The MORRIS SALESMAN'S MANUAL

1932

MORRIS MINOR

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(No. 2 of Series)

Published by

MORRIS MOTORS LIMITED

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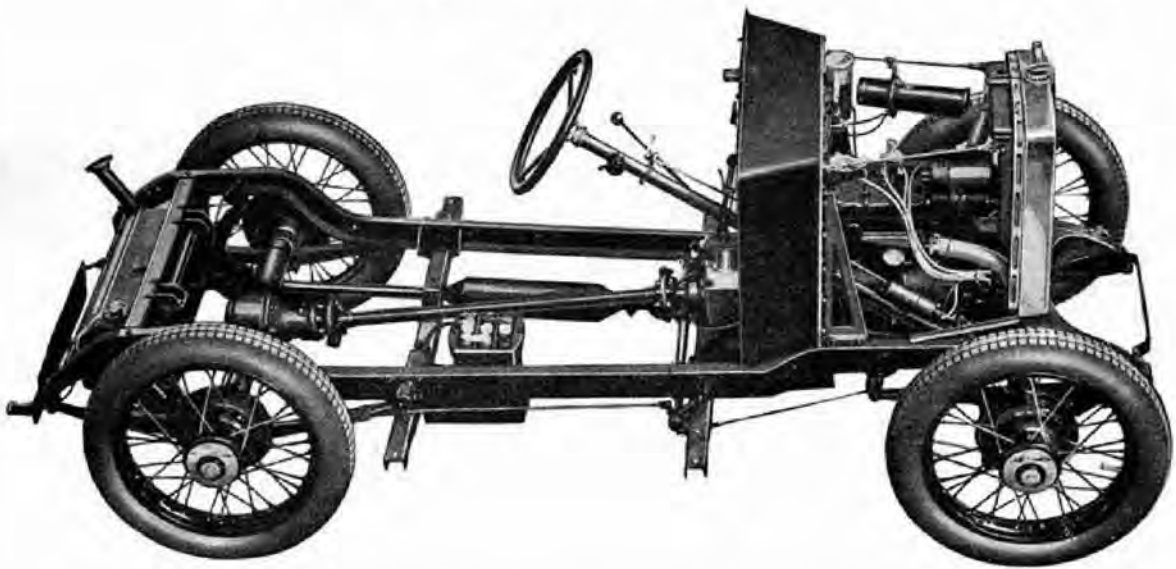
THE 1932 MORRIS MINOR CHASSIS



FOREWORD

THIS series of Salesman's Booklets has been produced with the primary object of giving the Staff of Dealers' organisations an insight into some of the science which lies behind the production of the Morris car.

To " read, mark, learn and inwardly digest " the characteristics of the various models will make the salesman's task an easier, more interesting, as well as a more profitable undertaking, and it is confidently believed that a close study of these pages will be amply repaid.

From time to time it is not improbable that certain details as to specification, etc., may be subject to alteration. It must be pointed out, therefore, that it is not intended that this work shall supplant the usual catalogues and specifications, which will still be issued periodically by our Sales Department as heretofore. Needless to add, it is one of the first duties of a salesman to keep his information absolutely up-to-date by keen personal observation both of sales literature and the cars themselves.

Every endeavour has been made to avoid encroaching upon the instructional matter contained in the *Car Manual*—although the *Car Manual* is full of information of use to the salesman—and the purely " Service " side, which is already catered for in the Dealers' Service Information Manuals.

In conclusion, rest assured that no stone will be left unturned at Cowley in a constant endeavour to maintain and increase the prestige of the Morris car. The success which has attended our mutual efforts in the past has been the result of enthusiasm and hard work. A continuance of that policy will ensure further success.

MORRIS MOTORS LTD.

A Personal Message
from
Sir William R. Morris, Bt.

IN presenting this Salesman's Manual I take the opportunity, earnestly desired, to express my unbounded appreciation of the efforts and enthusiasm displayed by Morris salesmen in the past, and the extremely valuable work they have contributed towards the building of the Morris organisation as it stands to-day. It has often been stated that a good article will sell itself, but modern experience definitely proves that this is but a half-truth. No article, however good it may be, can possibly achieve maximum sales unless it is properly presented to the buying public.

This publication is an acknowledgment of the value of the salesman to the Morris organisation, and an appreciation of the difficulties he has to contend with. With these difficulties in mind, we have endeavoured in its pages further to assist those engaged in selling Morris cars by providing them, in a concise form, with all the information and data concerning Morris Minor cars which they are likely to require in the course of their dealings with prospective Morris owners.

I sincerely hope that the information contained in this book will carefully be assimilated by all Morris salesmen, and that it will further cement the pleasant relationship which has existed between us in the past, and, furthermore, that it will culminate in increased prosperity for all those engaged in Morris sales.

Morris Minor Sales Features

By W. M. W.-THOMAS

THE special appeal which the Morris Minor range possesses, in addition to the general points outlined in the *General Salesman's Manual*, is that of low initial and upkeep cost, and there is little doubt that on this score alone many sales will be effected. At the same time, the salesman must not forget to lay stress upon the many other important attractions of the Morris Minor, and, in particular, the many points of advantage it possesses over other cars in the same, or even higher, price class.

First and foremost, there is the important fact that in spite of its modest price and external dimensions the Morris Minor is a complete motorcar in every sense of the term. It has a dropped frame of robust dimensions and sturdy construction whose design incorporates every proved desirable feature—a frame comparable in every way with that found on far larger and far more expensive cars, and one which has in no way been curtailed with the object of price reduction. This sturdy foundation ensures a low centre of gravity together with a general stability on the road much above the average, and, in conjunction with generous semi-elliptic springs fore and aft, controlled by progressive shock absorbers, provides a degree of riding comfort unsurpassed by any other small car. Road stability, when one is confronted with an emergency in these days of tricky road surfaces and relatively high speeds, may mean all the difference between safety and disaster.

The good riding qualities are well matched by the generous internal dimensions of the body and comfortable seating arrangements, and even the tallest of persons may easily be accommodated without cramping.

A point worthy of notice is the exceptional ease of entry provided by the large doors, which give a dimension between the front of the seat and the door pillar exceeding that found on some cars of even larger size, and that the doors are hinged at the front.

The prospective owner's next concern is usually that of road performance and reliability. On both these points the Morris Minor excels. With a top speed with full load in the neighbourhood of 55 m.p.h., it is capable of maintaining average speeds equal to most 12 h.p. cars, and can indeed maintain higher speeds than such cars when operating in congested areas—thanks to its excellent acceleration and manœuvrability. The advanced design of its well-tried four-cylinder side-valve engine, and the sound design of every detail of its chassis, ensure a high degree of reliability which is fully proved by the growing popularity of the range.

A good performance is of little practical value and may even become a danger without correspondingly good brakes, and the generously-dimensioned four-wheel brake system of the Morris Minor has been designed to provide brakes of an efficiency commensurate with the rest of the car. All four brakes are applied by the pedal.

The lamp equipment of the Morris Minor ensures an adequate amount of illumination on all occasions, the powerful combination headlamps in particular being of great value on un-illuminated country roads.

In its equipment the Morris Minor is in every way complete, including as it does a speedometer, oil gauge, suction petrol gauge, automatic windscreen wiper, pressure chassis lubricating pump, licence holder, driving mirror, automatic petrol lift, electric petrol gauge on dash, progressive shock absorbers, electric horn, ammeter, coil indicator light, combination head and sidelamps, lamp for instrument illumination, five detachable Magna 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 Minor is an all-in price, including Triplex glass and chromium finish.

To the owner with restricted garage accommodation, the Morris Minor very naturally makes a special appeal, and his attention should be drawn to the advantages of the rear safety petrol tank, and the general attractiveness of body lines.

