BOOK OF THE STANDARD

PITMAN

THE BOOK OF THE STANDARD CAR

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THE BOOK OF THE
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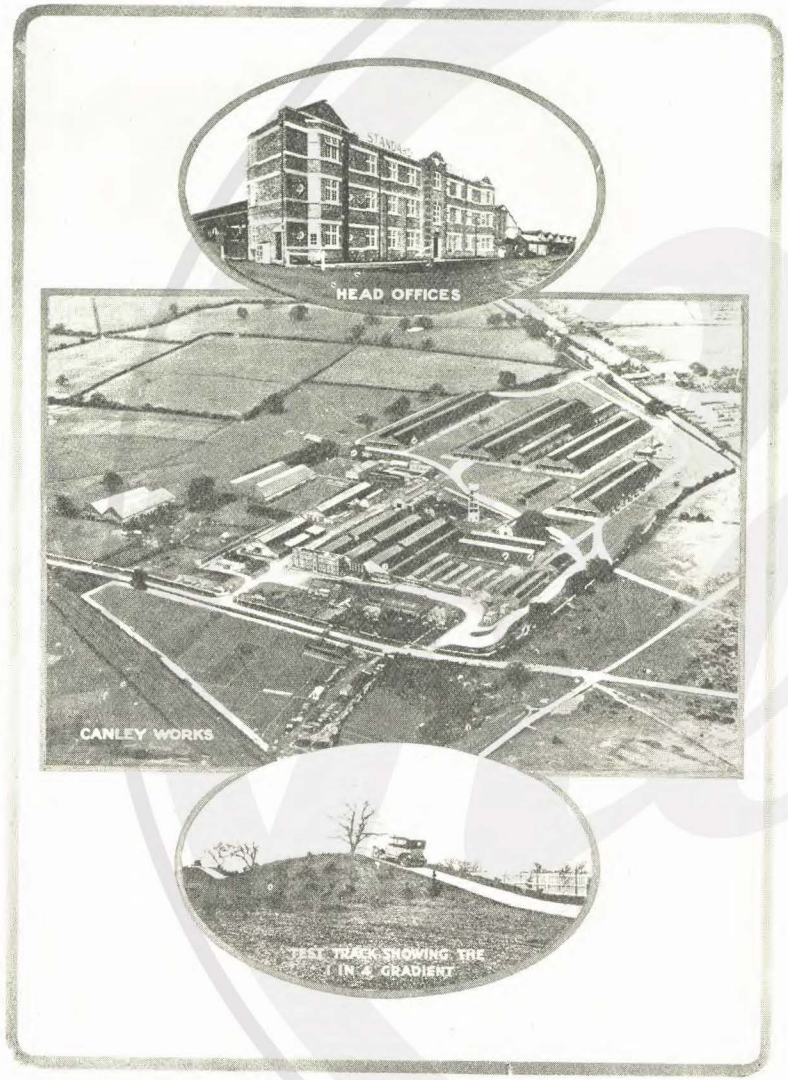


THE HOME OF THE "STANDARD" CAR.

In addition to the Canley Works, shown in the central view, where the chassis are erected and the cars completed, the Standard Motor Co., Ltd., has several more factories in Coventry where the components are made, and others where bodywork alone is constructed.

Frontispiece

THE BOOK OF THE "STANDARD" CAR

FOR THE GUIDANCE OF ALL WHO DRIVE A "STANDARD" OR INTEND TO BECOME OWNER-DRIVERS

FULLY DESCRIBES THE FUNCTION OF THE VARIOUS PARTS OF THE CAR, UPKEEP, ADJUSTMENTS, DRIVING AND MINOR REPAIRS; ALSO DEALS WITH THE LEGAL ASPECT OF MOTORING, LICENSING, INSURANCE AND TOURING

BY

"PIONEER"

LONDON
SIR ISAAC PITMAN & SONS, LTD.
PARKER STREET, KINGSWAY, W.C.2
BATH, MELBOURNE, TORONTO, NEW YORK
1925

PREFACE

THE primary object of this handbook is to present in a clear and concise form all the information which the owner of a " Standard " car, of either of the current chassis models and any type of bodywork, will need in order to ensure his being able to secure from it the maximum of satisfaction in its running at the minimum of trouble in upkeep, and the lowest possible maintenance costs. But beyond that are included sections giving information that motorists and would-be motorists in general should possess if they would be familiar with their responsibilities, with the essentials of touring, with the rules and courtesies of the road, with the broad principles of motoring law, and with many other aspects of motoring.

Although it is intended for " Standard " car owners in particular, this handbook will appeal, therefore, to motorists and potential motorists irrespective of the make of car they may use or contemplate acquiring; it is, in effect, a comprehensive work on motoring and motor upkeep, with practical advice which, specially relating to " Standard " cars, is very largely applicable to cars in general.

The author wishes to acknowledge the courtesy and assistance rendered by the Standard Motor Co., Ltd., in the preparation of this book, and would add, from his personal experience as an owner-driver of " Standard " cars, and from that of his many friends and acquaintances who also are " Standard " car owners, that the same courtesy and willingness to assist in every possible way are characteristic of the attitude of the Company and all its officials towards users of their cars.

CONTENTS

THE BOOK OF THE "STANDARD" CAR

CHAPTER I

THE "STANDARD" CAR

THE history of the "Standard" car dates back almost to the earliest days of motor manufacturing in Great Britain, and if it were written in detail would record, among other things, remarkable evidence of the consistent and ever-increasing popularity of this make of car. That is to say, from the time when the first "Standard" car was completed (in 1903) until the present day, there has never been a period during which some extension of one or other of the various factories has not been either contemplated or building. Even during the "slump" of 1920–21, factory extensions were continuously in progress; during the past few years the capacity and output of the works have increased by leaps and bounds. In 1924 approximately 10,000 cars were made.

If one reason more than another can be held to account for this consistent success it is the fact that the policy of the manufacturers has always been to cater especially for the owner-driver, to study his interests from his own standpoint, and the latter has been rendered possible because all the officials responsible for the conception, design, and manufacture of these cars have been and still are owner-drivers themselves.

Needless to say, that policy would have achieved nothing if the resulting cars had not been satisfactory in regard to reliability, efficiency, price, durability, and so on; nor could the loftiest of ideals under any head have been realized without suitable plant and works organization. But in respect of its performance characteristics the "Standard" car has an enviable reputation, while the factories in which it is made throughout at Coventry are equipped with the most up-to-date tools and embody an organization second to none.

HISTORICAL.

The "Standard" "light car," first manufactured in 1912–13, was one of the pioneers of a type that has subsequently made motoring possible to hundreds of thousands of people. Since that

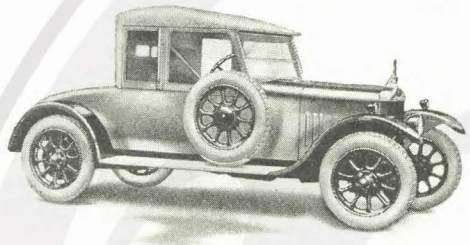


FIG. 2.—THE 11 H.P. "COLESHILL" TWO-SEATER, WITH HOOD AND SIDESCREENS IN USE.

time it has been developed almost out of recognition—apart from the distinctive outline of its radiator—and is now represented by two chassis models known respectively as 11 h.p. and 14 h.p. The

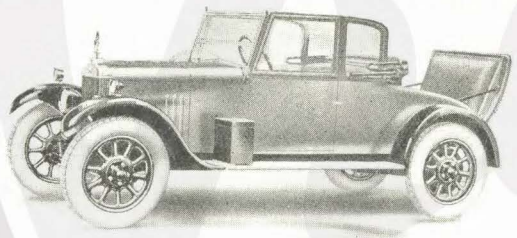


FIG. 3.—THE 11 H.P. "CANLEY" TWO-SEATER.
Showing the dickey seat open and the sidescreens erected; the latter are able to stand alone, having rigid frames quite independent of the hood.

latter has developed from the original of 1913, until it no longer falls within the light car category in motor competitions, though in relation to its seating capacity, engine size, and performance it is still a "light car."

The 11 h.p. model was introduced in 1922 to fill a niche which the development of the other had made vacant; originally known

as the 8 h.p. "Standard," it also has been increased in size and enlarged in engine dimensions, so that it more than justifies its present rating.

POWER, ROOMINESS, AND PASSENGER COMFORT.

A point to be noted here is that the rating of the "Standard" cars, 11 h.p. and 14 h.p., is no indication of the actual horse-power

FIG. 4.—SHOWING HOW THE RIGID-FRAMED SIDESCREENS OF THE "COLESHILL" TWO-SEATER AND "KINETON" FOUR-SEATER FIT IN POSITION.
The pegs indicated by arrows drop into sockets in the tops of the doors. In the other models a similar arrangement occurs, but the tubular frame of each screen is enclosed.

developed by each engine. The power which must be developed before an engine passes from the test shop, and which it possesses for car propulsion, is far and away greater than 11 h.p. in the one case and 14 h.p. in the other. Those "catalogue horse-powers," as they may be termed, merely serve to differentiate between the models and to give an indication of their rating for taxation. Hence it is not right or fair to judge of the value of any car or its capabilities by comparing its rating with that of some other make of which, may be, the catalogue horse-power represents the actual power of the engine or something akin to it.

Roominess and passenger comfort have been outstanding features of "Standard" cars from the very beginning, but never so much as at present, even when comparisons under those heads are made with cars of larger horse-power, catalogue or actual. The 11 h.p. cars, for example, are longer and wider than many others of 12 or 14 h.p., a characteristic which not only allows wider bodies with more leg room to be provided without that undesirable feature, "rear overhang," but also makes the car steadier on rough roads, not prone to rock and plunge like a small boat in a "choppy" sea

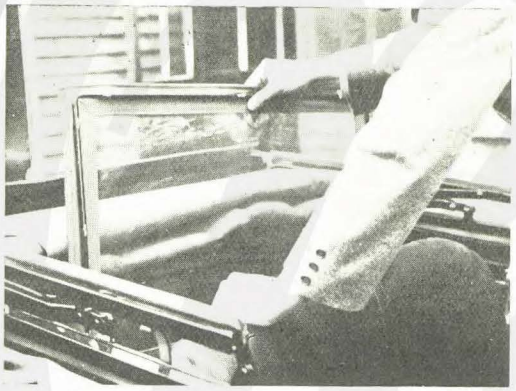


FIG. 5.—SHOWING HOW THE RIGID-FRAMED SIDE PANELS OF THE "STANDARD" CARS ARE STOWED AWAY WHEN OUT OF USE.
A locker is provided for them behind the upholstery of the main seat. The photograph is of the "Kineton" four-seater.

—a failing of so many light cars with their narrow wheel track and short wheelbase.

The dimensions of both the chassis and bodywork of the 14 h.p. "Standard" cars are similarly generous beyond the ordinary, and it is very notable that in both types, by the skill of the designers and by the use of the most suitable material at every point, the weight of the complete car is remarkably low; the advantage of the latter feature is evident in low running costs, for every additional pound or hundredweight of car calls for just as much fuel to move it, and wears the tyres as much as a similar addition in passenger weight or luggage. And here it may be added that one of the reasons why "Standard" cars in general are so popular and satisfactory is because their upkeep costs are so low in relation to their passenger capacity and other material factors.

THE TWO CHASSIS MODELS.

Although the 11 h.p. and 14 h.p. are two distinct models, they possess many features of design in common. On the other hand, where the dimensions, power, and other factors render differences in design advisable they have been embodied, and are mentioned where necessary in the following pages, with hints as to the treatment required in each case.

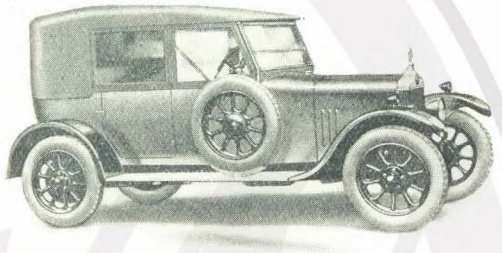


FIG. 6.—THE 11 H.P. "KINETON" FOUR-SEATER, THE "POPULAR" MODEL OF THIS SIZE, WITH HOOD AND SIDESCREENS ERECTED.

The following specification table will give a general idea of the features of design, though the details of construction remain for treatment in later sections of this handbook—

SPECIFICATION TABLE

	11 H.P.	14 H.P.
ENGINE.		
No. of Cylinders	Four	Four
Bore and Stroke (in.)	$2\frac{11}{16} \times 3\frac{9}{16}$	$2\frac{5}{16} \times 4\frac{5}{16}$
Bore and Stroke (mm.)	approx. 68 × 90	approx. 75 × 100
Cubic Capacity	1,307 c.c.	1,944 c.c.
Valves	Overhead	Overhead
Ignition	Magneto	Magneto
Water Cooling	Thermo syphon	Thermo syphon
Lubrication	Circulating splash	Pressure
Fuel Feed	Gravity	Vacuum
Electric Equipment	Two unit, 6 volt	Two unit, 12 volt
TRANSMISSION.		
Clutch	Dual plate in oil	Dual dry plate
Gearbox	Integral with torque tube	Separate
No. of Speeds	Three	Four
Final Drive	Underneath worm	Overhead worm

SPECIFICATION TABLE—(*contd.*)

	11 H.P.	14 H.P.
BRAKES.		
Hand	On rear wheels	On rear wheels
Foot	On rear wheels	On gearbox[1]
WHEELS		
Type	Hollow steel spoked	Hollow steel spoked
TYRE SIZES.		
"Kineton" and "Coleshill" models	27 × 4·40 in. balloon or 710 × 90 mm. cord	
"Kenilworth," "Canley," and Saloon models	28 × 4·05 in. balloon or 710 × 90 mm. cord	
Ordinary models and "Portland" Saloon		30 × 5·25 in. balloon or 765 × 105 mm. cord
Special models and "Pall Mall" Saloon		32 × 6·20 in. balloon or 820 × 120 mm. cord
SPRINGS.		
Type	Quarter elliptic	Semi-elliptic
STEERING.		
Type	Worm and wheel	Worm and wheel
DIMENSIONS.		
Wheelbase	8 ft. 9 in.	9 ft. 8 in.
Track	4 ft. 3 in.	4 ft. 6 in.
Ground Clearance	8½ in.	10 in.
Overall Length	12 ft. 2 in.	13 ft. 10 in. (with luggage grid 14 ft. 9 in.)
Overall Width	5 ft. 1 in.	5 ft. 7½ in.
Extreme Height (with hood raised)	5 ft. 9 in.	6 ft. 2 in.
WEIGHTS (Approx.).		
Two-seater	14¾ cwt.	20 cwt.
Four-seater or five-seater	15¼ cwt.	20½ cwt.
Saloon "Piccadilly"	17¾ cwt.	
,, "Portland"		20½ cwt.
,, "Pall Mall"		23 cwt.
GEAR RATIOS.		
Top	4·6 to 1	4·6 to 1
Third		7·72 to 1
Second	8·7 to 1	10·79 to 1
First	20 to 1	19·81 to 1
Reverse	15·8 to 1	25·81 to 1
SPEED (at 1,000 r.p.m.).		
Top Gear	18 m.p.h.	20 m.p.h.
Third Gear		11·9 m.p.h.
Second Gear	9·48 m.p.h.	8·5 m.p.h.
First Gear	4·14 m.p.h.	4·6 m.p.h.

[1] When front wheel brakes (an optional "extra") are fitted, they are operated by foot in conjunction with the brake on the gearbox.

RANGE OF COMPLETE CARS.

With two chassis models, the range of "Standard" cars comprises eleven types when the various kinds of bodywork are considered. On the 11 h.p. chassis, five different styles of bodies are fitted, while the 14 h.p. chassis is available with six body types. In both cases, however, the open two-seaters and the four- or five-seaters are duplicated, in regard to their design and the general features of construction, but with differences relating to the finish and equipment.

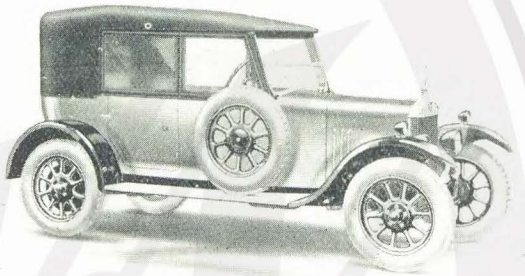


FIG. 7.—THE 11 H.P. "KENILWORTH" FOUR-SEATER.

Although resembling the "Kineton" model in its main constructional features, the "Kenilworth" has additional refinements in the all-weather hood, upholstery, and certain other features, as well as somewhat larger tyres.

The eleven complete cars are as follows—

11 H.P.		14 H.P.	
"Coleshill"	2-seater	"Leamington"	ordinary 2-seater
"Kineton"	4-seater	"Warwick"	ordinary 5-seater
"Canley"	2-seater	"Leamington"	special 2-seater
"Kenilworth"	4-seater	"Warwick"	special 5-seater
"Piccadilly"	saloon	"Portland"	saloon
		"Pall Mall"	saloon

GENERAL BODYWORK FEATURES.

The open bodywork fitted to all "Standard" cars is distinctive in the peculiarly efficient hood and side panelling. The hood framing is so constructed as to provide what is known as a cant-rail, a rigid and continuous member when extended, to form an abutment at the top for the rigid-framed side panels. Thus, unlike so many cars with side panels having enclosed metal frames for the transparent material, there is no dependence upon a flexible valance of the hood to maintain a draughtproof joint—an obvious impossibility,

in windy weather especially. In the "Standard" hood the draught seal between the hood and panels is positive, thus rendering the entry of draughts impossible; the same applies to the vertical joints between the individual panels.

The Standard Motor Co. were the originators of the rigid framed side "curtains," now almost universal on open cars, and they have constantly maintained their lead in thus affording an "all-weather" car by repeatedly improving upon the details of the design.

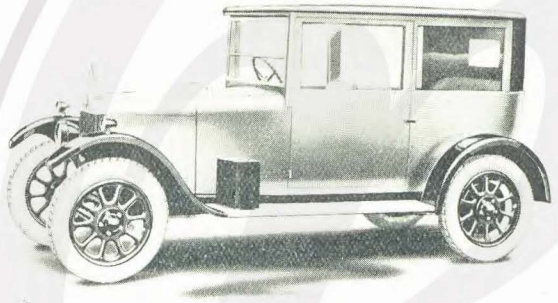


FIG. 8.—THE 11 H.P. "STANDARD" WITH THE "PICCADILLY" SALOON BODYWORK.

An exceptionally wide door is provided at each side, giving access to both back and front seats, the latter being of the folding and hinged type. Roominess and passenger comfort are special features of this popular-priced closed car.

In all models the framed side panels are readily detachable, can be stored when out of use in a special compartment behind the main upholstery, and can be used as a whole or in part to form sidescreens when the hood has been lowered; the units that are attached to the doors open with the latter, but at no point are snap-fasteners or turn-buttons required to secure any of the units —they are self-supported by projecting extensions of the framing inserted into sockets on the top of the doors or body.

All open models have sloping two-panel windscreens, of which the top half is adjustable, and all have an open-fronted locker or covered tray for small parcels, gloves, maps, etc., under the scuttle dash, the opening being at the centre of the instrument board.

THE 11 h.p. CARS.

"Coleshill" and "Canley" Two-seaters. These models differ only in regard to certain details of the hood and sidescreens, colour finish, tyre size, and upholstery; the latter, for example, is of

FIGS. 9, 10, 11.—THREE VIEWS OF THE ADJUSTABLE FRONT SEATS OF THE 11 H.P. "STANDARD" SALOON ("PICCADILLY" MODEL).

The nearside seat is shown in three positions, viz.: (1) ready for use, (2) with the back-rest hinged forward to permit access to the rear compartment, and (3) with the seat as a whole hinged forward to provide an exceptionally roomy entrance to the rear compartment.

leather in the "Canley" model, while leather cloth is used for the lower-priced "Coleshill." Both have an exceptionally roomy and comfortable front seat and two-seated dickey, the lid of the latter when open forming a back-rest with thickly-padded upholstery.

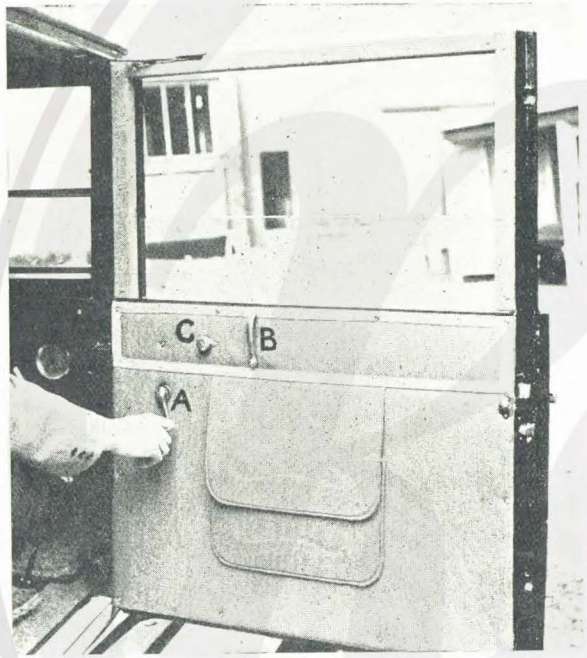


FIG. 12.—THE WIDE DOOR OF THE "PICCADILLY" AND "PORTLAND" SALOONS, RESPECTIVELY MOUNTED ON 11 H.P. AND 14 H.P. "STANDARD" CHASSIS.

A—Regulator of the frameless window, which can be completely opened or closed.
B—Inside control of the door latch.
C—Horn switch.

The equipment includes an electric lighting and engine starting set, headlamps, sidelights on the front wings, and a tail-lamp; an electric horn is provided, spare wheel and tyre, speedometer, spring gaiters, a full kit of tools and spare parts, and plates ready for the painting of the registration numbers.

Certain optional extras apply to the "Canley" model; the upholstery may be in any of five "antique" leathers, the colour finish (normally fawn with black wings) can be condor grey, blue, crimson, brown or green, while a hood cover, bulb horn, and

screen wiper are also available. The "Coleshill" is supplied by the makers only with the normal equipment and colour finish (brown with black wings), but agents are, of course, prepared to fit special accessories if required.

"Kineton" and "Kenilworth" Four-seaters. Fitted to the 11 h.p. chassis, these four-seated models differ only in the same details as the two-seaters, viz., in regard to hood material, colour finish, tyre size, and upholstery, the "Kineton" having leather cloth upholstery and the "Kenilworth" leather. In the design and construction

FIG. 13.—THE 14 H.P. "STANDARD" TWO-SEATER, "LEAMINGTON" TYPE.

This view shows the "special" model, which has certain refinements in addition to those of the ordinary model. One of these is apparent in the illustration, viz., the adjustable windscreen attached to the lid of the dickey seat.

of the body framing and upholstery no difference occurs. Comfort and roominess are remarkable in view of the size of the car, the leg room back and front, the width of the seating, and the depth of the upholstery being exceptional. The "Kineton" finish is brown and that of the "Kenilworth" fawn, the wings, wheels, etc., of both being black. The equipment is identical with that of the two-seaters, and the optional extras with the "Kenilworth" model are the same as those of the "Canley" two-seater, this statement referring also to the optional colours of the paintwork.

The "Piccadilly" Saloon. This 11 h.p. model is a noteworthy example of "Standard" car efficiency, passenger comfort, and convenience. It has ample accommodation for four adults, and entrance to both back and front seats from either side. Two remarkably wide doors are provided, both front seats are adjustable to suit the occupants' leg-reach, and have hinged backs that can be moved forward to permit passengers to enter or leave the rear of

the body. In addition, the nearside front seat as a whole is hinged to swing forward, giving an unrestricted entrance, wider than that provided on many far larger cars.

The upholstery throughout and the "ceiling" are in cloth, while the outside of the roof is covered with black waterproof material; each of the four large frameless windows, moving in silent channels,

FIG. 14.—A NEAR VIEW OF THE DICKEY SEAT OF THE 14 H.P. "STANDARD" ("LEAMINGTON" TWO-SEATER SPECIAL MODEL).
The illustration shows how the front half of the lid forms a knee-shield to which is attached an adjustable and folding windscreen.

can be raised or completely lowered by means of interior handles operating enclosed mechanical regulators. This last feature is usually found only on large and costly cars; sliding half-windows, far less satisfactory, are generally fitted to small saloons and to many others sold at higher prices than that of the 11 h.p. "Standard."

The power of the engine, in conjunction with the gear ratios and weight of the car complete, is ample for the designed passenger load; in fact, the speed, acceleration, and hill-climbing abilities of this model are cause for special remark.

Three optional colour finishes (all with black wings and black superstructure) are available, viz., fawn, blue, and crimson. The equipment and fittings include an electric lighting and starting outfit,

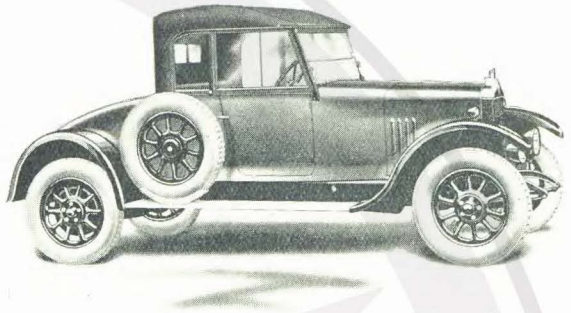


FIG. 15.—THE 14 H.P. "STANDARD" ("LEAMINGTON" TWO-SEATER ORDINARY MODEL) WITH ITS HOOD ERECTED AND SIDESCREENS IN USE.

FIG. 16.—SLIDING PANELS OF THE RIGID-FRAMED SIDESCREENS OF THE 14 H.P. "STANDARD" ALL-WEATHER OPEN CARS.
The sections of transparent material are in metal frames and slide within rubber channels, to afford adjustment for ventilation or signalling purposes.

five lamps, interior light, double-panel driving screen, electric horn, spare wheel and tyre, spring gaiters, plain number plates, a full kit of tools and spares, mats for front and back seats, tray for parcels under the scuttle dash, and curtains for the large rear window.

THE 14 h.p. CARS.

"*Leamington*" *Two-seater.* This car is supplied in two forms, known respectively as the "ordinary" and "special." So far as the body design and construction are concerned the two models are identical, the differences relating to the tyre size, equipment, colour

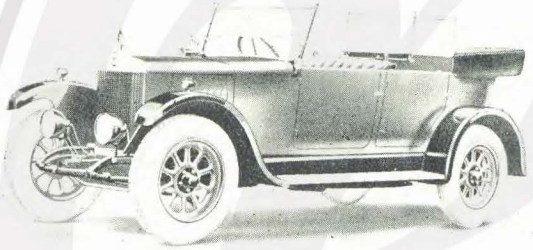
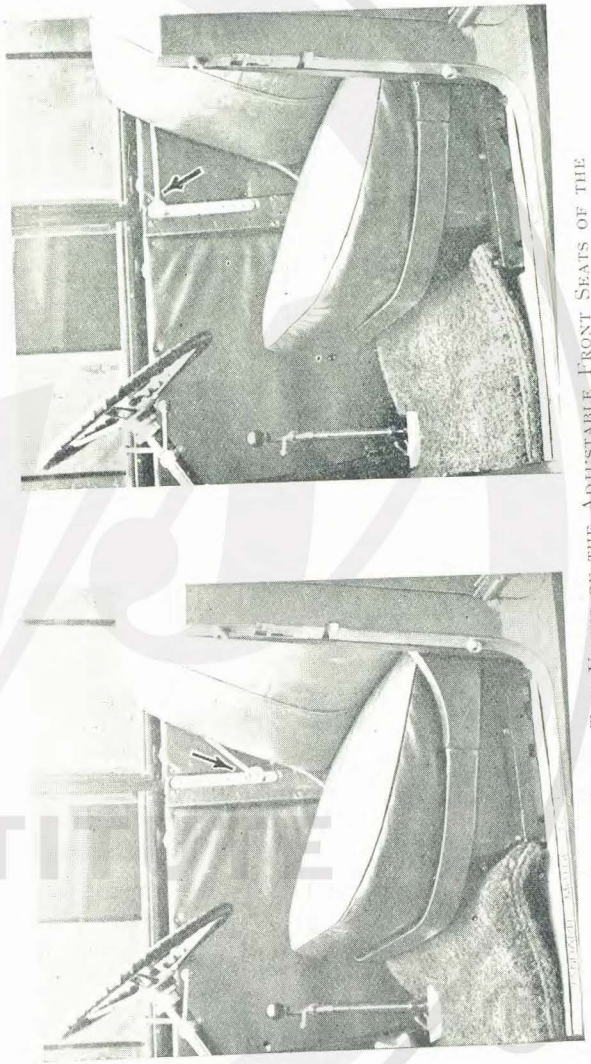


FIG. 17.—THE 14 H.P. "STANDARD" ("WARWICK" FIVE-SEATER).
The illustration shows the special model which, among other additional features, has a folding and collapsible three-panel rear screen.

finish, screen design, and upholstery. The "special" model has best quality "antique" leather, with pleated cushions and back-rest, while the "ordinary" has plain brown leather upholstery. A choice of five colours is available with the "special," fawn being the standard colour of the other model.

Both models have electric lighting and starting sets, five lamps, electric horn, speedometer, spring gaiters, spare wheel and tyre, full kit of tools and spare parts, and can be fitted with four-wheel brakes as an optional extra. The "special" model has the following additional items of equipment: driving mirror, windscreen wiper, folding windscreen for the dickey seat, roof light, bulb horn, luggage grid, and larger tyres. The side panels of the hood of both models have sliding sections of the transparent material, the rear half of each panel sliding forward for signalling purposes or ventilation.

The "boot," which encloses the two-seated dickey, has a two-part hinged lid, the front section of which, hinging forward,



FIGS. 18–19.—TWO VIEWS OF THE ADJUSTABLE FRONT SEATS OF THE 14 H.P. "STANDARD" OPEN CARS.
The arrows indicate the means for adjusting and securing the seat in any desired position within limitations.

shields the legs of the occupants; on the "special" model a glass windscreen is attached to the top edge of this lid section. The dickey seat is peculiarly comfortable and roomy, being upholstered

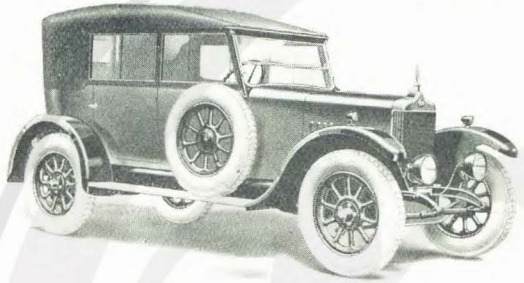


FIG. 20.—THE 14 H.P. "STANDARD" ("WARWICK" FIVE-SEATER ORDINARY MODEL), WITH ITS ALL-WEATHER HOOD AND SIDESCREENS IN POSITION.

on the same lines as the front seat, with a well-sprung cushion and padded back-rest.

"*Warwick*" *Five-seaters.* These 14 h.p. cars, like the two-seaters, are also made as "ordinary" and "special" models, identical in

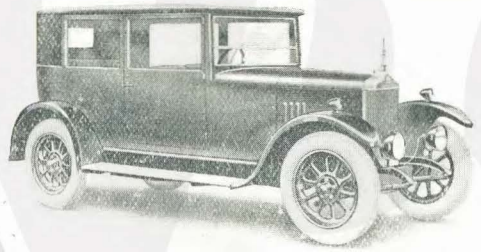


FIG. 21.—THE 14 H.P. "PORTLAND" SALOON.
A two-door model, with access to the rear compartment afforded by very wide doors and collapsible and hinged front seats.

body design and seating accommodation, but varying in regard to equipment, tyre size, upholstery, and available colours. They have roomy seating for five adults, with the front seat adjustable fore and aft, the adjustment being effected by means of a thumbscrew on each side. The "Standard" patent side panels are provided for the hood; there are two units for each side, opening with the

doors, and capable of being used as sidescreens without the hood being raised. A feature of note is that each panel has two sections of transparent material, the rear part being made to slide forward if required for signalling purposes or ventilation. The additional equipment of the "special" includes a driving mirror, rear screen of the three-panel extending type, with apron, carpets and mats, hood cover, luggage grid, roof light, and bulb horn; a selection of five colour finishes is available. Both models have a full electric equipment with five lamps, speedometer, electric horn, spring gaiters, spare

FIG. 22.—THE ADJUSTABLE, COLLAPSIBLE, AND HINGED FRONT SEATS OF THE 14 H.P. "STANDARD" ("PORTLAND" SALOON).
To secure access to the rear compartment the front seat back is folded down and the seat as a whole hinged forward.

wheel and tyre, and a parcel tray within the scuttle dash. The upholstery of the "ordinary" model is in plain leather, while the "special" has best quality antique leather with pleated cushions and back-rests.

The "Portland" Saloon. This is a two-door model, the doors being exceptionally wide and giving direct access to the front compartment; the nearside front seat can be tipped forward bodily to give entry to the rear compartment, which can also be reached from the offside by normally agile people. The offside door also affords an entrance for the driver from that side. The front

seats are of the "bucket" type, thickly upholstered and adjustable fore and aft. Interior upholstery and roof lining are in cloth, the

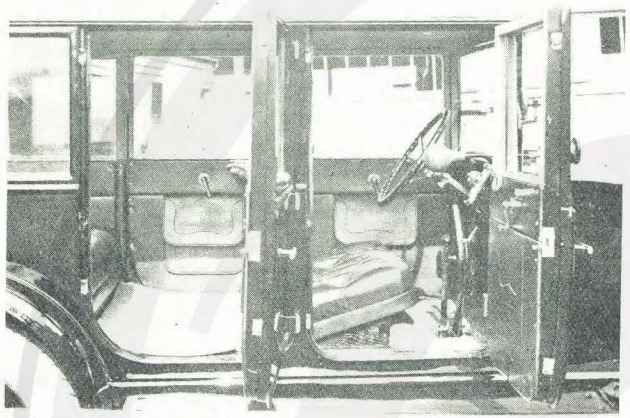


FIG. 23.—AN INTERIOR VIEW OF THE 14 H.P. "PALL MALL" SALOON.
This saloon has two wide doors at each side providing, as shown, very easy access to the front or rear compartments.

roof covering being of a black waterproof material on a light wooden framing.

Frameless glass windows in silent channels are fitted in both

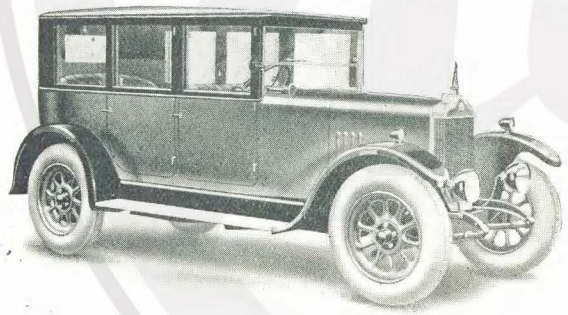


FIG. 24.—THE 14 H.P. "STANDARD" ("PALL MALL" SALOON).

doors and to the rear compartment; each one can be raised or lowered easily by means of mechanical regulators, which automatically lock the windows at any points at which they may be set.

A choice of three colour finishes is offered, viz., fawn, blue or crimson, with roof, rear quarters, wheels, and wings in black. The equipment includes electric lighting and starting, five lamps, speedometer, spring gaiters, electric horn, spare wheel and tyre, and a full kit of tools and spares.

The "Pall Mall" Saloon. As an example of luxurious saloon coachwork this is a model of which the makers may well be proud. It differs from the lower-priced "Portland" saloon in several respects, accounting for the difference in first cost and making the complete car equally good value. In the first place it has four doors, with frameless windows, controlled by mechanical regulators and moving vertically as desired in silent channels. The upholstery covering is of a superior quality, and the choice of five antique leathers or two carriage cloths is offered to purchasers. Mats and carpets are provided and also a driving mirror, bulb and electric horns, silk blinds to rear and quarter lights (the latter alongside the rear seat), screen wiper, interior light, luggage grid, 820 × 120 mm. cord or 32 × 6·20 in. balloon tyres, and a choice of five colour finishes, viz., condor grey, blue, crimson, brown or green. The roof is lined to match the upholstery, and is covered with black waterproof material. The comprehensive equipment mentioned in connection with the "Portland" saloon is also included.

CHAPTER II

LICENSING AND REGISTRATION

BEFORE a new car can be used by a private owner the latter must—

1. Secure a driving licence.
2. Pay the tax and secure the car licence, together with the registration "book" (a four-fold card).
3. Have the registration number or "identification mark" painted on plates at front and rear.
4. Fit the licence in a holder on the car.

THE DRIVING LICENCE.

The driving licence, renewable annually on or before the date specified on it, must be secured from the applicant's local authority, either the county council or county borough council; in London the authority is the L.C.C., County Hall, Westminster, S.E.1. No examination or test has to be passed, but a car driving licence cannot be secured by any person under the age of seventeen. The cost of the licence is five shillings.

A driving licence must always be carried by its holder while he or she is driving, for it must be produced upon demand made by an authorized person—a policeman, for instance, either in uniform or in plain clothes, though in the latter case the motorist can demand proof of his authority.

THE CAR TAX AND LICENCE.

The tax is payable on the basis of £1 per h.p. according to the Treasury rating, assuming that a full year's tax is paid. At certain times of the year it is of benefit to take out a part-year or short-period licence, or to pay the tax quarterly or monthly until the end of the year, for it becomes due again in any case on 1st January.

The annual tax in respect of the 11 h.p. "Standard" is £12, because its Treasury rating is 11·4 h.p., while the rating of the 14 h.p. "Standard" being 13·9 h.p., its tax is £14 per annum.

A quarterly licence can be obtained for one-quarter of the annual tax, plus a surcharge of 2½ per cent (*see* Table I). A part-year licence to the end of the year for a longer period than a quarter is obtainable for the normal proportionate figure, plus 5 per cent;

for example, in the case of the 11 h.p. "Standard," £7 7s. paid at any time in June will cover the tax up to 31st December (*see* Table II). As regards licences taken out for any period less than a quarter, to expire on the last day of the quarter, the tax is proportionate to the quarterly rate, viz., two-thirds for two months and one-third for one month. For the purposes of car taxation the quarterly periods end on 24th March, 30th June, 30th September, and 31st December.

As in the case of the driving licence, the application for the licence for a new car, and the payment of the tax, must be made to the licensing authority in the applicant's own county or county borough, though manufacturers and agents are empowered to obtain a licence and have it transferred later to the purchaser. The prospective car owner's best plan is, however, to apply to his local

TABLE I

QUARTERLY LICENCES FOR "STANDARD" CARS

Licences Expiring at end of Quarter (24th March, 30th June, 30th September, or 31st December)

MODEL.	AMOUNT PAYABLE IF TAKEN OUT ON OR AFTER:		
	1st Jan., 25th Mar., 1st July, or 1st Oct.	1st Feb., 1st May, 1st Aug., or 1st Nov.	1st Mar., 1st June, 1st Sept., or 1st Dec.
	£ s. d.	£ s. d.	£ s. d.
11 h.p.	3 6 –	2 4 –	1 2 –
14 h.p.	3 17 –	2 11 4	1 5 8

TABLE II

PART-YEAR LICENCES FOR "STANDARD" CARS

Licences Expiring 31st December

MODEL.	AMOUNT PAYABLE IF TAKEN OUT ON OR AFTER:							
	1st Feb.	1st Mar.	25th Mar.	1st May.	1st June.	1st July.	1st Aug.	1st Sept.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
11 h.p.	11 11 –	10 10 –	9 9 –	8 8 –	7 7 –	6 6 –	5 5 –	4 4 –
14 h.p.	13 9 6	12 5 –	11 – 6	9 16 –	8 11 6	7 7 –	6 2 6	4 18 –

authority for application forms for driving and car licences, fill these up, and return them with a cheque to cover the amounts due.

