plates at the correct setting, thus ensuring that no engine is passed out, with its power output below standard.

As an additional check a percentage of Morris Family Eight engines are tested on a special electrical dynamometer testing set. This set is particularly sensitive, and consists of two D.C. special shunt-wound



The special dynamic balancing machine and drill used for accurately balancing Morris Family Eight flywheels.

separately excited dynamos, connected together in mechanical tandem by means of a flexible coupling. The machine is equipped with a steel torque reaction arm giving a constant of 1,200lb., and it is possible to measure the torque in either direction—that is to say, when the engine under test is being motored, or, alternatively, is running under its own power. The machine has a very fine gradation of speed and power readings up to a maximum of 4,000 r.p.m.

In order to produce an engine which has the vibrationless characteristics of the Morris Family Eight, it is essential that all moving parts are balanced both statically and dynamically to extremely fine limits. The illustration on this page shows the dynamic balancing machine and drill used for balancing the flywheel. Similar equipment is used for balancing the crankshaft.

Piston Testing

Each piston is accurately weighed and all the pistons assembled into an engine are closely matched.

Each piston is also carefully measured for diameter and graded.

The upper illustration on the opposite page shows the Jubilee piston weighing scales. On these scales all the pistons are weighed and matched to a maximum error in weight of two drams.

The other illustration shows the special fixture for measuring pistons and grading them by diameter.

Cylinder bores are tested for straightness and roundness by instruments which can easily be read to one two-thousandth part of an inch.

The cylinder bore testing operation on the cylinder block line.

One essential of continuous production is that no operation need be hurried, and that by the machinery and jigs provided every operator has ample time to watch his tools and ensure accurate results.

The method of boring the cylinders is shown overleaf. Three cylinder blocks are clamped in the jig by the movement of a single handle, and twelve bores are produced by one passage of the machine, against the old-fashioned method of producing bores one at a time. A similar machine finishes the bores ready for honing, after the high-pressure water-testing operation.

Two further illustrations show the machine used for drilling and tapping respectively all the holes in the top, bottom, sides, and ends of the cylinder block. On this machine seventy-two holes are drilled and tapped at the one operation. Equipment such as this produces threaded holes to much finer limits than can possibly be obtained by the old hand or radial drilling machine method of tapping.

Machining the Cylinder Block

Boring Morris Family Eight cylinder blocks on the special multiple boring machine.

A close-up view of the cylinder block drilling machine with a cylinder block in position in the fixture.

The Camshaft Test

As the camshaft is such a vital part of an engine, special attention is paid to its manufacture, and the accompanying illustration shows the fixture for checking cam form and valve timing. It will be seen that a dial indicator is provided for each cam, and the opening and closing points for the whole series of cams are very finely graduated

One of the special camshaft testing fixtures.

on the large index wheel in the operator's hand. By means of this special testing fixture camshafts can be checked in a few minutes to a degree of accuracy which could only be obtained by a skilled toolmaker using ordinary equipment after many hours of careful manipulation.

In addition to providing an accurate check on the lift of the cams and the diameter of the base circle—so important portions—this fixture also reveals any lack of truth which the camshaft may possess. The valves of Morris Family Eight engines are thus ensured an accuracy of operation conducive to exceptional efficiency.

Spiral Bevel Gearing

The battery of special machines used to cut the spiral bevel gears used on the Morris Family Eight.

The special spiral bevel testing machine on which rear axle final drive gears are checked.

Testing Bevel Gearing

A portion of one of the erecting rooms in which engine and rear axle gears are tested for silent running.

The fixture on which the combined bevel gears are inspected.

Producing the Axles

The huge special drill employed to bore the accessory holes in the front axle beam.

A general view of the rear axle assembly line.

Machining the Cylinder Head

Another special machine in the bore chapter, which drills in one operation all the holes required in the cylinder head.

The special boring tool and fixture which is employed to bore the camshaft drive tunnel in the cylinder head.

Checking the Gauges

Checking the accuracy of a plug gauge on a special measuring machine.

Checking a thread gauge on the special thread measuring machine.

On Gauge Accuracy

It will be appreciated that with the large number of components being machined to tolerances under three ten-thousandths of an inch, the gauges used for checking these parts must be made and kept up to limits of less than one ten-thousandth part of an inch. These gauges are returned to the stores each day and others issued, and the returned gauges are then checked again before re-issue.

The accompanying illustration shows a plug gauge being checked, and a thread gauge. All the extremely accurate thread gauges are produced in the gauge room and the illustration below shows the operation of thread grinding.

The last word thread grinding machine which is capable of grinding the thread gauges to the very fine limits necessary.

Since the gauges must be kept within limits of one ten-thousandth part of an inch, it follows that the measuring instruments used to check their accuracy must be capable of measuring to infinitely finer limits than this. Most of the measuring instruments used for gauge testing purposes by Morris Motors Ltd. are therefore capable of recording dimension variations of one hundred-thousandth part of an inch.

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