THE POWER OUTPUT OF THE MORRIS MINOR ENGINE

	Engine Revolutions Per Min.	Brake Horse-Power
MORRIS MINOR ..	1000	5·25
	1500	8·50
	2000	11·5
	2500	14·00
	3000	16·5
	4000	19·00

The Morris Minor

GENERAL DATA

Bore	57 mm.
Stroke	83 mm.
Bore/Stroke Ratio	1·4561
Cubic Capacity	847 c.c.
R.A.C. Rating	8·056
Compression Ratio	4·9
Firing Order	1.3.4.2.
Cooling System	Thermo-syphon
Valve Diameter	29 mm.
B.H.P./Revs.	See Table
Engine Sump Oil Capacity	4 pts.
Petrol Tank Capacity	5 gals.
Teeth on Starter and Teeth on Flywheel	10–83
Starter Ratio	8·3–1
Gearbox Ratios	
1st	3·5–1
2nd	1·83–1
Top	1–1
Reverse	2·83–1
Back Axle Ratio	5·375–1
Teeth on Drive Gear	43
Teeth on Pinion	8
Driving Ratio	
1st	18·81–1
2nd	9·852–1
Top	5·375–1
Reverse	14·227–1
Cooling System Capacity	2 gals. 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″ × 3″ Wire Magna
Tyre Size	3·50–19

Tyre Pressures	2-str. 22 F., 24 R. Saloon 22 F., 26 R.
Ground Clearance	6½"
Weight, Average	12 cwt. 0 qr. 8 lb.
Permissible Body Weight on Chassis	4 cwt. 3 qr.
Track	41½"
Wheel Base	6' 6"
Length Overall	119"
Width Overall	51"
Height, Average	60½"
Brake-drum Diameter	F.W.B. 8"
Steering Box Ratio	7·7–1
Turning Circle	R.H. 31' 4" L.H. 30' 6"

SEATING DIMENSIONS

DESCRIPTION	MORRIS MINOR			
	Two-seater	Four-seater	Saloon (Fixed Head)	Saloon (Sliding H'd)
	in.	in.	in.	in.
Width of Front Doors ...	26	25½	32	32
Width of Rear Doors ...	—	—	—	—
Floor to Roof	44	47	47	46
Front Seat Cushion to Roof	37	36	36	35
Rear Seat Cushion to Roof ...	—	33	34	34
Width over Front Seats ...	40	42	40	40
Width over Rear Seats ...	—	42	41	41
Height of Front Cushion ...	9	9	10	10
Height of Rear Cushion ...	—	14	14	14
Depth of Front Cushion ...	21	20	20	20
Depth of Rear Cushion ...	—	16	17	17
Height of Front Squab ...	22	18	18	18
Height of Rear Squab ...	—	19	19	19
Legroom (Front) Max. ...	40	40	40	40
Legroom (Front) Min. ...		34	34	34
Legroom (Rear) Max. ...	—	34	34	34
Legroom (Rear) Min. ...				
Sliding Roof Opening (Length)	—	—	—	14
Sliding Roof Opening (Width)	—	—	—	29
Overall Height	60	60	61	61
Overall Length (Grid closed)	118	118	121	121
Overall Width	51	51	51	51
Unladen Weight of Car (in cwt. and qr.)	10—3	11—2	12—1	12—2

Morris Minor Running Costs

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

Actual Running Costs

	£	s.	d.
Petrol @ 47½ m.p.g.	17	7	4
Oil @ 1000 m.p.g.	3	8	0
Set of 4 tyres and 1 tube	5	14	6
	£26	9	10

Total cost per mile=.53d.

Standing Charges

	£	s.	d.
Interest on Capital @ 5%	6	5	0
Taxation	8	0	0
Insurance	11	5	0
Depreciation 1st half year @ 15%	18	15	0
,, 2nd ,, ,, @ 12½%	15	12	6
Cleaning, Repairing, Overhauling	15	0	0
	£74	17	6

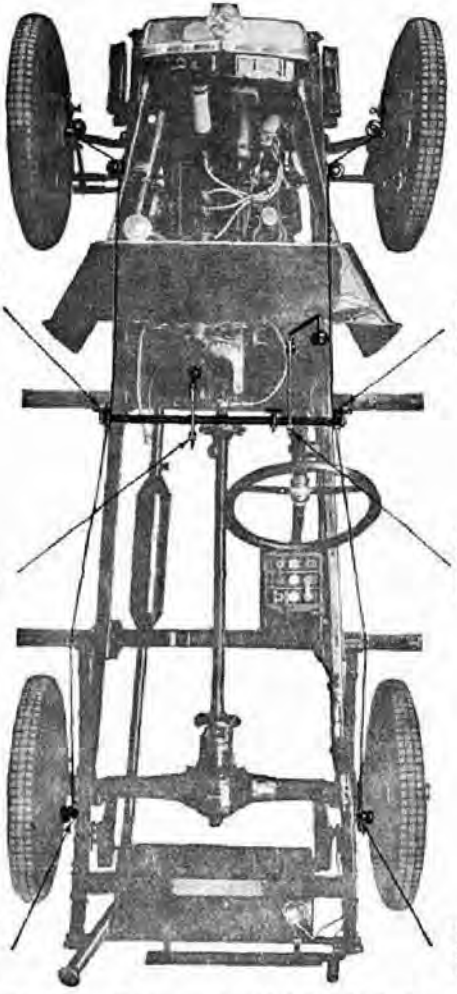
Total cost per mile=1.497d.

Total cost of running car for 12,000 miles=2.027d. per mile.

Based on the following prices :—

	£	s.	d.
Petrol (per gallon)		1	4½
Oil (per gallon)		5	8
Tyres (3.5–19) (each)	1	7	0
Tubes (3.5–19) (each)		6	6

The Brake Adjustments



Here are shown the adjustments provided for the brakes. The four-wheel brakes are equipped with individual adjustments so that they may be accurately balanced, and all four can be taken up simultaneously to compensate for wear by means of main turnbuckle adjustments indicated.

Morris Minor Brakes

GENERAL DESCRIPTION

Brakes on all four wheels.

Foot-operated brakes act on all four wheels.

Operating Mechanism. Foot pedal, cross rocker shaft, adjustable cables, camshafts and levers. Pull-rod connects foot pedal with cross shaft.

Diameter of Axle Brake Drums, 8".

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), $7\frac{1}{2}" \times 1"$ and $\frac{3}{16}"$ thick.
Rear (two halves), $7\frac{1}{2}" \times 1"$ and $\frac{3}{16}"$ thick.

Brake Cables. Special rust proof multi-stranded steel. Tested to 2,000 lb. pull.

Brake Rocker Cross Shaft. Heavy gauge tube underslung on chassis frame and secured on stout 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 lubricators.

Hand Brake operates on all four wheels.

Operation. Centrally placed hand brake lever and rods.

Advantages

The design of the Morris Minor 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. Friction losses are reduced to a minimum, and the cables being outside the chassis frame are immediately accessible.

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.

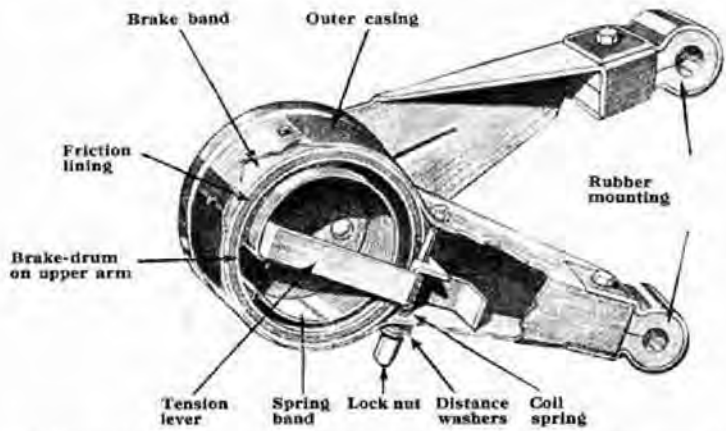
4. The friction linings are of generous dimensions, thus ensuring longevity.

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 components.

Electrical Equipment

LUCAS 6-VOLT EARTH RETURN

Ignition.—By coil and battery.

Coil.—Type 4Q6.

Distributor.—Type DJ4 (anti-clockwise).

Lighting and Starting.

Dynamo.—Type C45E (clockwise). Gives full or half output according to position of charging switch.

Starter.—Type M35A (anti-clockwise).

Battery.—Type STW9E. Capacity, 51 amp. hours.

Cut-out and Fuse.—Type CF3.

Instrument Panel.—Type C/A1331 incorporates lighting, charging, and ignition switches, ammeter and coil ignition warning lamp. Panel illuminated by a festoon dashlamp.