The form RF/1 upon which application must be made for the car licence, and incidentally for a registered number, has blank spaces in which the following, among other information, must be given: make of car, horse-power, type and colour of body, numbers of engine and chassis, where the car will usually be garaged, and the owner's name and address. If the application is made in advance of the delivery of the car, the agent or the makers will usually be able to give the engine and chassis numbers, so that the form can be completed. If the car is available, the chassis number will be found on either model stamped on a plate at the centre of the steering wheel. The engine number of the 11 h.p. car is stamped on the cylinder block at the side of the oil filler, and that of the 14 h.p. model on the crankcase, near the handle of the oil-level cock, on the offside of the engine.

THE NUMBER PLATES.

Both the car licence and the registration book or card will give the identification mark (letters and number) allotted to the car.

FIG. 25.—ALTERNATIVE PATTERNS OF IDENTIFICATION PLATES.
Letters and figures must be 3½ in. high, ⅝ in. broad, and of a total width (except Fig. 1) of 2½ in. The space between the adjoining letters and figures must be ½ in.; the top and bottom margin must be ½ in., and the side margins 1 in. Between the two rows on the "square" design there must be a space of ¾ in.

This must be painted on the number plates, back and front, before the car is used by its purchaser, for here it must be emphasized that the car must not be used by its private owner with "trade numbers," the red plates with white letters and numerals, that manufacturers and agents utilize while a car is being tested, demonstrated, collected from the factory, or delivered to the buyer. The private motorist must have black plates with white "identification marks."

Each plate and letter or numeral, the spaces between the latter, and between them and the edges of the plate must comply with

definite dimensions, though the letters may be arranged either to the left of or over the figures. Under the diagrams (Fig. 25) are the dimensions in question, and it should be noted that although the police authorities in some areas have overlooked even gross variations in the past, in other districts they are inclined to summon car owners who infringe the regulation in any respect, however small the extent.

The identification marks may be painted on the vehicle itself, instead of on separate plates, so long as they are on a flat, unbroken, and vertical surface; the latter condition renders it illegal to paint the marks on the radiator tubes or on a corrugated petrol tank, for example. Number plates with detachable letters or figures are prohibited, but cast or pressed metal plates with integral and raised letters and figures can be used. "Standard" cars are supplied with sheet metal number plates ready for the mark to be painted on in white.

REGISTRATION AND LICENSING AUTHORITIES.

The local authorities of the following county boroughs are also registration and licensing authorities in respect of cars owned within their boundaries—

Barnsley
Barrow-in-Furness
Bath
Birkenhead
Birmingham
Blackburn
Blackpool
Bolton
Bootle (Liverpool)
Bournemouth
Bradford (Yorks)
Brighton
Bristol
Burnley
Burton-on-Trent
Bury
Canterbury
Carlisle
Chester
Coventry
Croydon
Darlington
Derby
Dewsbury
Dudley
Eastbourne
East Ham
Exeter
Gateshead
Gloucester
Gt. Yarmouth
Grimsby (Gt. Grimsby)
Halifax
Hastings
Huddersfield
Ipswich
Kingston-on-Hull (Hull)
Leeds
Leicester
Lincoln
Liverpool
Manchester
Middlesbrough
Newcastle-on-Tyne
Newport (Mon.)
Northampton
Norwich
Nottingham
Oldham
Oxford
Plymouth
Portsmouth
Preston (Lancs)
Reading
Rochdale
Rotherham
St. Helens (Lancs)
Salford
Sheffield
Smethwick
Southampton
Southend-on-Sea
Southport
South Shields
Stockport
Stoke-on-Trent
Sunderland
Tynemouth
Wakefield
Wallasey
Walsall
Warrington
West Bromwich
West Ham
West Hartlepool
Wigan
Wolverhampton
Worcester
York

Motorists resident in any of those boroughs should apply to the car licensing department at the borough offices. In the metropolitan area application should be made, as already mentioned, to the London County Council, County Hall, Westminster, S.E.1, not to the borough councils, nor to the Corporation of the City of London.

When the car owner does not reside in any of the county boroughs indicated above, nor within the metropolitan area, application should be addressed to the Clerk to the County Council (of Kent, Warwickshire, or whatever county is appropriate).

CHAPTER III

INSURANCE

THE motorist who drives his car on the road, even no farther than the length of a street, without having first taken out an insurance policy is extremely unwise, to say the least. His responsibilities are not confined to himself, his passengers, or his car, but relate also to the general public. His potential "third-party" risks and liabilities may be, and generally are, far more important, for at any time he may be involved in an accident resulting in his being sued for damages and condemned to pay them, irrespective of whether the fault was entirely his own or not. Evidence as to the cause of accidents and who was responsible for them is often difficult to secure; contributory negligence may be proved and a motorist ordered to pay damages and costs running into thousands of pounds, quite apart from any damage that may be done to the car, the owner, and those accompanying him.

A policy should be applied for *before* the car is delivered. The agent will probably be able to arrange emergency "cover," by telegraphing to an insurance company at the last moment if necessary, but the prospective car owner is better advised in selecting a company and writing for a proposal form well in advance of delivery, stating approximately when the car is expected, and arranging to send on the registration number as soon as it is known.

The insurance companies that handle motor risks can be divided into tariff offices and non-tariff offices. The former have mutually agreed as to the scale of premiums for cars of various values and horse-power, and comprise the majority of motor insurance companies. Non-tariff offices are independent, and may be held to include insurance brokers who issue policies backed by members of Lloyd's.

The car owner may well feel inclined to obtain literature from half a dozen offices, and compare the benefits offered and the scale of premiums. But whatever features he may favour in one or another policy he should insist upon having one in which "cover" to an *unlimited* amount is given in respect of third-party risks. In addition, it should cover accidental damage to the car, malicious damage by third-parties, fire and theft, transit and continental risks, personal accident and medical expenses, and loss of accessories

by theft, as well as third-party claims and all other risks when some person other than the owner is driving; a bonus should be given in the event of no claim being made during any one year.

It is impossible to give here all the schedules of premiums of the large insurance offices, but the "tariff" rates for "Standard" cars can be quoted. They are as follows—

INSURANCE PREMIUMS, TARIFF OFFICES

Model.	Value not Exceeding.	Premium.
11 h.p. "Kineton" and "Coleshill"	£200	£12 12 6
11 h.p. "Canley" and "Kenilworth"	£250	12 15 –
11 h.p. "Piccadilly" Saloon	£300	12 17 6
14 h.p. "Warwick" Ordinary	£350	15 15 –
14 h.p. "Warwick" Special	£400	15 17 6
14 h.p. "Leamington" Ordinary	£350	15 15 –
14 h.p. "Leamington" Special	£400	15 17 6
14 h.p. "Portland" Saloon	£400	15 17 6
14 h.p "Pall Mall" Saloon	£500	16 2 6

Special reductions of premium are made in the following circumstances—

If the policy is limited to the *owner only driving*	less 10	per cent
If the owner bears the first £5 of each claim under accidental damage section	,, 7½	,,
If the owner bears the first £10 of each claim under accidental damage section	,, 10	,,
If the owner bears the first £25 of each claim under accidental damage section	,, 12½	,,
If the owner bears the first £5 of each accident under all sections	,, 10	,,
If the owner bears the first £10 of each accident under all sections	,, 12½	,,
If the owner bears the first £25 of each accident under all sections	,, 20	,,

CHAPTER IV

PREPARING FOR THE ROAD

THERE are certain forms of attention which the car will need daily, before it is taken on to the road, unless the mileage covered since they were previously given has been quite small, and even then, if the car has been out of use for a week or two, neglect to observe certain precautionary measures may have ill effect sooner or later.

Assuming, therefore, a mileage of 200 as the daily maximum, the following points should be observed each morning or before the car is again used.

FUEL REPLENISHMENT.

The fuel tank should be replenished with any of the well-known brands of petrol, or with National benzol mixture. If petrol is used, improvement in running and consumption may be effected by adding 20 to 25 per cent of benzol, though it is safer not to make use of benzol unless some brand of repute can be obtained. "No name" motor fuels are sometimes unsatisfactory, giving rise to loss of power and reduced hill-climbing and top-gear abilities, besides being prone to foul the cylinders and sparking plugs and cause difficulty in engine-starting.

On the *11 h.p.* "Standard" cars the fuel tank is enclosed by the scuttle dash, the filling spout projecting through it in front of the screen, the feed to the carburettor being by gravity. The tank when full holds approximately 5½ gallons, and, although the petrol consumption will probably work out at nearer 40 than 30 m.p.g., it will be safer at first to assume that replenishment will be required after 150 miles have been run on country roads in undulating districts. In town work, in the case of the saloon model, and in hilly districts, the mileage between replenishments may be put conservatively at 120, though even under the worst of conditions driving experience should enable a tankful of petrol to run the car at least 150 miles. But at first, until the car has "run itself in" and the driver has gained experience, the consumption will be higher than later on. And here it may be said that driving methods have a great deal of effect upon fuel consumption.

The *14 h.p.* "Standard" has its petrol tank at the rear end of

the chassis, whence the fuel is raised by suction to the vacuum tank fixed to the front face of the dashboard, under the bonnet; from the vacuum tank the feed to the carburettor is by gravity. The main tank holds approximately 9 gallons, and as the petrol consumption may vary, according to the type of car, its load, the driving methods, route, and so on, from 25 to 35 m.p.g., it will be as well at first to make replenishments after each 200 miles.

In regard to both *11 h.p.* and *14 h.p.* models, however, it is preferable to add fuel to the tank without waiting until a definite mileage has been covered; to be on the safe side it is better to make daily use of the scaled dip rod that accompanies the car; by that means the approximate quantity of petrol in the tank can be ascertained, and a rough idea gathered as to whether there is ample to complete the run in prospect. If there is the slightest

FIG. 26.—THE DIP ROD PROVIDED WITH "STANDARD" CARS FOR GAUGING THE CONTENTS OF THE PETROL TANK.
The rod is scaled at both ends in half-gallons.

doubt, take care that the car is not stranded "miles from anywhere" with an empty tank; fill up before starting, or as soon as possible en route.

Although it does not improve the appearance of the car if carried on one of the running boards, and is inconvenient when kept on the interior floor, a spare tin of petrol is distinctly advisable. There are several possibilities that might result in the tank being prematurely emptied; a broken feed pipe, for example, a miscalculation of mileage, or a temporary failure to recollect that the tank needs replenishment—the latter being a lapse to which novices are peculiarly prone. The spare tin can be painted the same colour as the car, and should be carried on the running board, in one of the many special holders sold by car agents and accessory dealers. Preferably it should be secured by some form of lock and key.

ENGINE OIL REPLENISHMENT.

This is a form of attention to which no amount of care can be considered excessive. Lubricating oil is the life-blood of the engine, petrol being no more than its food, without which it will merely stop, suffering no harm. Lack of sufficient engine oil leads sooner

or later to serious trouble, premature wear and a lowered efficiency. For that reason it is wise to replenish the supply daily, or after each 200 miles running. Full instructions on this subject are given in Chapter XV (*see* page 108).

RADIATOR WATER.

Before taking the car on the road it should be an invariable rule to note the level of the water in the radiator, and replenish the latter if necessary. There is no need, however, to fill "up to the brim" every day; if the water is cold, and the radiator quite full, a certain quantity will issue from the overflow pipe within a few minutes after the engine is started, owing to the natural expansion of the water with a rise of temperature. The radiator can be considered full when the level, with the water cold, is approximately 3 in. below the top of the filling spout.

TYRE INFLATION PRESSURES.

If the car owner would obtain the maximum mileage-life from his tyres, he must give particular and frequent attention to the inflation pressures. This should be a preliminary to the first run on a new car, and, in addition to a daily glance at all the tyres before starting out (to make sure that none of them obviously is completely or partially deflated), a careful test of the pressures should be made weekly. It is futile to attempt to judge by mere inspection or "feel" whether the pressures are correct or not; an essential means to that end is a reliable pressure gauge. The Schrader can be recommended in preference to a gauge attached to the pump, because it gives the actual pressure in the tyre, whereas the other merely indicates the pressure in the pump while inflation is proceeding; there may be an appreciable difference between the two.

The ill-effects of under-inflation and overloading (which are much the same in the end) are serious enough when high-pressure tyres are in question; but the advisability of maintaining correct pressures is even more important in the case of balloon tyres. A fall of 10 lb. pressure in the latter may represent a reduction of 30 to 40 per cent, whereas it may be no more than 15 or 20 per cent with a high-pressure tyre. Some detailed information concerning tyre pressures for "Standard" cars is given in a later section, with advice as to how to find out the correct pressures for the individual car (*see* Chapter V, page 189).

DAILY PRECAUTIONS.

Summarizing the foregoing—

1. Replenish the fuel tank.

2. Test level of oil in engine and, if necessary, replenish the supply as mentioned.

3. Inspect water level in radiator, and add a sufficient quantity, if needed, to bring level within 3 in. of top of filler spout.

4. Note whether the tyres are normally inflated; if the pressure gauge has not been used for several days, make a precise test of each tyre and use the pump if required to restore the correct pressure.

In the case of a new car it can be assumed that the oil levels in the gearbox and back axle are approximately correct. But if it is desired to check them, instructions will be found in Chapter XV.

CHAPTER V

STARTING THE ENGINE

As a general rule the electric equipment will be used for engine-starting, but in cold weather and when the engine is "stone-cold" the starting handle may well be used as a preliminary, just to "break the oil film" between the pistons and cylinders, and thus relieve the electric starting outfit of the heaviest part of its work; all that is necessary is to push the handle in towards the engine as far as possible and give the latter two or three complete turns. Neither the ignition nor the petrol feed need be "on" while that is done.

When the supplies of petrol, oil, and water have been assured, the essential preliminaries to engine-starting are as follows when the engine is cold—

1. Turn on the petrol.
2. Set the ignition lever.
3. Set the throttle lever.
4. Switch on the ignition.
5. Close the carburettor air-strangler.
6. Press the starter switch control.

Explaining these processes—

1. TURNING ON THE PETROL.

The petrol tap of the *11 h.p.* car is at the rear of the dashboard, at the centre of the front end of the scuttle interior when looking forward from the front compartment. It is "on" when its handle is vertical, and "off" when the handle is horizontal.

On the *14 h.p.* car the petrol tap is just below the vacuum tank attached to the front face of the dashboard, under the bonnet on the offside. When the handle is vertical the petrol is "on." If the car has recently been used there will probably be more than sufficient petrol in the vacuum tank to effect a start and to run the engine for a mile or so; immediately the engine begins to run, the operation of the vacuum tank mechanism should commence automatically and continue to maintain the supply indefinitely. To ascertain whether there is plenty of petrol in the vacuum tank, the tap should be turned on and the end of the carburettor float

spindle, which projects through the lid of the float chamber, may be lifted and held up for ten or fifteen seconds; by that time petrol should overflow from the float chamber and other parts of the carburettor.

That process is known as "flooding" the carburettor, and is not necessary in the ordinary course as a preliminary to engine-starting.

To replenish the vacuum tank if it should be empty, the throttle must be closed and the engine given half a dozen turns with the

FIG. 27.—FLOODING THE CARBURETTOR.
This process is rarely needed to facilitate engine starting on the "Standard" cars, an air-strangler being provided instead. Flooding is only necessary, as a rule, in order to test whether the petrol feed is normal.

starting handle; after a pause of half a minute or so the tank will have filled. Turning the engine sets up the vacuum needed to "lift" a supply of fuel from the main tank.

2. SETTING THE IGNITION LEVER.

The function of the ignition lever will be explained later. Meanwhile it may be said that on both "Standard" models it is the lever projecting from the right-hand side of the steering column, just under the steering wheel. It is "retarded" when moved back as far as it will go without being strained, and "advanced" when pushed forward. For engine-starting it should be set approximately two-thirds advanced as a rule, though the best position often varies with the individual car, according to the "tune" of the engine, the state of the starter batteries, and other factors that may vary

from time to time; it may be better to have it fully advanced, or at half advance, but two-thirds is a good average setting.

3. SETTING THE THROTTLE LEVER.

The throttle lever is that projecting from the left-hand side of the steering column; it is "closed" when arranged as far back as possible, and "open" when pushed right forward. In its "closed" position, however, it does not actually shut the carburettor throttle completely, for on the carburettor itself is an adjustable "stop," which is set by the makers so that it holds the throttle open very slightly. That is known as the slow-running and starting position of the throttle, and when the lever under the steering wheel is brought right back it should be correctly set for engine-starting. But that is not always the case. With a cold engine in cold weather it may be necessary to move the lever forward slightly—say, one-eighth to a quarter of an inch, gauged at the knob on its end.

4. SWITCHING ON THE IGNITION.

This is a process which practically all motorists overlook at times; novices are peculiarly prone to do so. Consequently, it is not at all a bad plan to switch on after the engine has been stopped on the previous occasion of its running. There is no harm whatever in leaving the magneto switch on for any length of time; no current is wasted, because none is being generated while the engine is stationary.

The ignition or magneto switch on the *11 h.p.* "Standard" is the left-hand of two levers on the "switchboard," the latter being the circular plate carrying those two levers and a dial (the ammeter), and attached to the instrument board adjacent to the nearside front door. Over the lever will be seen the following from left to right: "D," "M," "off." When the lever points to "M" the ignition is switched on; when it points to "D" the dynamo for charging the lighting and starting batteries is switched on, *as well as the magneto*; the word "off" is self-explanatory. There is rarely need to use the "M" position; the switch may just as well be moved direct from "off" to "D," for the reason that, except on very long runs, it is distinctly advisable to take every opportunity of replenishing the batteries by bringing the dynamo into use. When, however, the ignition is to be left "on," as already suggested, as a precaution against forgetfulness on a subsequent occasion, the switch should be left at "M."

Separate switches are fitted for dynamo and magneto on the *14 h.p.* "Standard." The ignition switch is a small "tumbler" type, the extreme right of three "instruments" at the centre of the instrument board below the parcel shelf. When the knob is up the switch is "off," and vice versa.

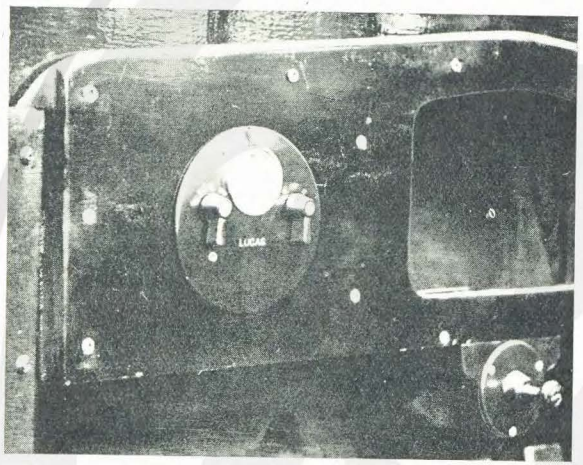


FIG. 28.—PART OF THE INSTRUMENT BOARD OF THE 11 H.P. "STANDARD."

On the left is the switchboard, with the ammeter in the centre. The left-hand switch lever affects the dynamo and magneto, the latter being "on" in the position shown. The right-hand switch is concerned with the lamps. In the lower right-hand corner of the illustration is the engine starter switch, while above it is a portion of the enclosed shelf for small parcels, etc.

5. CLOSING THE AIR-STRANGLER.

The air-strangler is a rotating valve on the carburettor which, when its control is operated, closes the main air inlet of the carburettor—shuts off the air, in other words—and so ensures a strong suction on the starting jet and a fuel mixture rich in petrol vapour. A richer mixture than is normally required is essential for starting and also for slow-running, but the carburettor automatically enriches the normal mixture sufficiently for slow-running when the throttle lever is set right back; to enrich it still further for starting, the air-strangler should be used, though another plan—universally adopted until the air-strangler was introduced—is to flood the carburettor by lifting up the float spindle (*see* "Turning on the Petrol," 14 h.p. model, page 32). The control of this fitting is a cord passing back through a hole in the instrument board to the

right-hand side of the steering column. To close the air-strangler, the cord must be pulled out as far as possible (without using undue force), and it must be held so until the engine commences to run.

6. PRESSING THE STARTER SWITCH.

With the air-strangler cord pulled out, the starter switch should be pressed and held so until the engine starts. The latter should take place within ten or fifteen seconds with a cold engine, and in two or three seconds if the engine is warm. On the *11 h.p.* "Standard" open cars the starter switch is below the centre of the instrument board, and should be pressed by the left foot; on the "Piccadilly" saloon it is at the right-hand end of the instrument board and can be operated by hand; on the *14 h.p.* model it is alongside the ignition switch, and is intended for operation with the left foot.

Immediately a start is secured (a change in the kind of sound will indicate that the engine is running under its own power) the air-strangler cord should be released, otherwise the engine will receive too rich a mixture, and sooted plugs may ensue, causing subsequent misfiring.

If the engine starts and stops again almost at once, the air-strangler and the starter switch must both be used again, and to keep the engine going on this occasion the cord may be only partially released, or even held taut, for a few seconds, just to afford a very rich mixture until the engine gets into its stride, as it were. But that additional use of the air-strangler ought not to be necessary for more than ten or fifteen seconds, and not at all except in cold weather with a cold engine.

Should the engine fail to start within a quarter of a minute or so, the effect of advancing the ignition a little more should be tried; if that does not have the desired result almost immediately, the throttle may be opened a shade. But the starter switch should not be used continuously for more than a minute at the outside, for, if the engine has not started then, it is evident that something has been overlooked or that something is amiss. Possibilities in the latter connection are dealt with in a later section (*see* page 202).

CHAPTER VI

RULES AND COURTESIES OF THE ROAD

BEFORE attempting to become proficient in any sport or pastime it is necessary to be acquainted with the "rules of the game." The same thing can be held to apply to motoring, and before the novice attempts to pilot his car on the public highway it will be advisable for him to have some knowledge of the rules and courtesies of the road.

It will not be necessary to emphasize here that, in Great Britain, drivers of all kinds of vehicles, including bicycles, must keep to their left-hand or nearside of the road when other vehicles are approaching, and that in overtaking other vehicles the latter must be passed on their right-hand or offside. In most of the other countries of the world the rule is the opposite, "Keep to the right" being enforced as compared with "Keep to the left" in Great Britain.

"CUTTING-IN."

Another important rule, only too frequently broken with consequent danger to all concerned, is that a driver must not overtake and pass another vehicle, pedestrians or bicycles, if by doing so he will get in the way of approaching traffic; he must slow down and keep behind the vehicle or road user proceeding in the same direction in front of him until the right-hand side of the road is clear of approaching vehicles, cyclists or pedestrians. No driver is entitled to leave his own, the left-hand, side of the road, if the other half is about to be used by approaching traffic. If there is any doubt as to whether the latter is far enough away for the first driver to swerve to his right and back to his left before the second is close at hand, the latter must be given the benefit of the doubt. "Cutting-in" between two converging vehicles, or road users of any kind, is forbidden by the rules of the road, no matter whether either of them is travelling at 5 or 50 m.p.h.

Another form of "cutting-in" which is undoubtedly discourteous, if not actually dangerous, consists of "taking the ground" of another driver too soon after he has been overtaken and passed. The overtaking car should not be steered to the left, directly in front of the overtaken one, until the former has gained a lead of at least

three car lengths. Failure to observe that rule has resulted in an overtaken driver swerving to his left and hitting the roadside, the swerve being made because the driver imagined, wrongly no doubt in some cases, but rightly in others, that unless he did so the passing car would hit his front mudguard or wheel.

WHEN DESCENDING HILLS.

When a car driver is descending a stiff hill and approaching him are two other vehicles, the first of the latter travelling a good deal slower than the second, the descending driver will be conforming with one of the courtesies of the road if he slows down and allows the faster of the two approaching vehicles to run wide and pass the other. He should, in other words, waive his right of way, and signal to the other man to "come on." That, at all events, should be done if it be possible by merely slowing down as distinct from stopping. But the ascending driver has no right in the matter, and he must not attempt to pass the vehicle in front of him, taking the descending car's path, unless the driver of the latter signals to him to do so.

STOPPING ON CORNERS.

A practice to be avoided, because of the danger it involves to everybody concerned, is that of stopping the car at or near more or less sharp corners—to allow one's passengers to admire the view there to be had, for instance. The danger arises from the fact that the stationary car still further impedes the vision of the drivers of other cars passing that way, and partially blocks the road just at the point, quite possibly, where two converging cars may meet, the stationary one preventing their drivers from catching sight of one another until the last moment. Even if a puncture is observed just at the corner, the car should be driven on for 100 yards or so to keep the road clear at what is, even normally perhaps, a danger point.

DRIVING AND TRAFFIC SIGNALS.

Although there is only one universally recognized driving signal (consisting of holding out the right arm when it is intended to turn to the right, across the path of approaching and overtaking traffic), the Ministry of Transport has issued a set of signals for motorists, and another for the use of police on traffic control duty, which cover practically all conditions likely to be encountered.

SIGNALS FOR DRIVERS

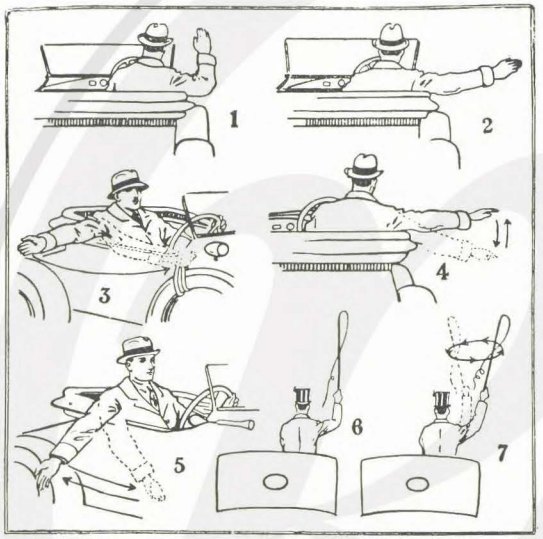


FIG. 29.—THE DRIVING SIGNALS OFFICIALLY RECOMMENDED; NOS. 3 AND 5 HAVE BEEN CRITICIZED AS BEING LIABLE TO BE MISUNDERSTOOD AND AS IMPRACTICABLE IN THE CASE OF MANY CLOSED CARS.

No. 1.—"I am going to STOP." Hold the right forearm and hand (or dummy arm) vertical, palm turned to the front.

No. 2.—"I am going to TURN TO THE RIGHT." Extend the right arm and hand (or dummy arm) horizontally straight out from the offside of the vehicle, palm turned to the front.

No. 3.—"I am going to TURN TO THE LEFT." Extend the *right* arm and hand horizontally, straight out from the offside of the vehicle, *and then carry them forward and towards the nearside with a circular sweep on a level with the shoulder.*

No. 4.—"I am going to SLOW DOWN." Extend the right arm and hand horizontally as in Nos. 2 and 3, but with the *palm turned downwards*, and move the arm slowly up and down.

No. 5.—"COME PAST ME ON MY RIGHT." Extend the right arm and hand *below* the level of the shoulder, and move them backwards and forwards.

In the case of *horse-drawn* vehicles, if the driver carries a whip, these "stop" and "turning" signals should be given.

No. 6.—"I am going to STOP." Raise the whip vertically with the arm extended above the right shoulder.

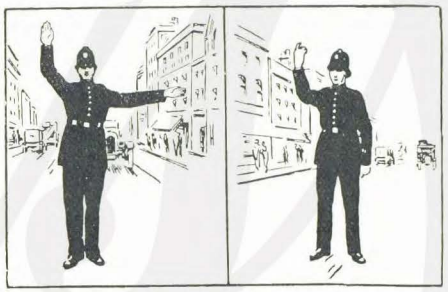
No. 7.—"I am going to TURN." Rotate the whip above the head; then incline the whip to the right or left to show the direction of the turn.

In addition to giving the above signals a driver, when approaching a corner, should point as clearly as possible with the hand or whip so that the police and other drivers may understand in which direction he intends to proceed.

OFFICIAL POLICE SIGNALS.

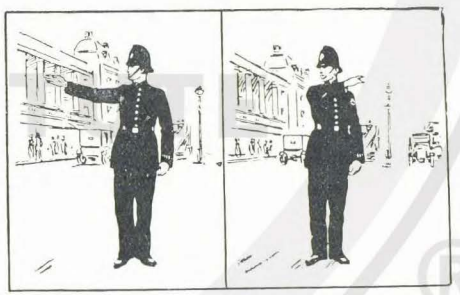
Signal No. 1.—To halt a vehicle approaching from *the front.*

Signal No. 2.—To halt a vehicle approaching from *behind.*



Signal No. 3.—To halt vehicles approaching simultaneously from front and behind.

Signal No. 4.—To bring on a vehicle halted by Signal No. 1.



Signal No. 5 (First position).—To bring on a vehicle in other circumstances.

Signal No. 5.—The finish of this signal to be used except when No. 4 applies.

FIG. 30.—THE SERIES OF SIGNALS RECOMMENDED FOR THE USE OF TRAFFIC CONTROL CONSTABLES.

These official signals are illustrated herewith and their purpose indicated in the accompanying drawings, but, as inferred above, some of the driving signals—and in certain districts some of the police signals—are more frequently honoured in the breach than in the observance. In fact, one or two of the suggested driving signals have been widely criticized; in the first place because they are liable to be misunderstood, in the second place because they resemble one of the others too closely, and in the third place because they cannot be made precisely by the drivers of many closed cars, or by those of open cars with all-weather hoods and screens.

But no matter whether a driver adopts or ignores some or most of the other suggested signals, he must not fail to observe No. 2; in other words, he must, before turning across a road to the right, invariably make quite clear to other drivers that he is about to do so, by holding out his right arm.

It must be remembered, however, that the mere holding out of the right arm does not absolve a driver from further responsibility; he must turn to the right cautiously as well, for it may be that another car travelling a good deal faster is just on the point of overtaking him. The signal must be given well in advance of the turn, so that plenty of warning is available to other drivers, both those in front and those behind.

RIGHT OF WAY AT CROSS ROADS.

Contrary to a widely held opinion, it is not the case that a main road user has full right of way and no responsibility in the avoidance of collisions at points where secondary roads cross the main highway, or where debouching roads are of a secondary character. True, the main road user *ought* to have right of way, and the responsibility referred to *ought* to be upon the user of the by-road alone. But at present the responsibility is on both parties, and in cases that have come before the courts it has been held that if the main road user does not observe caution wherever a road, even a private road, debouches, he exhibits "contributory negligence," and is therefore not only prevented from securing redress if an accident occurs, but may be ordered to pay damages to the other or a third-party.

PASSING TRAMCARS.

There is no universally recognized rule relating to the overtaking and passing of tramcars. The only point to be taken into consideration is whether the plan actually adopted in any case is safe or not,

from the standpoint of pedestrians, tramcar passengers, and road users in general.

If passengers are attempting to enter or are leaving a tramcar, a motor driver must give way to them; he must not attempt to "force his way through" on the left-hand side. Nor must he pass the tramcar on its right if by so doing he endangers or takes the path of drivers of vehicles proceeding in the opposite direction. But when safety is assured for everybody concerned, a tramcar may be passed either on the left or the right.

Great care should be taken at all times when meeting as well as when overtaking tramcars; the particular point to be observed is that some pedestrian does not suddenly appear in front of the car from the opposite side of the tram, in front of or behind the latter. And at tram stopping places a risk to be avoided is that of colliding with a passenger who has alighted from the tram and is attempting to cross behind it to reach the other side of the road.

PEDESTRIANS AND CYCLISTS.

The carelessness of a large proportion of pedestrians is the cause of a great number of accidents; often the actual delinquent (the pedestrian) is unharmed, the car driver swerving to avoid running him down and crashing into another vehicle, or off the road into a ditch. The pedestrian's greatest fault is in stepping off the pavement without first seeing whether a vehicle is approaching, and for that reason it behoves all car drivers to keep a watchful eye upon the people on the pavement, always being prepared for one of them to step suddenly into the road in front of the car. The use of the hooter is frequently no preventive; moreover, the fact that it was used does not necessarily absolve the car driver from responsibility when a running-down case occurs.

Pedestrians are entitled to the use of the road just as much as vehicle drivers; the latter are prone to imagine that pedestrians are trespassing, as it were, when they walk in the roadway. But that is not so; and where there is no footpath, a pedestrian is entitled to as much consideration and "elbow-room" as if he were a vehicle. He should be given plenty of clearance.

So with cyclists. The width of their "vehicles" is no measure of the road space to which they are entitled. For one thing, they are prone to swerve or wobble more or less in retaining their balance, and the prudent and considerate motor driver will give every cyclist at least as much room as if the latter were on a car.

When children are observed by the roadside, the car driver should

always be prepared for one or more of them suddenly attempting to rush across the road just in front of the car, no matter whether the latter has been seen or not. The one-time exceedingly popular game of a certain class of children, known as "last across," in which the winner is the child who crosses the road last before the car passes, is still in vogue in many parts of the country.

CATTLE, SHEEP, AND DOGS.

The motorist should beware of unlighted cattle and sheep on the roads at night, for the drover is not obliged by law to carry a lantern.

In overtaking or passing sheep and cattle the car driver must take every precaution against a collision with an animal, for he may otherwise be held responsible for any injury done to it. Animals of that kind are not trespassing when they are on the public highway, and although the owner may be summoned by the police if they are roaming unattended, the motorist is not absolved from responsibility if he should injure one of them, attended or unattended.

Similarly in the case of dogs. If a car runs over and kills or injures one, the driver may be held liable for damages, unless he can prove that he did all in his power to avoid contact with it.

CHAPTER VII

THE DRIVING CONTROLS

ALTHOUGH, for some reasons, it is preferable that the novice should receive personal instruction from an experienced driver, at all events on the first occasion upon which he takes his car on to the road, thousands of car owners have become proficient drivers without having had a "lesson," other than hints derived from one source or another prior to receiving the car or making ready to start for the first drive. Self-tuition is quite feasible, therefore, and unless the novice "loses his head," attempts to drive fast before he is proficient, or uses undue force in manipulating the controls, he is quite justified in "teaching himself to drive."

But obviously it is essential that he shall know "which is which, and why" in the matter of the controls, and how and when to use each of them. The hints in this and subsequent chapters are given primarily to that end, but will also, in many cases, be of assistance to the experienced driver if he has not previously driven "Standard" cars of the current models.

THE DRIVING CONTROLS.

The various controls utilized in driving consist of the following—

Clutch pedal, the extreme left-hand of the three (two large and one small), projecting through the floor boards in front of the driving seat. The purpose of this pedal is to disconnect the driving from the driven members of the clutch, the latter a frictional device which is located within the flywheel. The clutch is said to be "engaged" or "in" when the pedal is released, and "disengaged" or "out" when the pedal is pushed forward.

Brake pedal, the extreme right-hand of the three pedals; this control is sometimes called the "service" brake, implying that it is the one most frequently used. It is applied by pushing the pedal forward.

Accelerator or throttle pedal, the small one midway between the other two. It serves to open the carburettor throttle and admit more or less gas (or "mixture") into the engine, thus regulating, within limits, the power developed by the engine and its speed.

Brake lever, the longer of the two hand levers on the right of the

driver. Sometimes known as the "emergency" brake, it has a ratchet and pawl device which holds the lever in its "on" position, unless the trigger near the handle is clasped towards the latter. This is the brake that should be applied when the car is stopped, and left on until a restart is about to be made.

Gear lever, the smaller of the two right-hand levers; its purpose is to vary the relative speeds of engine and rear wheels (thus enabling stiff hills to be climbed) and to engage the reversing gears. It must

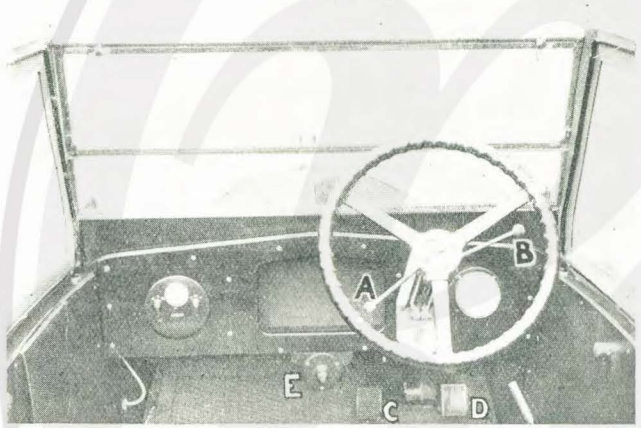


FIG. 31.—A VIEW OF THE DRIVING COMPARTMENT OF THE 11 H.P. "STANDARD" CAR FROM THE DRIVER'S SEAT.

A—Throttle lever. *B*—Ignition lever. *C*—Clutch pedal. *D*—Brake pedal. *E*—Starter switch.

Between the clutch and brake pedals is the accelerator pedal, while on the left of the instrument board is the lighting and ignition switchboard. Below the lever *B* can be seen the dial of the speedometer, while at the right-hand lower corner is the horn switch.

never be moved in a fore-and-aft direction unless the clutch pedal is first depressed, otherwise damage to the gears will be caused.

The gear lever moves within a "gate," a slotted plate with positions representing the various forward gears and the reverse. In both the 11 h.p. and 14 h.p. "Standard" cars, the reverse slot is the front one nearest the centre line of the car, on the left as the driver looks down to it. The lever cannot, however, be moved into that slot until the reverse trigger has been lifted; that trigger projects forward from the lever just below the top of the latter, and can be held up with the forefinger—or the first and second fingers—while the lever is moved first towards the left and then forward into the slot.

All the other gears are engaged without the trigger being touched, for it merely serves to prevent the reverse gear from being engaged inadvertently. The relative locations of the slots in the gate for the forward and reverse gears are shown in the diagrams on page 48, one relating to the 11 h.p. model (three speeds), and the other to the 14 h.p. car (four speeds). In referring to these diagrams and in reading subsequent chapters, it should be remembered that the first speed is the lowest (or slowest), while the third in the 11 h.p., and the fourth in the 14 h.p., are the highest or top gears. That nomenclature can be easily recalled if it be borne in mind that the first speed is the one that is *first used* when starting the car from rest.

Throttle lever, the ball-ended lever projecting from the left-hand side of the steering column under the wheel. It functions in exactly the same way as the accelerator or throttle pedal, but whereas the lever is unaffected in its range or position at any moment by the pedal, the latter cannot move back beyond a limit represented by the position of the lever. Thus the lever forms a "stop" for the pedal, preventing the throttle from closing beyond a certain point.