Ignition Warning Lamp Bulb.—Type No. 252MES. Lucas screw-cap type. 2.5 volts, 1.6 watts.

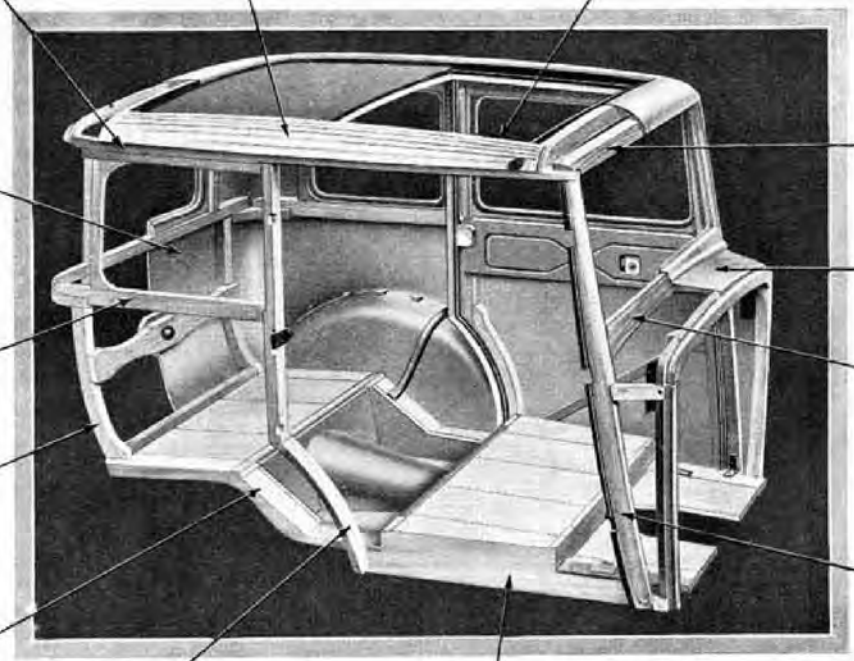
Headlamps.—Type RG8SF. Main bulb No. 612LGD, Pilot bulb, B.A.S. No. 8S. 12 watts.

Tail-lamp.—Type T101. Bulb, B.A.S. No. 8S, 3 watts.

Dashlamp.—Type D5. Bulb, B.A.S. No. 8S, 3 watts.

Electric Horn.—Type M11. Motor driven type.

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



Morris Minor Body Construction

MINOR TWO-SEATER, TOURER, SALOON AND VAN

Body Framing

The timber from which the pillars and rails of the framing of all Morris Minor 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 shut 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 foot well 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 bucket seats 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 cant 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. Cross-rails, shaped to the camber of the roof and known as head-sticks, are supported at each end of the cant rails and themselves support the roof laths, which, in turn, support the outside covering material in the case of fixed roof models. Sliding head models are fitted with the Pytchley 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 assembled together in jigs, to eliminate the risk of errors due to the human element.

Panels

The outside panels of the Morris Minor Tourer are of No. 22 I.W.G. steel, and those of the Saloon of No. 20 I.W.G. steel. The latter are formed to shape in presses, completely finished and assembled into four 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 belt 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 interlocked. 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 plyboard panels covered with leathercloth, and are immediately detachable by the removal of the fixing screws.

Fittings

The windscreens are built up from brass channel and tubular members chromium finished and glazed with $\frac{1}{4}$" Triplex safety glass, which is bedded in rubber under pressure. The door and quarter glasses of the Saloon are $\frac{3}{16}$" Triplex glass and the door-windows are raised or lowered by a quadrant-type regulator riveted to a pressed metal garnish rail and operated by the interior 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.

Van Body

The framing of the van body is built on the same principles as the other models. The shaped panels are of No. 22 I.W.G. sheet steel, and the flat panels 4 mm. Plymax, which is three-ply board faced with lead-coated sheet steel, giving a stiff panel with a dead flat surface. The interior is painted a light stone colour, and the outside is coated with shop grey. This is intended as a protective coat until the van is painted to the purchaser's choice, which must be done before the vehicle is put into regular use.

Equipment

MORRIS MINOR SALOON (SLIDING HEAD)

Two combination head and 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.
Two quarter-lights—Triplex.
Pytchley sliding head.
Polished instrument board.
Two doors with safety catches.
Lucas rear vision mirror.
Speedometer.
Oil gauge and ammeter. Ignition warning light. Summer and Winter charging switch.
Electric petrol gauge on dash.
Jet control. Slow-running control. Ignition timing control.
Electric horn with push-button under steering wheel and with dimming switch.
Screen-wiper, suction operated.
Spare wheel at rear of car.
Pressure chassis lubricating oilgun.
Armstrong shock absorbers for front and rear axles.
Licence holder.
Chromium finish on all external bright parts.
Two independent front bucket seats, adjustable.
Complete tool kit, tyre pump and jack.
Carpet mats for front and rear compartments.
Pockets in doors.
Rear blind with remote control.
Rear safety petrol tank with automatic petrol lift.

MORRIS MINOR SALOON (FIXED HEAD)

Two combination head and 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.
Two quarter-lights—Triplex.
Polished instrument board.
Two doors with safety catches.
Lucas rear vision mirror.

Speedometer.
Oil gauge and ammeter. Ignition warning light. Summer and Winter charging switch.
Jet control. Slow running control. Ignition timing control.
Electric horn with push-button under steering wheel and with dimming switch.
Screen-wiper, suction operated.
Electric petrol gauge on dash.
Spare wheel at rear of car.
Pressure chassis lubricating oilgun.
Armstrong shock absorbers for front and rear axles.
Licence holder.
Chromium finish on all external bright parts.
Two independent front bucket seats, adjustable.
Complete tool kit, tyre pump and jack.
Carpet mats for front and rear compartments.
Pockets in doors.
Rear blind with remote control.
Rear safety petrol tank with automatic petrol lift.

MORRIS MINOR TWO-SEATER

Two combination head and sidelamps. One tail-lamp.
Single-piece windscreen—Triplex (fixed).
Two sidescreens.
Best quality waterproof hood with hood bag.
Polished instrument board.
Two doors with safety catches.
Lucas rear vision mirror on windscreen pillar.
Speedometer.
Oil gauge and ammeter. Ignition warning light. Summer and Winter charging switch.
Jet control. Slow-running control. Ignition timing control.
Electric horn with push-button under steering wheel and with dimming switch.
Electric petrol gauge on dash.
Screen-wiper, suction operated.
Spare wheel carried on boot of car.
Pressure chassis lubrication.
Armstrong shock absorbers for front and rear axles.
Licence holder.
Chromium finish on all external bright parts.
One-piece front seat, to accommodate two persons, with hinged back, giving access to rear boot of car.
Complete tool kit, tyre pump and jack.
Rear safety petrol tank with automatic petrol lift.

MORRIS MINOR OPEN TOURER

Two combination head and sidelamps. One tail-lamp. One instrument board light.
Two-piece windscreen—Triplex. Top panel made to open.
Four sidescreens with wicket panels for forward pair.
Hood and hood bag. Polished instrument board.
Two doors with safety catches.
Lucas rear vision mirror on windscreen pillar.
Speedometer.
Oil gauge and ammeter. Ignition warning light. Summer and Winter charging switch.
Jet control. Slow-running control. Ignition timing control.
Electric horn with push-button under steering wheel and with dimming switch.
Screen-wiper, suction operated.
Electric petrol gauge on dash.
Spare wheel at rear of car.
Pressure chassis lubricating pump.
Armstrong shock absorbers for front and rear axles.
Licence holder.
Chromium finish on all external bright parts.
Two independent front bucket seats, adjustable.
Complete tool kit, tyre pump and jack.
Safety rear petrol tank with automatic petrol lift.

MORRIS 5-CWT. VAN

Two full-width rear doors with oval lights in each.
Body carrying capacity—5 cwt.
Triplex glass screen—single panel, adjustable.
One sliding window in each door—with locking catch.
Spare wheel carried on near-side door.
Two combination head and sidelamps. One tail-lamp. One instrument panel light.
External rear vision mirror mounted on door pillar.
Two-level petrol tap.
Speedometer.
Oil gauge and ammeter. Ignition warning light. Summer and Winter charging switch.
Jet control. Slow-running control. Ignition timing control.
Electric horn with push-button under steering wheel combined with dimming switch.
Screen-wiper, suction operated.

Pressure chassis lubricating oilgun.
Armstrong shock absorbers for front and rear axles.
Licence holder.
Chromium finish on all external bright parts.
One bucket seat for driver.
Full kit of tools, tyre pump and jack.
Finished with grey priming coat and ready for painting.

A Morris Minor chassis ready for delivery.

MORRIS MINOR CHASSIS

Four wings. Spare wheel, complete with tyre. Running-boards.
Instrument panel, complete with speedometer. Oil gauge and ammeter. Ignition warning light. Summer and Winter charging switch.
Jet control. Slow-running control. Ignition timing control.
Electric horn with push-button under steering wheel, and dimming switch.
Electric petrol gauge on dash.
Armstrong shock absorbers for front and rear axles.
Plymax dash. Dash shroud. Scuttle frame front member with bonnet rest fitted. Splasher.
Two combination head and sidelamps with dimming switch. One tail-lamp.
Battery.
Bonnet ledge.
Front and rear number plates.
Full kit of tools, tyre pump and jack.
Bonnet fitted to chassis, complete with fasteners.
Pressure chassis lubricating oilgun.

The Power Unit

GENERAL DESCRIPTION

The Engine Unit.—Four-cylinder water-cooled engine (thermo-syphon), side valves operated by side camshaft, driven from the forward end of the crankshaft by means of duplex roller chain.

Bore 2·2435". Stroke 3·268", 51·68 cub. in.
" 57 mm. " 83 mm., 847·1 c.c.
R.A.C. rating, 8·05. B.H.P. at 1,000 r.p.m. = 5·25. B.H.P. at 2,000 r.p.m. = 11·5. B.H.P. at 4,000 r.p.m. = 19.
Compression ratio, 4·9 to 1.
Sump capacity, 4 pts.
Valve timing with tappet clearance ·003", inlet opens 6° after T.D.C. Inlet closes 40° after B.D.C. Exhaust opens 46° before B.D.C. Exhaust closes 6° after T.D.C.
Ignition—coil, $2\frac{7}{8}$" before T.D.C. Full advance. 6 volt.
Flywheel circumference, 31". 11·6° per in. of circumference.
Cooling system, thermo-syphon. Radiator capacity, $7\frac{1}{2}$ pts. Water capacity of block, $3\frac{1}{4}$ pts. Total in system, $10\frac{3}{4}$ pts.
Forced feed to all white-metal bearings.
Weight of engine, including clutch and less gearbox, 209 lb.

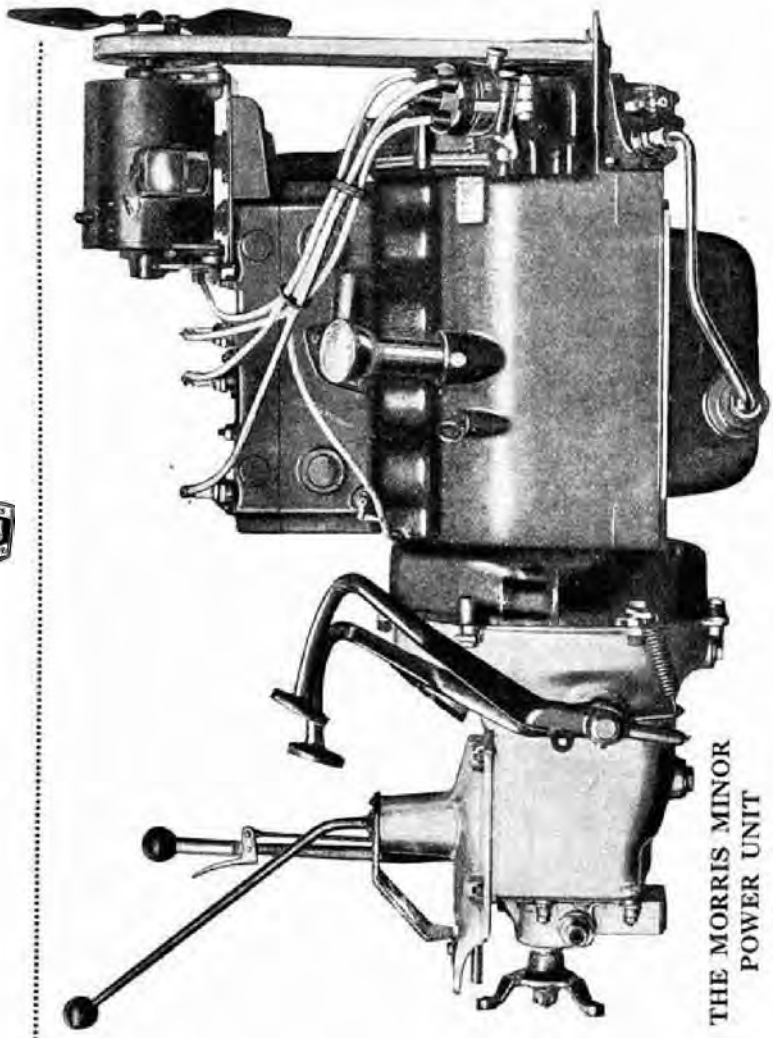
Cylinder Block.—Combined crankcase and cylinders of cast iron. Bores honed finish. Graded by ·0005", Z being greatest, Y normal, and X small.

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 90° round each gudgeon pin boss and for a distance of $\frac{2}{16}$" below the gudgeon pin centre line and $\frac{3}{16}$" above. The grading of the piston and cylinder is such as to give ·003" working clearance on diam.

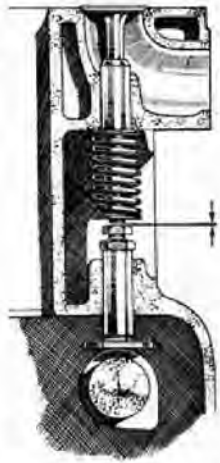
Weight of the three scarf-jointed rings, i.e. two pressure and one scraper, plus one gudgeon pin = 1 oz. 14 dr. to 2 oz.



THE MORRIS MINOR
POWER UNIT

Gudgeon Pins.—Case-hardening 5% nickel steel. Tensile, 50 to 80 tons per sq. in. max. $\frac{9}{16}$" + ·000 "; − ·0004" dia.
Ground and lapped. Weight, 1 oz. 6 dr.
Held in connecting rod by $\frac{1}{4}$" diam. 3% nickel pinch bolt.

Crankshaft.—0·50% carbon steel. Tensile, 45 to 60 tons per sq. in. Weight, 11 lb. 12 oz. Dynamically balanced. Ground on journals and pins.



The valve operating mechanism of the Morris Minor engine, showing the correct tappet clearance.

Front journal—R. & M. notchless ball.
Bearing type M.J. $1\frac{3}{8}$. ($3\frac{1}{2}$" × $1\frac{3}{8}$" × $\frac{7}{8}$".)
Rear journal white metal bearing.

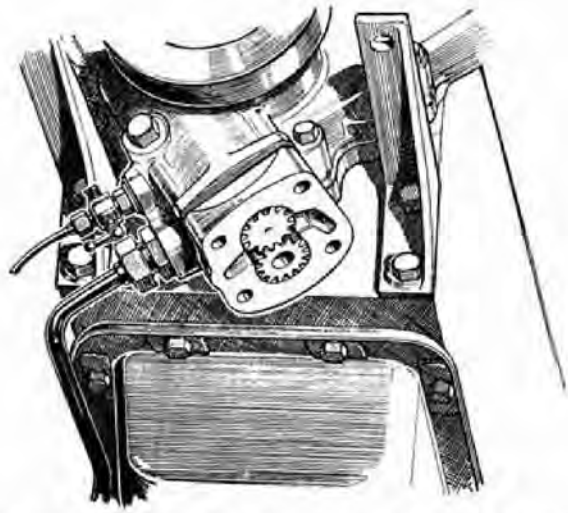
Camshaft.—Case-hardening steel. Tensile, 30 tons per sq. in. min.
Ground finish with 2 bearings.
Mounted on ball and roller bearings.