The object of providing both hand and foot control for the throttle is not so much to afford alternative means of operating it while the car is being driven (though on long runs it is sometimes of benefit to give the foot a rest and "drive on the hand throttle," as it is termed). The principal use of the lever is to regulate the slow-running of the engine, by forming a "stop" as just mentioned, and so to allow the driver to remove his foot from the pedal without doubt as to the engine continuing to run.

The "idling" speed of the engine—the speed at which it runs while the car is stationary with the pedal free—is therefore controlled by the throttle lever, with one reservation, viz., that on the carburettor itself is the "minimum throttle stop," consisting of a thumbscrew with a lock-nut, which prevents even the lever from closing the throttle beyond a certain point. But for the time being, the novice can ignore the minimum throttle stop and consider that the throttle is closed, i.e. at its slowest-running position, when the lever is moved back as far as it will go. When the engine is warm it ought to "tick-over" (i.e. run very slowly) with the lever thus arranged.

Ignition (or "spark") lever, the right-hand lever extending from the side of the steering column. The precise function of this lever will be explained in a subsequent chapter. Meanwhile, it will

suffice to say that it regulates the timing of the magneto spark in relation to piston movement, and that strictly speaking it should be advanced (pushed forward) or retarded (pulled back) with every variation of engine speed. But no driver gives it such precise attention as that; what he does is to keep it fully advanced (while the car is running on the road), unless he hears the engine labouring, as denoted by something like thuds at the worst or by "pinking" (a light metallic knock) when the need for retarding commences.

"Pinking" will occur if the car is driven slowly on top gear, while the engine is pulling hard with the throttle fairly wide or fully open (with the throttle pedal almost or fully depressed); when that noise is heard, the ignition lever should be retarded a little way, or perhaps half-way if the engine is running very slowly and pulling hard at the same time. Pinking is also liable to occur on any gear when a hill is being climbed, one that is steep enough to cause a reduction of engine speed.

While the car is moving the ignition lever should always be advanced as far as possible without giving rise to "pinking." When the engine is idling and the car is stationary, the lever can be appreciably retarded with advantage, for it enables the engine to run slower and with greater smoothness.

Horn switch. This is attached to the inside of the body, alongside the driver.

CHAPTER VIII

STARTING AND GEAR-CHANGING

BEFORE the engine is started the driver should be assured that the side-brake, or hand-brake, is "on" (the lever pulled back as far as it will go), and that the gear lever is in "neutral." The latter is the case when the lever is in the transverse slot of the gate and can be moved more or less freely in a lateral direction, as distinct from backwards and forwards or fore-and-aft. In that state the car cannot move and the engine can be run idly, for when the gear lever is in neutral the drive between the engine and the rear axle is disconnected.

STARTING FROM REST.

Having started the engine as described in Chapter V, the driver should leave the ignition lever advanced approximately three-quarters, and the throttle lever set right back, or nearly so; then he should first apply the pedal-brake and release the hand-brake. Keeping the foot-brake on for awhile, the clutch pedal must be depressed to its full extent and held in that position while the gear lever is moved into "first," i.e. the low, speed.

When quite ready to start, the driver must release the brake pedal and press lightly on the accelerator pedal with the right foot, thus speeding up the engine slightly and making more power available for moving the car. As soon as the engine responds to the opening of the throttle (the depressing of the accelerator) the clutch pedal should be released; not with a "bang," but gradually, so that the clutch takes up the drive smoothly and without jerk.

Some little practice will be needed to effect a smooth start. At the first two or three attempts the clutch may be too suddenly engaged and the engine stopped on that account; or the accelerator may be depressed too much or unsteadily, causing the engine to "race" and a jerky start to ensue; or, again, the natural tendency may be followed and the accelerator pedal released when the clutch pedal is released, causing the car to move forward a few inches and stop.

As a way of practising clutch operation, it is not a bad plan to make the first two or three attempts to start without using the accelerator; instead, the throttle lever on the left of the steering

column may be pushed forward ¼ in. or ½ in. to speed up the engine prior to and during the engaging of the clutch. But the adoption of that plan should merely form a preliminary test, and not be used for the actual starting of a drive; the car may be started in that way, moved a few feet, and stopped again by depressing both clutch and brake pedals, and the cycle of operations repeated three or four times, prior to an attempt to move off with clutch and accelerator pedals in use, and the throttle lever set right back.

Another good plan before the real start is made is to try the effect of depressing the accelerator pedal, noting how much or how

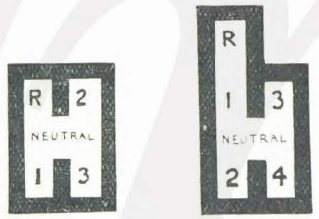


FIG. 32.—DIAGRAMS OF THE GEAR LEVER "GATES" OF "STANDARD" CARS.

The 11 h.p. (three speeds) is shown on the left and the 14 h.p. (four speeds) on the right.

R—Reverse. 1—Lowest speed. 3 or 4—Top gear.

little movement is needed to make quite a big difference in the engine speed. But the engine should not be raced unduly. If it is almost cold and "pops" are heard from under the bonnet, no great notice need be taken of them; they merely indicate a carburettor tuned for efficiency and economy, and will not occur when the engine becomes warm. They are liable to occur only if the throttle is opened rather suddenly when the engine is cold.

ACCELERATING AND PRACTISING STARTS.

Immediately the car begins to move the accelerator pedal will need to be regulated; depressing it will increase the engine and road speeds, and vice versa. Let the effect be tried of moving the pedal slowly down and up again, but, once more, the engine should not be raced; the speed should be kept for the time being below, say, 6 or 8 m.p.h. Then let the car be stopped, by pressing both clutch and brake pedals (the latter without undue force), so that another start can be made for the sake of practice. As soon as the car comes to a standstill, move the right foot back to the accelerator,

open it a shade and release (i.e. "let in") the clutch once more. Try several practice starts; keep on trying them, until they can be made with a fair degree of assurance. But remember that while the car is stationary, and is intended to remain so for awhile, the gear lever must be moved into the neutral position before the clutch pedal is released.

CHANGING "UP."

Changing gear upward, from a low to a higher gear, consists of the following series of movements, which should not be attempted until the car has been speeded up to about 8 m.p.h., if the first or bottom gear is in use—

1. Release accelerator pedal; immediately
2. Depress clutch pedal to its full extent;
3. Move gear lever from the low gear slot to that of the second speed;
4. Release clutch pedal; and immediately
5. Depress accelerator pedal gradually.

That sequence of movements should follow one another without hesitation or pause, otherwise a "good change" will not occur. If there is much hesitation the car will come to a standstill before the clutch is re-engaged (4), or the accelerator reopened (5). In that event, the gear lever must be moved back into the first speed slot (with the clutch pedal held depressed) and a fresh start made, as previously explained.

If the gear lever is allowed to remain stationary in the neutral position for even no more than three or four seconds, while movement (3) is being made, a harsh grating of gears may be heard when an attempt is made to complete that movement. In that case the novice is well advised to stop the car and start all over again; to attempt to force the second speed gears into engagement will encourage damage to their teeth.

The easiest time to practise moving the lever out of one slot, across the gate and into another slot, is before the car is taken on to the road. But the lever should not be forced from one position into another; if it will not move freely from, say, first to second or second to third, its reluctance is probably due to the gear wheel teeth being stationary and out of suitable alignment for moving into mesh.

Many drivers have acquired the knack of moving the gear lever by jacking up a rear wheel (or preferably both, scotching the front wheels so that the car cannot move forward or backward), starting

up the engine and then proceeding to engage the gears and the clutch, and performing the other operations already mentioned as though the car were on the road. The brakes must, of course, be "off," hence the reason for scotching the wheels. That plan can be recommended if any difficulty is experienced on the road, or even as an initial trial, though it should not be continued for more than a minute or two with one wheel only jacked up; nor should the engine be "raced."

Changing gear from the second to the third gear (and from that to the fourth on the 14 h.p. car) is represented by the same sequence of movements as in the case of changing from first to second; the only difference is that the car must be moving at a higher road speed when the change is attempted.

From the very beginning, gear-changing should be made *without looking at the lever or gate*. The position of the various gear slots should be thoroughly memorized beforehand, and also the necessary movements to be made with the lever in changing from one gear to another. For example, it should be remembered that in changing from first to second in the case of the 11 h.p. car, and from second to third on the 14 h.p., the gear lever must be moved—

1. Forward. 2. Across the gate. 3. Forward again.

If the hand be moved on to the top of the gear lever in advance of the need or desire to change, those three movements can be made as one, and without even glancing down, if the thrust by the hand is diagonal throughout, viz., not directly forward, then sideways and then forward, but all the while towards a point slightly to the right of the offside front wheel.

The reason why neither the raw novice nor the experienced driver should look at the gate and gear lever when changing is that, as he cannot look in two directions at once, he will not be able to see whether the car is keeping to its correct course if his eyes are removed from the road. Moreover, the sequence of movements of the lever with the right hand will tend to cause a reaction with the left hand, and, as the latter must be kept on the steering wheel, a swerve will probably accompany the change of gear unless the driver "looks where he is going" all the while.

Keep your eyes on the road, but keep them off the gear lever.

The right hand must become accustomed to finding the lever unassisted, naturally and instinctively; changes of gear will certainly have to be made at some time or other when it would be the height of folly for the driver to take his eyes off the road

ahead—in thick traffic, for instance—so he should practice "changing without looking" from the beginning. Bad habits in car driving, as in everything else, are easily acquired but are very difficult to overcome. Looking at the gear lever is a bad habit.

CHANGING "DOWN."

Changing from a high gear into a lower one—changing "down"—has been termed the bugbear of the novice, and admittedly it is an operation more or less difficult to carry through correctly, i.e. silently and quickly, on most cars. But "Standard" gears are exceptionally easy to change in either direction, for reasons that need not be explained here; nevertheless certain precautions are desirable above and beyond those applying to changing "up."

A brief explanation may be given to show why a somewhat different method is needed in this case. In changing "up," the shaft carrying the driving gears in the gearbox is initially rotating at a higher speed than that on which the driven gears are fixed. But when the clutch is disengaged the driving shaft (attached to the driven member of the clutch) tends naturally to slow down while the gear lever is being moved across or through the neutral slot in the gate. Thus, by the time the higher gears are brought into contact we have the required condition existing, viz., that they should both be rotating at approximately the same speed (with due allowance for the size of their gear wheels).

But, when changing "down," natural tendencies are against us. The driving shaft must be accelerated at a time when, in the other case, it was required to decelerate and did so automatically. By some means or other it has to be speeded up between the moment the higher gears are disengaged and that at which the lower ones are engaged. That can be done by using brute force with the gear lever, but a grinding noise will arise and chipped gears will result.

Method I. A "Straight" Change. There are several better methods than that, methods by which a silent change can be secured, almost without the passengers realizing that the gears have been changed, either by ear or by variation of car speed. The easiest, but not the best when experience in driving has been acquired, though quite a good plan for the raw novice to adopt until he has "got the feel" of the pedals and levers, is as follows—

Just before the gear is to be changed—on a hill or elsewhere—the hand throttle lever should be moved forward about an inch measured at its extremity, and left in that position until the change

is completed. The subsequent operations are practically the same as those mentioned for changing into a higher gear, viz.—

1. Release throttle pedal ;
2. Depress clutch pedal ;
3. Move gear lever into the lower gear slot ;
4. Release clutch pedal ;
5. Depress accelerator as required by prevailing conditions ;
6. Bring back throttle lever.

The extent to which the throttle lever should be moved forward (viz., the throttle opened) prior to beginning the operations enumerated, depends upon the speed at which the car is travelling at the moment. If, for instance, the change into a lower gear is to be made while the car is running in traffic or elsewhere at, say, 10 m.p.h. on top gear, the lever need be pushed forward only a half-inch or so ; but if the change is to be made on a stiff hill, with the car travelling at 16 to 20 m.p.h., the throttle is best opened rather more than an inch.

Two further points should be noted. The first is that the clutch pedal should not be depressed (operation 2) more than about half-way ; in changing into a higher gear it should be fully depressed, as mentioned on an earlier page. The second is that if the change down is made in traffic releasing the clutch pedal and depressing the accelerator (operations 4 and 5) need not be completed at once ; the clutch can be held depressed and the right foot kept away from the accelerator for the time being, until, in fact, the car is required to move on faster than it will run by momentum, or, maybe, to start from a standstill. But in any event the throttle lever should be drawn right back after the change has been made.

Method II. A "Slip" Change. The second method is fairly widely used, even by experienced drivers. Its main features are: (1) the accelerator pedal is not completely released while the change is made, being held down slightly to keep the throttle open approximately a quarter of its travel ; and (2) the clutch pedal is depressed but very slightly beyond the point at which appreciable resistance (that of the clutch springs) is felt. The clutch pedal is merely depressed, in other words, until the engine is released from the drive and is heard to accelerate. The actual movement of the gear lever is then made smartly, the clutch pedal released at once, and the accelerator operated as required by prevailing conditions, e.g. depressed fully at once if a stiff hill is being climbed.

When first attempting to utilize this plan, some difficulty may be experienced in holding the accelerator steadily in one position with the right foot, while the clutch pedal and gear lever are operated with the left foot and right hand respectively. But the natural tendency to press both feet, and raise them again simultaneously, can be overcome with a little practice.

This second method is completed, then, as follows—

1. Release accelerator partially, if fully depressed already ; or, depress accelerator slightly, if already released.
2. Depress clutch pedal slightly.
3. Move gear lever.
4. Release clutch pedal.
5. Operate accelerator as required.

Method III. The "Double-clutch" Change. This is sometimes known as "double-declutching," a term that is rather more descriptive of the process, for the latter comprises the re-engagement of the clutch and declutching a second time while the movement of the gear lever is taking place. Specified in detail, the plan appears to be decidedly involved, and, admittedly, there are rather a lot of different things to do in quick succession. But this is undoubtedly by far the best system of changing down, and as soon as the novice has acquired some precision in operating the various pedals and levers he should set himself to mastering the double-clutch change ; once the knack has been acquired, gear-changing becomes "as simple as A B C," the sequence of operations being made quite automatically and unconsciously.

The double-clutch change, strictly followed, is as follows—

1. Release accelerator.
2. Depress clutch pedal.
3. Move gear lever into neutral and, if necessary, across the gate to a point in line with the slot of the lower gear to be engaged.
4. Release clutch pedal.
5. Depress accelerator almost fully, release it again instantly ; then, without the slightest delay,
6. Depress clutch pedal and simultaneously move gear lever into the required slot.
7. Depress accelerator and, as that movement commences, release the clutch pedal.
8. Regulate accelerator as required.

A variation of the foregoing consists of releasing the accelerator pedal merely partially, to begin with, and holding it depressed slightly while the other movements are completed ; the brief re-engagement of the clutch, while the gear lever is passed through neutral, is made as in the other case. On the whole, this variation

is an improvement, so long as the accelerator pedal position is judged fairly well and is maintained throughout, until the clutch is finally re-engaged.

GENERAL HINTS ON GEAR-CHANGING.

Under no conditions should undue force be applied to the gear lever ; there is no need for its violent operation. If the movements of the pedals are correctly made, the lever can be moved with thumb and two fingers, so far as the needed effort is concerned. A vice-like grip is quite unnecessary ; in fact, it discourages an easy and quiet change, because the wrist is not then able to move freely. Moreover, a " fierce " grip, set teeth, and a do-or-die movement of the lever are very prone to give rise either to a " crash " change, implying a great deal of noise and damage to the gears, or, alternatively, missing the gear, i.e. failing altogether to get the gear lever into the new slot.

The safest and wisest policy for the novice, when any difficulty arises, when the grating of gear teeth is heard and recurs upon each attempt to engage the new gear, is to stop the car and start again. No harm is done by stopping, for even if the stop is made while climbing a stiff hill, the brakes will prevent the car from running back. Preferably, however, the first few runs should not include any really steep hills ; it is easier to become accustomed to driving and to practise changing gear on merely undulating roads.

Do not shirk gear-changing. In other words, do not try to force the engine to carry the car on top gear up hills that really call for a lower gear, and do not, if a slack to walking pace is necessitated, make an invariable practice of remaining in top gear, especially if the gradient is against the car. A change down into the next lower gear will enable the car to pick up speed again more rapidly, while in hill-climbing the car will maintain a higher speed with the next lower gear if, with top engaged, it has dropped to 15 to 18 m.p.h. despite " full throttle " being given (i.e. the accelerator being fully depressed).

Bear in mind that the faster the engine runs the more power it develops ; that is one respect in which the petrol engine differs from the steam engine. So, if more power is required when the engine is already pulling hard on full throttle, change into a lower gear, thus enabling its speed to increase—not necessarily the speed of the car, though that also follows under many conditions if the driver so desires.

It is impossible to lay down any definite rule, to be invariably

followed, as to the lowest speed to which the car should be allowed to drop prior to changing into a lower gear. But the following may be taken as a rough guide until experience indicates when and where a preferable standard should apply—

11 H.P. " STANDARD "

Change into the next lower gear when the gradient of a hill has caused the car speed to fall—

On Top Gear	On Second Gear
to 18 m.p.h.	to 10 m.p.h.

14 H.P. " STANDARD "

Change into the next lower gear when the gradient of a hill has caused the car speed to fall—

On Top Gear	On Third Gear	On Second Gear
to 20 m.p.h.	to 15 m.p.h.	to 10 m.p.h.

The minimum speeds specified above may be considerably reduced when the car is running on the level or up slight gradients, and when the need for changing down is not really imperative. Both models will run at and " pick-up " from not much over walking pace, if required, on top gear, and will continue to pull hard and steadily at 8 to 10 m.p.h. if put to it—so long as the ignition lever is brought back to about half-advance. But, as already suggested, the full use of the top gear abilities of these, or any other, cars is not conducive to the most rapid acceleration. Slow-running on top gear is very attractive, and can be recommended under certain conditions, but to secure the best average speed (irrespective of the maximum), and to negotiate traffic and hills to the best advantage, the gear lever must be used—and that applies to any car, no matter what its power or number of cylinders.

CHAPTER IX

STARTING ON A HILL

THE difficulties experienced by the novice, and the awkward positions in which he sometimes finds himself, owing to his lack of knowledge concerning the correct method of starting his car from rest on a stiff hill, justify this aspect of driving being given a separate chapter. Unless a driver knows how to start on a steep gradient, and feels assured that he can do it without difficulty or fuss, he is inclined to "take risks." For instance, he will hesitate to stop behind a stationary cart, we will say, at the middle of a steep hill when he ought to do so, because another vehicle is approaching from the other direction; he will try to cut-in rather than stop, and, as mentioned in a previous chapter, that is always a reprehensible and sometimes a dangerous practice.

Assuming, then, that the car has been stopped on a stiff hill, and that the hand-brake has been applied to prevent running-back, the procedure should be as follows—

1. Depress clutch pedal.
2. Engage bottom gear.
3. Place right foot above accelerator ready for use.
4. Grip hand-brake lever and its release trigger, but, still holding the brake on,
5. Depress accelerator; at the same time release clutch pedal slowly, and as soon as there is evidence that the clutch is commencing to engage,
6. Release hand-brake and clutch pedal fully and simultaneously (but not too suddenly).

The great point is to engage the clutch (with the throttle well open) neither before nor after the releasing of the hand-brake.

Where so many more or less inexperienced drivers go wrong is in attempting to start on a hill while holding the car with the pedal brake alone; as a result, when they move the right foot from the brake pedal to the accelerator the car starts to run back, the driver becomes "flustered," engages the clutch without opening the throttle, and stops his engine.

Starting on a hill can, admittedly, be done with certainty and ease without using the hand-brake, and, although it is not the method

of an expert driver, the novice may prefer the plan for awhile. It is as follows—

1. Apply the pedal brake.
2. Release hand-brake.
3. Depress clutch pedal.
4. Engage first speed.
5. Move throttle lever forward (about half-way) with left hand, and simultaneously
6. Release clutch and brake pedals, the clutch ever so slightly in advance of the brake—that is to say, the brake is held on only until the clutch begins to "catch hold," when both pedals must be fully released.

Immediately the car begins to move the right foot must be moved to the accelerator and depressed fully, while the hand throttle lever is pulled back to its normal position.

CHAPTER X

REVERSING (DRIVING BACKWARD)

DRIVING backward with precision is an "art" which many motorists have never acquired. Whenever possible, they shirk reversing, and when they do attempt it, are prone to do the wrong thing at an awkward moment, more often than not. There is, however, nothing of exceptional difficulty in reversing properly; but it is a process which must be practised in order to secure proficiency—and practised methodically.

First, it must be recalled that to bring the reverse gear into use in both "Standard" models, the forward-projecting trigger on the gear lever must be lifted, the lever moved as far as it will go towards the left, and then pushed forward; from that it will be inferred that the reverse slot in both cases is the front one on the extreme left of the gate. But in the *14 h.p.* model the reverse slot is an extension of that for the first or lowest forward speed. To get into reverse from neutral, therefore, it is necessary to pass through the first speed, the safety catch being between the two gear positions (see diagrams on page 48).

It need hardly be said at this stage that, as in the case of forward speeds, no attempt should be made to engage the reverse until the clutch pedal has been depressed.

The novice should not wait until he is positively compelled to use the reverse gear, before attempting to drive backward. As soon as he feels tolerably capable of driving forward he should take the car out, especially on to some quiet road with one or two side turnings, and set himself to acquire the art. He should always keep three points in mind. They are—

1. The back wheels will move towards the *same* side of the road towards which the front edge of the steering wheel is moved.

2. The front wheels will move towards the *opposite* side of the road towards which the front edge of the steering wheel is moved (that is to say, just the reverse of what occurs when driving forward.)

3. The front wheels and the front of the car will move towards the left while the back wheels run towards the right, and vice versa. (When running forward both front and back wheels move in the same direction).

Taking those points together, and assuming the car is standing in the centre of a road, the back part of the car will move towards the right-hand side, and the front part towards the left, if the steering wheel be rotated clockwise (i.e. as the hands of a clock,

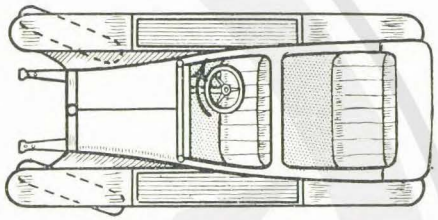


FIG. 33.—DIAGRAM INDICATING (BY ARROW ALONGSIDE STEERING WHEEL) THE DIRECTION IN WHICH THE WHEEL MUST BE ROTATED TO MOVE THE BACK OF THE CAR TO RIGHT IN REVERSING.

the front edge of the wheel towards the right) when the car begins to move backward. Conversely, the front will move to the right, and the back to the left, if the steering wheel be moved anti-clockwise.

Studying those points from another aspect, we find that the "trailing" wheels cut a corner closer than the back ones when

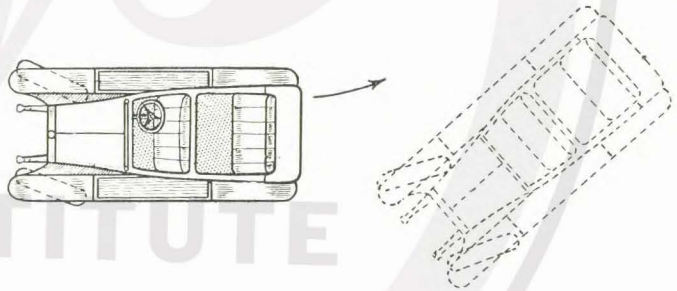


FIG. 34.—DIAGRAMS SHOWING THE EFFECT OF STEERING BACKWARD TOWARDS THE RIGHT.

Note that, while the back of the car moves in the required direction at once, the front part first swings out to the left; hence the need for watching the front of the car as carefully as the back when reversing. Correspondingly opposed movements of the ends of the car occur when the latter is steered backward towards the left.

the car is running forward; but in running backward the "leading" wheels cut in, the trailing wheels running wide of the corner. The wheels that cut in closely are the rear or driving ones in both cases, but they are the trailing wheels when running forward and the leading

wheels when running backward. Remembering that, we find, in trying to steer as closely as possible to a corner when driving backward, that the leading wheels may be directed as close as we like to the inner edge of the corner; the trailing wheels (the front ones) will run wide, and all we have to observe is that they do not run too wide. But in running forward the trailing wheels run closer to the corner than the leading ones. Hence, if we cut in close to a corner—a gatepost, for instance—with the leading wheels running forward, we shall jam the rear part of the car against the post; but in driving backward the leading part of the car must be kept as close to the gatepost as possible, so that the other side will not hit the opposite post.

In reversing round a corner, then, keep the back wheel on the inner side of the curve as close as possible to the kerb, road edge, or gatepost on that side.

CONTROLLING SPEED BACKWARD.

In driving backward the novice is well advised not to use the accelerator until he has become more or less proficient. Instead, he should keep the hand throttle lever pushed forward slightly, so that the engine runs rather too fast for normal idling, and should "drive on the clutch and pedal brake." That is to say, after making sufficient power available (due to the partially opened throttle) for moving the car on approximately level ground, he should control the speed of the car, and the distance it travels, by means of the clutch and foot-brake only.

With the throttle opened as suggested, he will keep his feet against the two pedals (clutch and brake) and steering according to requirements—or as thought best—he will drive the car back a few inches or a few feet at a time in successive movements, the latter accomplished by releasing the brake and letting back the clutch pedal, the latter not being fully released but only just enough to impart movement to the car.

If it is found that the car as a whole, or the front or the back of it, is not going in the required direction, both pedals should be depressed so that it can be stopped at once, before any damage is done. It must then be driven forward for a fresh attempt to be made, or the steering wheel direction must be altered more or less as required before the car moves backward any farther.

The reason why it is recommended that the hand throttle lever should be used in preference to the accelerator pedal to begin with, is that in "screwing himself round," to see where he is going, the

novice is liable to lose his sense of pedal location; on that account many mudguards have been crumpled, the drivers having pressed the accelerator instead of the brake pedal, causing the car to "jump" back when it should have been stopped. Then, too, even if the correct pedal is used, the accelerator may be used too much, and the car travel too quickly for the reversing abilities of the novice.

Play for safety for awhile in reversing; take time over it; refuse to be hurried or flustered, and remember that no harm will be done if the car is stopped when doubt or difficulty arises. Stop, go forward, and try again. Another thing, do not move the steering wheel too much in the opposite direction if the initial movement has been overdone.

But, above all, practise reversing whenever possible, until proficiency is secured. It will be of considerable advantage at some time or other, for not only will proficiency prevent crumpled wings and dented panels; it will also enable the car to be moved into or out of awkward situations, for it is often the case that a car cannot be manoeuvred into some position when driven forwards, but can be arranged there if it be driven in backwards.

CHAPTER XI

GENERAL DRIVING HINTS

USE OF THE ACCELERATOR.

It is a great mistake to assume that under all conditions the engine develops its utmost power when the accelerator is fully depressed —when the throttle is fully open, as it is usually said—for, as a matter of fact, there are circumstances in which the engine will cope with its work if the accelerator is raised slightly, whereas if the pedal were held right down the car speed would be reduced (or continue to fall).

That may be the case when, for example, the car is climbing a fairly stiff hill on top gear; the speed gradually falls off and the driver may assume that before long he will have to change into a lower gear. But quite possibly the car speed will cease to fall if the accelerator pedal is raised half an inch or more. The reason is that, with a fully opened throttle, the proportion of petrol to air entering the engine tends to become less as speed is reduced below a certain point; the mixture becomes weaker in fuel and the engine less powerful. Closing the throttle a little way (raising the accelerator) will counteract that tendency more or less.

The point just dealt with is particularly observable when an attempt is made to accelerate on top gear as rapidly as possible from, say, 6 to 8 m.p.h. If the accelerator is pressed right down, the mixture may be weakened so much that the engine will "choke," as it is termed; it may actually stop with the throttle wide open. In accelerating from a low speed, therefore, the accelerator should be pressed down not more than half-way to begin with; but as the speed increases so can "more throttle" be given with advantage.

Similarly, it is wrong to "bang" the accelerator down from a nearly closed position; that is particularly to be avoided when the engine is cold or merely warm, but it is not conducive to the best results at any time. Open the throttle (depress the accelerator) gradually, then; and do not open it fully if the engine shows signs of "choking," jerkiness, popping, hesitation, or knocking.

Despite the foregoing, however, it can be assumed that at any speed above 18 m.p.h. on top gear on the level and on hills, and at any above 12 m.p.h. on a falling gradient, the utmost power and speed is secured with "full throttle."

USE OF THE IGNITION LEVER.

Do not be afraid of using the ignition lever, but note carefully the result of any variation in its position. Listen for "pinking" —sharp metallic knocks—if it is advanced, and when that is heard, move the lever back slowly until the sound ceases.

No definite rule can be laid down in regard to the use of the ignition lever beyond that given in a previous chapter, viz., keep it as advanced as possible without causing "pinking."

OPERATING THE CLUTCH.

Two points in regard to the movement of the clutch pedal should be noted. The first is that there is, of necessity and by intention, a certain amount of "lost motion" in the early part of the range of pedal movement; the pedal can be moved forward an inch or so before the clutch is actually operated. That lost motion is needed to prevent the clutch from slipping when wear has occurred. The clutch is not even partially disengaged (or "out") until the pedal has been moved an inch or so beyond the point at which the full resistance of the springs is first noted.

The second point is that from its fully depressed position the clutch pedal travels back some distance before the re-engagement of the clutch commences. Just how far it can come freely depends upon the individual adjustment, but a test to determine the matter can be made by applying the hand-brake firmly with the engine running slowly, engaging a gear with the clutch pedal depressed, and then slowly allowing the pedal to come back, observing when that process has effect in slowing-down or stopping the engine.

Never let the clutch pedal back "with a bang"; it should be released steadily, without hesitation, but not too slowly. After a very short while the novice will know instinctively how far he can let the pedal come back before the clutch begins to catch hold; it is subsequent to the latter condition when steady release is desirable for many reasons.

Never cause the clutch to slip; except momentarily when changing gear, it should either be "in" or "out," i.e. fully engaged or completely disengaged. Maintaining continuous pressure upon the pedal, without moving it forward more than half an inch or so beyond the range of lost motion, will cause the clutch to slip, and will result in the friction surfaces wearing quickly, or becoming rough and giving rise to "shuddering" and fierceness when the clutch is used normally.

APPLYING THE BRAKES.

The brakes should be used as infrequently and as gently as possible. In approaching corners (in fact, whenever it is obvious well in advance that speed must be reduced) allow the accelerator pedal to come up, so closing the throttle more or less and causing the engine to act as a brake—for it has a decidedly powerful retarding effect when the car is running at any speed above 10 m.p.h. and the throttle is closed. That condition of affairs is known as "the car over-running the engine," and implies that the car is pushing the engine instead of the engine pulling the car.

When the brakes, or either of them, must be used, apply them gradually. Do not stop more suddenly than is necessary, for the reason that forcible and sudden application of the brakes is bad for the tyres, and by no means conducive to the welfare of the transmission in the case of the foot-brake on the 14 h.p. model. "Locking the wheels," i.e. causing them to cease rotating and skid along the road until the car stops or the speed is reduced as required, wears away the tyres very quickly at the points at which they are in contact with the road. Moreover, locked wheels directly encourage side-slips if the roads are muddy or wet.

Make use of the hand-brake as an alternative to the foot-brake, besides using it to hold the car stationary. If it be reserved for emergencies only, the driver will probably be unable to put his right hand on to it instinctively; he may even have to look down to find it, thus wasting valuable seconds, which may make all the difference between avoiding an accident and causing one.

On long hills, calling for use of the brakes, the hand and pedal brakes should be applied either alternately or together. Excessive and lengthy brake pressure is conducive to rapid wear of the shoes and overheating of the drums; dividing the duty of retarding the car between the two sets will equalize, if not actually reduce, brake wear and prevent excessive overheating.

Do not omit to push the hand-brake forward as far as it will go (i.e. take the brake off completely) when it is not required, otherwise the shoes will rub the drums and wear away quickly, besides causing loss of power. To the raw novice, it may be necessary to add, "Don't try to start the car before releasing the brakes." He will probably do so, several times, nevertheless. And, unless he represents an exception to the general rule, he will probably on some occasions leave the hand-brake on when he has reached the bottom of one hill and attempts to climb another or run on the level. But, obviously, he must try not to forget the need for releasing the brakes, and keeping them off whenever the engine is pulling or is about to do so.

STEERING.

There is very little that can be usefully said in regard to steering the car. It is an operation in which precision can be acquired by practice alone. But one or two pieces of advice may be given. For example, do not "saw" at the wheel. In other words, do not move it jerkily first in one direction and then in the other. Move it gradually and slightly when correcting minor divergencies of the car from the straight path.

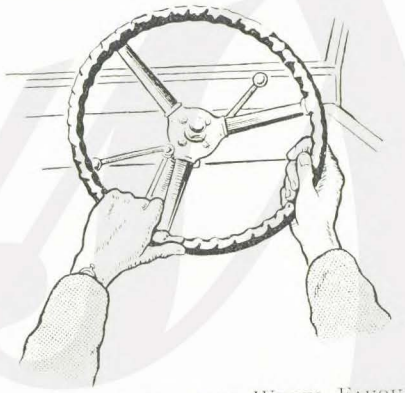


FIG. 35.—A HOLD OF THE STEERING WHEEL FAVOURED BY MANY DRIVERS AS BEING COMFORTABLE AND AFFORDING PRECISION IN STEERING CONTROL.

Then, do not hold the wheel with a vice-like grip; a relatively light hold is all that is required in the ordinary course, and by allowing the wrists free play it will result in less erratic, violent, and sudden deflections of the front wheels.

Another point. Drive as a rule with one hand *behind* the centre of the wheel, if not both hands. The tendency of the beginner is to grip the wheel as firmly as possible with the left hand at "nine o'clock," and the right hand at "three o'clock" (viewing the wheel as a clock face). But most drivers eventually find that for ease and precision the best hold is with the left hand at "seven o'clock," and the right hand at "four o'clock."

The novice should attempt, very soon after he commences to drive, to steer on a straight road with the left hand alone. He will have to take the right hand away frequently in driving, in order

to change gear, apply the hand-brake, and use the horn switch; so it is better that he should accustom himself to steering with the left hand in quite the early stages.

TO AVOID SIDE-SLIPS.

Although the non-skidding treads of the tyres are of considerable assistance (when they are new) in preventing the wheels from slipping on wet or muddy roads, they must not be expected to have that effect invariably if the brakes are applied suddenly, if corners are taken fast on "greasy" roads, or if the car is swerved on to the crown of a wet road from the gutter, as when passing another car.

Use the brakes as little as possible on muddy or wet roads, and when they must be used apply them as gently as circumstances warrant. That implies that the car should be driven carefully, even slowly, when slippery roads are encountered, for although the expert driver—more by instinct than from forethought—can usually "correct" a skid, and bring the car straight again without mishap, the novice generally makes matters worse when attempting to do so.

Steer towards the direction in which the car is skidding, is advice sometimes given; but it does not serve the purpose of correcting a skid on all occasions, though it is a good general rule. But whatever else is done, the brakes should be released, more or less, when a skid occurs. Excessive braking and fast cornering are responsible for 90 per cent of side-slips.

WHEN LEAVING THE CAR ON A HILL.

When a car is to be left unattended facing either up or down a hill, the hand brake should be applied securely, as at other times; but as an additional precaution—against the interference of small boys, for example—the car may be left with either front or rear wheels inclining towards the nearest side of the road. If the brakes should be taken off by some unauthorized person, or should not have been applied securely, the car cannot then run away down the hill.

CHAPTER XII

HOW THE CAR FUNCTIONS

THE owner with previous experience of cars will probably have no need to read this chapter to secure knowledge of the function and operation of the various parts of the *11 h.p.* and *14 h.p.* "Standard" cars, for in their fundamental principles the engine, clutch, gearbox, etc., are in full accord with modern practice in motor design generally. This chapter is written for the novice, the owner who has no idea, or, at all events, the haziest of notions, as to how the contents of the petrol tank are utilized to move the car; the elementary information it contains should assist him to realize the requirements of his car in regard to its replenishment, lubrication, upkeep, and driving.

THE ENGINE.

The engine consists of a "block" of four cast-iron cylinders arranged "in line-ahead," each containing a piston roughly resembling an inverted cup with parallel sides and moving up and down within its cylinder. The pistons have connecting rods attached to them which, at their lower ends (the big-ends, as they are termed) encircle the crankpins of a four-throw crankshaft; to the rear end of the latter the flywheel is secured. The parts already mentioned (excepting the flywheel in the *14 h.p.* model) are enclosed by the upper and lower halves of the crankcase; the upper half is of cast iron, formed as a single unit with the cylinder block, in the *11 h.p.*, but is a separate aluminium casting in the *14 h.p.*

The cylinder block has a detachable head secured to the block by a series of screwed hexagon-headed studs. Passing through the head is a set of eight valves, which are, very roughly speaking, of mushroom shape, inverted so that their heads normally cover apertures or valve ports.

Valves. There are two valves for each cylinder; the first covers, or moves down to open, the inlet port through which petrol gas enters the cylinder; the second is the exhaust valve, which normally covers the port through which the burnt gas is discharged from the cylinder when this valve is open. The valves are held upward against bevelled-edge seatings in the cylinder head by exterior springs taking effect upon their projecting stems, and each one is

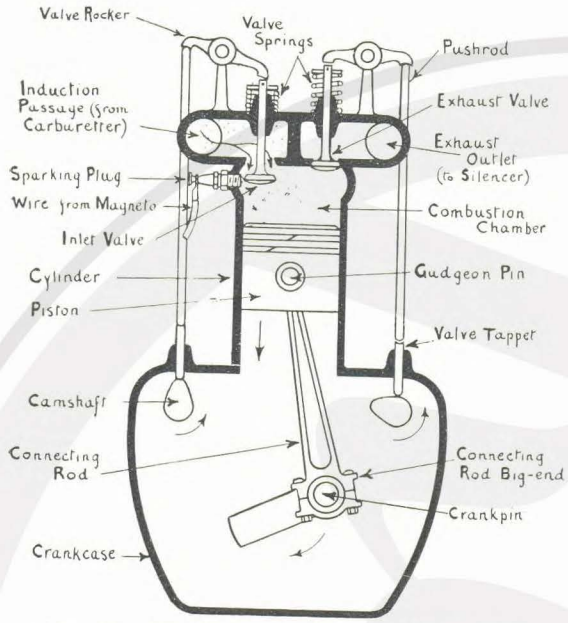


FIG. 36.—THE CYCLE OF ENGINE OPERATION.

I. Piston moving down on induction stroke and drawing in explosive mixture from the carburettor through the inlet valve port, the valve being held open during this stroke by the cam acting upon the pushrod and rocker.

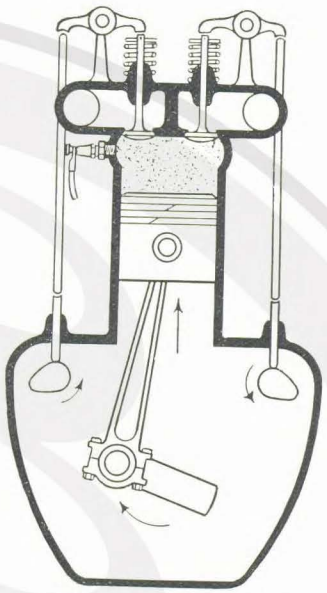


FIG. 37.—THE CYCLE OF ENGINE OPERATION.