Connecting Rods.—Material, 0·4% carbon steel. Min. tensile, 35 tons per sq. in. Air Board specification, S/6.
White metal is cast direct into the rod and bored.
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 13 oz. to 14 oz.

Connecting Rod Bolts.—3½% nickel steel. Tensile, 60 tons per sq. in. B.S. 5005/402.

Valves.—5% case-hardening nickel steel. Ground. $\frac{9}{32}$" stem; $1\frac{1}{8}$" head.
Foot potash hardened in pot and quenched.

Valve Spring.—Spring steel. Rate, 71 lb. per in.



The accessible gear-type oilpump is carried low down to avoid priming troubles.

Camshaft and Auxiliary Drives.—A duplex roller chain driven from the front end of the crankshaft drives the camshaft. Hans Renolds No. 14036 $\frac{3}{8}$" pitch, 52 links. The dynamo is driven by endless belt from a pulley on the forward end of the crankshaft.

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

Fan.—Steel sheet blades on cast-iron centre mounted on dynamo spindle.

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

Lubricating System.—Full pressure system from gear pump to crankshaft front journal and crankpin bearings. Splash lubrication by overflow from crankshaft to pistons, camshaft and gudgeon pins. Other mechanisms 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 Rappa or Vellumoid.

Oil capacity, 4 pts. 3 fl. oz.

Starter.—Ratio, 8·3 to 1.

Teeth on flywheel, 83. 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.—5% case-hardening nickel steel. Tensile, 50–80 tons per sq. in. Teeth generated by grinding.

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

Main shaft spigot bearing, R. & M. roller bush R. 115 ($1\frac{15}{16}$" × $\frac{3}{16}$")

Main shaft rear bearing, R. & M. notchless ball bearing M.J. $\frac{7}{8}$" ($2\frac{1}{4}$" × $\frac{7}{8}$" × $\frac{11}{16}$").

Bushes for layshaft gears, (2) $\frac{5}{8}$" diam. × 1" grooved gunmetal.

Bushes for reverse gear, (2) $\frac{5}{8}$" diam. × $\frac{5}{8}$" grooved gunmetal.

Spigot bearing in crankshaft flange. R. & M. notchless bearing type L.J. $\frac{5}{8}$" (1·$\frac{1}{8}$" × $\frac{5}{8}$" × $\frac{9}{16}$").

Main Shaft.—Four-spline type 1 $\frac{7}{16}$" O.D. × $\frac{15}{16}$" base diam. Material, case-hardening steel. Tensile, 30 tons per sq. in. min.

First Motion Shaft.—Carries a six-spline for engagement in clutch plate centre. Material, case-hardening steel. Tensile, 30 tons per sq. in. min.

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

Speedometer Gears.—Spiral gears, 8 drives 14. Material, case-hardening steel. Tensile, 30 tons per sq. in. min. Driven gear carried in gunmetal bearing screwed for attachment of speedometer cable.

Oil Capacity.—One pint.

Gearbox Ratios.—1st, 3·5 to 1. 2nd, 1·833 to 1. 3rd, direct. Reverse, 2·833 to 1.

Universal Joint.—Fabric disc.

CLUTCH

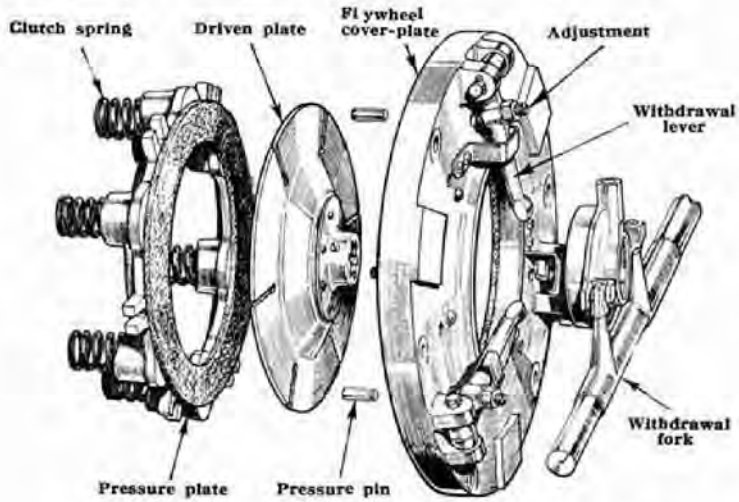
General Description.—Single dry plate loaded with six helical springs circumferentially placed and withdrawn by three toggle levers operated by means of a pedal through a withdrawal bearing carried on first motion shaft.

Bearing, $2\frac{1}{2}'' \times 1\frac{1}{2}'' \times .400''$. R. & M. double purpose bearing L.N.J.T. $1\frac{1}{2}''$.

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, 18 lb.



The component parts of the Morris Minor clutch separated to show their construction.

The Transmission

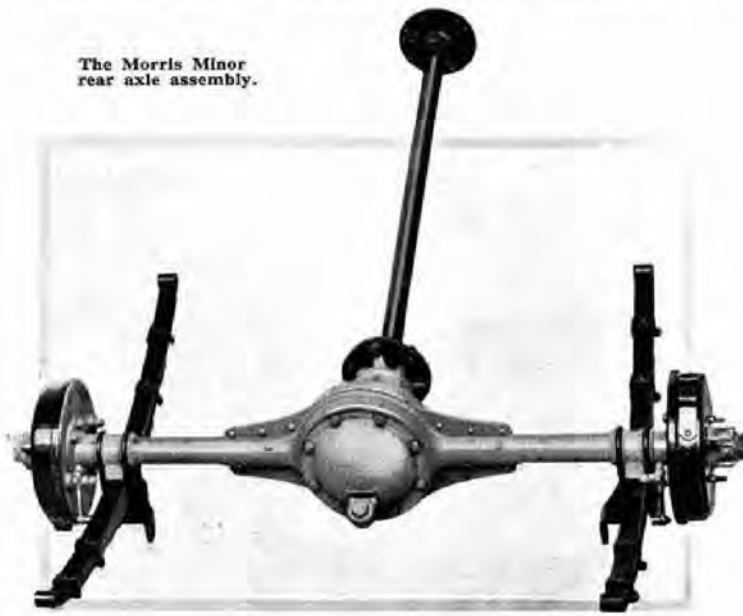
GEARBOX TO ROAD

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 cage and locating lock nuts on either end of the differential carrier.

The Morris Minor rear axle assembly.



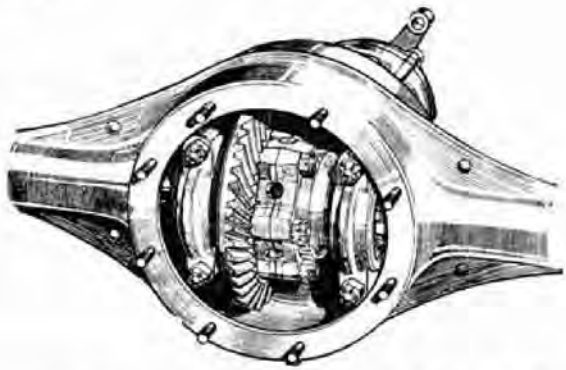
Propeller Shaft.—High tensile carbon steel tube. 1⅜" O.D. × 12 S.W.G.

Bevel Pinion and Gear.—5% case-hardening nickel steel. Tensile, 50-80 tons per sq. in. Ratio, 5·375-1. 8 teeth on pinion, 43 teeth on wheel.

Pinion Bearings.—Front, R. & M. notchless 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. notchless ball bearing L.J. 40 (80 × 40 × 18 mm.).



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

Differential Shaft.—3½% nickel steel. Tensile, 60 tons per sq. in. min. 1″ diam. B.S. 5005/402.

Rear Axle Casing.—Solid-drawn tube. ·25%-·30% carbon steel. Tensile, 30 tons per sq. in.

Oil Capacity.—1 pt.

Springs.—Material. Silico-manganese alloy.
Five main leaves, two rebound leaves.
Length of spring between eyes, 36″.
Width of leaf, 1.25″.
Offset, none.

Wheels.—19″ × 3″ wire.

Tyre Size.—3·50–19.

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. 5005/203 specification. Izod, 35 ft.-lb.
Steering centres, 21¼".

Knuckle Pins.—5% case-hardening nickel steel. Tensile, 55 tons per sq. in. ⅝" diam. Izod, 40 ft.-lb.

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

Steering Knuckles.—3½% nickel steel. Ultimate tensile, 60 tons per sq. in. Izod, 50 ft.-lb. B.S. 5005/402.

Steering Ball Pins.—5% case-hardening nickel steel. Tensile, 55 tons per sq. in. Izod, 40 ft.-lb.

The front axle assembly of the Morris Minor.

Wheel Bearings.—R. & M. notchless type ball bearing M.J. 20 (52 × 20 × 18 mm.) and L.J. 25 (52 × 25 × 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, 25·81 (free).
Width of leaf, 1·25".
Offset, 1·25".

Turning Circle.—R.H., 31' 4". L.H., 30' 6".
Tyre size, 3·50—19. Wheel size, 19" × 3" wire.

The Steering Gear

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

Worm.—Three starts. Material, case-hardening steel. Tensile, 32 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. 5005/402

The steering column and steering gear assembly of the Morris Minor.

Bearings.—Steering column top, twenty-three $\frac{3}{16}$" balls, double purpose bearing. Steering column worm bearing, cast iron bush, $\frac{3}{4}$" bore. Steering worm wheel and steering box bushes, phosphor-bronze, $\frac{3}{4}$" bore.

Chassis Frame and Road Springs

CHASSIS FRAME

Description.—Pressed steel channel. 20% carbon steel. Tensile, 26 tons per sq. in. BS. 5007/215 specification.

Dimensions.—Maximum depth, 3". Average width, 1¼". Thickness of plate, ·128".

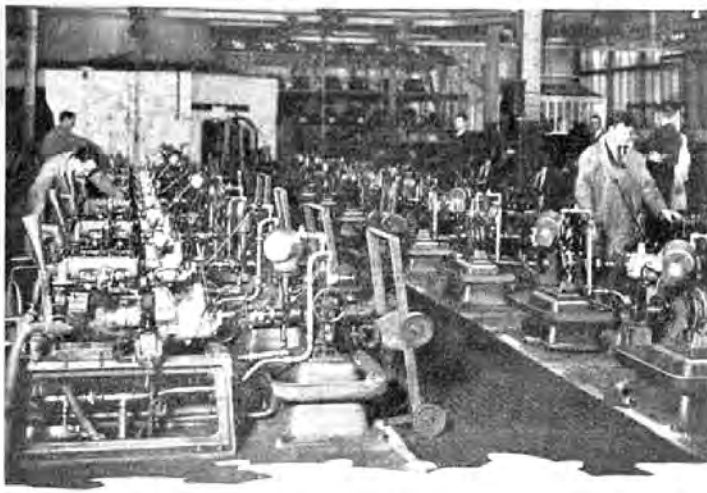
The sturdy downswept chassis frame of the Morris Minor.

ROAD SPRINGS

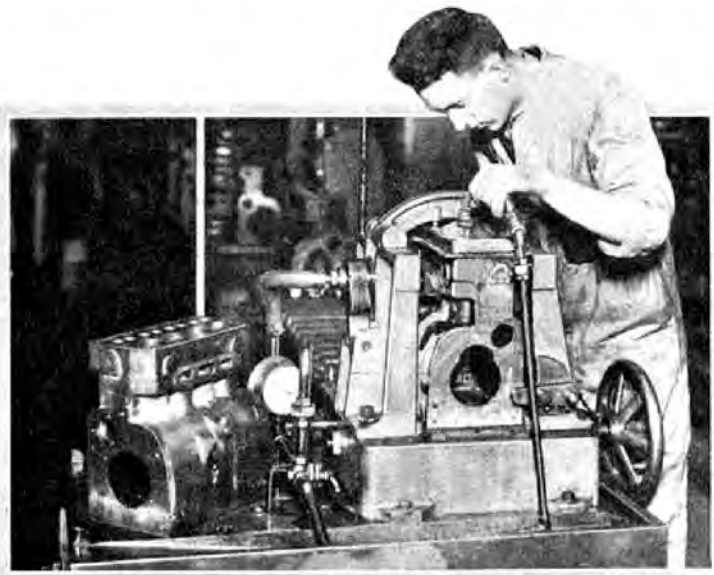
Rear (half-elliptic).
Length under load of 550 lb., 36".
Width, 1¼".
Offset, nil.
Number of leaves, five and two rebound plates.
Material, silico manganese steel. Tensile, 80/85 tons per sq. in. max.

Front (half-elliptic).
Free length 25·81".
Width, 1¼".
Offset, 1¼".
Number of leaves, five and two rebound plates.
Material, silico manganese steel. Tensile, 80/85 tons per sq. in. max.

Morris Minor Engines on Test



A corner of the Morris Minor engine test section, which is equipped with "Froude" hydraulic brakes.



Every Morris Minor cylinder block is subjected to high-pressure hydraulic test to ensure complete absence of water leaks before being assembled.

Morris Minor Production

In the production of the Morris Minor, 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.

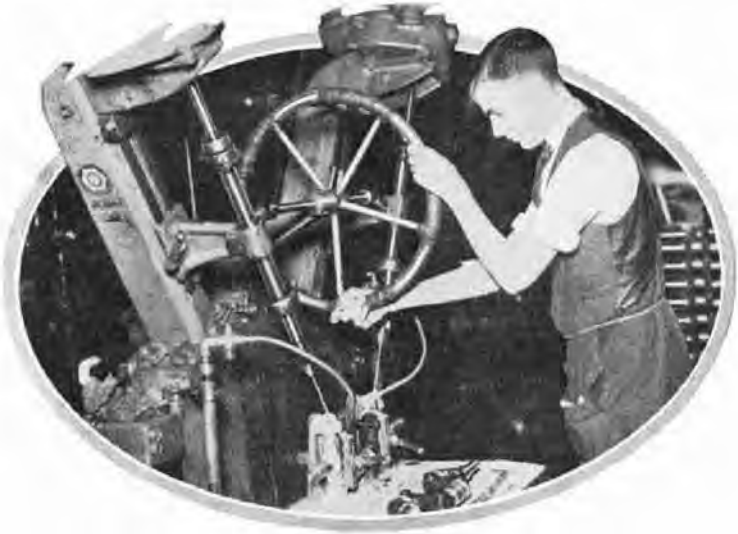
The illustration on page 33 is a general view showing some of the engine test plant with a series of Morris Minor engines on the production "Froude" water brake. The "Froude" water brake shaft is surrounded by a casing which is filled with water; on the shaft is mounted a "Froude" rotor, which consists 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 portion of the Morris Minor engine assembly conveyor on which the engines are assembled.

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.



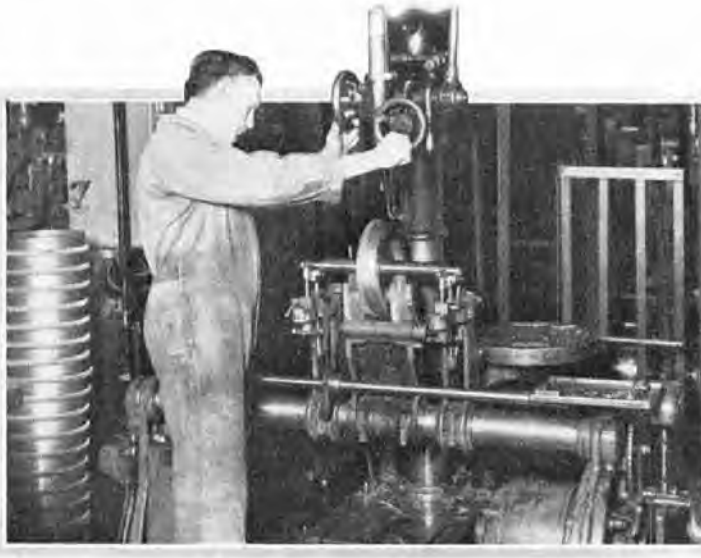
This special drilling machine is employed to drill the two long diagonal oil ducts through the crankshaft webs in a single operation.