II. The piston, having completed induction stroke, is now moving upward compressing the explosive mixture within the cylinder; the inlet valve has closed and the exhaust valve is still seated.

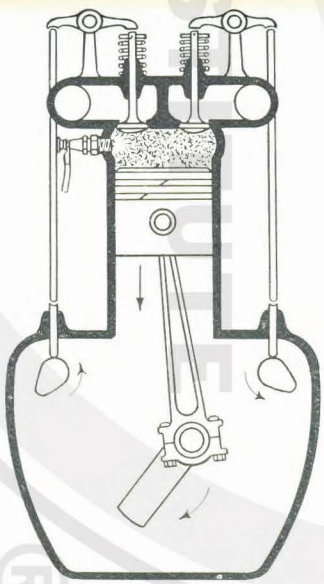


FIG. 38.—THE CYCLE OF ENGINE OPERATION.

III. The piston is now commencing to descend on the explosion or power stroke. A spark has just occurred at the plug and the resulting "explosion" is driving the piston down, and thus delivering "power" to the crankshaft through the medium of the connecting rod. Both valves are still closed.

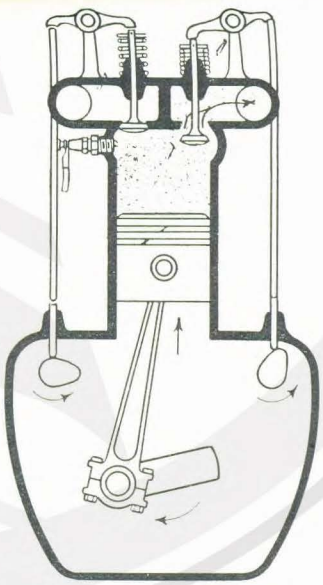


FIG. 39.—THE CYCLE OF ENGINE OPERATION.

IV. The piston is shown rising on the exhaust stroke, driving before it, through the now open exhaust port, the burnt gases resulting from the ignition of the explosive mixture on the preceding downstroke. When the piston reaches the top of this stroke the exhaust valve will close and the inlet valve will open, thus completing the cycle and reinstating the conditions shown in No. 1.

Note. These four illustrations are purely diagrammatic; the shape, location, and dimensions of the parts are not intended to represent those of "Standard" cars. Camshafts and pushrods on both sides are shown, for example, to simplify the illustrations; in "Standard" cars there is only one camshaft, the pushrods are all on one side, and the valves are in line. The water-jackets are omitted, also for the sake of clearness.

opened at the correct moment by the overhead rockers. The latter in turn are actuated by the camshaft through the agency of the pushrods at one side of the cylinder block and the tappets, which extend upward through the top of the crankcase. (In the *14 h.p.* "Standard" the pushrods and the overhead rockers are normally enclosed.)

Camshaft. The camshaft has eight cams, or projecting and integral "humps"—four inlet and four exhaust—and is rotated by means of a "silent" chain passing around toothed sprockets; the driving sprocket, fixed to the front end of the crankshaft, is half the size of the driven one on the camshaft, and the latter therefore rotates at half the speed of the crankshaft and flywheel.

Cooling. The actual cylinders, as well as the valve ports and the passages leading from the ports to the carburettor and exhaust branch respectively, are encased by a water-jacket, with communicating holes and a joint between the cylinder head and cylinder block; the water prevents the engine temperature from rising above boiling point and circulates naturally through the tubular radiator. Of the connecting pipes between radiator and cylinders, one (or one large and one small, in the *14 h.p.*) permits the hot water in the top of the jacket to flow naturally upward out of the latter, while the lower one allows cooled water from the radiator to enter the bottom of the jacket.

Carburettor and Magneto. Two other important items are the carburettor and the magneto. The former comprises a float-chamber, wherein petrol is maintained at a definite level, and a mixing chamber alongside where petrol, issuing from concentric standards or jets, is mingled with air to form an explosive mixture for the cylinders. The magneto generates electric current which, passing at predetermined moments to the sparking plugs, causes a spark to occur within each cylinder in turn, in order to ignite the mixture within.

Cycle of Operations. It must now be explained that the engine operates on what is known as the four-stroke cycle. That is to say, the crankshaft and flywheel receive an impulse from each cylinder only once in every four strokes, or up and down movements, of the piston; in other words, once in every two revolutions. Hence the need for four cylinders, operating successively, to ensure that the crankshaft receives something approaching continuity of impulse.

During every two revolutions of the crankshaft a cycle or series of four operations occurs in each cylinder as follows—

1. *Suction Stroke.* The piston travels downward in its cylinder

and draws into the engine past the inlet valve, then open, a mixture of petrol gas and air from the carburettor. Near the end of the piston movement downward the inlet valve closes.

2. *Compression Stroke.* The inlet valve having closed, the piston moves upward and the mixture above it is compressed in the now closed top end of the cylinder, the combustion chamber.

3. *Firing Stroke.* When the piston reaches the end of its upward travel a spark occurs at the sparking plug gap and ignites the compressed mixture, causing the latter to "explode" and drive

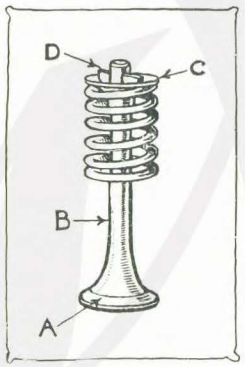


FIG. 40.—A VALVE REMOVED FROM THE ENGINE, WITH SPRING, SPRING CUP OR WASHER AND COTTER IN THEIR NORMAL POSITIONS.
A—Coned seating. *B*—Stem.
C—Cup or washer, forming upper abutment for spring.
D—Cotter, or collet, passing through a slot in the stem and holding the spring compressed when in use.

the piston downward. This is the only impulse stroke of the four, the pressure upon the piston being conveyed by its connecting rod to the crankshaft and causing the latter to rotate.

4. *Exhaust Stroke.* Just before the piston reaches the end of its downward movement on the firing stroke, the exhaust valve is opened and, during the ensuing upward movement of the piston, the burnt gas is driven out of the exhaust port into the exhaust pipe and thence away through the silencer to the open air.

The cycle of operations just described occurs successively in each cylinder, resulting in two impulses being given to the crankshaft during every revolution, instead of one during every two revolutions which the individual cylinder affords.

Carburettor Throttle. In order to regulate the volume or quantity of explosive mixture admitted to the cylinders, and thus control the speed and power development of the engine, a throttle valve

is provided within the carburettor; this is varied to accord with the requirements of the moment—opened, for example, to give more power for climbing a hill or for increasing the speed. It is controlled (as mentioned in a previous chapter) by the small pedal in front of the driver, or, alternatively, by the hand lever on the left-hand side of the steering column.

Ignition Control. The function of the other lever below the steering wheel (the ignition lever) is to vary the moment at which

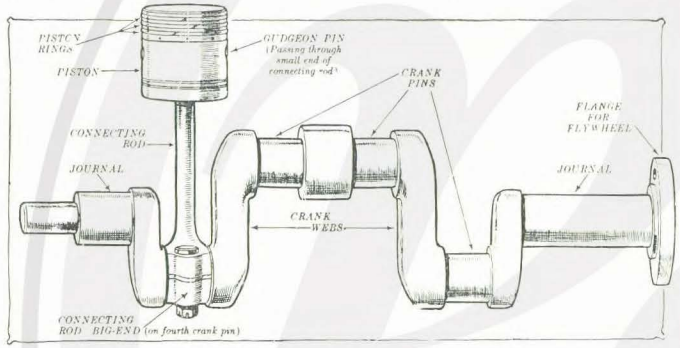


FIG. 41.—TWO-BEARING CRANKSHAFT WITH ONE CONNECTING ROD AND PISTON IN PLACE.

The journals rotate in bearings in the crankcase, while the "pins" form the bearing journals for the four connecting rod big-ends. A crankshaft of this type is used in the 11 h.p. "Standard," but in the 14 h.p. engine the crankshaft has three bearings, the third between the two central crankpins, with short webs connecting the latter to the additional journal.

the spark takes place in each cylinder in relation to the movement of the piston. The need for this variation arises from the fact that the igniting of the gaseous mixture occupies a definite period of time; a very brief period, it is true, but long enough, when the engine is rotating at all except very low speeds, for the piston to move quite an appreciable distance. Therefore, if the spark always occurred just as the piston reached its highest point before the firing stroke, the useful effect of the "explosion"—the pressure or impulse—would not be applied to the piston until it had moved downward some little distance; that would represent serious loss of power, for the most effective part of the firing stroke is the first inch or so.

But by means of the ignition or spark lever, the spark can be more or less "advanced"; it then occurs before the piston has quite finished moving upward on the compression stroke and the mixture therefore becomes fully ignited by the time the piston

is ready to receive the force of the "explosion," i.e. at the very beginning of its downward travel.

The higher the engine speed the greater the distance travelled by the piston while the spark is igniting the whole of the gaseous mixture; for that reason it might appear necessary offhand to vary the ignition timing, as it is termed, with every variation of engine speed. But, in practice, that is not essential. During 90 per cent of the running the lever can remain fully advanced; only when the throttle is wide or nearly wide open, while the engine speed is low or falling, need the lever be retarded more or less.

Oiling. Lubrication of all the moving parts must obviously be continuous and thorough so long as the engine is moving. That need is met automatically, providing a sufficient quantity of oil is maintained in the base or "sump" of the engine by occasional replenishments. (Details of the oiling or lubrication systems are given in subsequent chapters, *see* pages 81–83 and 94–98.)

THE CLUTCH.

The principal function of the clutch is to enable the rotating flywheel of the engine to be connected progressively and smoothly to the stationary units of the transmission when the car is to be started from rest. It also serves to permit the gears to be changed without shock; the latter would be excessive, and also serious in its ill-effects, if the gears were changed while power was actually being conveyed through them. Further, it provides a convenient means of disconnecting the engine from the transmission at any time it should be thought desirable to allow the car to "free-wheel," as it were; but such occasions are rare, for it is inadvisable and unnecessary to use the clutch for coasting downhill, for instance. Generally speaking, the clutch is intended for use only when starting or stopping the car and when changing gear. It consists of a series of plates or discs (driving and driven), normally held in contact by spring pressure, but separated from one another when the clutch pedal is depressed. From the driven plates a short shaft carries the drive or power to the gearbox.

THE GEARBOX.

The purpose of the gearbox is to enable the relative rotational speeds of the engine and rear wheels to be varied. On top gear, the front and rear mainshafts—which are better known as the primary and secondary shafts—rotate as one; they are locked or "clutched" together, and afford a "direct drive."

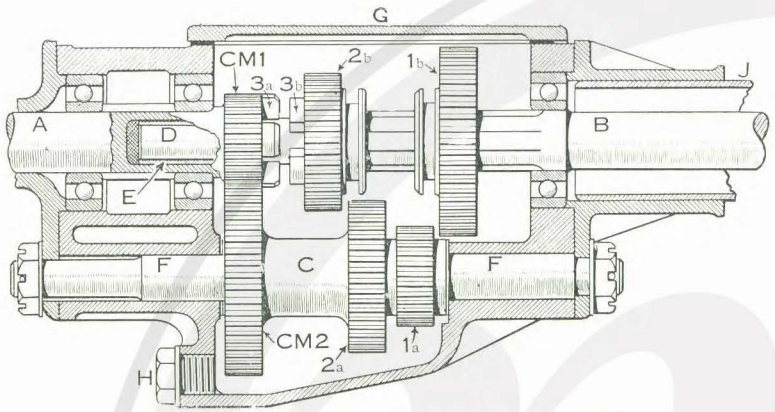


FIG. 41A.—DIAGRAM OF THREE-SPEED GEARBOX.

The design shown is on lines of that in 11 h.p. "Standard"; the four-speed box of the 14 h.p. car is similar in principle. The reverse gear is omitted from the drawing; it may consist of a sliding double-width pinion that engages with both 1*a* and 1*b* while they are in the position shown.

A—Driving or primary shaft.
B—Driven or secondary shaft.
C—Layshaft or countershaft.
D—Spigot extension of shaft *B*.
E—Bearing of spigot in shaft *A*.
F—Fixed spindle of *C*.
G—Top cover plate.
H—Drain plug.
J—Casing of propeller shaft; the shaft, in the diagram, is integral with *B*, as in the 11 h.p. "Standard."
CM1—Constant mesh driving pinion integral with shaft *A*.
CM2—Constant mesh driving pinion integral with shaft *C*.
1*a*—First speed driving pinion.
1*b*—First speed driven pinion.
2*a*—Second speed driving pinion.
2*b*—Second speed driven pinion.
3*a*—Third or top speed driving "dogs" integral with *A* and *CM1*,
3*b*—Third or top speed driven "dogs" integral with 2*b*.

NOTE THAT

CM2, *C*, 2*a*, and 1*a* are integral and rotate together continuously.
1*b* and 2*b* are free to be moved endwise independently on the castellated part of shaft *B*.
The spigot *D* ensures shafts *A* and *B* remaining in alignment, and at all times, except when the top gear is in use, *A* and *D* rotate at different speeds.
In neutral (with the engine running, car stationary, and clutch engaged) *A*, *CM1*, *CM2*, *C*, 2*a* and 1*a* rotate, while the other units remain stationary.
The gears are brought into use by forks that engage with the grooves at the sides of 1*b* and 2*b*.

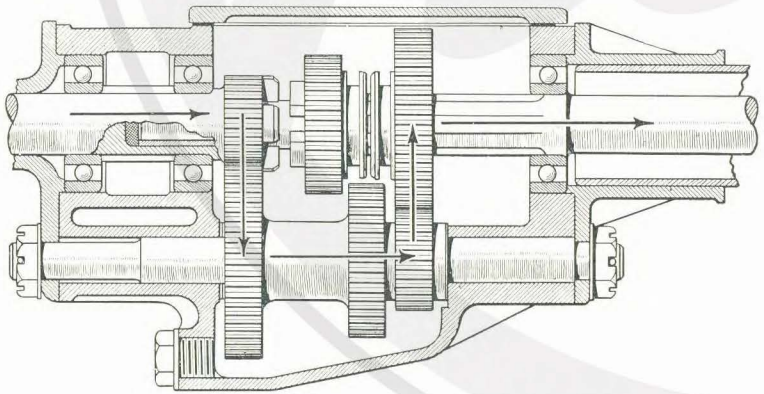


FIG. 41B.—DIAGRAM OF THREE-SPEED GEARBOX.

The first or lowest speed is shown engaged, the drive then passing from the driving to the driven shaft by the path indicated by the arrows.

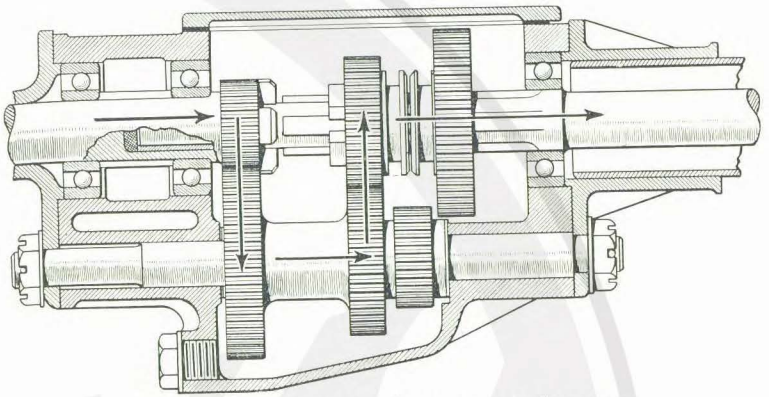


FIG. 41C.—DIAGRAM OF THREE-SPEED GEARBOX.

The second or middle gear in use. The power is now being taken from driving to driven shafts by the path indicated by the arrows.

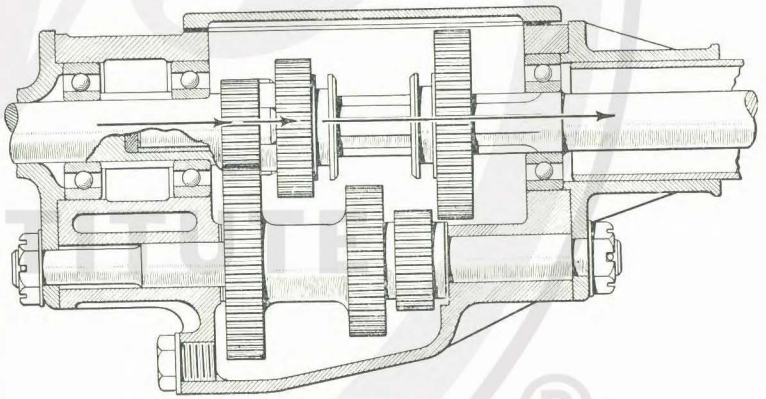


FIG. 41D.—DIAGRAM OF THREE-SPEED GEARBOX.

The third or top speed in use. The drive is now taken direct from driving to driven shafts; they are locked together by the engagement of the units of the "dog clutch" crossed by the short central arrow.

Thus on top gear the drive is conveyed straight through the gearbox, front to back, without any reduction of the speed ratio occurring; for all practical purposes the gearbox is not required in this case, and the only gearing in actual use is the worm drive in the back axle. This gives a reduction of 4·6 to 1; that is to say, on top gear the engine turns round just over $4\frac{1}{2}$ times while the rear axle shafts and wheels rotate once. Therefore, there are approximately nine explosions or impulses serving to provide the power to move the car forward a distance represented by one revolution of the rear wheels.

But on stiff hills more than nine impulses are required, because of the greater resistance of the car to motion. So, by moving the gear lever into the slot of the next lower speed, we bring into use certain gear wheels secured to what is known as the countershaft or layshaft in the gearbox. The drive then passes from the primary to the countershaft, and from the latter to the secondary shaft, and so through the rear axle worm gearing as before. This gives a relative engine and road wheel speed of 8·7 to 1 in the *11 h.p.* car, so affording just over 17 impulses to rotate the back wheels once. (The third-speed ratio on the *14 h.p.* model is 7·72 to 1, and that of the second 10·79.)

On bottom or first speed, other gear wheels are brought into use, making the ratio 20 to 1 in the *11 h.p.* car, which means that 40 impulses of the engine are available to rotate the road wheels once; this ratio or gear will take the car and a full load up the steepest of hills, but it is also to be used for starting the car from rest because the resistance to motion—the inertia of the car—is then of a high order. (The first speed ratio of the *14 h.p.* "Standard" is 19·81 to 1.)

The reverse motion is afforded by a gear wheel which engages with two of those forming the bottom speed ratio; it gives a reduction of engine and rear wheel speed in the ratio of 15·8 to 1 in the *11 h.p.* model, and 25·81 to 1 in the *14 h.p.* car.

PROPELLER SHAFT AND UNIVERSAL JOINTS.

Conveying the drive back from the gearbox is the propeller shaft. On the *11 h.p.* model it runs enclosed within a stationary tube (known as the "torque tube") rigidly connecting the gearbox with the back axle. The gearbox, torque tube, and back axle are a composite unit which, when the rear springs are deflected, pivots vertically—and more or less rotationally when only one rear wheel drops into a hole or passes over a bump on the road—the pivoting

point being a spherical joint at the front end of the gearbox. To allow of this occurring without stressing the coupling shaft between the engine and gearbox, the coupling shaft has a "universal" joint at each end, consisting of a flexible fabric disc held between two "spiders," of which the "legs" are equi-distant at each side of the disc.

In the *14 h.p.* "Standard" there are similar flexible joints between engine and gearbox, but as the latter is rigidly attached to the

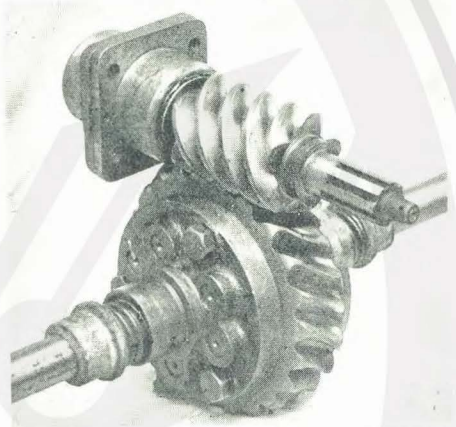


FIG. 42.—WORM GEARING, AS USED ON "STANDARD" CARS, DETACHED FROM THE REAR AXLE CASING.

The worm is seen above the wormwheel; the latter surrounds the casing of the differential gear. At each side are the driving shafts with spring-backed sleeves which, when assembled in the casing, prevent the leakage of oil from the worm gear compartment.

frame of the chassis, the propeller shaft—unenclosed in this case—also has a pair of joints, one at each end. The propeller shaft joints permit freedom of movement, vertically and otherwise, to the back axle as a whole. The differences in design thus occurring, as compared with the *11 h.p.* model, are necessitated by the use of different types of springs—half-elliptic in the *14 h.p.* and quarter-elliptic in the *11 h.p.*—and by the difference in the way in which the gearboxes are supported.

BACK AXLE AND FINAL DRIVE.

From the propeller shaft the power is conveyed to the "worm" of the final drive—the worm gearing. The axes or shaft lines of

the worm and the wormwheel, with which the former engages, are at right angles; the drive is thus taken "round a square corner" as it were, and passes through what is known as the differential or balance gear, the whole of these parts being enclosed in the axle casing. The differential permits one road wheel to run faster and farther than the other—as when the car is rounding a corner—and yet balances the power conveyed to both.

Were it not for the presence of the differential—that is, if the rear wheels were fitted to a solid axle extending from one side to the other—one or both of the wheels would have to slip rotationally on the road at corners or when the car was being manoeuvred; that would result in excessive tyre wear, and a very perceptible drag would be felt on the steering. The car would always try to run straight ahead, against the efforts of the driver to steer it in the required direction by moving the steering wheel.

From the differential, the drive passes through two shafts (also within the axle casing), one to each rear wheel, the outer ends being fixed to the hubs.

BRAKES.

The rear wheel brakes take effect upon drums attached to the hubs; the drums have segmental shoes within them, each pair of shoes being pivoted on a fixed spindle or anchor pin at one end and, at a diametrically opposite point from that pin, are separated by a flat-sided cam integral with a shaft extending towards the centre-line of the car. This brake camshaft is operated by one of the pullrods that run forward to the brake lever or pedal. When the brake is applied the camshaft and its cam partially rotate and separate still farther the free ends of the shoes; the latter are expanded, in other words, and make frictional contact with the interior of the drums.

In the *11 h.p.* model both sets of brakes (hand and foot operated) are located within the rear wheel drums, side by side. But in the *14 h.p.* car the hand-brake shoes apply to those drums, the foot-brake actuating a pair of contacting shoes, encircling a drum at the rear end of the gearbox. This is known as a "transmission brake."

The *14 h.p.* car is fitted, as an optional extra, with front wheel brakes in addition. They closely resemble the rear ones, and are operated simultaneously with the transmission brake by means of the same pedal.

STEERING.

Steering control is effected by worm gearing enclosed in a "box" at the lower end of the steering wheel column. The worm is attached to the shaft of the column, and the wormwheel to a short shaft, from which depends an exterior lever coupled to the front wheels. The worm gearing not only constitutes a "reduction gear," thus increasing the leverage available to the driver, but also tends to prevent lateral road shocks, applied to the front wheels, from being conveyed to the driver's arms. It is more or less "irreversible," which means that while the front wheels can be diverted by slight effort applied to the steering wheel, the latter rotates very reluctantly if an attempt is made to deflect the front wheels by effort applied directly to them.

CHAPTER XIII

CONSTRUCTIONAL DETAILS OF THE 11 H.P. "STANDARD"

(*See* page 92 for similar particulars concerning *14 h.p.* model)

FOLLOWING the elementary information given in the preceding chapter, as to how the main components of "Standard" cars function, it will be advisable for the owner-driver to learn how the underlying principles there described are carried out in the actual chassis. The following particulars of the *11 h.p.* model will assist the owner still further in realizing the needs of his car, how it is constructed, and how it works.

THE ENGINE.

General. The four-cylinder engine has a cylinder bore and piston diameter of $2\frac{11}{16}$ in. (approximately 68 mm.) and a piston stroke of $3\frac{9}{16}$ in. (approximately 90 mm.), which dimensions give it a cubic capacity of 1,307 c.c. The latter implies that the size of the cylinders and the stroke of the pistons result in 1,307 c.c. of gaseous mixture being drawn into the engine during every two revolutions of the flywheel; that is to say, when every piston has received one impulse, that volume of "gas" has been utilized to develop power.

The cylinders have a detachable head, but apart from that are cast as a single unit with their water-jackets and also with the upper half of the crankcase. The lower portion of the latter is a separate aluminium casting with a rearward extension forming the oil sump and bottom of the flywheel casing, the top of the latter also being of aluminium with a large handhole cover, through which the flywheel and clutch can be seen and attended to when necessary.

The cylinder block and crankcase unit carries the crankshaft in two white-metal bearings, which can be dismantled and adjusted from below, when need arises, by removing the lower part of the crankcase. In front of the latter is the cover of the distribution gearing, which consists of a silent chain passing around sprockets on the crankshaft, camshaft, and magneto drive shaft. From two points on the distribution cover the front of the engine is carried upon the front cross-member of the frame, the rear portion being

supported by side extension brackets attached to the crankcase. To insulate the engine from frame distortion, which might occur on uneven road surfaces, each of the four points of the engine suspension has an interposed rubber buffer.

Aluminium pistons are used, each with three rings, the bottom one serving as a "scraper" to remove excess of oil from the cylinder

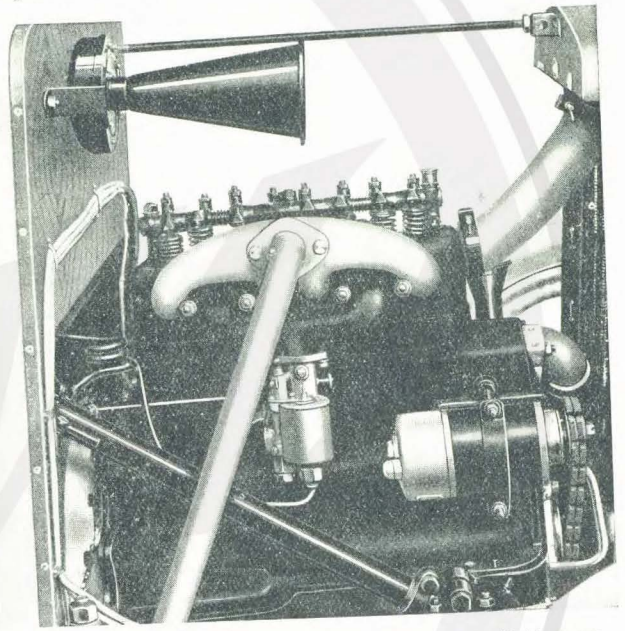


FIG. 43.—OFFSIDE OF THE 11 H.P. "STANDARD" ENGINE.
Showing the carburettor in the centre, exhaust branch and pipe and, near the right-hand bottom corner, the belt-driven dynamo of the electric equipment.

walls, as well as assisting the others in preventing compression leakage. Below the bottom ring groove the piston is slightly bevelled and there has small holes drilled through to the interior to carry away the excess of oil.

The connecting rods are tubular and are secured to the pistons by "floating" and hollow gudgeon pins, with aluminium plugs at the ends to prevent the pins from moving endwise and scoring the cylinder walls.

Lubrication. Although the oil supply carried in the sump of the crankcase is continuously circulated, the absence of an oil pump is a notable feature. The circulation is maintained as follows.

The flywheel, with teeth formed on its rim to engage with the pinion of the starting motor, extends below the level of the oil in the sump so long as the supply in the latter is maintained above the danger point (*see* page 108). When the flywheel is rotating it picks up oil and throws it off by centrifugal force. At the top of

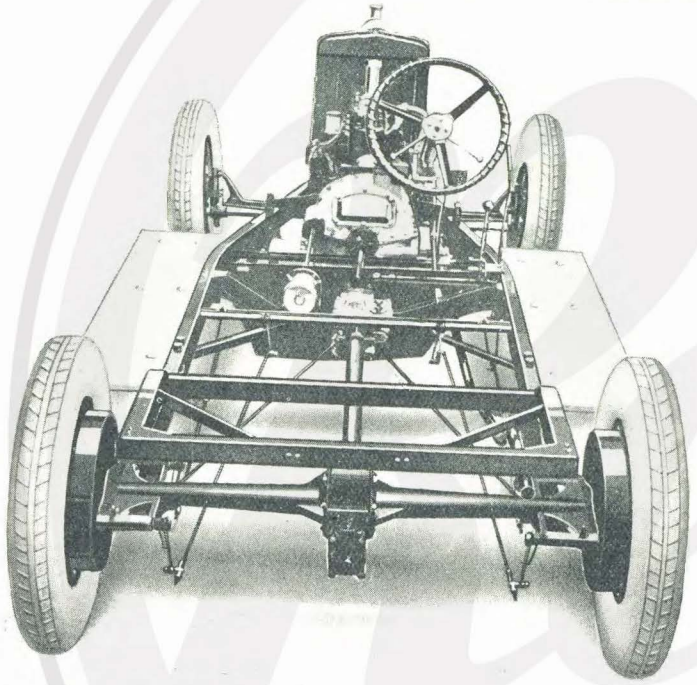


FIG. 44.—REAR AND SEMI-PLAN VIEW OF THE 11 H.P. "STANDARD" CHASSIS.

the flywheel casing, on the right, is an extension containing a "bucket," which catches some of the oil thrown off by the flywheel, whence the lubricant runs in galleries by gravity to (1) the front of the engine, where it lubricates the front bearing of the crankshaft and silent chain of the distribution; (2) a trough over the rear crankshaft bearing; and (3) troughs below the path of the crankshaft webs. The latter have dippers (projecting pins) attached to them; as the shaft rotates these dip into the troughs and take up a small quantity of oil at each revolution, throwing it in all directions and causing a continuous mist of oil to occur within the crankcase

and to be deposited on the cylinder walls, big-end bearings of the connecting rods, pistons, camshaft, etc.

So long as the oil supply is maintained, therefore, the interior parts of the engine are lubricated automatically.

Valve Operation. The camshaft, which is located within the crankcase on the left, operates the overhead valves by means of tappets, pushrods, and rockers. The tappets, which bear directly upon the cams, are parallel-sided plungers with hemispherical lower ends; they are of hardened steel and move up and down in holes (i.e. "guides") formed in the cast iron of the cylinder block and crankcase unit. Projecting through their guides, the upper ends of the tappets are recessed to receive the bottom ends of the pushrods, the latter running upward, exposed, alongside the left of the cylinder block. The upper end of each pushrod is provided with a "cup," in which rests a spherically-ended and threaded stud screwed into the outer end of its rocker and fitted with a lock-nut; this stud forms the means of adjusting the valve clearances, viz., the slight clearance which must be provided at some point between the camshaft and the valve, to allow for expansion with increase of temperature and for wear; but for the clearance there would be risk of the valve failing to make firm contact with its seating, in which case loss of power and a burned valve would occur.

The valve rockers pivot on a hollow shaft, carried in brackets attached to the cylinder head; they are grouped in pairs with a helical spring between the end and middle pairs, these springs serving to take up any wear in the ends of the rocker bearings, so preventing noise from arising at these points.

Lubrication of the rocker bearings is maintained as follows from a large oil cup at the front end. The rocker shaft is hollow and has within it a concentric tube surrounded by a wick. Oil from the cup keeps the wick saturated, leaking slowly through small holes in the concentric tube; from the wick the lubricant exudes through holes in the shaft at points where it is encircled by the rocker bearings. Thus, apart from the need for occasional replenishment of the oil cup, the rocker lubrication system is also automatic.

Cooling System. No pump is used in the engine cooling system, and, except in the case of cars prepared for use in tropical countries, a fan is neither fitted nor required behind the radiator. The circulation of the water is, nevertheless, continuous and effective, occurring automatically owing to the natural tendency of the

heated water in the cylinder block to rise into the top of the radiator, and be displaced by cooled water issuing from the lower outlet of the radiator. Within the latter the water circulation is from top to bottom, through the vertical gilled tubes. The water can be drained off at two points; the first is a hole normally closed by a screwed plug at the bottom of the radiator, and the other a drain tap fitted at the lowest point of the cylinder jacket (on the left-hand side, behind the magneto, close to the front of the flywheel casing).

Ignition. The magneto, generating current for ignition purposes and distributing it in proper sequence to the sparking plugs, projecting from the left of the cylinder head, is driven from the silent chain distribution gearing within the front cover plate. Between it and its driving shaft is a flexible (rubber) coupling, which counteracts any slight lack of alignment that might occur, and also forms an accessible means of varying the "timing" of the magneto as a whole in relation to its drive and the movement of the pistons.

Instead of being bolted directly to the crankcase, the magneto is supported by a bracket, roughly L-shaped, of which the vertical portion is secured to the rear face of the distribution casing by screwed studs and nuts, two of the studs passing through slotted holes in the bracket. By slackening the nuts the base of the bracket can be swung away from the side of the crankcase, and this has effect in tightening the silent chain which drives the magneto and camshaft.

From the rear end of the magneto four high-tension cables run directly to the sparking plugs, while from the contact breaker (also at the rear end) is a wire running to the ignition switch on the instrument board.

Carburettor and Petrol Feed. The carburettor is the Zenith vertical type, controlled by hand and foot; it is fitted with an "air-strangler" to shut off the main air supply and thus facilitate engine-starting. Bolted by a flange-fixing to a separate induction pipe on the right of the engine, the carburettor is fed by gravity from the fuel tank, the latter being located within the scuttle dash and holding 5½ gallons. The filling orifice projects through the top of the scuttle in front of the driving screen.

DYNAMO AND STARTER.

The electrical equipment for lighting and starting is of the two-unit type. That is to say, the generator or dynamo is separate from the starter or starting motor. The purpose of

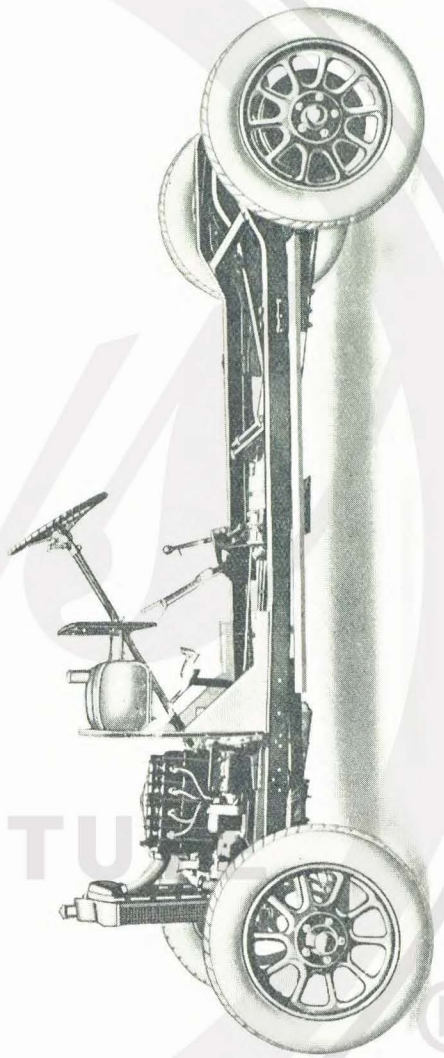


FIG. 45.—SIDE VIEW OF THE 11 H.P. "STANDARD" CHASSIS.

the dynamo (which is driven by belt from the front end of the crankshaft and is secured to the right of the cylinder block) is to generate current for charging the battery or accumulator, the latter in turn forming a store of electrical energy (or current) available for lighting the lamps, and operating the horn and starting motor. The starter is attached to a cross-member of the chassis frame, alongside the front end of the gearbox (under the front floor boards), and has running forward from it a flexibly-jointed shaft, which passes into the left-hand rear face of the flywheel casing or clutch-pit. The shaft carries at its front end a small gear pinion which, when the starter switch is used and the motor shaft commences to rotate, automatically moves endwise into engagement with the teeth on the flywheel rim. When the engine starts, and the flywheel gear moves faster than the starter pinion can turn it, the latter automatically moves back out of mesh, though if the starter switch is not then released, the pinion will make repeated attempts to re-engage with the flywheel gear; hence the need for releasing the switch immediately the engine commences to run under its own power.

CLUTCH.

The clutch is of the type known as the "dual plate," having two driven plates which distinguish it from the single-plate pattern. Actually, however, there are five main members or plates, the driving and driven ones being arranged alternately.

The five plates consist of the following—

1. Clutch cover plate. The rearmost of the five; it encloses the remainder within the flywheel.

2–3. Main and centre driving plates, the main plate being the foremost of all, while the centre plate lies between the two driven plates.

4–5. The floating or driven plates.

The units 1, 2, and 3 (driving members) are attached to the flywheel and rotate with it, the rear cover plate being bolted to the flywheel rim, while passing through it are equally spaced bolts which project forward through the other two driving plates and rearward to carry springs, which clamp all the plates together under normal driving conditions.

The driven plates, on the other hand, are not attached to the flywheel, apart from the frictional contact they make with the other three units. They are of smaller diameter than the latter and move together rotationally by reason of one of them having

studs or pins projecting from it, passing through a large hole of the central driving plate and carrying round with them the other driven plate.

The floating or driven plate in contact with the main driving member or clutch cover plate has a central boss or hub, through which passes the front end of the castellated clutch shaft; it is

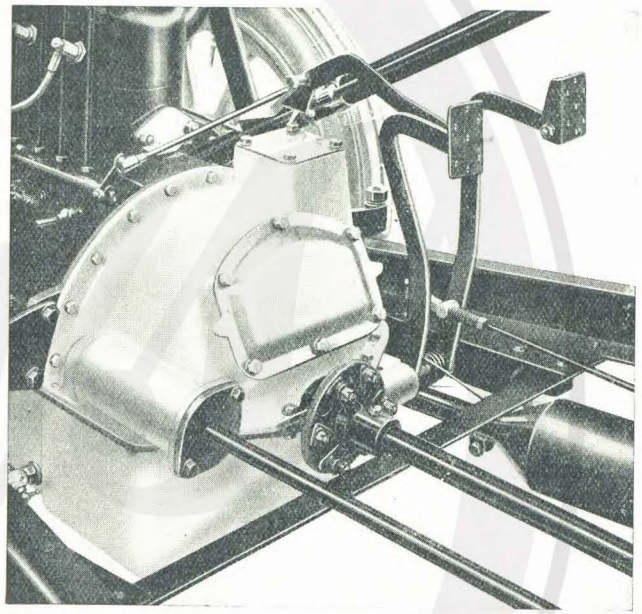


FIG. 46.—THE CLUTCH AND FLYWHEEL CASING OF THE 11 H.P. "STANDARD" CHASSIS.

The large cover plate affords an inspection "door" for the clutch. The smaller shaft is that of the engine-starting motor, while the other (with a flexible universal joint at its front end) is the intermediate shaft between the clutch and gearbox.

free to move endwise, but not rotationally, on this shaft, so that when all the plates are held in frictional contact by means of the springs, the driven plates carry the clutch shaft with them.

Of the three driving members the middle one consists of a disc of friction fabric, while the other two are of steel, but have similar discs of fabric riveted to them; thus the driven plates, which are of steel, are clamped between four fabric facings or discs.