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 despatch 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 Minor engine test shop, every engine must be capable of attaining this speed with the bronze plates at the correct setting, thus ensuring that no engine is passed out if its power output is below standard.

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

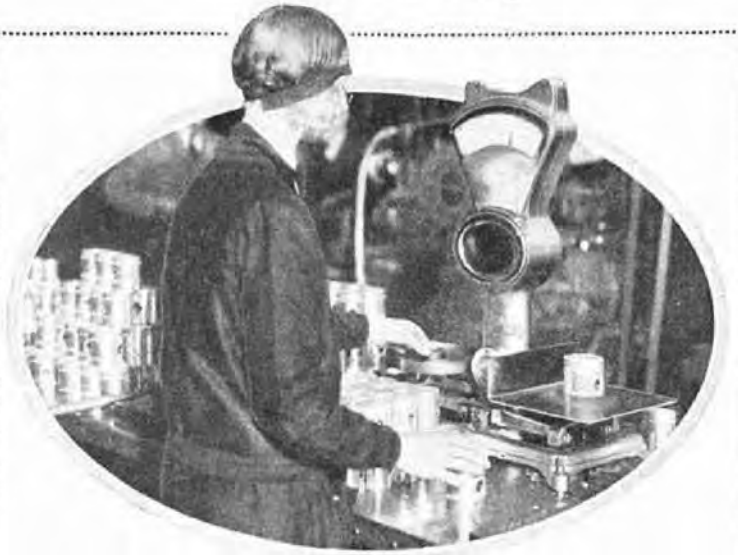


The special dynamic balancing machine and drill used for accurately balancing Minor flywheels.

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 1/2000, 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 graduation of speed and power readings up to a maximum of 4,500 r.p.m.

In order to produce an engine which has the vibrationless characteristics of the Morris Minor, 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 delicate 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 ten-thousandth part of an inch.

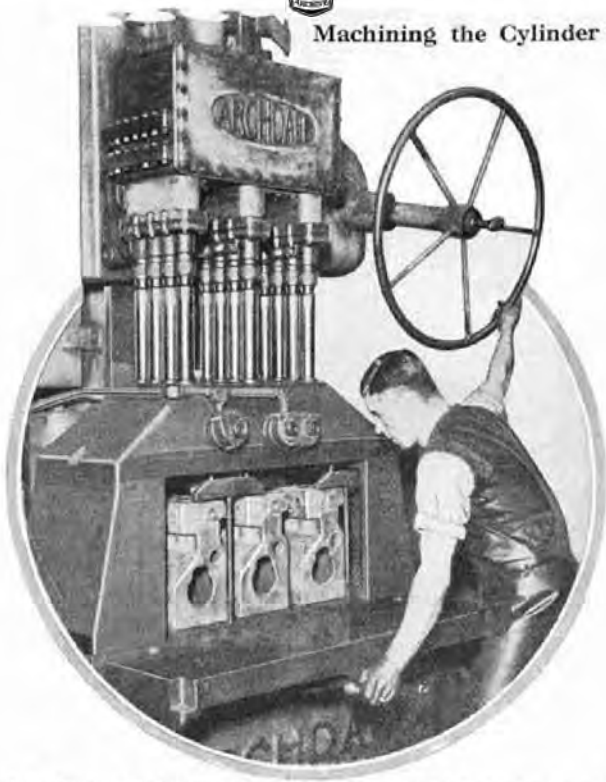
A general view of the gearbox assembly line. Here again a conveyor track and special fixtures to expedite the work are employed.

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 uniform results.

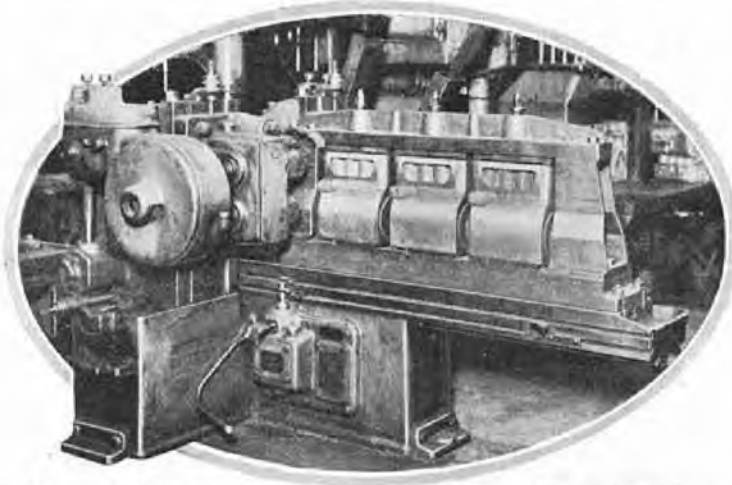
The method of boring the cylinders is shown on page 39. Three cylinder blocks are clamped in the jig by the movement of a single handle, and twelve bores are produced by one passage of the machine, against the old-fashioned method of producing bores one at a time. A similar machine finishes the bores 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 Minor cylinder blocks on the special multiple boring machine.



A close-up view of the cylinder block milling machine with a series of three cylinder blocks 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

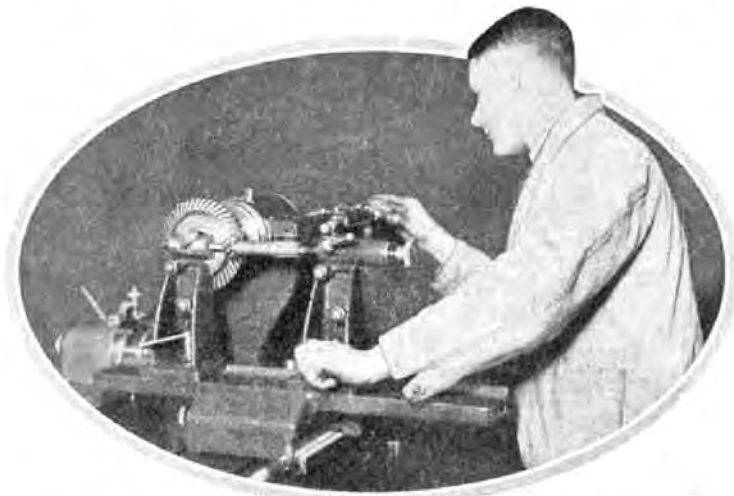
One of the special camshaft testing fixtures.

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 tool-maker 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—or inoperative portion—this fixture also reveals any lack of truth which the camshaft may possess. The valves of Morris Minor engines are thus ensured an accuracy of operation conducive to exceptional efficiency.

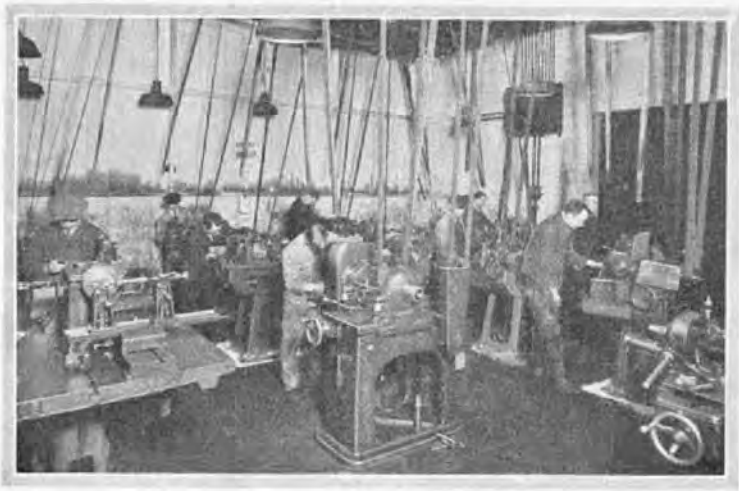
Spiral Bevel Gearing

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

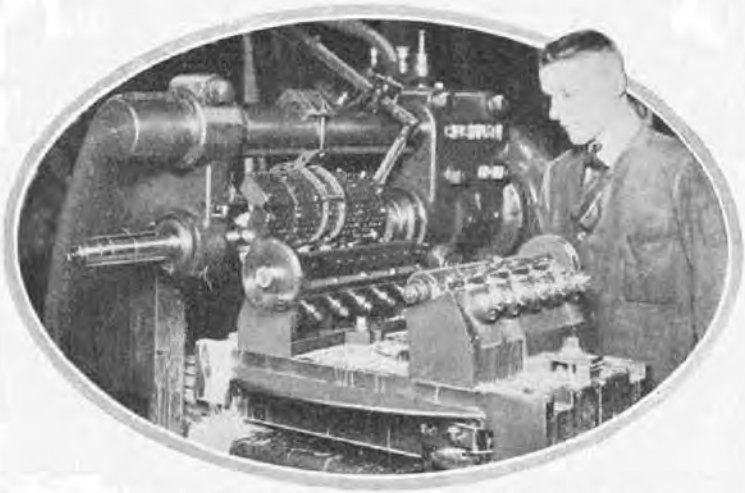


The special spiral bevel testing machine on which rear axle final drive gears are checked.