The clutch will operate equally well with or without oil, but actually it runs in oil reaching it from the engine oil sump, in which,

as previously mentioned, the flywheel as a whole is partially submerged.

When the clutch pedal is depressed, three levers pivoted to the cover plate take effect upon steel pins, pressing the latter towards the inside of the clutch, where they bear upon the main or front driving plate and move it forward, thus releasing the spring pressure upon the driven plates, and permitting the latter to rotate independently of the others, or to remain stationary whilst the others continue to turn.

The levers just referred to are operated by the clutch pedal through the agency of a ball-thrust bearing and sliding collar. They do not make direct contact with the operating pins, but each one has passing through it, near its pivoted end, a set-screw provided with a lock-nut, the inner end of this screw bearing upon the outer end of its operating pin. This arrangement provides a means of adjustment, enabling the three levers to take equal effect upon the front driving plate, thus causing the floating plates to become equally disengaged at all points of their circumference from the fabric friction surfaces, and also enabling them to return uniformly into contact with the driving members when the clutch pedal is released.

The fact that the flywheel runs in oil not only enables lubricant to reach the clutch plates, but also keeps the operating levers, thrust bearing, and other moving parts continuously lubricated. Although the flywheel and clutch are enclosed within the flywheel casing, the latter has a large inspection hole on the rear face of the top half, through which, when the cover plate is removed, the clutch can be examined and the springs and levers adjusted if necessary.

CLUTCH COUPLING SHAFT.

Between the clutch and gearbox is a universally jointed coupling shaft, one of the joints connecting it to the clutch shaft proper and the other to the main or primary gear shaft. These joints are of the fabric disc pattern; they require no attention in use and have an almost indefinite life.

GEARBOX.

Affording three speeds and reverse, with control by a lever operating in a gate on the right-hand of the driver, the gearbox is bolted up rigidly to, and forms a unit with, the propeller shaft casing or torque tube and the rear axle. At the front end it

is supported on a cross-member of the chassis frame by means of a spherical extension which lies within a suitably shaped socket with a removable top half. This is known as a trunnion bearing. The gearbox extension is drilled through its centre to carry the primary gearshaft which, at its rear end, has formed on it a unit serving as the driving half of a dog-clutch (an all-metal coupling), for the top gear, and a gear pinion constantly in mesh with one of the gears on the layshaft. On second, first, and reverse gears the power passes through these "constant mesh" pinions, but on top

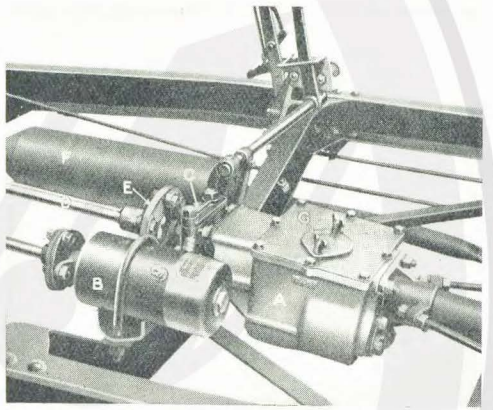


FIG. 47.—THE CENTRE OF THE 11 H.P. "STANDARD" CHASSIS.
A—Gearbox. *B*—Starting motor. *C*—Spherical trunnion support of gearbox. *D*—Clutch shaft. *E*—Flexible universal joint. *F*—Silencer.

speed they run idly, the drive, as explained in the previous chapter, then being direct. (*See* diagrams on pages 74 and 75.)

All the bearings and pinions of the gearbox are automatically lubricated by the oil carried within the casing, which has a filler hole covered by a plate secured by wing nuts and also an overall cover plate which, when removed, enables the interior parts to be directly inspected. The spherical trunnion bearing, already mentioned, is also automatically lubricated by oil from the gearbox.

PROPELLER SHAFT AND BACK AXLE.

Bolted rigidly to the gearbox is the propeller shaft casing; the latter runs back to the central part of the rear axle casing, to which it is also rigidly attached, while diagonal tie-rods brace together the axle casing and propeller shaft casing, preventing the two from

departing from their normal relative positions, viz., at right angles to one another.

The back axle casing has an aluminium centre containing the underneath worm drive. Tapered steel and flanged extensions are bolted to the aluminium centre, these extensions supporting at their outer ends the ball bearings of the wheel hubs. Behind the axle centre is an extension which contains an additional supply of oil for the worm gearing, and in which is a hole (with a cover plate secured by wing-nuts) enabling the lubricant within to be replenished or its level tested.

The wormwheel is secured to the casing of the differential gear, from the driven members of which the axle shafts extend to the wheel hubs. All the shafts within the back axle run on ball bearings, the worm shaft in addition having double-thrust bearings, while similar provision is arranged for resisting the side thrust from the wormwheel.

BRAKES.

Both sets of brakes on the *11 h.p.* "Standard" are concentrated upon the rear wheels, taking effect within drums of 14 in. diameter attached to the hubs. Each drum has within it two pairs of shoes side by side, one pair within each wheel being operated by hand lever and the other by pedal. The shoes are of aluminium with Ferodo fabric facings, and have renewable steel contact surfaces where the flat-sided cams of the brake camshaft take effect to expand them when brake application occurs. These renewable contact plates not only preserve the aluminium shoes from wear, but also permit brake efficiency to be restored when cam and plate wear has occurred after lengthy use; the means of adjustment for normal use is, however, entirely exterior to the brake drums, and consists of self-locking nuts on the rear ends of the operating rods and upon the pedal and lever.

WHEELS.

The wheels are of the detachable pressed-steel spoked pattern. They are interchangeable, being secured to the hubs by four nuts which can be removed by means of the brace provided in the tool-kit. The rear wheel hubs run on ball bearings, while those at the front have tapered roller bearings; the latter are better able to withstand the heavier side thrust to which front wheels are subjected, and have provision for adjustment.

STEERING.

The steering is of the worm and full wormwheel pattern, as distinct from the worm and worm segment. The provision of a full wormwheel enables the worm to be engaged with a different section of the wheel when wear has occurred after lengthy service; thus the wormwheel is said to have two or three "extra lives." The casing of the steering gear is attached to the right-hand side member of the chassis frame under the engine bonnet, where it is accessible for occasional replenishment of the grease with which it should be charged for lubricating the worm gearing.

From an exterior lever, attached to the wormwheel shaft, a connecting rod runs across the car to the left-hand swivel axle, which, in turn, is connected by an adjustable cross rod with the right-hand swivel. These swivel axles are carried between the jaw ends of the main front axle, a steel stamping of H-section; the swivels are provided with bronze bushes and a ball-thrust bearing.

SPRINGS.

Front and rear springs are of the quarter-elliptic type, and are fitted with leather gaiters to exclude dirt and water from the spring leaves and to retain the grease with which they should occasionally be recharged.

CHAPTER XIV

CONSTRUCTIONAL DETAILS OF THE 14 H.P. "STANDARD"

(*See* page 80 for similar particulars concerning *11 h.p.* model)

THE following particulars of the *14 h.p.* "Standard" will serve not only to amplify the elementary information given in a preceding chapter (page 67) and to indicate to the owner how the car is constructed, but will also assist him in matters of upkeep and driving, by showing why the need for various forms of attention is required by certain parts in order to maintain the original efficiency of the car as a whole. In other words, the description forms a useful prelude to what follows in subsequent chapters relating to the processes of upkeep and maintenance.

ENGINE.

General. The four-cylinder engine, having a bore and stroke of $2\frac{15}{16}$ in. by $3\frac{5}{16}$ in. (approximately 75 × 110 mm.), has a cylinder block which is bolted to the top half of an aluminium crank chamber and a detachable head. In the latter the inlet and exhaust valves are located, arranged in line and operated by overhead rockers. The cylinder head is secured to the block by hexagon headed set-screws, while the block is held to the upper half of the crankcase by studs and nuts. The lower half of the crankcase is subdivided, the upper portion serving merely to enclose the crankshaft, camshaft, connecting rods, etc., while the lower section consists of a sump or well in which the oil supply for the engine is carried.

The engine is supported in the frame by means of integral extensions of the upper half of the crankcase, which project to the side members of the chassis frame and form at each side a tray, protecting the parts above from mud and dust. In the front of the crankcase is the distribution casing, containing the silent chains which serve to drive the camshaft, magneto shaft, and dynamo shaft. The crankshaft is carried in three white-metal bearings by the upper half of the crankcase, and has a flanged rear end to which the flywheel is secured by four bolts.

Camshaft and Valves. The overhead valves are operated by the camshaft through the agency of enclosed tappets, pushrods, and rockers. The hardened steel tappets, which have guides formed in the foot of the cylinder casting with detachable and easily renewable

bushes, are cupped at their top ends to form sockets for the lower ends of the pushrods and project into the chamber on the left of the cylinder block, normally closed by a large aluminium cover plate. Through this chamber the pushrods run upward, also passing through slots in the cylinder head, above which they project to take effect upon the valve rockers. The latter have spherical-ended studs screwed through their outer ends with lock-nuts, these studs resting upon sockets at the top ends of the

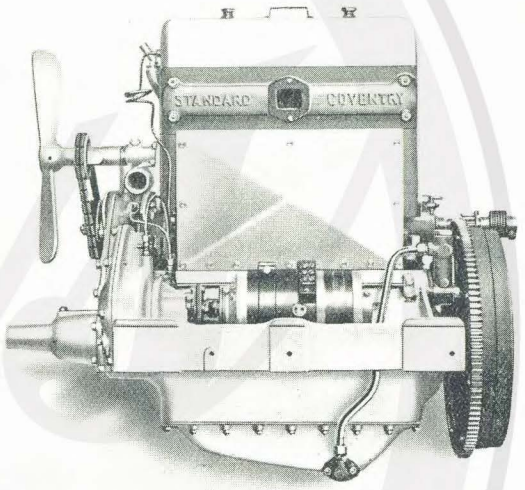


FIG. 48.—NEARSIDE OF THE 14 H.P. "STANDARD" ENGINE.
Running from the bottom of the sump to the rear end of the engine is the oil suction pipe. In the "tray" is the dynamo. The coiled pipe at the front of the engine is the oil feed to the overhead valves.

pushrods, and forming a means of effecting valve clearance adjustments, as described hereafter.

Each valve is held up to its seating in the detachable head by a helical spring anchored to the valve stem by a coned washer and a collet, or key, passing through a slot in the stem. The whole of the overhead details of the valve gearing, as well as the pushrods and tappets, are normally enclosed in an oiltight and dustproof casing, the cylinder head having a detachable aluminium cover, easily removable by unscrewing two nuts. The valve rockers are pivoted upon a hollow shaft, carried in three brackets, and every part of the valve gear is automatically lubricated from the oil supply carried in the crank chamber sump.

Engine Lubrication. With one or two exceptions, every moving part of the engine is automatically lubricated by oil contained within the sump. From this source the lubricant is drawn through a gauze filter by a pump driven from the rear end of the camshaft.

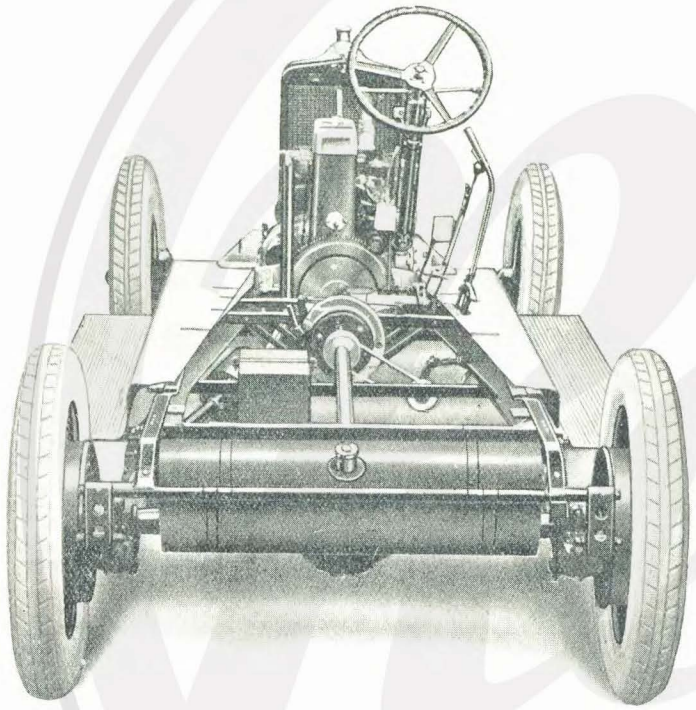


FIG. 49.—REAR VIEW OF THE 14 H.P. "STANDARD" CHASSIS.

The pump delivers the lubricant under high pressure to the camshaft bearings, thence to the main bearings of the crankshaft and, through oilways drilled in the latter, to the crankpins for the lubrication of the big-end bearings of the connecting rods. By way of external pipes the oil is also forced to the overhead valve gear, and to the chain distribution gear driving the camshaft, etc.

The oil that exudes from the big-end bearings is thrown by centrifugal force on to the cylinder walls, pistons, cams, and lower ends of the tappets, the surplus running back into the sump through

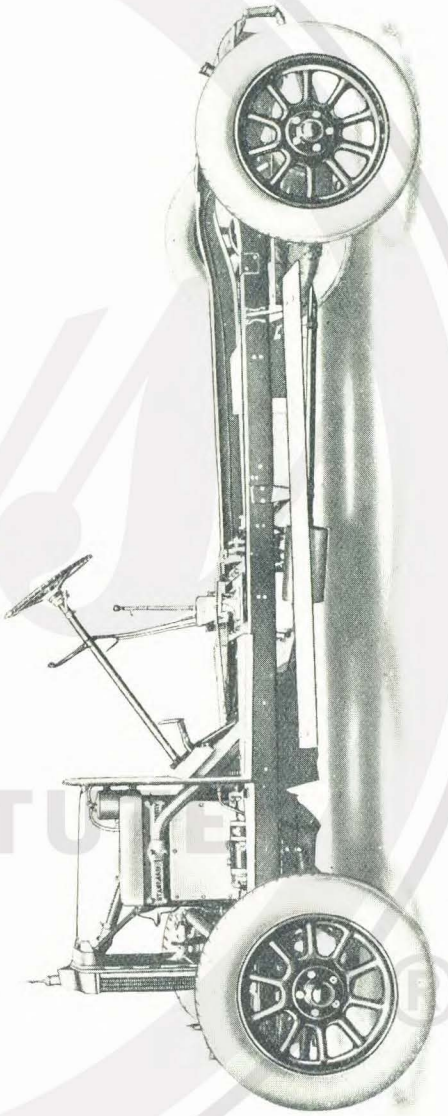


FIG. 50.—SIDE VIEW OF THE 14 H.P. "STANDARD" CHASSIS.

a perforated metal sheet forming an oil strainer and a false bottom to the crankcase.

The lubrication of the distribution chains (one of which drives the camshaft and dynamo shaft, and the other the magneto shaft and the fan belt driving pulley) is effected by oil sprays delivered directly upon their toothed or inner sides from branch pipes leading from the front crankshaft bearing, while the dynamo and magneto shaft bearings are fed by a branch from the main supply pipe running forward alongside the crankcase on the left.

The branch to the dynamo shaft passes into the aluminium casting by way of a small cock which, when its handle is vertical, causes the oil to flow into the dynamo shaft bearing; but when the handle is arranged horizontally a small outlet is open through which, when the engine is running and the lubricant is circulating properly, the oil should exude in a small stream. This is a test cock, by means of which assurance can be had that the lubricant is circulating properly to the front end of the engine.

Valve Gear Lubrication. At the front end of the engine a pipe with a coil in its length runs upward to the end of the valve rocker shaft. The latter is hollow and contains a distributing tube surrounded by a wick. Oil is led under pressure to this inner tube from the feed pipe and exudes through small holes, thus keeping the wick constantly saturated with lubricant, which then percolates through holes in the actual shaft to the rocker bearings. Any excess of oil which passes this way issues from the rear end bracket of the rocker shaft, through a return pipe, and runs back to the crankcase through the pushrod chamber. Oil that exudes from the rocker bearings returns by the same way to the crankcase.

In the outer arm of each rocker a small hole is drilled to carry a small quantity of oil to a felt washer surrounding the neck of the spherical-ended stud screwed into the rocker end; by this means the contact surfaces of each rocker and pushrod are automatically lubricated.

Oil Circulation Indicator. Above the rear main bearing of the crankshaft is a hole, formed in the crankcase, which serves as a cylinder for a small plunger or piston. The latter has two purposes: in the first place it serves to operate an oil circulation indicator, which faces the driver at the centre of the instrument board, and in the second place it forms an oil pressure relief valve. When the engine is running the plunger is kept raised by the pressure of the oil below it, thus holding the indicator on the instrument board so that its arm points to the word "safe." When the oil pressure

is excessive the plunger is raised as far as possible, and then uncovers a small hole forming a by-pass for any excess of oil delivered by the pump, the excess being short-circuited back to the crankcase and the sump. The plunger has no spring requiring adjustment or renewal, for its own weight causes it to fall by gravity if the oil feed should fail or when the engine stops.

Oil Filters. Whilst the oil is in circulation it is filtered at three points. In the first place it is drawn from the sump through a

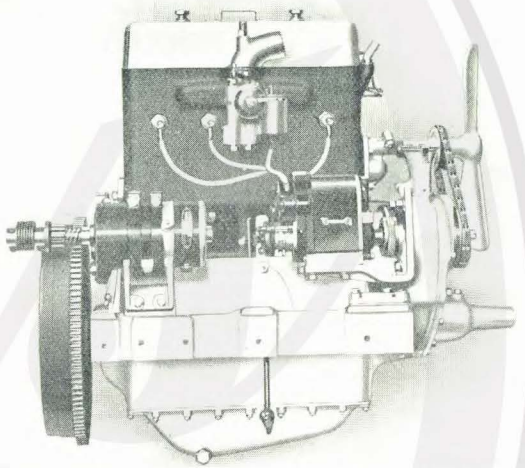


FIG. 51.—OFFSIDE OF THE 14 H.P. "STANDARD" ENGINE.
Showing the engine-starting motor on the left, the magneto being farther to the right. Above is the carburettor, surmounted by the main water outlet to the radiator. Below the carburettor, immediately behind the magneto, can be seen the upstanding wire of the oil level float indicator. At the bottom of the oil sump is the hexagon-headed drain plug, while slightly to the right and above it is the oil overflow cock.

metal gauze of fine mesh, arranged in the shape of a cylinder and lying across the bottom of the sump; this filter is attached to an elbow-piece, from the outside of which the suction pipe runs upward to the pump. The second filter is contained within a small chamber forming part of the oil pump casing; it is normally enclosed by a hexagon-headed cap, and consists of an elongated thimble of gauze, through which the oil is continuously drawn by the pump. The third filter is in the form of a perforated sheet metal tray separating the crankcase from the oil sump; at this point large particles of foreign matter are intercepted if they should be introduced with fresh lubricant, while the latter is being poured into the crankcase.

Oil Level Indicators. To enable the driver to ascertain the amount of oil in the sump at any moment, a float level indicator is provided on the right-hand side of the engine. Its visible portion consists of the upstanding end of a wire located alongside a plate marked "empty," "half full," and "full" at various levels. When oil replenishments are being made through the filler spout on the same side of the engine at the front, the movement of this wire can be watched, thus enabling the rising level of the oil to be realized,

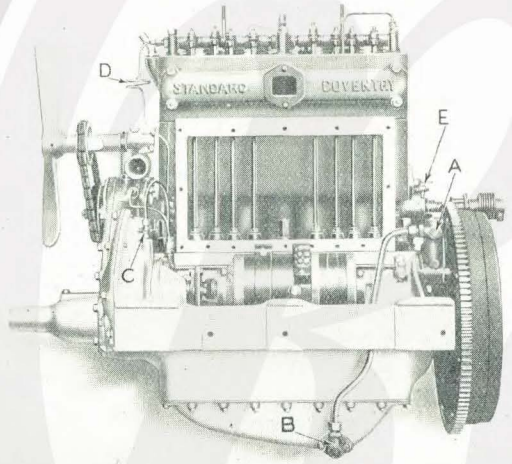


FIG. 52.—NEARSIDE OF THE 14 H.P. "STANDARD" ENGINE, WITH THE VALVE COVER AND THAT OF THE PUSHROD CHAMBER REMOVED.

A—Oil pump and filter casing.
B—Suction pipe elbow, supporting the sump filter inside the engine.
C—Oil circulation test cock.
D—Oil feed pipe to overhead valves.
E—Water cock for draining cylinder jackets.

and obviating the need for guesswork as to the amount of additional oil needed to ensure a plentiful supply.

In addition, and also on the right-hand side of the engine just below the rear end of the magneto, is the handle of an overflow cock, the latter arranged outside the oil sump at such a height as to cause any excess of oil to run out when the control lever is moved to the open position, viz., at right angles to the frame.

Water Cooling. The circulation of the cooling water in the cylinder jackets, head, and radiator is maintained by thermo-syphonic action, the heated water passing from the cylinder head

to the radiator, while from the bottom of the latter cooled water passes into the cylinder jacket. The main outlet for the water from cylinder head to radiator is on the right-hand side of the engine, immediately over the carburettor; thus the hottest water is taken to a point where it serves a useful purpose in assisting to vaporize the fuel. In order to prevent the formation of "steam pockets" in the cylinder head (and so giving rise to local overheating) a supplementary water outlet is provided at the front end, which leads directly to the extension tank at the top of the radiator.

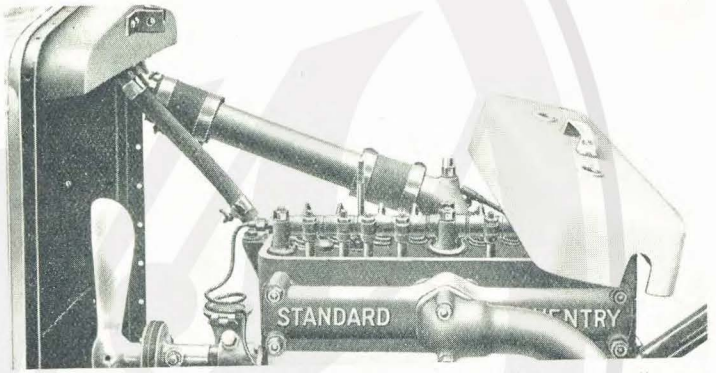


FIG. 53.—THE CYLINDER HEAD OF THE 14 H.P. "STANDARD" WITH THE VALVE COVER REMOVED.

This view shows clearly the supplementary water outlet to the radiator, which prevents the occurrence of "local overheating" within the water jackets due to the presence of "pockets" of steam.

Behind the radiator is a two-bladed fan supported by a combined bracket and water inlet elbow secured to the front of the cylinder casting. The fan is driven by a leather link belt with a simple means of adjustment for tension, the fan spindle being eccentrically mounted. To drain off the water a screwed plug is provided at the front of the lower tank of the radiator, but to ensure that the cylinder jackets, as well as the radiator, shall be completely emptied when the water system is drained (in frosty weather, for example), a supplementary drain cock is fitted at the rear end of the cylinder casting immediately over the flywheel.

Ignition. Supported by a bracket of approximately L-shape on the right of the engine, the magneto is driven through a flexible coupling which affords a means of altering the timing of the magneto as a whole when that is considered necessary, and also enables the

magneto to be readily detached when it has been freed from its bracket by the unscrewing of four hexagon-headed set-screws passing upward into the base of the machine.

As previously inferred, the magneto is driven by a silent chain enclosed within the distribution casing. When this chain needs adjustment the latter can be effected by slackening the nuts and set-screw that hold the magneto bracket in position and moving

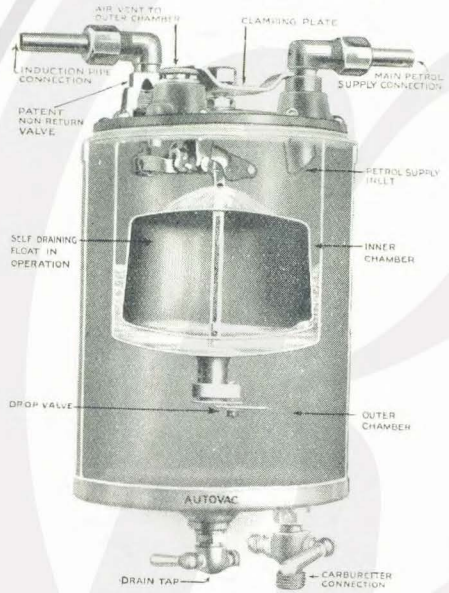


FIG. 54.—A VIEW OF THE AUTOVAC PETROL TANK AS FITTED TO THE 14 H.P. "STANDARD" CAR.

The lower part is shown in section to illustrate the details within. The float which regulates the supply is of a special type, having the peculiar property of being self-draining; thus its correct operation is unaffected by leakage.

the bracket farther away from or closer to the centre of the engine by means of an adjusting screw provided for that purpose; as the magneto bracket also carries the bearing of the drive shaft, adjusting the chain does not affect the alignment of the magneto with its drive.

Carburettor. The type of carburettor fitted to the *14 h.p.* "Standard" car is the Zenith horizontal pattern, and is peculiarly accessible on the right of the cylinder block. It is provided with an "air-strangler" for shutting off the main air supply to assist engine-starting, and is bolted to an integral induction passage,

which branches right and left within the cylinder head to the valve ports.

Petrol Feed. The main supply tank, holding nine gallons of fuel, is at the rear end of the chassis; petrol is drawn therefrom by the partial vacuum which occurs continuously within the induction passage whilst the engine is running. The mechanism which effects this automatically and regularly is contained within the Autovac tank secured to the front face of the dashboard.

The Autovac tank consists of two compartments, the upper of which contains automatic valves which serve (1) to put the induction pipe and main tank into communication, so that petrol is drawn from the latter, and (2) to break that connection when the Autovac contains petrol at a predetermined level in its lower compartment. From the latter the petrol runs by gravity to the carburettor float chamber.

DYNAMO AND STARTING MOTOR.

Generating electric current for charging the battery and for the use of the lamps and engine-starting motor, the dynamo is located on the left of the engine, where it is supported by an adjustable bracket and shares a silent chain drive with the camshaft. The bracket is separate from the crankcase, and its front end is secured to the distribution casing by a series of studs and nuts; by slackening these, and making use of a set-screw provided for the purpose, the silent chain can be adjusted without varying the alignment of the drive shaft.

Secured to the rear end of the crankcase on the right-hand side is the starting motor; its shaft extends over the flywheel and carries a small pinion which, when the starter switch is operated, automatically engages with a toothed ring on the flywheel, and automatically disengages as soon as the engine commences to run under its own power; the pinion will, however, make successive attempts to re-engage with the flywheel gear if the starter switch is not released—hence the need for releasing the switch immediately the engine commences to run.

CLUTCH.

The clutch is of the "dual plate" type, which descriptive term implies that it has two driven plates or discs, though actually there are five main members, three of which convey the drive from the flywheel to the driven units.

The five members are as follows—

1. The clutch cover plate, which is bolted to the rear face of the flywheel and encloses the other units; it has attached to its outer face three operating levers which are actuated when the clutch pedal is depressed, and have effect in disconnecting the driving from the driven units of the clutch.

2–3. The centre driving plate and the main driving plate.

4–5. The floating or driven plates.

These five members are arranged within the clutch alternately; that is to say, each driven member is located between two driving plates. The centre driving plate consists of a fabric disc with a

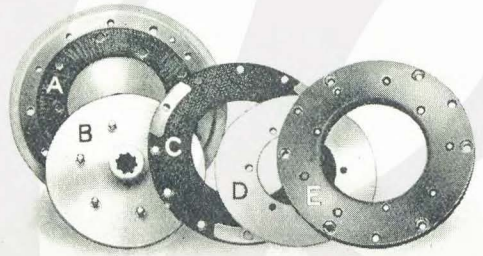


FIG. 55.—THE PLATES OF THE 14 H.P. "STANDARD" CLUTCH DISMANTLED.

A—Combined cover and rear driving plate. *B* and *D*—Driven plates.
C—Centre driving plate. *E*—Main driving plate.

When assembled, the plates *B* and *D* are clamped by spring pressure between the other three plates; if, then, the clutch pedal is depressed, the plates are relieved of spring pressure, and the two driven ones are free to rotate independently of the others.

large hole in the centre, while the other two driving members have fabric facings riveted to them; thus the driven plates, which are wholly of steel, do not make metallic contact with the driving members.

Frictional contact under high pressure is maintained between the clutch plates by a series of six helical springs, which extend rearward from the cover plate and are secured by nuts affording adjustment. The bolts which pass through these springs continue forward through the centre driving and main driving plates, resulting in the five units being clamped together under normal running conditions. When, however, the clutch pedal is depressed the operating levers take effect, through the agency of adjustable contact screws, upon disengaging studs; the latter press forward the main

driving plate and thus (by releasing all the units from spring pressure) permit the driven plates to rotate independently of the others, or become stationary whilst the other three continue to revolve with the flywheel.

The driven plates are interconnected by studs, which project from the rearmost of the pair through holes in the front one, the former having a boss or hub with a slotted hole engaging with castellations on the clutch shaft.

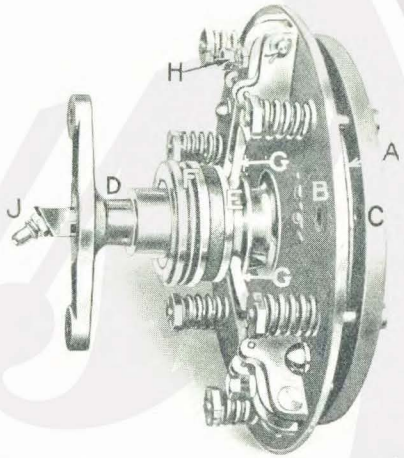


FIG. 56.—THE 14 H.P. "STANDARD" CLUTCH ASSEMBLED, BUT REMOVED FROM THE FLYWHEEL.

A—Centre driving plate.
B—Combined clutch cover and driving plate.
C—Main driving plate.
D—Clutch shaft.
E—Thrust collar.
F—Ball race.
G—Operating levers.
H—Adjusting studs of operating levers.
J—Grease nipple.

The driven plates do not appear in this view, being screened by the driving plates *A* and *B*.

Normally the clutch runs dry (i.e. without lubricant) for the friction fabric contact surfaces are able to take up the drive smoothly without oil, though provision is made for the introduction of a small quantity of oil to the interior if any fierceness or squeaking should occur when the clutch is engaged. That minor defect will not, however, take place unless the clutch is ill-treated by frequent slipping intentionally caused by the driver pressing upon the clutch pedal while the engine is pulling.

CLUTCH COUPLING SHAFT.

Connecting the clutch shaft to the primary shaft of the gearbox is a universally jointed coupling shaft, the joints consisting of fabric discs bolted to two-armed "spiders," integral with the clutch coupling shaft and gearshaft respectively. These joints are provided to counteract any lack of alignment between the engine and gearbox, which might arise owing to the car running over serious irregularities of road surface.

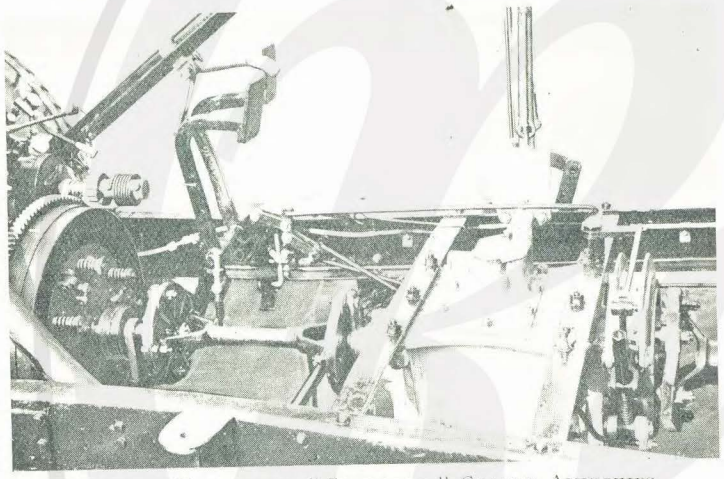


FIG. 57.—THE 14 H.P. "STANDARD" CHASSIS AMIDSHIPS.
Showing the clutch shaft, with flexible joints at each end, connecting the flywheel and gearbox. On the extreme right is the pedal-operated transmission brake.

GEARBOX.

Providing four speeds forward and one reverse, the gearbox is carried by two cross-members of the frame, the gears within being operated by a lever on the right-hand of the driver. The primary gearshaft has formed upon its rear end a unit consisting of the driving half of a dog-clutch for the top gear, and a gear pinion constantly in mesh with one of the gears on the layshaft below. On all except top gear the power passes through those "constant mesh" pinions and back to the secondary shaft (an extension of the primary shaft in alignment with the latter, but free to rotate independently of it).

On top speed, however, all the gear wheels run idly, the drive passing through the dog clutch already mentioned, the halves of

which are then coupled together to convey the drive straight through the gearbox via the primary and secondary shafts. (See diagrams on pp. 74–75.) The reverse gear is completed by an "idler" pinion, brought into engagement with the two gear wheels of the first forward speed.

All the bearings and gear wheels within the box are automatically lubricated by oil carried in the casing, which has a filler hole normally closed by a steel plate that can be swung to one side when replenishment or inspection of the oil level is to be made.

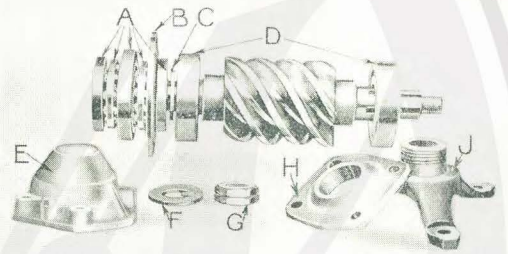


FIG. 58.—UNITS OF THE 14 H.P. "STANDARD" WORM SHAFT DISMANTLED FROM THE REAR AXLE.

A—Double thrust ball bearings
B—Thrust plate.
C—Distance washer.
D—Journal ball bearings.
E—Rear end cover.
F—Tongued washer.
G—Lock-nuts.
H—Front end cover.
J—Star-piece of flexible disc universal joint at the rear end of the propeller shaft.

PROPELLER SHAFT AND REAR AXLE.

The drive from the secondary gearshaft is conveyed to the worm gearing in the rear axle through a tubular propeller shaft having at each end a fabric disc universal joint. The driven spider of the rear universal is secured to the shaft of the overhead worm gearing, which is located within the aluminium centre of the rear axle casing; the latter has tapered steel tubular extensions with ends in which are located the ball bearings of the road wheel hubs.

From the worm gearing the power is conveyed through the differential gear (to the casing of which the wormwheel is attached), thence through the axle shafts to the wheel hubs. All the bearings in the back axle are of the ball type with ball thrust bearings where necessary; these, as well as the worm gearing and differential, are lubricated by oil contained in the axle casing.

Two oil-filling orifices are provided, one above the centre of the

axle casing and the other at the front of the axle centre. This second filling orifice consists of a hole normally closed by a cover plate and formed in a hollow "elbow," which serves as an oil well to supplement the supply of oil carried in the axle centre, thus increasing the efficiency of the worm gear lubrication and reducing the frequency with which replenishments are needed.

BRAKES.

The hand-brake equipment takes effect within drums attached to the rear wheel hubs, each drum having within it a pair of shoes integral with their friction surfaces of cast iron; these shoes are expanded by a cam at the end of a horizontal shaft, supported by a bracket projecting from the rear axle casing, this "camshaft" being actuated when the side lever is pulled towards the driver.

The pedal brake is of the contacting type, two aluminium shoes lined with asbestos fabric applying to the drum attached to the secondary gearshaft. Both sets of brakes have accessible means of adjustment, with automatic locking devices.

When front wheel brakes are fitted they are actuated by the pedal in conjunction with the brake on the gearbox, and are independent of the hand-operated set in the rear wheel drums.

FRONT AXLE.

The main portion of the front axle consists of an H-section steel stamping, through the ends of which pass the pivot pins of the swivel axles, the latter carrying the bearings of the front wheels. The jaws of each swivel axle move around the pivot pin on plain bearings, but the weight of the front of the car is taken by ball-thrust bearings at the top of each pin; these bearings are adjustable, and are secured by means of a castellated nut and splitpin. The ball bearings are enclosed from above by aluminium caps which screw on to a threaded extension of each pivot pin.

STEERING.

The steering wheel is attached to the upper end of a tubular shaft enclosed within a stationary column, and is provided with an adjustable ball bearing at the top and a long plain bearing at the lower end. The steering gear is of the worm and wormwheel pattern and has four "lives," afforded by the ability of the wormwheel to be engaged with the worm at any of four segments, thus enabling slackness due to wear to be counteracted after lengthy use. Projecting from the steering gear casing (the latter attached to the

chassis frame) is the shaft of the wormwheel, which has depending from it a long lever coupled to a rod running forward to the right-hand swivel axle; the latter is connected with the left-hand swivel axle by means of a cross-coupling rod.

SPRINGS.

Both front and rear springs are of the semi-elliptic type, the front ones being 34 in. in length and the back ones 45 in. The rear springs serve to convey the drive from the back axle to the frame and also resist the torque, the latter inferring that they prevent the rear axle casing from rotating when power is being conveyed through the drive shafts and worm gearing within it.

WHEELS.

Both back and front wheels are detachable and interchangeable, being of the hollow-spoked pressed-steel type, secured to the hubs by five driving studs and nuts.

CHAPTER XV

LUBRICATION

NEGLECT of the lubrication requirements of engine or chassis, and even erratic attention to the needs of the various parts calling for oil or grease, cannot fail sooner or later to have harmful results. Insufficient or irregular lubrication is not only conducive to the seizure of bearings, pistons, etc., and to rapid wear ; it also reduces the efficiency of the engine, transmission, and brakes. The results become evident in excessive petrol consumption, poor hill-climbing, reduced speed, and loss of braking power, to say nothing of noise and " roughness " in the running of the car.

Attention to the lubrication of the car should have precedence over cleaning and polishing, though that statement requires qualification in that when or where dirt might find its way into the engine or bearings with the lubricant, it should be removed as a preliminary.

ENGINE REPLENISHMENT.

Replenishment of the engine oil should be made after each 200 miles running and is effected through the filling spout which, in both models, is normally closed by a hinged lid and has within it a gauze strainer. The latter should not be removed when oil is to be poured in, its purpose being to keep back any impurities that may have harmful effect if allowed to enter the engine.

In the case of the *11 h.p.* " Standard " the filling spout is at the front end of the engine on the left. Before fresh oil is poured in the overflow cock should be opened ; this will be found low down on the same side of the engine, near the rear end of the sump—the lowest part of the crankcase, wherein the oil supply is carried. Replenishment should continue until the oil is seen issuing from the overflow cock, but, as indicating the maximum height the oil should attain in the sump, it should be left open for a minute or so after the pouring in of oil has ceased, so as to allow any surplus to drain out. On no account, however, should the cock be left open while the engine is running, otherwise the whole of the oil will be blown out and the engine run dry.

This model has a special warning device intended to operate when the oil level has fallen to the danger point ; but it is not provided

with the idea of allowing the engine always to be used until that point is reached, and must be looked upon merely as a danger signal that will give warning in the last extremity. It consists of a small whistle, through which air from the inside of the engine is blown (owing to the pulsations that occur on account of piston movement) when its lower end is no longer submerged in the oil. The exposed upper end will be found projecting from a flanged portion or web of the crankcase, just behind the rear end of the magneto on the nearside.

A means of ascertaining the approximate amount of oil in the engine is a float wire projecting through the flanged portion of the

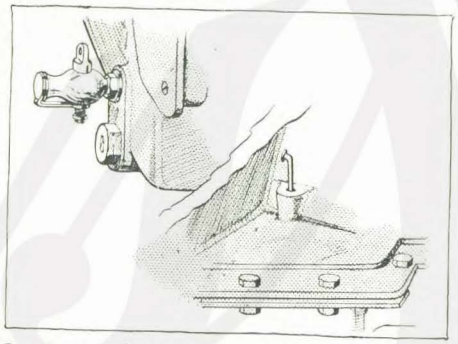


FIG. 59.—OIL LEVEL INDICATORS ON THE 11 H.P. " STANDARD " ENGINE.

At the top is the overflow cock with the drain plug of the oil sump shown immediately below it, while on the right below can be seen the projecting end of the float level indicator wire.

crankcase, just behind the magneto. When this wire can be depressed about 2 in. the engine sump is fully charged, but the danger level is approached if it cannot be pressed down easily, with one finger, more than an inch or so.

This latter oil level indicator is particularly useful for judging the amount of oil remaining after several short runs have been taken since the last replenishment, and also before fresh oil is poured in on any occasion, because it gives a rough idea of how much will be needed before surplus commences to run out of the overflow cock. As a safeguard, it is just as well to depress it before commencing to use the car each day, no matter if the same test was made 24 hours earlier and only 20 to 25 miles have since been covered.

The *14 h.p.* " Standard " oil filler is reached by opening the offside of the bonnet, when the spout will be seen projecting up in

front of the magneto. Before replenishment commences the overflow cock should be opened, its handle extension being located just above the centre of the side web of the aluminium crankcase, below the rear end of the magneto. The cock is closed when the

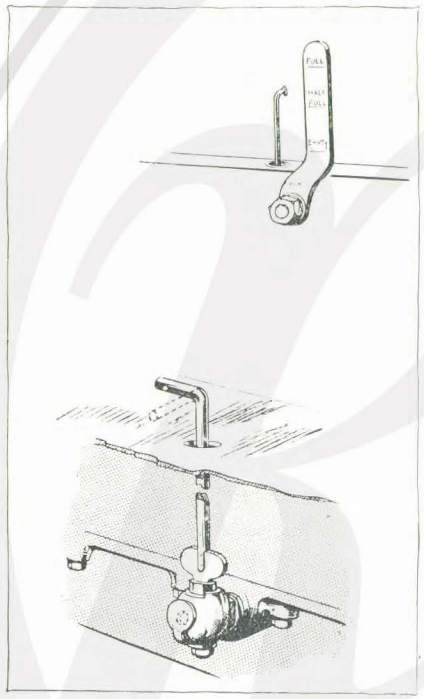


FIG. 60.—OIL LEVEL INDICATORS ON THE 14 H.P. "STANDARD" ENGINE.

At the top is the float wire with the marked plate alongside, while below is the overflow cock with its extension handle projecting up to a convenient level at the side of the crankcase.

handle lies lengthwise in relation to the car, and open when the handle projects towards the offside.

Above the extension handle of the overflow cock, projecting upward alongside the cylinders, is the wire of the oil level indicator float. By the side of it is a plate bearing the words "full," "half full," and "empty." This enables the approximate quantity of oil in the engine to be ascertained at a glance, though it is advisable before noting the height of the wire to depress it once or twice to make sure that it is free to move quite easily. The oil level should

not be allowed to fall below the height represented by the top end of the wire being in line with "half full."

While replenishment proceeds the overflow cock should be left open and the level indicator wire observed, so that the rate of pouring can be reduced as the top of the wire approaches the height of the word "full." Before this occurs oil will commence to run out of the overflow cock, the latter serving principally as a check on the level indicator. When that is observed the cock should be closed; approximately another pint of oil can usually be given before the wire reaches "full." If the wire attains the latter height before oil exudes from the cock, a clean wire should be pushed into the latter to see whether its hole is clear. The cock should never be left open while the engine is running.

In place of the warning whistle of the *11 h.p.*, the *14 h.p.* car has a circulation indicator, which is the more desirable in this case because of the difference in the lubricating systems of the two engines. This indicator is located near the centre of the lower edge of the instrument board in front of the driver. It bears the words "safe" and "danger," and supports a pointer which should always be directed towards the word "safe" while the engine is running. Only when the engine is stationary should it move back, pointing to "danger"; if it does so while the engine is running the cause, in all probability, is an urgent need for replenishing the oil supply in the crankcase; the engine should be stopped at once. If replenishment fails to restore the indicator to its normal position when the engine is restarted, the latter must be stopped again immediately and the cause of the irregularity found out and removed. Particulars of possible causes are given on pages 116 and 205.

DRAINING THE SUMP.

In course of use, despite replenishment with fresh oil from time to time, the lubricant in the crankcase sump deteriorates, becoming contaminated by particles of carbon that form on, but do not all adhere firmly to, the underside of the pistons; and also by some of the heavier elements of the fuel, which, when the engine is started from cold, do not vaporize but mingle with the oil on the cylinder walls, and eventually work down past the pistons into the crankcase.

The oil in the sump should, therefore, be drained off periodically and thrown away (unless a use can be found for it on lawn mowers, garden rollers, and such-like implements). It is not uneconomical in the end to throw away anything up to a gallon of oil in this

way, for, if deteriorated oil is persistently used, it gives rise to unduly rapid wear of the bearings and lowers the general efficiency of the engine, thus indirectly causing a heavy petrol consumption, loss of power, and so on.

After approximately 1,000 miles have been run on a new car the sump should be drained, and the same treatment afforded at the end of each subsequent 2,000 miles.

In the *11 h.p.* "Standard" the sump is drained by removing the hexagon-headed screw at the bottom of the flywheel casing. When the oil ceases to run out, a pint of paraffin should be poured into the oil-filling spout and allowed to drain off thoroughly before the screw plug is refitted. With the plug replaced, fresh oil should be poured in as usual, until it is seen running out of the overflow cock, which must be opened, as previously mentioned, prior to replenishment being given. The oil level should then be checked by means of the float wire.

In the *14 h.p.* model the sump is drained by removing the hexagon-headed screw plug projecting from the right of the sump, just behind the overflow cock. A pint of paraffin should be poured into the filling-spout when oil has ceased to run out of the drain-hole, and should be allowed to drain off as well. The plug must then be replaced and a fresh supply of oil poured in through the filler, until the float wire reaches the level of the word "full" on the plate alongside. The float indicator must finally be checked by noting whether oil runs out of the overflow cock when the latter is opened.

SELECTION OF ENGINE OIL.

No particular brand of oil is recommended, but it should be of medium body and bought in sealed tins or drums, bearing the name of some well-known oil refiner. A first-class grade of oil is essential to ultimate satisfaction, and on no account should attempts be made to "economize" by buying cheap oils. The latter give rise to loss of efficiency, rapid formation of carbon deposit in the cylinders, and other ill-effects which detract from the performance of the engine and car as a whole, as well as encouraging rapid wear of the cylinders, pistons, bearings, and other moving parts.

OVERHEAD VALVE LUBRICATION.

The rockers of the overhead valves of the *11 h.p.* "Standard" are lubricated by oil introduced periodically from an oil can into the large spring-lid cup at the front end of the rocker shaft; thence

it percolates (as described in a preceding chapter) to each of the rocker bearings. The cup should be refilled after each 200 miles running. Engine oil should be used for this purpose, as at other points of the engine and chassis requiring lubrication with an oil can, as specified hereafter.

If the need for replenishing this oil cup should be overlooked, the rocker bearings will become dry and operate sluggishly, which in turn may give rise to noise, as well as undue wear and loss of engine power. If that should happen, oil may be applied directly to the

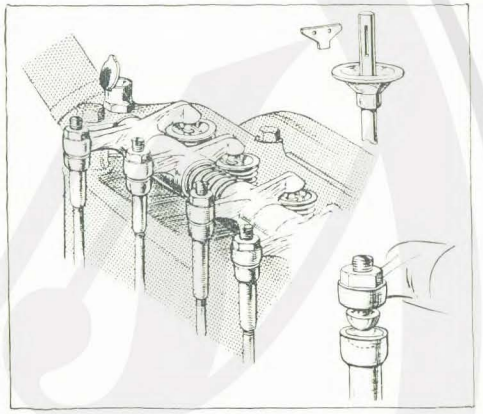


FIG. 61.—A PORTION OF THE OVERHEAD VALVE GEAR OF THE 11 H.P. "STANDARD."

At the top left-hand corner can be seen the oil cup from which lubricant is supplied to the valve rocker shaft. At the top, on the right, is a valve stem with the spring cup and collet, while at the bottom right-hand corner is the top end of a pushrod and rocker, showing the provision for valve clearance adjustment.

bearings by pushing the pairs of rockers to one side, against the helical springs, thus restoring the lubrication at once instead of waiting for the oil to percolate through from the cup; the latter is intentionally a slow process, for otherwise the cup would become empty very quickly, no matter how frequently it might be replenished. As a simple precaution, it is just as well occasionally to push the rockers to one side as mentioned, in order to make sure that oil is reaching the bearing surfaces in the ordinary course.

On each occasion when the oil cup is replenished, two or three drops of oil should be applied to each of the pushrods, at the upper and lower ends, to lubricate their areas in contact with rocker and tappet respectively. There is no need, however, to flood these parts

with oil; it will merely make an unsightly mess; the better policy is to lubricate them "little and often."

The lubrication of the overhead valve gear is maintained automatically on the *14 h.p.* "Standard," oil being delivered under pressure to all parts from the main oiling system.

CLEANING THE OIL FILTERS.

The lubrication system adopted for the *11 h.p.* "Standard" does not require any filters, apart from that in the filling spout. But in the *14 h.p.* engine there are three filters, two of which call for periodical attention and cleaning. The oil in this engine has to pass through small ducts, and if any large particles of foreign matter should get into those passages, they will be restricted or blocked, preventing the oil from circulating properly, if at all. The lubricant is therefore strained first of all through the gauze in the filling spout; next it passes through a perforated sheet-metal tray forming the false bottom of the crankcase, this holding back any pieces of cork, etc., that might be allowed to enter with the oil if the filler gauze were not in use while replenishments were being made. This strainer tray will not become choked in use, and the only time it will need cleaning (even if then) is when the engine is dismantled after lengthy use for overhauling.

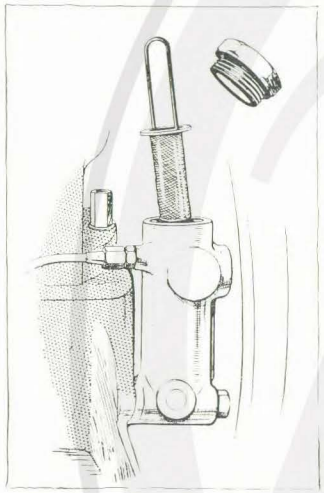


FIG. 62.—THE OIL FILTER REMOVED FROM ITS CASING ON THE PUMP OF THE 14 H.P. "STANDARD."
Normally the filter is enclosed by the hexagon-headed cap.

Next the oil is filtered through a cylinder of fine gauze which lies across the bottom of the sump, closed at one end and communicating at the other (open) end with the outlet to the pump suction pipe elbow. Before oil can leave the sump, it must run into and along the inside of this cylinder of gauze to reach the suction pipe; from the latter it passes to the pump, reaching the latter through a second gauze filter located in a chamber integral with the pump casing. The pump is at the rear end of the camshaft, at the left-hand rear end of the crankcase, between the latter and the flywheel.

To remove and clean the sump filter, the union nut at the lower end of the suction pipe must first be unscrewed; then the two nuts which hold in place the flange of the suction pipe elbow must be removed, after which the flange can be drawn away, bringing with it the cylindrical filter gauze. The oil in the sump will gush out while this is being done, so a bowl should be in readiness to receive it. Care should be taken to avoid damaging the brown-paper joint washer between the flange and the crankcase; if it is torn during the process of removal a new one must be cut and fitted before the parts are reassembled, otherwise an oil leak may occur subsequently.

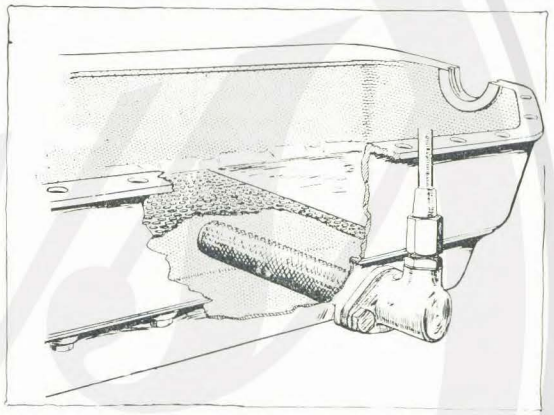


FIG. 63.—CUT-AWAY VIEW OF THE 14 H.P. "STANDARD" CRANKCASE.
Showing a part of the perforated sheet-metal forming a false bottom and oil strainer; under the cut-away portion is the cylindrical oil filter attached to the suction pipe elbow, the latter being seen on the right.

The filter when removed should be washed thoroughly in paraffin or petrol to remove any impurities and sludge that may be adhering to its outer surface. If a cloth be used it should be of a fluffless variety.

After the filter has been cleaned and replaced (care being taken to tighten the flange nuts thoroughly, but not excessively or with a big wrench), the sump must be refilled with oil to the prescribed level; possibly a supply of fresh oil will be due, for this filter should be cleaned after each 1,000 miles running, and fresh oil is advisable after each 2,000 miles (as mentioned previously). If the old oil is poured back, make certain that the level indicator float rises to the word "full" on the plate alongside it, for some may have been lost in draining-off.

The pump filter is more easily attended to, and should be removed

and cleaned at similar intervals (after each 1,000 miles running). It is accessible after a hexagon-headed screwed plug on the top of the pump casing has been removed, the top of a hairpin-shaped wire handle being then visible, enabling the filter to be lifted out and replaced. Do not omit to tighten the screwed plug thoroughly when the filter has been refitted.

After the filters have been cleaned and the sump recharged with oil, it is advisable to start up the engine and see whether the oil is circulating properly. First, it should be noted whether the circulation indicator on the instrument board points to "safe." Then the test cock should be used, as described in the following paragraph.

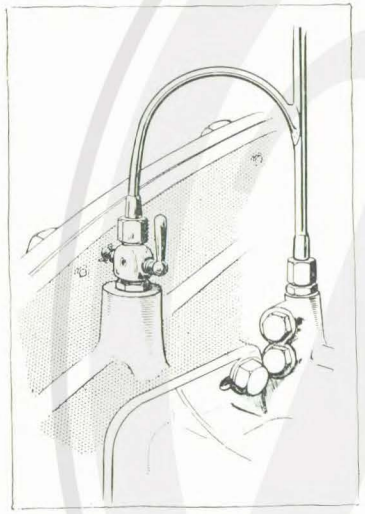


FIG. 64.—THE OIL CIRCULATION TEST COCK ON THE 14 H.P. "STANDARD" ENGINE.

USE OF THE TEST COCK.

The oil circulation test cock is located at the front end of the engine on the left, screwed into the top of the distribution casing, just in front of the magneto bracket. Normally the handle of this cock should be vertical, allowing oil to reach the dynamo shaft bearing. If a test is to be made the handle is moved to a horizontal position, when oil should issue from a small hole in the side of the body of the cock. If that occurs and continues while the cock remains open for a few seconds, all is well, providing the indicator on the instrument board points to "safe."

Should oil issue from the cock and the indicator point to "danger," the cause will in all probability be some derangement in the connection between the plunger above the rear main bearing of the crankshaft and the indicator; maybe the connecting wire is bent or disconnected at one end or the other.

If oil does not issue from the open test cock while the engine is running at a fair speed, the cause may be (1) a loose or leaky joint (allowing air to enter) at one end or other of the suction pipe between the sump filter and the pump, (2) a choked filter, or (3) insufficient oil in the sump.

MAGNETO AND CONTROLS.

Two or three drops of oil should be given from an oil can to the front and rear bearings of the magneto after each 500 miles running. But no more than that is needed; in fact, more may be actually harmful, because any excess will be liable to find its way to the insulating material of the interior of the machine and on to the contact breaker, causing misfires, if not an actual breakdown of the insulation.

There are numerous joints of the control rods running to the magneto and carburettor throttle, and each one should be given two or three drops of oil occasionally, not so much to ensure their working freely as to prevent excessive wear and consequent rattle and "lost motion" in the controls. The specified quantity of oil should be given once a month or after each 1,000 miles running.

FAN.

The bearing of the fan on the *14 h.p.* "Standard" needs replenishment with grease occasionally (say, after each 500 miles running). The fan hub has a nipple screwed into it; to this the grease gun should be applied and the handle given two or three turns, or until grease is seen exuding from the end of the fan hub.

CLUTCH.

The clutch of the *11 h.p.* model is automatically lubricated by reason of its being enclosed within the flywheel casing, wherein oil is constantly being thrown in all directions by the flywheel.

On the *14 h.p.* "Standard" the flywheel and clutch are exposed, and a few details of the latter require occasional attention with an oil can. The clutch plates normally require no lubrication, but if the clutch is "fierce" in taking up the drive, causing the car to start with a jerk or "shudder," no matter how carefully the clutch pedal is released, a small quantity of engine oil (a dessert spoonful or so) can be introduced into the interior, through a hole exposed in the rear cover plate by removing one or other of two round-headed brass screws.

To introduce oil to the clutch interior, the hole from which the screw has been removed should be brought vertically over the clutch shaft (by rotating the flywheel), and half an inch or so of the spout of an oil can pushed in; the oil then injected will fall on to the edges of some of the friction discs, and will run on to the contact surfaces if the clutch pedal is depressed immediately and held so for a few seconds.

Grease or thick oil should never be put into the clutch casing, for a slipping clutch is almost sure to be the result. If that effect is observed after engine oil has been introduced, the lubricant can be drained out by removing both of the round-headed brass screws, and arranging one hole above and the other below the clutch shaft. Should slipping even then continue, one screw should be replaced and a tablespoonful of paraffin poured into the other; next replace the second screw, start up the engine, press the clutch pedal two or three times, stop the engine, and drain off the paraffin.

But neither oil nor paraffin should be needed if the clutch is used fairly; if, that is to say, the driver refrains from causing it to slip by pressing on the pedal for more or less lengthy periods while the engine is pulling. He should bear in mind that the clutch pedal should be used only when gears are to be changed, or when the car is to be started or stopped.

There are, however, three bearing surfaces of the clutch that require the regular application of lubricant. The first two are the clutch shaft bearing and the front castellated end of that shaft passing through the rearmost floating plate. They are lubricated by grease introduced through a nipple to be found on the rear end of the clutch shaft, projecting through the central hole of the foremost fabric disc joint. The grease gun, applied to this nipple after each 500 miles running, should be given not more than two or three turns; it is most important to note that an excessive amount of grease here is harmful, because it will work its way through to the clutch plates and cause either slipping or "spinning." The latter infers that the clutch shaft continues to rotate indefinitely when the clutch pedal is depressed while the gear lever is in neutral; as a result, difficulty and a good deal of noise occur when an attempt is made to engage one of the gears.

The third part requiring lubrication is the thrust collar. This is the grooved sleeve which, actuated by the clutch pedal and its connections, takes effect upon the three clutch-operating levers. The grease nipple mentioned above supplies lubricant indirectly to this part, but it is advisable occasionally to apply a few drops of oil to it as well; the oil should be dropped on to the clutch cover hub (over which the collar fits), on to the front end of the latter, and on to the ball thrust bearing.

To keep them free from rust and reduce their rate of wear, the pivot pins of the operating levers may also be given a few drops of oil occasionally.

GEARBOX.

Any well-known brand of special gear oil may be used in the gearbox, but on no account should grease be introduced.

Oil replenishments are made through the hole in the top of the box, normally closed by a cover plate secured by a pair of nuts.

The oil level in the gearbox should be tested after each 500 miles running, or earlier if pronounced leakage has been observed, though in the latter event it is obviously desirable that the source of the leak should be ascertained and the cause removed.

In the case of the *11 h.p.* model the gearbox has sufficient oil if the level of the latter is approximately 4 in. below the top edge of the filler hole, while in the *14 h.p.* gearbox it should be deep enough just to cover the smallest pinion on the lower shaft, or approximately 7 in. below the top of the filler hole. No great quantity of oil is needed, merely sufficient to allow the lowest gears to be about half submerged; any quantity beyond that is useless and undesirable, because it merely results in leakage and waste.

After each 3,000 miles running the gearbox oil should be drained off (by removing the drain plug under the casing) and thrown away, the box then being flushed out several times with paraffin to remove any chippings of gear teeth that may have been dislodged by faulty gear-changing; finally, fresh gear oil should be poured in up to the specified level.

The whole of the interior parts of the gearbox are automatically lubricated by the oil in the casing, but in the *11 h.p.* model there are one or two small items which should be given a few drops of oil after every 500 miles; they are the bearings at each end of the gear lever shaft and the forked ends of the "selector rods," which project from the box and are actuated by a short lever or "finger" attached to the inner end of the gear lever shaft.

REAR AXLE.

Lubrication of the back axle worm gearing, differential, and all the bearings in the casing is effected by oil, which must be of one of the well-known brands of special worm gear oil. Replenishments are effected through holes on extensions of the axle casing normally closed by cover plates; the latter are secured by wing nuts, but these need not be removed, merely slackened, to allow the plate to be swung to one side.

On the *11 h.p.* "Standard" the filling hole is in a rearward extension of the centre of the axle casing, but on the *14 h.p.* model it is in a front extension. These filling holes also serve as level

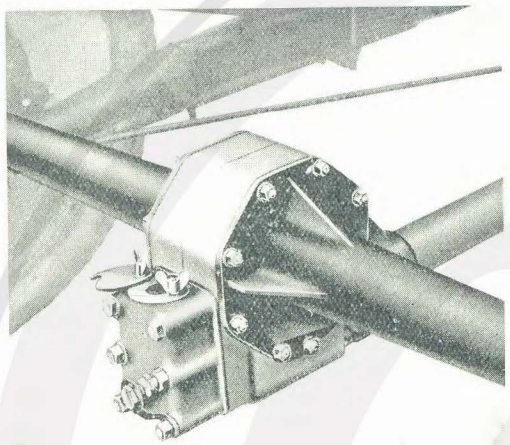


FIG. 65.—THE CENTRE OF THE 11 H.P. "STANDARD" BACK AXLE.
This view shows the oil filler extension with its cover plate moved to one side.

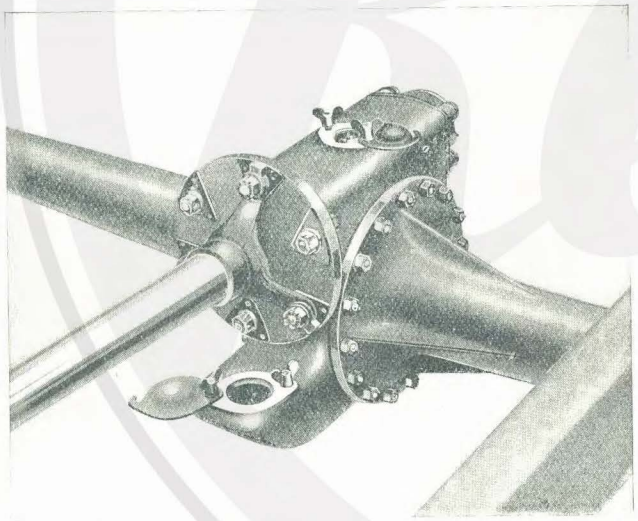


FIG. 66.—THE BACK AXLE CENTRE OF THE 14 H.P. "STANDARD."
Showing the inspection hole above the worm casing, and the oil filling and level testing extension below.

indicators, for the oil in the casing should be maintained at a level approximately 1 in. to 1½ in. below the top edge of the hole.

Inspections of the oil level, and replenishments, if needed, should be made after each 500 miles running; they should preferably be made at the end of a run, because the old oil is then warm and flows more readily to a true level when replenishments are effected.

At the conclusion of each 3,000 miles running, the oil in the axle should be drained out by removing the hexagon-headed screwed plug below the axle casing; this old oil should be thrown away and

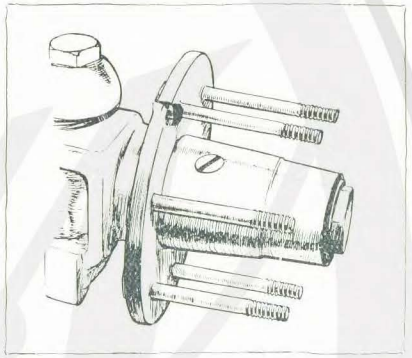


FIG. 67.—A FRONT HUB OF THE 14 H.P. "STANDARD."
With the wheel removed to show the screw that may be removed for grease to be introduced to the interior.

a fresh supply to the correct level poured in, but before the latter is done the casing should be flushed out with paraffin, repeating this process several times so as to remove any sludge.

Great care should be taken to prevent any form of dirt or grit from getting into the axle casing; as a preliminary to removing the cover plate of the filling orifice, all dirt should be wiped away and not a speck should be allowed to fall into the hole while it is open. Any form of abrasive entering the axle will do harm to the parts within, especially the worm gearing. Moreover, care should be taken to secure a good seal when the cover plate is refitted.

FRONT AND REAR WHEELS.

The bearings of the rear wheels are lubricated by grease introduced by means of the grease gun. On the *11 h.p.* car the nipples are located inside the wheel caps, which can be removed after unscrewing the nuts that hold the wheels in place; but the latter should be jacked up as a preliminary. On the *14 h.p.* model the

rear wheel bearing nipples are behind the centre of the brake drums, projecting towards the centre-line of the chassis. The grease gun should be applied in both cases, and its handle given two or three turns after each 500 miles running. But these bearings should not be over-lubricated, otherwise the excess of grease will find its way into the brake drums and reduce the braking efficiency.

The front wheel bearings require additional lubricant very infrequently; in fact, its prime purpose is to resist the effects of moisture, which might otherwise cause "pitting" due to rust. Grease is the lubricant needed and is introduced through a small

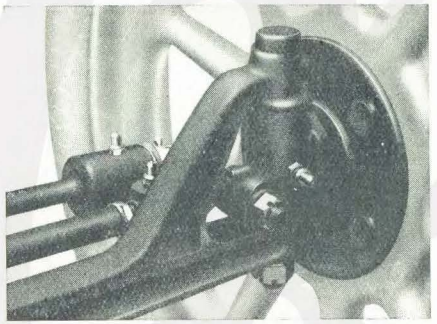


FIG. 68.—LEFT SIDE OF THE 11 H.P. "STANDARD" FRONT AXLE.
Showing the grease nipples on steering swivel and coupling rod joints.

hole in the hub shell, disclosed by removing the wheel; normally, this hole is closed by a screwed plug, the replacement of which should on no account be omitted when additional grease has been forced in. A spare grease nipple is included in the tool-kit for use in this hole and in conjunction with the grease gun; half a dozen turns of the handle of the latter should be given each 2,000 miles.

STEERING AND FRONT AXLE.

The worm gearing enclosed within the casing at the lower end of the steering column may be lubricated by special gear oil, or a mixture of oil and grease of a consistency making it barely fluid. The casing should be completely filled, replenishments, given after each 2,000 miles running, being made through the large filling orifice at the top of the casing; the cover plate can be swung to one side by slackening the wing nuts on the *11 h.p.* chassis, and removing the set screws on the *14 h.p.* model.

On the cover plate of the *11 h.p.* casing is a grease nipple, and the

grease gun should be applied to this after each 500 miles, and its handle given half a dozen turns. On this model there are other grease nipples requiring attention periodically to keep the steering free. One is on the downward extension of the casing, and might be overlooked if its presence were unsuspected; it serves to convey grease to the wormwheel shaft, and is slightly below and beyond the casing, when one is standing on the right-hand side of the car. It should have the grease gun applied, and the handle of the latter given two or three turns every 500 miles.

FIG. 69.—THE STEERING GEARBOX OF THE 11 H.P. "STANDARD" WITH ITS COVER PLATE REMOVED.
The three grease nipples are in view, viz., those on the cover plate, wormwheel shaft, and connecting rod joint.

There are two grease nipples on the steering gear casing of the *14 h.p.* "Standard"; one is for lubricating the lower bearing of the steering column, and the other the wormwheel shaft; both are prominently located and cannot be missed.

The steering coupling rods—one leading from the drop lever on the gear casing, and the other connecting the swivel axles—have grease nipples at each end. The grease gun should be applied to them, and its handle given two or three turns after each 500 miles running.

Then there are highly important nipples on the swivel axles (at each end of the main front axle); they serve to lubricate the swivel pin bearings, which will work stiffly unless they are well lubricated. It is impossible to give these bearings too much grease (apart from the fact that it will exude and be wasted), and the grease gun should

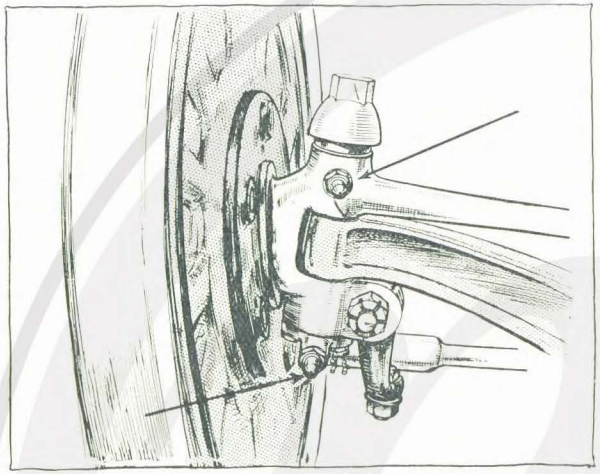


FIG. 70.—FRONT AXLE SWIVEL OF THE 14 H.P. "STANDARD."
The arrows indicate the two grease nipples for the swivel pin bushes. The hexagon-headed cap contains grease for the ball-thrust bearing.

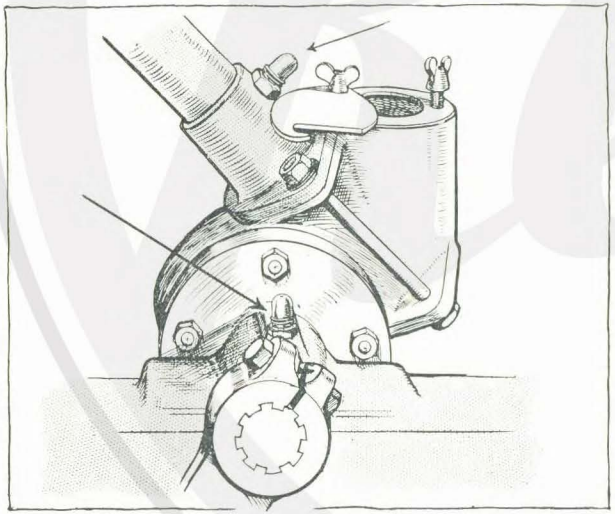


FIG. 71.—THE STEERING GEAR CASING OF THE 14 H.P. "STANDARD" WITH THE FILLING ORIFICE OPEN.
The arrows indicate the grease nipples for the bearings of the steering column and the lever shaft respectively.

be used on them as often as possible—say after each 200 miles running. The handle of the gun should be turned until grease is seen or heard exuding from one or both ends of the "knuckle" joints.

SPRINGS.

The initial flexibility of the springs should be maintained for six months at least by the gaiters, which enclose them and retain the grease with which they are charged while being assembled. But after that, and at six-monthly intervals (say 3,000 miles running) it is advisable to remove the gaiters, apply fresh grease freely to the

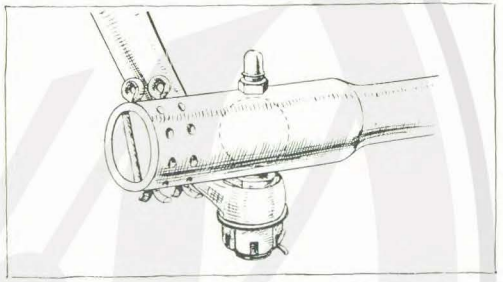


FIG. 72.—STEERING ROD JOINT, NORMALLY ENCASED IN A RUBBER SLEEVE, THROUGH WHICH THE GREASE NIPPLE PROJECTS.

springs and refit the gaiters, making sure that the edges overlap as before under the springs, so that they will exclude dirt and water.

Although there are no shackles on the quarter-elliptic springs of the *11 h.p.* car, there are sliding anchorages at their ends secured to the axles. A few drops of oil can therefore be applied with advantage to the anchor pins on the front axle, and at each side of the spring leaves below the rear axle; a liberal smear of grease should also be applied under the bottom leaf of each rear spring, at the back and in front of the hexagonal sleeve on which the leaf rests. This process and the oiling of the other joints should be completed after each 500 miles running.

The nipples on the spring pins and shackles of the *14 h.p.* model should have the grease gun applied to them after each 200 miles running, and its handle turned until grease is seen or heard exuding from the ends of the shackle bearings. The pins at the rear ends of both front and back springs need regular attention in this way, for they are subjected to rapid, considerable, and almost continuous movement; they are likely to wear unduly and squeak if their lubrication is neglected.

BRAKES.

Extending from the inner sides of the wheel brakes are the bearing brackets of the brake camshafts. They are fitted with grease nipples, and it is imperative, if braking efficiency is to be maintained, that these bearings should be kept thoroughly lubricated. If they work stiffly the brakes will not be so effective when the pedal or lever is used, and the shoes will tend to rub the drums—causing loss of power and unnecessary wear—after the pedal or

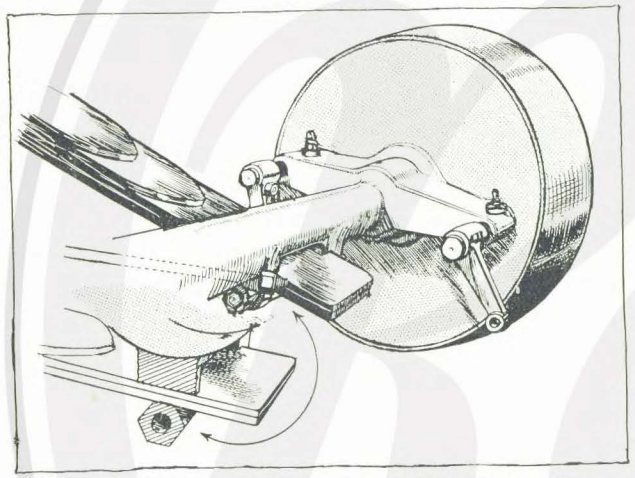


FIG. 73.—RIGHT-HAND END OF THE REAR AXLE OF THE 11 H.P. "STANDARD."

Showing the spring anchorage and brake camshafts, each of the latter provided with a grease nipple. The inset below shows the hexagon sleeve on which the spring ends slide, the latter occasionally requiring a smear of grease.

lever has been released. In other words, the brakes will neither "go on" nor "come off" properly.

The grease gun should be applied here after each 500 miles running, or once a month if the car is infrequently used, especially when wet roads obtain. At similar intervals two or three drops of oil from a can should be applied to all the joints of both hand and foot brakes, to keep them from rusting, rattling, and becoming stiff.

USE OF THE GREASE GUN.

The grease gun system of chassis lubrication, which has displaced grease cups that needed replenishing individually, is capable of delivering the lubricant at high pressure into the bearing surfaces that are provided with nipples to which the gun can be applied.

But it must not be assumed, after some or all of the points provided with nipples have been neglected for a long while, that the grease can always be forced in. The lubricant hardens in the passages after a month or so, and blocks them as effectually as if each one were plugged with wood. Hence, although in the foregoing the intervals between the application of fresh grease have been specified in terms of the number of miles run since the previous application, it will be safer, when the car is not in regular service, to make use of the grease gun at all points at intervals of a month or less. The following will form a guide in this respect—

Where 200 miles is specified, use gun weekly, at least.
" 500 " " " " fortnightly, at least.
" 1,000 " and over is specified, use gun monthly, at least.

The grease gun is replenished as follows. Screw back the handle as far as it will go, then unscrew the barrel cap at that end and pull out the plunger. Stuff the barrel nearly full of fresh grease and refit the plunger. Great care should be taken in the latter process not to crumple the leather "bucket" or cup, otherwise grease will escape back past it, and a greatly reduced pressure will be available at the nipple. Next the cap should be screwed on, care being taken in this case not to "cross the threads." The gun is then ready for use, though on the first nipple to which it is applied air may be ejected with the grease, until the latter becomes tightly packed in the barrel.

Grease cannot be ejected from the gun unless it is fixed properly on a nipple, for its nozzle contains a valve which is normally closed, and is opened only when the nipple is in firm contact with it. That is why grease does not continue to exude from the nozzle when it is disconnected.

The nipple also contains a non-return valve, preventing grease from returning through its exposed end. Care should be taken, however, to remove any dirt that may be on the nipple before the gun is applied to it, otherwise difficulty may be experienced in fitting the gun nozzle properly, dirt may be carried into the bearing with the grease, and the non-return valve may be rendered inoperative.

The gun nozzle and nipples of the *11 h.p.* model differ from those of the *14 h.p.* "Standard." In the former case, the nozzle must be pushed firmly against the nipple, overcoming the resistance of the non-return valve spring, and then a partial turn given to the knurled sleeve attached to it. If the interior of the nozzle be

examined it will be seen that, when the sleeve is turned as far as possible in one direction, two small pins project inwardly; that represents the "locked" position of the sleeve, and before the nozzle is applied the sleeve should be turned until the pins no longer project.

A quick-thread attachment occurs between the gun nozzle and one type of nipple found on the *14 h.p.* "Standard." Screwing one on to the other is all that is needed to connect them ready for the gun to be used. With another type of nipple on the *14 h.p.* model there is need only to push the connector of the gun on to the tapered end of the nipple; but the push must be direct and firm,

FIG. 74.—THE GREASE GUN SUPPLIED WITH THE 11 H.P. "STANDARD" CAR.

the T-handle having previously been screwed down as tightly as possible.

With regard to the kind of lubricant to be used in the grease gun, the latter, as its name implies, is intended to be charged with one of the brands of special motor greases to be obtained at any garage. But an increasing number of motorists now use, instead, a mixture of thick oil and grease that will just flow and find its own level in a tin or other receptacle if left alone for a few moments; alternatively they favour one of the heavier types of gear oils.

These preferences are due to experience having shown that a "thinner" lubricant than grease more readily "circulates" within the bearings to which it is applied, coating the whole of the surfaces instead of—as is often the case with grease—merely reaching the parts that lie in the path of least resistance towards the ends of the bearings. Then, too, it has been found that a semi-fluid, as distinct from a solid, lubricant is less prone to harden in the passages and slots of the bearings if left undisturbed for lengthy periods. The current tendency, then, is for the grease gun to become an oil-gun, but one in which a very thick oil is used—certainly not engine oil, though the latter may be used thoroughly mixed with solid grease to form a semi-fluid mixture.