Testing Bevel Gearing

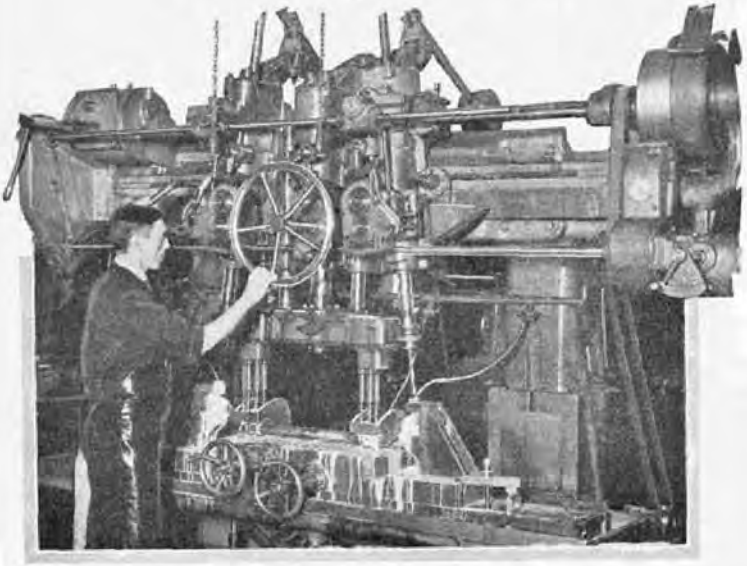


A portion of one of the silence rooms in which engine and rear axle gears are tested for silent running.

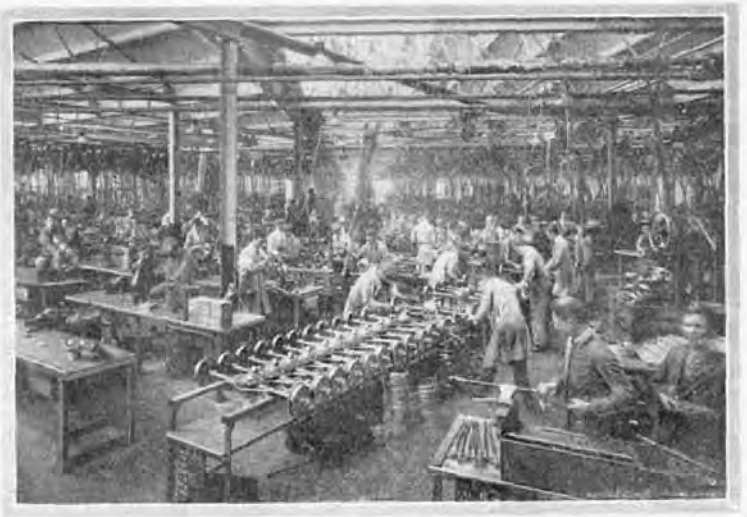


The fixture on which the differential bevel gears are cut.

Producing the Axles

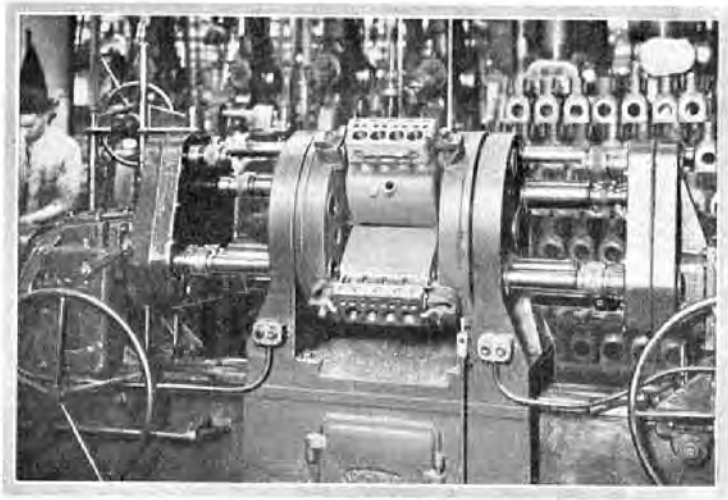


The huge special drill employed to bore the necessary holes in the front axle beam.

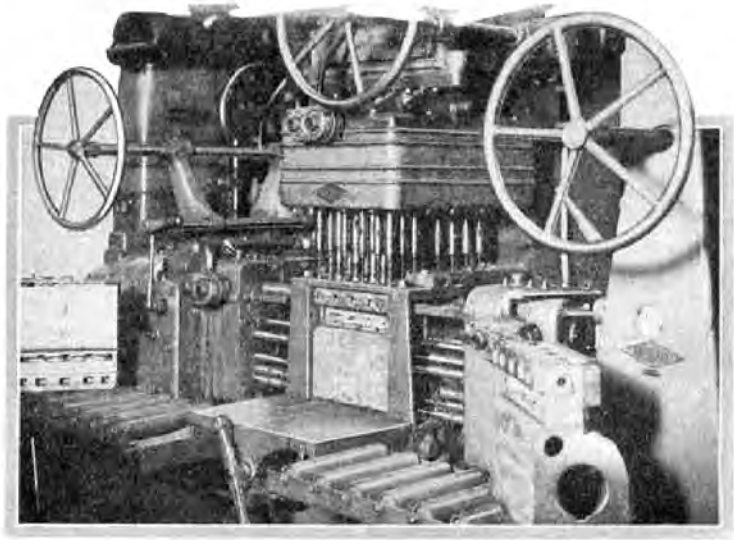


A general view of the rear axle assembly line.

Machining the Cylinder Block



The special machine which simultaneously finishes the crankshaft and camshaft tunnels of three cylinder blocks.



All the required holes in the cylinder blocks are dealt with in one operation on this highly developed multiple drilling and tapping machine.

The end of the axle assembly line, showing finished axles undergoing final inspection before being transferred to the spray painting booth.

The gearbox housing is undergoing the necessary machining operation on this specially equipped high capacity capstan lathe.

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.

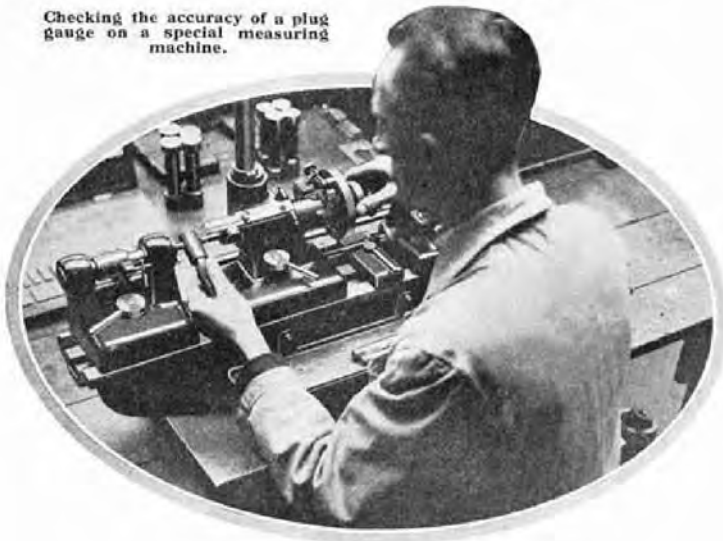
The accompanying illustrations show a plug gauge being checked, and a thread gauge. All the extremely accurate thread gauges are produced in the gauge room and the illustration below shows the operation of thread grinding.

The tool room 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.

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.