LUBRICATION SUMMARY.

Summarizing the recommendations given in detail in this chapter, but with the qualifications specified in the last section ("Use of the Grease Gun"), the following are the routine processes in regard to engine and chassis lubrication that should be completed at the intervals mentioned in each case—

INTERVAL.	11 H.P. "STANDARD."	14 H.P. "STANDARD."
Each Day or after 200 Miles . .	Test oil level in engine and replenish, if necessary. Refill oil cup on valve rocker shaft. Apply few drops of oil to pushrod ends. Use grease gun on front axle.	Test oil level in engine and replenish if necessary. Use grease gun on front axle and spring shackles.
Each 500 Miles .	Use grease gun on nipples on steering box, joints of steering coupling rods, in rear wheel hubs, and on brake camshaft brackets. Oil magneto bearings, gear lever shaft bearings and selector rod forks. Lubricate (oil and grease) exposed ends of springs. Examine oil level in gearbox and rear axle and replenish if necessary.	Use grease gun on nipples of fan, clutch shaft, steering gearbox, joints of steering coupling rods, back wheel bearings, and rear brake camshafts. Oil clutch thrust collar and magneto bearings. Examine oil level in gearbox and back axle and replenish if necessary.
Each 1,000 Miles .	Oil control rod joints (brakes, throttle, ignition, etc.).	Clean oil filters of engine. Oil control rod joints (brakes, throttle, ignition, etc.).
Each 2,000 Miles .	Replenish lubricant in steering gearbox. Drain oil sump of engine, flush out with paraffin, and recharge with fresh oil. Replenish front wheel hubs with grease.	Replenish lubricant in steering gearbox. Drain oil sump of engine, flush out with paraffin, and recharge with fresh oil. Replenish front wheel hubs with grease.
Each 3,000 Miles .	Drain off old oil from gearbox and rear axle, flush out with paraffin, and refill with fresh worm gear oil. Remove spring gaiters, and recharge with fresh grease.	Drain off old oil from gearbox and rear axle, flush out with paraffin, and refill with fresh worm gear oil. Remove spring gaiters, and recharge with fresh grease.

CHAPTER XVI

BRAKE ADJUSTMENTS

On the *11 h.p.* "Standard" the provisions for brake adjustments consist of self-locking sleeve-nuts towards the lower ends of the brake pedal and hand lever; the nuts screw on to the ends of the rods running back to the brake cross-shafts, and are rendered accessible by lifting the front floor boards, though the adjusting

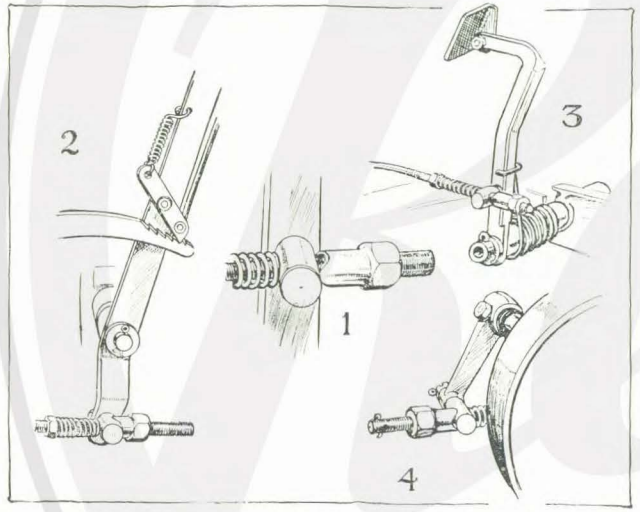


Fig. 75.—The Brake Adjustments of the 11 h.p. "Standard."
1. Type of self-locking nut used throughout.
2–3. Adjustments on hand lever and pedal.
4. Adjustment on one of the levers of the brake camshafts.

nut on the pedal can be reached from the left-hand side of the engine space.

A similar means of adjustment occurs at the rear ends of the pullrods, where these are attached to the levers of the camshafts on the back axle. The nuts on the pedal and hand lever can, however, be considered as the service adjustments and the others kept in reserve. When the service adjustments have been "used up"—i.e. when the sleeve-nuts have been tightened as far as they

will go after successive adjustments have been made—the nuts should be screwed back towards the end of their rods and the brakes adjusted at the rear pullrods. Each of the nuts on the latter, when either hand or foot-brakes are in question, should be given an equal number of turns; although the brake connections include a compensating device, it is better not to depend wholly upon this to correct irregularities of adjustment but to leave it to serve its main function, viz., to equalize the brake pressure applied to the rear wheels. Here it should be mentioned that the pullrods fixed

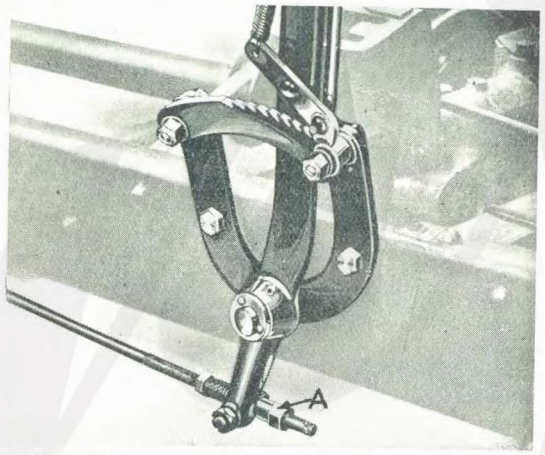


Fig. 76.—The Brake Adjustment on the Lower End of the Hand Lever of the 14 h.p. "Standard."
The self-locking nut is shown at *A*.

to the camshaft levers in *front* of the back axle are those running from the hand-brake, while the other two, behind the axle, are the pullrods of the pedal brake.

After the brakes have been adjusted by the nuts on the rear ends of the pullrods the service adjustment on pedal or hand lever will come into use again, without the need for attention being given to the nuts near the axle until, for a second time, the service adjustments have been used up.

The adjustment of the pedal-operated brake of the *14 h.p.* "Standard" consists of a sleeve-nut projecting upward from the left of the brake shoes behind the gearbox; it becomes accessible if the rear footboard of the front seat is removed. This nut is of the self-locking type, being prevented from rotating inadvertently

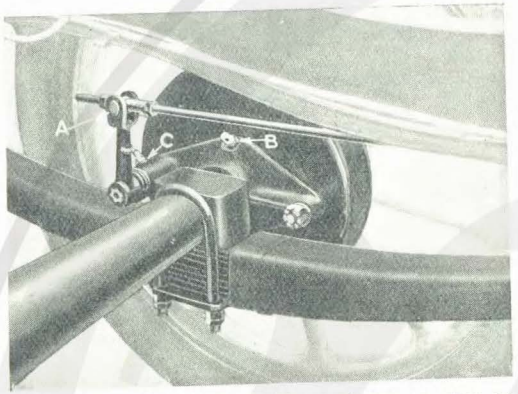


FIG. 77.—LEFT END OF THE REAR AXLE OF THE 14 H.P. "STANDARD."

A—Brake adjustment on camshaft lever.
B—Grease nipple for wheel hub bearings.
C—Grease nipple on brake camshaft.

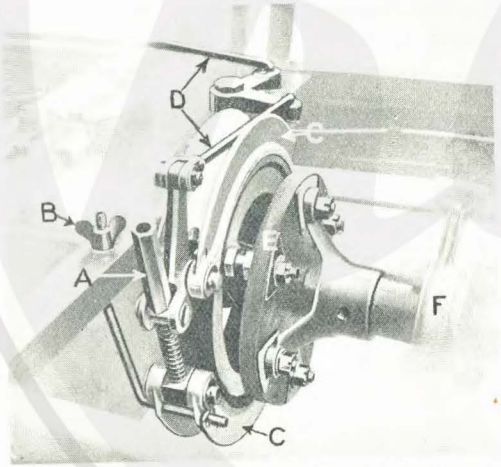


FIG 78.—THE TRANSMISSION OR PEDAL BRAKE OF THE 14 H.P. "STANDARD."

A—Hexagon sleeve adjusting nut.
B—Wing-nut of brake-stop adjustment.
C—Fabric-lined aluminium shoes.
D—Operating rods.
E—Fabric disc universal joint.
F—Speedometer drive pulley attached to propeller shaft.

by the pressure of a spring and notches at two points in its diameter.

To prevent the shoes from rubbing on the drum when the pedal is released an adjustable stop is provided. Immediately in front of the sleeve-nut (on top of a cross-member of the frame there to be found) is a wing-nut screwed to a rod which takes the weight of the bottom shoe ; if it is impossible, when the brake is released, to insert a narrow strip of thin tin between the top shoe and the drum, this wing-nut should be turned until the shoe and drum are clear of one another.

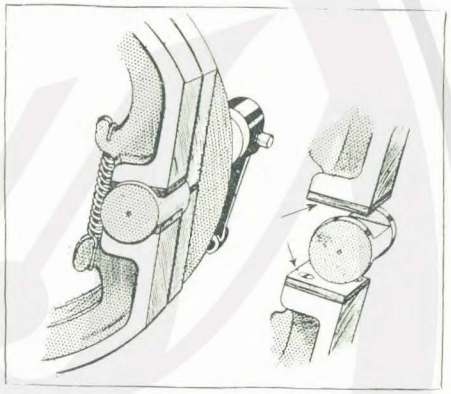


FIG. 79.—OPERATING CAMS OF THE BRAKE SHOES ON THE 11 H.P. "STANDARD."

The arrows indicate the renewable hardened steel plates with which the cams make contact, and which can be renewed when wear has taken place.

There is an adjustment at the front end of the pullrod on the bottom of the brake pedal, but this should not be used to adjust the brake ; it is provided merely to adjust the angle of the pedal in relation to the coupling levers.

The service adjustment of the hand-brake shoes is at the bottom end of the lever, consisting of a self-locking sleeve-nut screwed on to the end of the pullrod. This adjustment will require to be slackened off after it has been used on several successive occasions, and the brake shoes correctly adjusted by means of the nuts at the rear ends of the rods projecting over the back axle ; this will make the nut on the end of the lever effective again for some while.

When front wheel brakes are fitted to the *14 h.p.* "Standard," they can be adjusted at three different points. They are operated by the pedal in conjunction with the gearbox brake, and the gear

brake adjustment affects both the front brakes as well. The other two points are at the rear ends of the operating cables, running back from the front wheel brake camshaft levers; the cable ends are of solid steel, threaded and fitted with self-locking nuts. Dual equalizers are provided, viz., one between the two front brakes and one between the latter and the gear brake; so adjustments at any one point will have effect at the other two. Nevertheless, it is better to adjust alternately at the gear brake and at the ends of the operating cables; if that plan be followed the equalizers will be called upon to serve their main purpose alone, viz., to equalize the braking effort. When the cable-nuts are used they should be adjusted equally.

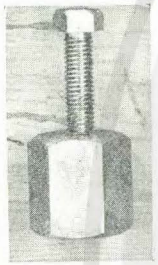


FIG. 80.—A SPECIAL TOOL PROVIDED FOR DRAWING OFF THE REAR HUBS.

Here it should be said that the front brake camshafts are provided with grease nipples; these should receive attention at the same intervals as those on the rear brake camshafts, viz., after each 500 miles running.

The brakes should not be adjusted too closely; in other words, both pedal and hand lever should have a certain amount of "lost motion" or free movement. They should move through approximately one-third of their range before taking effect, otherwise there will be a possibility of the brake shoes rubbing continuously in or on their drums. This and the following paragraph applies to both the *11 h.p.* and the *14 h.p.* cars, it should be noted.

If after lengthy service the brake levers on the cam-operating shafts attached to the rear axle move forward beyond the vertical, when the brakes are applied, the angle of the levers can be reset and the shoes given a new lease of life by fitting thin metal packing-pieces under the detachable steel contact plates at the ends of the shoes to which the cams apply. These plates are secured by screws, and are made accessible by removing the wheels and brake drums. When the wheels are detached, two countersunk screws become visible, passing through the flanges of the drums, and the removal of these screws will permit the drums to be withdrawn.

CHAPTER XVII

CLUTCH ADJUSTMENT

IF the clutch should have a tendency to slip (which is indicated by the engine running at an excessive speed in relation to the speed of the car on any gear), it will nearly always be due to an incorrect adjustment of the coupling rod between the pedal and the clutch

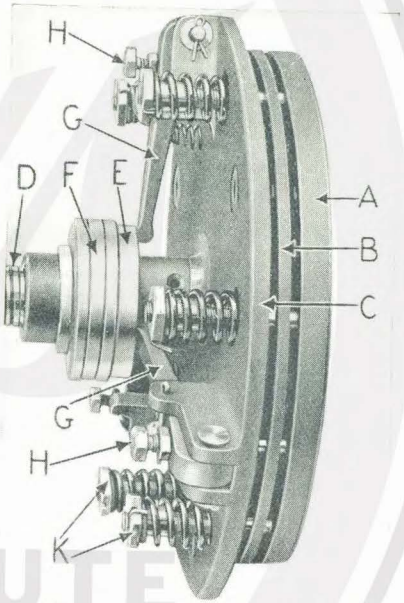


FIG. 81.—CLUTCH OF THE 11 H.P. "STANDARD" CAR REMOVED FROM THE ENGINE FLYWHEEL.

A—Main driving plate.
B—Centre driving plate.
C—Combined clutch cover and rear driving plate.
D—Clutch shaft.
E—Thrust collar.
F—Ball-thrust race.
G—Operating levers.
H—Adjusting studs of operating levers.
K—Nuts for spring adjustment.

fork, the latter being located behind the ball-thrust bearing. There should always be a certain amount of lost motion of the pedal, i.e. it should be possible to move it forward an inch or so before the full resistance of the clutch springs is felt. If that does not occur, the adjusting nut on the clutch-operating rod of the *14 h.p.*

car should be suitably varied, while lost motion can be given to the *11 h.p.* clutch pedal by screwing back equally the set-screws on the three operating levers attached to the clutch cover plate.

If the clutch should slip, despite the pedal having an inch or so of lost motion, it may be necessary to tighten the nuts forming the abutments for the clutch springs; but this is an extremely improbable requirement, unless the clutch has been ill-treated, on account

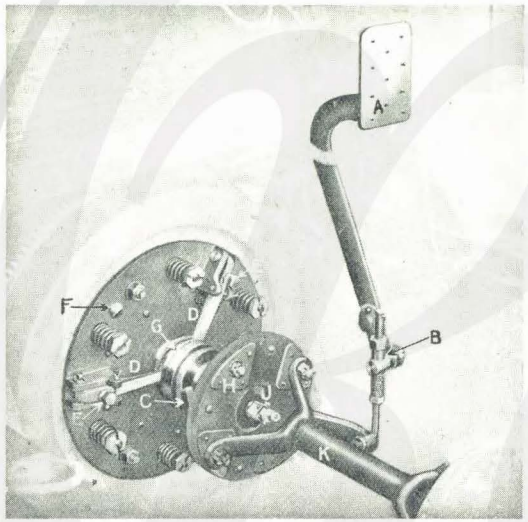


FIG. 82.—THE CLUTCH OF THE 14 H.P. "STANDARD" MOUNTED ON THE FLYWHEEL.

A—Pedal plate.
B—Sleeve-nut for clutch fork adjustment.
C—Clutch fork end.
D—Operating levers.
E—Set-screws for adjusting operating levers.
F—Drain plug.
G—Thrust collar.
H—Fabric disc universal joint.
J—Clutch shaft grease nipple.
K—Coupling shaft.

of the driver frequently causing it to slip by pressing upon the clutch pedal when the engine is pulling.

Fierceness of the clutch, or "shuddering" when the car is started, has been referred to in the section dealing with clutch lubrication. It is possible, however, that it may arise from an incorrect adjustment of the set-screws on the operating levers attached to the clutch cover plate. To make a test of this point, two-finger pressure should be applied to the clutch pedal with the right hand, whilst, with the left hand, each operating lever in turn is tested for lost motion. If there is some "shake" of one lever, and none in the

case of the others, the set-screw of that lever should be screwed in towards the clutch slightly, until no slackness or shake remains, thus implying that it is doing its share in releasing the clutch. If all three levers are not equally adjusted, the clutch plates are allowed to make contact at one side before the other.

Other references to the care of the clutch will be found in Chapter XV, dealing with lubrication.

CHAPTER XVIII

VALVE CLEARANCE ADJUSTMENT

It is essential to the satisfactory running of the engine that there shall be a slight clearance between the valve rockers and the ends of the valve stems. This clearance is indicated by each rocker (when it is not functioning to open a valve) being free to move up and down through a distance measured in thousandths of an inch. The clearance varies according to the temperature of the

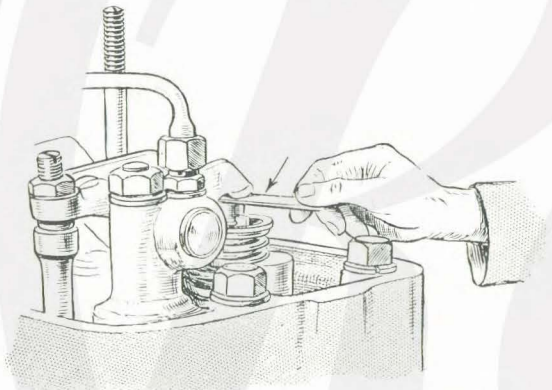


Fig. 83.—A Valve Clearance Gauge in Use.

engine; when the latter is hot the clearance is at its minimum. The normal clearance with the engine cold is five to six-thousandths of an inch, and a gauge of that thickness is provided in the tool-kit.

To test a valve clearance, the gauge should be inserted between the end of the rocker and the valve stem; it should pass between those two points easily, but it should not be possible to insert a piece of thicker metal. Noisy valve operation is prone to occur with an excessive valve clearance; if the latter be insufficient, the probable result will be a burnt valve seating, rendering valve-grinding necessary to prevent leakage of explosion and compression pressures.

On both models valve clearances are adjusted by means of the spherically-ended set-screw and lock-nut at the outer end of each

rocker. The lock-nut must first be slackened and the screw turned clockwise (viewed from above) to decrease the valve clearance, and vice versa. When an adjustment has been made, the set-screw should be prevented from rotating while the lock-nut is retightened, for if the screw moves ever so slightly one way or the other during that process, it may vary the clearance adjustment considerably. Even when that has been done, it is advisable to check the clearance again, for tightening the nut without moving the screw will sometimes vary the clearance by a few thousandths of an inch.

It is better that the clearance should be excessive rather than the reverse, for, although noisy operation may occur in the former case, no harm will be done.

CHAPTER XIX

CARE OF IGNITION DETAILS

THE sparking plugs will require occasional adjustment, for it is desirable that the width of the gap between the sparking points should approximate to a certain standard. In the tool-kit will be found a small spanner for the magneto, with a gauge attached to it in the form of a thin blade. The thickness of this blade is approximately fifteen-thousandths of an inch, which represents

FIG. 84.—SPARKING PLUG WITH THE ARROW INDICATING THE GAP, WHICH SHOULD BE SET TO A CERTAIN WIDTH AS MENTIONED IN THE TEXT.

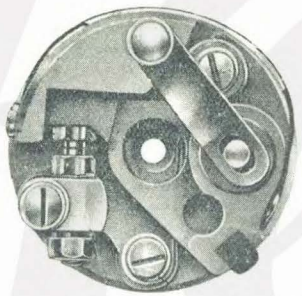


FIG. 85.—THE CONTACT BREAKER OF THE WATFORD MAGNETO FITTED TO 14 H.P. "STANDARD" CARS.
Showing the adjustable contact screw with its lock-nut.

almost the maximum width the spark gap of the plugs should be set. Too wide a gap will cause difficulty in starting, erratic slow-running, and possibly misfiring on hills. Too narrow a gap is also to be avoided, having somewhat similar effects as one that is too wide.

If the plugs, when removed, are found to be sooty or coated with oil, they should be cleaned thoroughly, especially the projecting ends of the insulators, for both oil and soot are prone to cause misfiring by short-circuiting the current.

The only adjustment likely to be required by the magneto is on

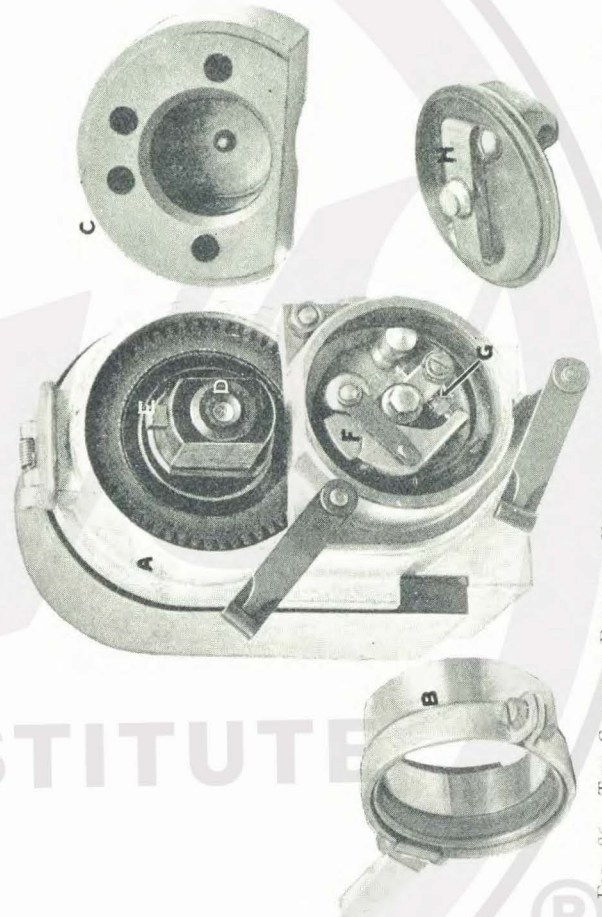


FIG. 86.—THE CONTACT BREAKER END OF THE LUCAS MAGNETO AS FITTED TO THE 11 H.P. "STANDARD" CARS.

A—Aluminium end-plate of machine.
B—Cam ring, normally surrounding contact breaker mechanism.
C—Distributor block, with insulated segments and sockets for high-tension cables.
D—Distributor.
E—Carbon brush of distributor.
F—"Heel" of rocking lever making contact with cam ring *B*.
G—Contact points, one fixed but adjustable, the other attached rigidly to the rocking lever.
H—Cover of contact breaker and cam ring.

the contact breaker, the latter contained within the lower projection at the rear end, covered by a metal plate held in position by a spring. If, while the engine is slowly rotated by hand, the movement of the contact breaker rocking lever is observed, it will be seen that at two diametrically opposite points it is actuated by the surrounding cam-ring, causing a platinum point, attached to its free end, to separate from a similar contact piece fixed to the back-plate. When these points have separated there should be a space between them, represented by the thickness of the magneto gauge. If greater or less space occurs the contact screw on the back-plate should be adjusted. It has a locking-nut which must first be slackened. Probably no more than a quarter of a turn of the screw will be needed to secure the correct gap. Adjustment of this kind is, however, rarely needed until many thousands of miles have been covered, unless the magneto bearings have been over-oiled and some of the excess of oil has reached the contact breaker.

CHAPTER XX

CARBURATION

UNLESS an ill-conceived adjustment has been made to the carburettor, the only attention the carburation system and fuel feed will require is the cleaning of the petrol filters. In the *11 h.p.* car the filter is located just below the tank outlet cock, above the front floor boards. It should be removed after each 1,000 miles

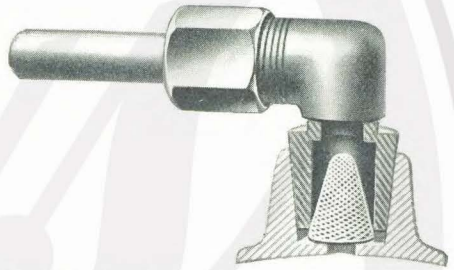


FIG. 87.—THE "THIMBLE" FILTER WITHIN THE PETROL FEED PIPE UNION OF THE AUTOVAC PETROL TANK ON THE 14 H.P. "STANDARD."

running, in order that the gauze within can be cleared of any foreign matter it has held back.

On the *14 h.p.* "Standard" there are two petrol filters. The first consists of a small gauze "thimble" within the union joint connecting the feed pipe from the main tank to the top of the Autovac; the other is below the Autovac in a small chamber, attached to the outlet pipe to the carburettor. Both of these filters should be removed and cleaned occasionally; certainly at the end of each 1,000 miles.

At the bottom of the Autovac tank is a drain cock; this should be opened from time to time to allow any sediment or water which may have collected in the tank to run out; the first tablespoonful to issue will probably bring the impurities away with it.

If at any time the Autovac tank becomes empty, it can be refilled to its normal level by closing the throttle, turning the engine half a dozen times by hand, and then waiting a few moments. The rotation of the engine will give rise to a partial vacuum in the

Autovac, resulting in petrol being drawn up from the main tank—as happens under normal conditions of use.

Trouble due to choked filters can be very largely prevented by straining the petrol through a fine mesh gauze while it is being poured into the tank. It is far better in that way to keep grit and foreign matter out of the tank and pipes than to depend entirely upon the filters to prevent impurities from reaching the carburettor.

FIG. 88.—PARTLY SECTIONED VIEW OF THE AUTOVAC TANK, SHOWING THE SEDIMENT AND WATER TAP AND THE DRAIN COCK.
On the left is the feed pipe to the carburettor.

Every two or three months or so it is advisable to remove the lid of the carburettor float chamber, lift out the float, and soak up the petrol within by means of a piece of clean rag. When that has been done it will probably be noticed that a very fine sediment occurs at the bottom of the float chamber. This should be carefully removed, for although it consists of very fine impurities, it is liable to cake and form blobs which, passing through the passages to the jets, may block one or other of the latter.

Screwing into the bottom of the carburettor are two hexagon-headed caps. It is advisable periodically to remove these, for they will often be found to contain similar impurities to that just mentioned, and sometimes small pieces of grit.

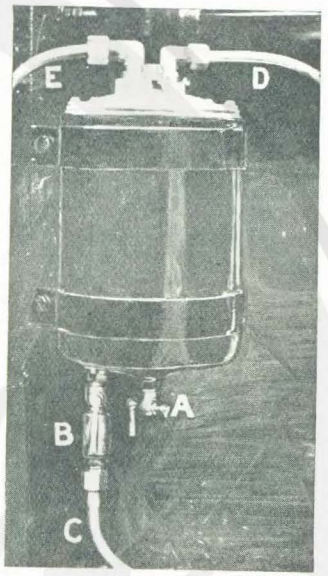


FIG. 89.—THE AUTOVAC TANK ON THE 14 H.P. "STANDARD."
A—Drain cock.
B—Petrol filter on outlet pipe.
C—Feed pipe to carburettor.
D—Suction pipe to engine.
E—Petrol pipe from rear tank.

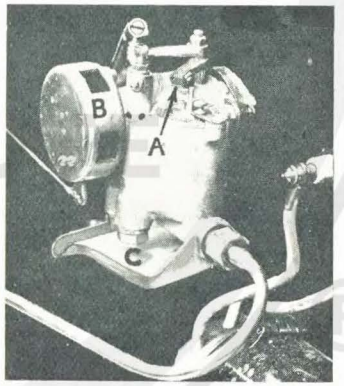


FIG. 90.—THE ZENITH CARBURETTOR ON THE 14 H.P. "STANDARD."
A—Adjustable throttle stop.
B—Air-strangler.
C—Aluminium tray to prevent petrol drippings from falling on to the magneto.

If the engine is prone to run too fast when idling, despite the throttle pedal and lever being moved as far as possible towards their closed positions, the adjustable throttle-stop on the carburettor may be varied. This takes the form of a set-screw, against which the throttle lever presses in its closed position. Varying the adjustment of this screw will allow the throttle to close still further or prevent it from closing so far, according to which way the screw is turned. If, however, the screw is slackened back too far, the engine will be liable to stop, unless the throttle lever under the steering wheel is very carefully adjusted in its slow-running position.

CHAPTER XXI

ADJUSTMENT OF BELTS AND CHAINS

THE driving belt of the dynamo on the *11 h.p.* "Standard" will require occasional adjustment; this is effected by slackening the nuts of the yoke or clamping-bar holding the dynamo to the engine. The dynamo shaft is eccentrically mounted in the casing; so if the latter be more or less rotated, the tension of the belt will be varied. The belt should not be excessively tight, for in that condition it merely stretches more rapidly and will have a shorter life; it can be considered approximately correct when, after a run

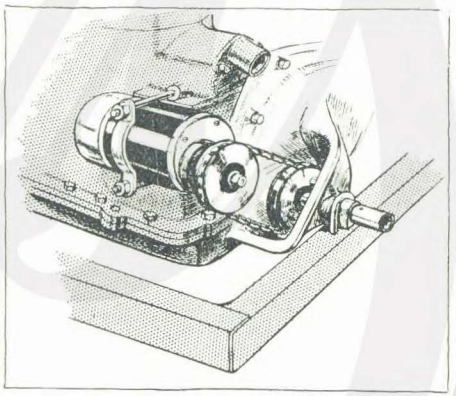


FIG. 91.—THE BELT DRIVE OF THE 11 H.P. "STANDARD" DYNAMO.
The belt is adjusted by slackening the nuts of the clamping plate and partially rotating the dynamo; the shaft of the latter is eccentric to the casing.

of 10 or 20 miles, it is only just possible to move the dynamo pulley by hand against the pressure of the belt in its groove.

The fan belt on the *14 h.p.* model is adjusted by rotating the shaft by means of a spanner applied to the flats adjacent to the fan bracket; first, however, the pinch-bolt on the latter must be slackened, though it is important that it should be thoroughly retightened after an adjustment has been completed. The belt should not be overtightened; it can be considered correct if, after a run of 10 or 20 miles, the fan can just be turned by hand while the belt slips over one or other of its pulleys.

The silent chain driving the camshaft and the magneto shaft on

the *11 h.p.* "Standard" is adjusted by slackening the three hexagon-headed studs, which pass through the end-plate of the magneto bracket into the back of the distribution casing; the bracket, with the magneto in position, can then be moved about a centre represented by the bottom stud, for the holes in the end-plate for the upper studs are slotted. To assist in moving the bracket a hexagon-headed adjusting screw is provided, making

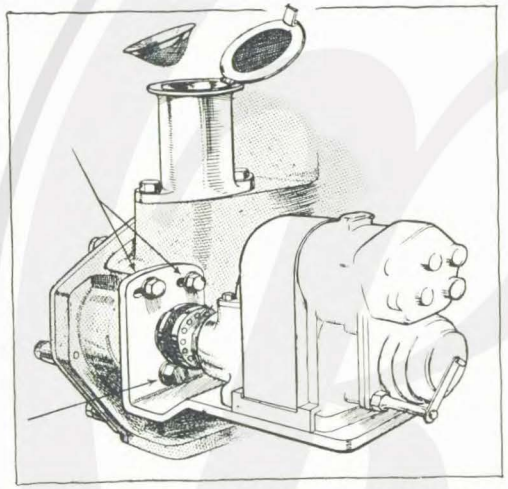


FIG. 92.—ADJUSTMENT OF THE DISTRIBUTION CHAIN OF THE 11 H.P. "STANDARD."

The arrows indicate the set-screws which locate the magneto bracket; the two slotted holes enable the chain to be adjusted without disturbing the magneto. Above is seen the filling spout for engine oil replenishment, with the cover open and the strainer removed.

contact with the side of the crankcase. After adjustment has been made the three studs must be thoroughly retightened.

A slight amount of backlash is desirable for the distribution chain, otherwise the latter will be unduly stressed and a "singing" noise will occur, with a rising note as the engine is accelerated. The chain can be considered correctly adjusted when the periphery of the magneto coupling can be moved freely to and fro approximately one-eighth of an inch.

On the *14 h.p.* "Standard" there are two silent chains in the distribution casing; one drives the camshaft and dynamo, and the other the magneto and fan-driving pulley. The camshaft chain is adjusted by slackening the nuts that secure the dynamo bracket to the rear of the distribution case, and then moving the dynamo,

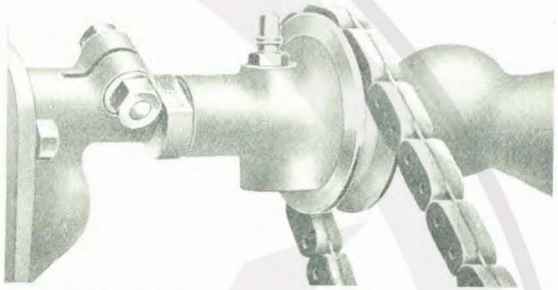


FIG. 93.—THE FAN BELT ADJUSTMENT OF THE 14 H.P. "STANDARD."

Adjustment is effected by turning the eccentrically mounted shaft after loosening the "pinch-bolt" on the left. Just behind the fan pulley is seen the grease nipple to lubricate the shaft bearing.

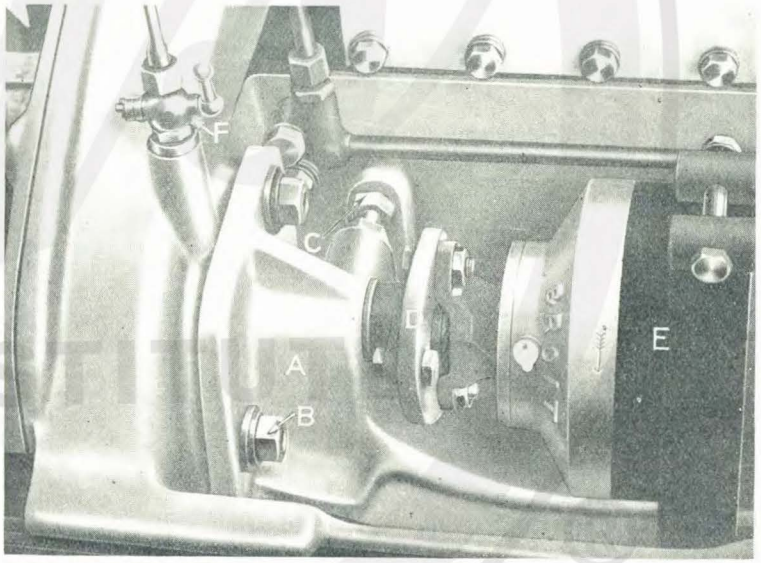


FIG. 94.—THE DYNAMO AND CAMSHAFT DRIVING CHAIN ADJUSTMENT OF THE 14 H.P. "STANDARD."

A—Dynamo bracket.
B—Nuts securing *A* to chaincase.
C—Adjusting stud and lock-nut.
D—Dynamo coupling.
E—Front end of dynamo.
F—Oil circulation test cock.

complete with its bracket, away from the centre line of the engine by means of the hexagon-headed adjusting screw, which abuts the side of the crankcase.

The magneto chain is adjusted in a similar way; two nuts and

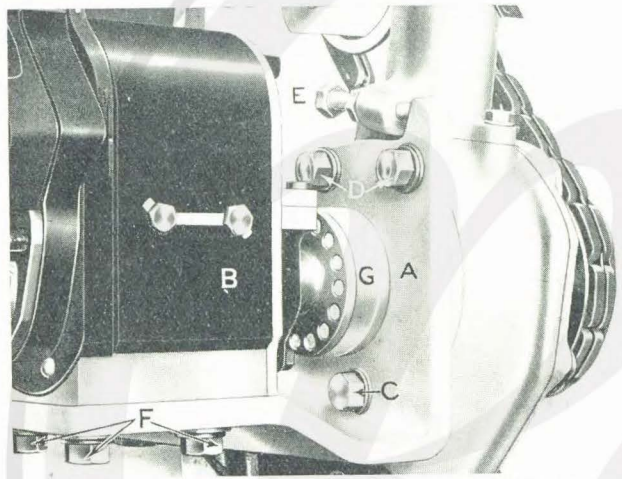


FIG. 95.—MAGNETO CHAIN ADJUSTMENT OF THE 14 H.P. "STANDARD."

A—Magneto bracket.
B—Magneto.
C—Screwed stud on which bracket pivots.
D—Lock-nuts of studs in slotted holes.
E—Adjusting stud and nut.
F—Studs holding magneto bracket.
G—Flexible and adjustable coupling.

a set-screw, passing through the end-plate of the bracket, must be slackened prior to making use of the adjusting set-screw on a boss of the oil filling spout.

Neither the magneto nor the camshaft chain should be "dead tight," about $\frac{1}{8}$ in. free movement of the periphery of the coupling should be evident when either chain has been correctly set. Noise and undue wear will occur if the chains are too tight.

CHAPTER XXII

OIL PUMP REMOVAL

NOT until the car has been run 20,000 miles or more should there be need for any form of attention to the oil pump of the *14 h.p.* "Standard." Located at the rear end of the crankcase, it is driven by means of a dog clutch, formed by a slot and a tongue in camshaft and pumpshaft respectively. To remove the pump, after the suction pipe from the sump has been uncoupled, the nuts on the two studs holding the pump casing in place should be slackened back four or five turns; if, then, the pump be moved rearward, it can be lifted away, the stud holes being slotted.

Between the pump and the crankcase is a metal distance-piece; at each side of this is a brown-paper gasket (flange washer) to prevent oil leakage. Care should be taken when the pump is refitted to see that these gaskets are neither torn nor crumpled, and if new ones are fitted they must have holes to correspond with the oil feed holes in the distance-piece and crankcase.

CHAPTER XXIII

FRONT AXLE ADJUSTMENTS

BEYOND the lubrication of the swivel axle pins, coupling-rod joints, and wheel hubs, no attention should be required by the front axle details until after the car has been in use a long while (20,000 to 30,000 miles). But if the lubrication of the swivel axle pins and the joints of the coupling-rods has been neglected for two or three months, it is not improbable that the grease passages and grooves in them will have become blocked by lubricant that has hardened to such a degree that the grease gun is unable to move it in order to allow fresh grease to enter. In that event it will be necessary to remove the swivel pins and joint pins to clear the passages and grooves.

REMOVING THE SWIVEL PINS.

To remove the swivel pins of the *11 h.p.* car, the split-pin and castellated nut below the axle end must be removed, when the pin can be driven upward; but a block of lead, copper or hard wood should be interposed between the hammer and the threaded end of the pin to prevent damage to the latter.

The swivel pin of the *14 h.p.* axle is secured by a drawbolt passing through the knuckle of the swivel, and engaging with a slot in the pin. To remove the latter, the nut on the drawbolt must be unscrewed (it is behind the axle), and the bolt driven out with a hammer, care being taken not to damage the threads. Next, the aluminium cap and the castellated nut within it must be detached, when the ball-thrust bearing can be lifted away. The swivel pin can then be pressed or driven out from above. In refitting the pin the drawbolt must be replaced and retightened first, after which the castellated nut above the thrust bearing should be tightened until it is possible (when the jack, needed until then, is removed) to insert a thin feeler gauge—or a piece of paper—between the top and bottom surfaces of the main axle and the swivel axle jaws.

FRONT WHEEL ALIGNMENT.

The cross-coupling rod between the swivel axles must be precisely adjusted as to its effective length, otherwise the front wheels will not be parallel, and rapid tyre wear will ensue. When the rod is

first assembled, the standard adjustment is such as to make the wheels slightly inset or "in-toed," but no more than enough to bring them one-eighth of an inch closer together at the front of the axle than at the back. This adjustment allows for the normal wear of the joints and for the natural inclination of the wheels to "spread" when the car is running forward.

Occasionally—say, once in six months—or at any time when it is suspected that the treads of the front tyres are wearing away rather quickly, and after any occasion upon which a front wheel

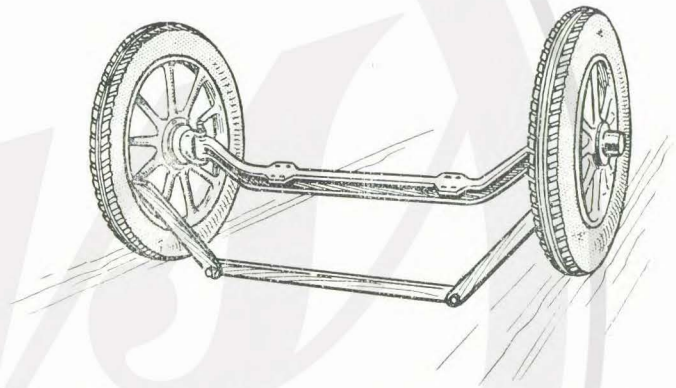


FIG. 96.—SUGGESTED GAUGE FOR TESTING FRONT WHEEL ALIGNMENT.
The gauge can be easily made with three pieces of wood and two bolts, as explained in the text.

receives a lateral blow (as when it is inadvertently driven against a kerb), the front wheel alignment should be tested. That is done by setting the wheels approximately straight ahead, measuring the distance between the two rims immediately in front of the axle (i.e. at the same height as the latter from the ground), and comparing that measurement with one taken between the rims behind the axle.

Another plan is to "line-up" front and rear wheels with a straight-edged plank or even a piece of cord; after the front and rear wheels on one side of the car have been brought into alignment (the tyres at front and back of their axles then touching the plank or cord at four points simultaneously), a similar test should be made of the wheels on the other side of the car, but those on the first side should not be disturbed in the slightest degree. It should be possible to set the four wheels so that they touch the straight-edge

or cord simultaneously, each one at two points, without any of them being moved after the test commences. That is the ideal; but in practice (owing to inequalities in the walls of the tyres, for one thing) it is usually unattainable and an approximation is accepted.

The accompanying sketch (Fig. 96) shows a simple form of gauge that can be made for testing front wheel alignment. It consists of three lengths of wood (about 2½ in. × 1 in.) jointed, as shown, by two bolts and nuts. It is first applied to the rims in front of the axle

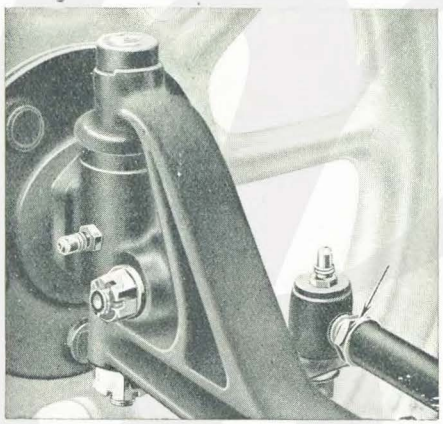


FIG. 97.—THE RIGHT-HAND END OF THE 11 H.P. "STANDARD" FRONT AXLE.

The greaser for the swivel pin is shown on the left, while the arrow on the right indicates the lock-nut of the cross-coupling rod adjustment. Nearby is seen the nipple for lubricating the joint.

and, when correctly set, the bolts should be tightened thoroughly. Then the gauge should be carefully inserted under the engine for use between the rims behind the axle. The latter test should show a discrepancy of not more than ⅛ in. to ¼ in., but it must indicate a greater width than at the front; if it is less, the cross-coupling rod must be adjusted.

CROSS-COUPLING ROD ADJUSTMENT.

The cross-coupling rod of the *11 h.p.* "Standard" has adjustable "eyes" at each end. To vary the effective length of the rod the lock-nut of one of the screwed eyes must be slackened, the joint pin at that end removed, and the eye screwed farther into or out of the tube. To set the wheels closer together in front of the axle,

the eye must be unscrewed slightly, and vice versa; perhaps no more than half a turn will be needed to bring the wheels parallel. Care should be taken to retighten the lock-nut thoroughly after the joint has been reassembled; it should not be tightened before the joint pin has been refitted, otherwise the latter might be difficult to insert.

The cross-coupling rod on the *14 h.p.* "Standard" has a spring-loaded ball-joint at each end. Each joint contains the following items in the order given: a screwed plug, locked by two large split-pins passing through holes in the rod and through a slot in the plug; a short, stiff spring; a half cup; the "ball" of the joint (fixed to the swivel lever); another half cup, and finally two discs of flat steel of different thickness.

To adjust the effective length of the rod, and thus vary the alignment of the front wheels, the number or total thickness of the steel discs must be varied; fitting an additional one has effect in setting the wheels closer together at the front; removing a disc or substituting a thinner one causes the wheels to spread—i.e. makes them wider apart at the front. A disc no more than ⅛ in. thick makes a great deal of difference, and as a rule when adjustment is needed it will be found that the fitting or removal of a disc 1/16 in. thick, or even less, is all that is required to make the wheels parallel again.

CHAPTER XXIV

ADJUSTING THE STEERING

THERE are three causes of slackness or "lost motion" developing in the steering gear, as follows: (1) Wear of the worm threads and wormwheel "teeth"; (2) wear of the thrust bearings that should prevent axial or end movement of the steering column; and (3) wear of the thrust bearing surfaces of the wormwheel shaft.

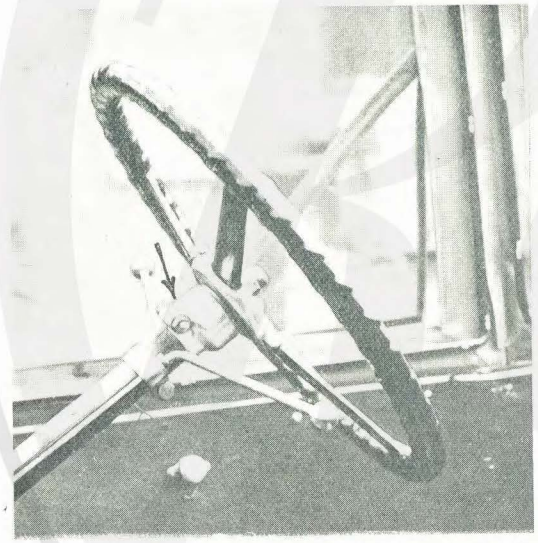


FIG. 98.—THE STEERING WHEEL OF THE "STANDARD" CARS.
The arrow indicates the adjustable ball bearing of the column.

The first cause of slackness can be counteracted more or less by engaging a fresh segment of the wormwheel with the worm. Wear of the thrust bearings of the worm and steering column is taken up by adjusting the ball-bearing at the top of the column, just under the hub of the steering wheel, while wear of the wormwheel thrust calls for the fitting of a thin packing washer at each side of the wormwheel in the case of the *14 h.p.* model, and a thin steel disc between the cover plate of the box and the interior thrust plate on the *11 h.p.* car.

To engage a fresh segment of the wormwheel of the *11 h.p.* "Standard," the cover plate of the box and the locking nut on the wormwheel shaft must be removed, and the shaft driven down through the wheel; the latter can then be lifted out, rotated one-third of a revolution and replaced. There are six castellations on the wormwheel shaft and six slots in the hole through the wheel; the one-third rotation suggested, therefore, brings a given castellation into engagement with the next slot but one to the original.

The position of the steering drop-arm or lever on the wormwheel shaft must be varied on the *14 h.p.* "Standard," to bring a fresh segment of the wormwheel into use. This is effected by withdrawing the bolt at the upper end of the lever, removing the latter, rotating its shaft a quarter turn with the steering wheel, and then refitting the lever to its shaft, inserting and thoroughly retightening the bolt. There are eight castellations on the shaft; thus, a given slot in the lever boss will engage with the next but one to the original, when the wormwheel has been rotated one quarter of a turn as suggested.

CHAPTER XXV

WORM GEAR ADJUSTMENT

No special provision is made on the *14 h.p.* "Standard" for adjusting the ball-thrust bearings of the worm shaft, and although it is possible to counteract wear by inserting thin packing washers, the makers do not recommend this, advising that new thrust bearings should be fitted when an excessive amount of wear has occurred. In practice, it is found that these ball-thrust bearings last almost

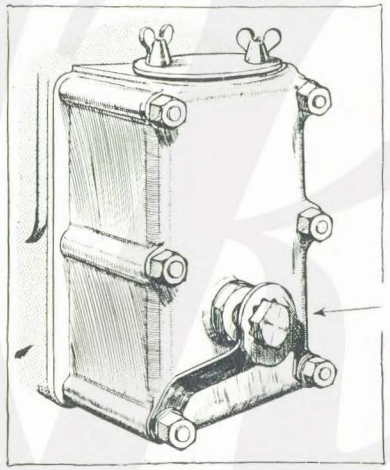


FIG. 99.—THE REAR EXTENSION OF THE 11 H.P. "STANDARD" BACK AXLE CENTRE, FORMING AN ADDITIONAL RESERVOIR FOR OIL.
The arrow indicates the worm gear thrust-bearing adjustment and locking device.

indefinitely, providing care is taken in ensuring that no grit or abrasive of any kind is allowed to enter the axle casing, and also assuming that a good brand of special worm gear oil is used whenever replenishments are made.

The foregoing remarks as to the durability of worm thrust washers also apply to the *11 h.p.* "Standard," though in this case an exterior adjustment is provided for them. This adjustment is, however, provided chiefly to facilitate assembly in course of manufacture, as distinct from affording a means of taking up slackness due to wear. It is a provision that should not be interfered with by anyone

unacquainted with the requirements of ball-thrust bearings, for if the latter are merely a shade overtightened, they will wear very rapidly and be liable to splinter and break.

With that in mind, it will be noted that at the back of the extension of the rear axle casing is a bridge piece of thin steel, with a notched hole in its centre surrounding the hexagon of a set-screw, the latter being provided with a lock-nut. The set-screw is the means for adjusting the worm thrust washer, the bridge piece forming a locking device that supplements the actual lock-nut.

To adjust the ball-thrust washers, and thus eliminate undue end play of the worm shaft, the bridge piece must be removed and the locking nut slackened back; the set-screw should then be screwed farther in, until it meets with obvious resistance (implying that the thrust washers are tight). The screw should then be slackened back a quarter of a turn to provide the shade of end play the washers should be allowed. The locking plate should then be refitted with six of its notches engaged with the corners of the hexagon-headed set-screw, and the locking nut retightened. Note that the locking nut must be retightened *after* the bridge has been refitted, that procedure assisting to ensure that the set-screw is not moved after the actual adjustment has been made.

CHAPTER XXVI

CYLINDER HEAD REMOVAL AND REFITTING

THE removal of the cylinder head is an essential preliminary to the grinding-in of the valves; it also facilitates decarbonizing the combustion space and piston, for although the latter process can be carried out "after a fashion" by means of specially shaped scrapers inserted through the sparking plug holes, decarbonizing can be done far more thoroughly and satisfactorily with the cylinder head removed.

On both models the cylinder head is held in place by a series of long hexagon-headed set-screws, some of which serve also to retain in place the brackets of the rocker shaft. But before these screws are removed, certain preliminaries must be completed; the water must be drained off, the carburettor removed, the water pipe uncoupled and their rubber connections moved clear of the pipes on the cylinder head; the exhaust branch must be removed, and also the induction branch of the *11 h.p.* engine, while, in the case of the *14 h.p.* model, the oil pipe leading up to the front end of the head must be taken away. It is safer also to remove the sparking plugs. The high-tension wires need not be uncoupled; if they are disconnected, care should be taken to note "which is which" (or to number them), so that they can be put back later in the same order.

In removing the screws holding the head in place, it is advisable to mark these, or place them on a bench in a certain order, so that when they are subsequently being refitted each one can be put back into the hole from which it was removed.

First, let the screws holding the rocker shaft brackets be taken away, to enable the shaft, with the rockers in place, to be lifted off and placed where it will not be disturbed, for it is preferable that the rockers should go back in the same relative order and position. The latter applies also to the pushrods, for if these are interchanged, there will probably be need later on for a lot of adjusting to be done to restore the correct valve clearances; for that reason it is advisable, in the case of the *11 h.p.* model particularly, to remove the pushrods (and number each one) before the rocker shaft is lifted off.

When all the set-screws have been removed the head should lift

away easily. Great care should be taken not to damage the gasket (the copper, brass, and asbestos joint washer), for if it is bent locally or damaged in any way, a new one will be required. In fact, for the reason that "accidents will happen," it is preferable to keep a new gasket in stock in order that there may be no delay in securing a fresh one, if the one in use should be accidentally damaged on any occasion the head is removed. If carefully treated, a gasket will survive a number of head removals and last for years.

It is advisable to put back the gasket "the same side up" when the head is to be refitted; so it is as well to make a faint scratch on it with a penknife to identify the top and bottom, but the mark should be made at one of the extreme corners, in case the knife should slip and cause a deep scratch that might subsequently give rise to a compression or water leak. The gasket should, in fact, be viewed as being exceedingly "tender" and fragile; carbon and rust deposited on the edges of holes should be carefully removed, and every speck of dirt of any kind wiped off before it is refitted. The same degree of cleanliness is essential in regard to the joint surfaces of the cylinder block and head. A grain of carbon or dirt may "bed" into the gasket when the head is tightened down, and it may not; instead, it may prevent a compression-tight or water-tight joint being secured, and the resulting leak will necessitate the head being removed a second time and, possibly, cause a new gasket to be required.

In refitting the head the set-screws should be tightened progressively and uniformly, including those that hold the rocker shaft brackets. Tighten them gradually, each one "a bit at a time," so that the head will not be uneven in its pressure on the gasket. This will mean that the spanner will be applied to each screw head half a dozen or more times, passing from one to the other in a definite order. But eventually they must all be as tight as possible, a spanner being used that will not slip off the heads, and burr the corners of the hexagons, when the final tightening is in progress.

CHAPTER XXVII

DECARBONIZING

THE process of decarbonizing consists of removing with suitable scrapers (the blade of an old table-knife will serve, except for odd corners), but unless an inferior brand of oil has been used, the engine sump overfilled excessively and often, or the air-strangler of the carburettor used unnecessarily, it will not be called for, as a rule, until several thousand miles have been covered. Its need is made evident by "pinking"—sharp metallic taps—or knocking, at almost every hill requiring full throttle. Pinking and knocking can be prevented or stopped by retarding the ignition lever, as mentioned in Chapter XI, but they should not occur unless the engine is working hard and very slowly; when decarbonizing is required, those noises will be heard at even 15 or 20 m.p.h. on top gear with the engine pulling, and can only be stopped by retarding the ignition considerably, possibly half-way.

It should be remembered that a badly carboned engine is not only annoying, in that it calls for frequent use of the ignition lever; it is inefficient as well, and loses all its liveliness on hills and when accelerating. Consequently, decarbonizing will often increase the pleasure of driving very appreciably, besides improving the petrol consumption by restoring the engine to its original standard of efficiency.

It is impossible to give any general advice as to the frequency with which an engine should be decarbonized; variations occur for many reasons, some connected with the particular engine, some with the brand of lubricating oil or petrol, others with such things as the nature of the country in which the car is run, and the driving methods adopted by the individual. But no trouble or annoyance in this respect should occur within less than 2,000 miles after the engine was last decarbonized, while something nearer 5,000 miles will often be covered between times. As a rule, decarbonizing periods are determined by the advisability of attention being given to the valves, a subject dealt with in the following chapter.

CHAPTER XXVIII

VALVE GRINDING

THE engine valves, especially those of the exhaust, need regrinding into their seatings in the cylinder head occasionally, and on the average it is advisable to give them that attention after approximately 3,000 miles running. They may operate with more or less satisfaction without attention over considerably longer distances, even 10,000 miles, but the owner who wishes to keep his engine in good tune, thereby securing the maximum economy in fuel and the highest standard of excellence in hill-climbing, speed, etc., should regrind them—or have the work done for him—certainly every 5,000 miles.

The need for regrinding is due to the fact that the heat of combustion and that of the high temperature of the exhaust gases, as well as other factors, tend to cause the valves and their seatings to become "pitted" in course of time, preventing the explosion and compression pressures being maintained, thus wasting power. Regrinding consists of removing each valve, coating its own seating and that in the cylinder head with a semi-fluid mixture of oil and fine emery powder (or other special abrasive), and then grinding the two seats into one another by a series of rotational movements.

A preliminary is the removal of the cylinder head (*see* Chapter XXVI). Then the valves must be removed by compressing their springs slightly to allow the spring-retaining collet or key to be withdrawn; between each spring and its collet is a washer or cup, shaped in such a way as to prevent the collet from moving out of the valve stem slot while spring pressure against it is maintained.

Each valve head has a slot across it so that it may be ground in with a large screwdriver, or a special valve-grinding tool. The movements of the valve while it is being ground should be a series of half-turns, the valve being lifted between each movement before it is rotated back. They may be stated thus: half-turn forward; lift; half-turn back; lift; half-turn forward, and so on, until squeaks or the stiffness of turning make it evident that a fresh application of grinding mixture is required.

Some motorists grind in their valves by a continuously rotating movement in one direction only; but that is not the best plan, for

more reasons than one. But when the semi-rotating movements and reversals are adopted, the valve under treatment should be given a full half-turn after every six or eight strokes, and the end of that half-turn taken as the beginning of the next in the same direction. Imagine that the valve seating in the cylinder head were marked as the face of a clock, and the valve notched or scratched in line with "12 o'clock"; the first half-dozen oscillations of the valve would carry the notch to "6 o'clock" on the cylinder head seating, and back to "12 o'clock"; but the second half-dozen should proceed on from "6 o'clock" to "12 o'clock" and back. When the full dozen oscillations are complete, the valve will have had every part of its seating ground into every part of the cylinder head seating. Full and continuous rotational grinding (as distinct from oscillating movements and lifting before reversals) tends to cause grooves to be cut in the seatings by the grinding medium, and subsequent leakage may occur on that account.

Before a fresh application of grinding compound is made, the previous application should be wiped off, and an inspection of the seatings made to note whether all signs of pitting have been removed. When that state is observed the valve should be ground in for half a minute or so with oil only, the seatings and all parts adjacent to them being thoroughly cleaned as a preliminary. Finally, the oil should be cleaned off.

If all the valves are removed at one time they should be marked carefully, so that they can be ground in and refitted to their original seatings, for, although they are interchangeable when new, they are not so after lengthy use, and if they are "mixed up" a very long grinding process will be needed to make them seat properly, i.e. without leaking.

After the cylinder head has been refitted, the valve clearances should be tested and reset, as described in a previous chapter (*see* page 138), otherwise the valves may not seat properly because of too small a clearance or none at all; and nothing will cause valve burning, pitting, and the need for regrinding quicker than an imperfectly seated valve.

If any doubt is experienced as to whether valve grinding is needed or not, the compression should be tested, for, although there are other causes of a poor compression, valve leakage is the most usual. The test is made by rotating the crankshaft slowly by means of the starting handle, and noting whether the resistance to rotation is appreciable at every half revolution. Each four successive compressions should be approximately equal. Loss

may not be evident by the hissing of a leak, for rarely is the latter heard.

The novice should make weekly or even daily tests of the compression with a new car, so that he may become experienced in judging what resistance is needed to overcome each one when the valves, etc., are in good order. Thus he will be able to realize when deterioration occurs or commences.

After the valves have been reground the compression may not be immediately and obviously better than before; but it should be greatly improved after ten miles or so have been run, causing the valves to "hammer" themselves down to a dead smooth seating. But if leaks are *heard* when the first test is made after regrinding, one has a sign that something is holding a valve off its seat; perhaps a particle of detached carbon, or some grit, is responsible, or maybe the regrinding was not properly completed. As a rule there is, then, no remedy except to carry the process through again; at all events, if a run for a mile or so does not stop the leak, it would be very unwise not to take off the cylinder head a second time and put things right at once. That possibility is mentioned, however, merely to indicate how extremely careful one should be to ensure that every seating is absolutely clean, and that there is no loose carbon inside the cylinders or head when the valves are refitted.

CHAPTER XXIX

BEARING ADJUSTMENTS

THE process of adjusting, or " taking up," the bearings of an engine is not one that should be attempted by anyone who has not served an apprenticeship at the work ; at all events, it is work requiring a high order of skill and a great deal of experience. Some amateur mechanics, who are also motor owners, are able to undertake this work on their own cars, but they form a very small minority, and the average motorist will be well advised not to attempt it. He will probably make matters worse, or run the risk of a melted bearing by overtightening it.

The need for engine bearing adjustments should not arise until the car has covered between 20,000 and 30,000 miles ; but " racing " an engine unduly—on the lower gears, for example—or insufficient oil in the crankcase sump is conducive to rapid wear, while a poor grade of lubricating oil will have similar effect.

Loose and worn bearings are indicated by regular " taps " (or, in extreme cases, by knocks), varying with the engine speed. In the initial stages, the tapping may be heard only when the engine is " over-run " by the car, as when the throttle is closed while the car is running downhill. But it requires a good deal of experience of car faults to distinguish between a bearing knock and one arising from some other source, and the average owner should call in expert advice whenever he hears strange noises issuing from the car, no matter whether he suspects bearing slackness or not. It should be remembered that when a knock arises from any part, the cause of the sound will rapidly become intensified, for the slackness thus inferred permits " hammering " to occur. Therefore, if the " stitch in time " be neglected, there may be relatively heavy expense in obtaining replacements, because the part may " hammer itself to pieces," and have similar or worse effect upon other parts. Neglect of " unauthorized " noises is fatal to economy in upkeep.

CHAPTER XXX

FIRING ORDER ; FLYWHEEL MARKINGS ; ENGINE AND IGNITION TIMING

THE order in which the ignition occurs in the cylinders of both " Standard " models is 1, 3, 4, and 2, viewing the cylinder next to the dashboard as No. 1. On the flywheel rim is stamped an arrow which, when it is brought to the top in line with the centre of the cylinder bores (i.e. immediately over the crankshaft), indicates that the pistons in cylinders Nos. 1 and 4 are at the top of their strokes—or, as it is usually termed, at top dead centre. One of them will be at the beginning of its firing stroke, and the other about to commence its induction stroke ; " which is which " can be ascertained by noting which inlet valve rocker commences to open its valve, when the flywheel is rotated from that point through 10 degrees in its normal direction of running.

Both models are " timed " alike in regard to ignition and valves. The normal setting for the magneto is such that, with a fully retarded ignition, the points of the contact breaker separate at the top dead centre of the firing stroke, which affords the full range of movement of the cam ring for advancing the ignition from the driving seat.

The magneto coupling provides a vernier type adjustment, for there is one more projection on one side of the rubber disc than on the other, and the plates are formed to accord. Before dismantling the coupling, a line should be scratched straight across the peripheries of the three units, so that the latter can be reassembled without doubt in their original relationship.

If the timing is not correctly reset, the engine will be either prone to knock unduly with a fully advanced ignition control, and " kick back " when it is started (implying too early a timing), or be sluggish in climbing hills, and refuse to attain its original maximum speed on any gear ratio, because the timing is " late."

The valve timings are as follows—

Exhaust valve opens when the flywheel still has 45° to pass through to bring the piston to its bottom dead centre, and closes on the top dead centre.

Inlet valve opens 10° beyond top dead centre of induction stroke. and closes 45° after bottom dead centre.

Each exhaust valve is, therefore, open during 225° of flywheel rotation, and each inlet valve during 215°.

If at any time the camshaft driving chain is removed, the valves may be retimed by observing one valve only, though, as a check to the process, two may be selected, one inlet and one exhaust. The following procedure is advised—

Turn the flywheel until the arrow stamped on its rim is in the top dead centre position. Then turn the camshaft until No. 1 exhaust valve opens; continue to turn the shaft slowly until the valve closes, and the valve clearance gauge can be inserted between the rocker and the valve stem, taking care that the pushrod and rocker are in firm contact. Holding the camshaft firmly in that position, refit the chain.

CHAPTER XXXI

THE ELECTRICAL EQUIPMENT

ELEMENTARY INFORMATION.

THE electrical equipment of "Standard" cars, apart from the magneto, consists of the following main components—

1. The dynamo, which generates electric current to charge
2. The battery, or accumulator, which stores the current for use in
3. The lamps, engine-starting motor, and horn.
4. The automatic cut-out, which prevents the battery from discharging back through the dynamo at low speeds.
5. The wiring, which conveys the current from dynamo to battery and thence to the lamps, starting motor, etc., and
6. The switches, which control the supply of current from dynamo to battery, and from the latter to the lamps, etc.

THE DYNAMO.

The dynamo comprises a fixed shell supporting the field magnets, within which is a rotating unit, consisting of the armature and the commutator; held in contact with the latter by springs are the brushes, formed of compressed carbon, which collect from the commutator the current generated by the rotation of the armature within the "field" of the magnets; from the brushes the current is led away to the insulated wiring.

Running on ball bearings that need very occasional lubrication, the armature consists of great lengths of thin insulated wire, closely wound on a spool. It requires no attention or adjustment. The ends of the wires of which it is formed are attached to the copper strips which, with insulation between them, form the commutator.

The latter will run for a very long time, sometimes for years, without attention, so long as it is kept free from oil and dirt. It is advisable, nevertheless, to inspect and clean it occasionally—say once in three months—in order to remove any carbon dust (rubbed off the brushes) that may have accumulated on the adjacent parts, and to note whether the copper strips are smooth and not grooved, the latter a sign of grit, which may be either loose or an imperfection in one of the brushes.

It should not be expected that the copper strips will be found bright and polished; their natural colour is brown. But if they

should be rough, blackened or greasy, the surface should be cleaned by means of a piece of fine glass-paper, pressed lightly upon it with one finger while the armature shaft is rotated. Emery paper should not be used, and any copper dust caused by the cleaning process should be wiped off the interior parts with a soft rag.

The blackening of the segments or strips will probably be due to one of the brushes making imperfect contact with them; in that case, the freedom of the brushes to move in their guides should be tested. If the spring that presses upon a brush is lifted, the latter should be quite free to move up and down. If it does not do so, the cause should be ascertained and remedied; but it is a very unlikely happening, one which is probably due to the presence of grit on the sides of the brush—or, after very lengthy use, to the brush having worn away to such an extent as to need replacement.

THE BATTERY OF ACCUMULATORS.

Without entering into a detailed description of the battery, it can be said to consist of a series of cells, each containing a number of positive and negative plates coated with a special paste in which chemical action or reaction occurs when electrical energy is passed into or taken from the battery; the plates are immersed in an "electrolyte," a mixture of sulphuric acid and distilled water.

The battery is a means of storing electrical energy, ready for use when required. In one sense it is the only vulnerable part of the electrical equipment, which means that it is the item that suffers directly from neglect or ill-use more than any other. It is out of sight, and too often out of mind. And yet its needs are few and simple.

Neglect of the battery consists, as a rule, of not maintaining the correct level of the electrolyte. The distilled water constituent of the latter is constantly evaporating when the electrical equipment is either in use or out of use; but the acid is not reduced in quantity in the ordinary course, only when the electrolyte leaks or is spilled. Consequently, the replenishment that is essential to the satisfactory working and lengthy life of the battery consists of nothing more than occasionally adding a little distilled water—not tap-water or rain-water, for either of those is harmful. *Distilled water must invariably be used.* It can be obtained from any drug store by the pint or the quart for a few pence.

The correct level of the electrolyte is approximately a quarter of an inch above the tops of the plates. That infers that each cell must be replenished until the liquid can be seen through the vent

holes at the tops of the cells, though the latter should not be "brimming full." It is to be noted, however, that each cell must be independently replenished; they are not in communication, except by means of the exterior "bridge pieces" which couple them together electrically.

Neglect to replenish the electrolyte (a process that should be completed every two weeks in summer and every month at least in winter) has two results. In the first place, it reduces the capacity of the battery, preventing the latter from storing a full supply of current; secondly, it leads to the deterioration (the "sulphating") of the plates, so that they may be permanently reduced in their capacity for storing electrical energy. Excessive neglect will prevent the engine-starter and lamps from being used, rendering a new battery necessary.

Ill-treatment of the battery is mainly caused by discharging it too much or too rapidly by the excessive use of the engine-starter. The latter makes very big demands for current and will completely "empty" a battery, for all practical purposes, in a comparatively few minutes. For that reason, the starter switch should be used in moderation. If the engine is reluctant to run under its own power, the cause of the reluctance should be found out and corrected; the trouble should not be laid at the door of the starter, and the latter should not be expected to counteract the failings of the engine.

It should be borne in mind that the battery does not contain an inexhaustible store of electrical energy; it cannot give out more current than is put into it. If, therefore, the car is used mainly on short runs at rather low speeds, it is quite possible for the demands of the starter to exceed the supply generated by the dynamo. As a rough guide it can be taken that the dynamo should charge the battery one minute for every second the starter is in use, so much more rapidly does the latter draw upon the battery than the dynamo "feeds" it. For that reason the dynamo charging switch on the instrument board should always be "on" when the car is running, unless very long runs—of, say, 100 to 150 miles—are made without a stop and without using the lamps.

Under normal conditions, the set of five lamps use less current than the dynamo generates from minute to minute, and the battery will keep them supplied for six or eight hours, even if the dynamo is not charging it. But, all the same, the charging switch should always be "on" when the lamps—or any of them—are in use, so that the battery may be kept in a fully charged condition, ready to meet the demands of the starter.

THE STARTING MOTOR.

The starting motor closely resembles the dynamo in its general design and construction, and the attention it needs is of a similar character. If it will not start or turn the engine, the fault is probably elsewhere; for example, in the depleted condition of the battery; not in some derangement of the starter itself. It is not directly connected to the dynamo, but draws upon the battery when its switch is operated, the latter permitting current to pass through the brushes to the commutator and cause the armature to rotate. When that occurs, the pinion on the armature shaft automatically moves endwise and engages with the gear ring on the flywheel, rotating the latter at a speed which enables the engine to function after a second or two, and start running under its own power.

But, as already suggested, the starting motor cannot correct any deficiency of the engine; nor will it start the engine if the petrol or the ignition switch is turned "off." There are only two further points to be noted in connection with the use of the starter. (1) If the engine starts and then shows signs of stopping when the starter switch is released, the switch should not be operated again until the engine has actually ceased to move; attempting to make the starter pinion engage with the rotating gear ring on the flywheel is liable to cause damage to the teeth of both units. (2) The starter switch should be released immediately the engine commences to run, the latter sometimes being made evident by a noise representing something between a series of "clicks" and a succession of "knocks," quite distinct from the regular "hum" of the starter gears that occurs before the engine picks up.

THE AUTOMATIC CUT-OUT.

This device requires no attention from the driver; it is purely electromagnetic, its function being to disconnect the dynamo from the battery at a time when the "pressure" of current in the latter exceeds that generated by the dynamo. But for its presence in the circuit, the dynamo would attempt to act as a motor at low speeds or when the engine was stationary and the charging switch "on," and the effects would be a waste of current from the battery and burned segments of the dynamo commutator.

The cut-out is a very reliable device; nevertheless, it is advisable to move the charging switch to its "off" position when the engine is stopped for more than a few minutes, as a precautionary measure, one that will prevent the battery discharging back through the dynamo, even if the cut-out should fail to function.

THE DYNAMO FUSE.

Contained within the switchboard of the electrical outfit is the dynamo fuse. It serves to prevent the "overloading" of the wiring, and the burning out of the dynamo windings and cables in the event of a loose or broken connection in the battery circuit, giving rise to a high resistance to the passage of the current generated by the dynamo. It is, in effect, a "safety valve," and consists of a short length of a special kind of soft wire with a low melting point, which "blows" or fuses before any serious harm can be done to other parts in the event of a derangement occurring.

As a rule, the melting of the fuse denotes a loose, corroded or disconnected terminal in the battery circuit, either on the battery itself or behind the switchboard. But it can also occur if the frayed ends of two wires make contact behind the switchboard, or if water enters the latter. Sometimes it is due to the fuse wire becoming loose in its holder, especially if the latter has been disturbed.

If a fuse "blows," an effort should be made to find the cause, otherwise it is not improbable that the new one will follow suit, either immediately or at some awkward moment. Spare wire will be found within the switchboard, and one of the first things the new car owner should do, after taking delivery, is to find out where the fuse and the spare wire are located, and how to get at them (*see* page 182); he should not wait until the fuse blows and then be compelled to search for it.

One sign of a blown fuse is a refusal of the ammeter hand to move, no matter how fast the engine is run. That condition implies that the dynamo is not functioning, and that the batteries are not being charged.

THE AMMETER.

The dial with a small hand moving over its face, located above the switches on the lighting switchboard, is the ammeter or amperemeter. This instrument indicates the rate at which the battery is being charged or discharged; it gives no indication whatever as to the state of the battery, whether it is fully charged or discharged. Its purpose is to show the driver when or whether the dynamo is functioning, and, if so, at what rate. Its hand should commence to move towards the side of the dial marked "charge," when the car on top gear is running at over 15 m.p.h. or so, and at proportionately lower speeds on the other gears; or, alternatively, when the engine is accelerated somewhat beyond its slow-running or

idling speed when the car is stationary. With the car running at 25 m.p.h. or so, the charging rate should be shown at approximately eight amperes, if no lamps are alight. If the rate is much below that figure it is probable that, in the case of the *11 h.p.* "Standard," the dynamo belt requires tightening, though a slipping belt is usually shown by the ammeter hand oscillating violently at fairly high speeds.

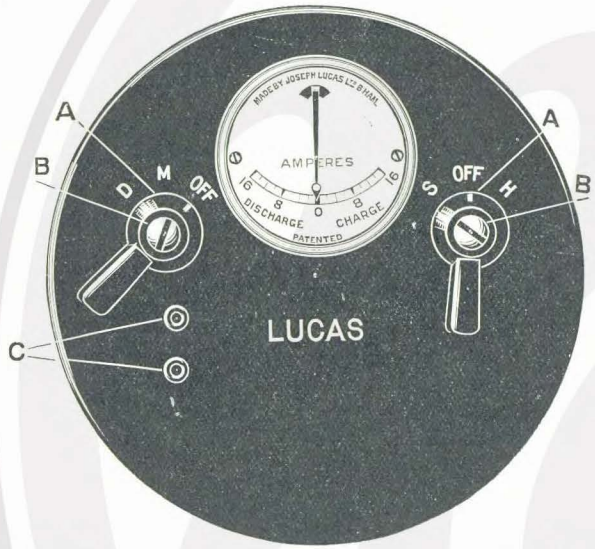


FIG. 100.—THE LUCAS SWITCHBOARD OF THE 11 H.P. "STANDARD."
A—Switch levers.
B—Screws holding levers and cover plate.
C—Sockets for inspection lamp adapter.

Another cause of a low charging rate is a dirty commutator of the dynamo, a fault already referred to, while oscillations of the ammeter hand are sometimes due to the insulating strips between the segments of the commutator "standing proud" of the copper, preventing the brushes from making continuous contact with the latter. But that is a failing unlikely to develop until two or three years have passed, if then, and one that should be corrected by an electrical mechanic.

When the lamps are alight the ammeter indicates the excess of current generated by the dynamo over that used by the lamps; or, if the engine is running slowly, the hand may move to the "discharge" side of the centre, showing that more current is being used by the lamps than the dynamo is generating.

LAMPS AND BULBS.

Of the five lamps with which "Standard" cars (those on the *11 h.p.* are 6 volt, and those on the *14 h.p.* are 12 volt) are equipped, two of them—the headlights—are adjustable as to focus. This feature enables a beam of light of a different nature to be secured, viz., one more or less concentrated or more or less diffused. A concentrated beam illuminates distant objects better than a diffused one, while the latter is of benefit in that it shows up the nearby

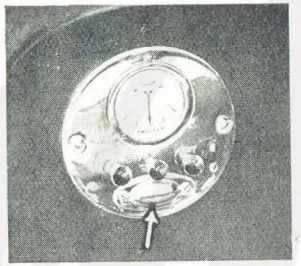


FIG. 101.—THE SWITCHBOARD OF THE C.A.V. LIGHTING AND STARTING EQUIPMENT ON THE 14 H.P. "STANDARD."
The arrow indicates the embossed plate which covers the fuse and encloses spare fuse wire. Above it are the three plunger switches for dynamo and lamps, the former on the extreme left-hand. At the top is the ammeter, with its hand seen in the zero position.

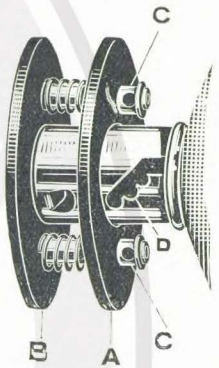


FIG. 102.—BULB-HOLDER OF LUCAS LAMPS ON 11 H.P. "STANDARD."
A—Movable fibre disc.
B—Fixed disc.
C—Sockets for cable ends.
D—Three optional notches for use when focusing.

roadsides better. Usually a compromise adjustment is adopted, though some drivers prefer to have the offside headlamp adjusted to give a concentrated beam, and the nearside one a widely diffused light.

It is not so much, however, to afford the driver a means of adjusting the beam with a given lamp bulb that the makers provide focus adjustment, as to enable the lamp to be adapted to the use of different kinds of bulbs. The latter vary considerably in the shape, size, and position of the filament, and it is always advisable, when a new one is fitted, to test the focus adjustment and to vary it as required to suit the ideas of the individual.

The electric equipment of the *11 h.p.* "Standard" is a Lucas, and the means of adjusting the lamp focus differs from that of the

C.A.V. outfit fitted to the *14 h.p.* "Standard." In the Lucas headlamps the "bayonet" fixing for the bulb has three pairs of notches, instead of one pair as usual, and the focus adjustment is made by utilizing one or other of the additional notches. The best way of adjusting the focus is to take the car on to a straight and level road, and engage the bulbs in each of the three pairs of notches

FIG. 103.—LUCAS HEADLAMP OF 11 H.P. "STANDARD."
This view shows how to grasp the rim of the front glass to rotate it partially prior to its removal.

in succession, noting which position gives the best illumination, or the light that appeals as being the best to the driver.

In the C.A.V. (*14 h.p.*) headlamps the focus is adjusted by moving the bulb holder backward or forward. It is secured by a milled-edge and slotted screw lying horizontally below the rear extension of the lamp; there is a second (vertical) screw on some lamps, but this merely secures the terminal sleeve of the cable. When the horizontal screw is slackened the lamp-holder can be moved readily, but it is to be noted that a slight movement of the bulb backward or forward makes a great difference in the shape and character of the beam. The screw should, of course, be retightened when the best focus has been secured; a coin can be used in the slot instead of a screwdriver, either for slackening or tightening the screw.

To fit a new bulb (or adjust the existing one in the Lucas lamps) it is necessary to remove the front glass or "door." The Lucas front glass is secured by means of a "bayonet" fixing between the rim and the body of the lamp. On the top of rim and lamp will be seen two "pips," and these will be in line when the front is properly fixed. (In some cases an arrow is provided instead.) To remove the front, the rim should be gripped firmly with both hands and turned towards the left (viewed from the front of the car); it will move about an inch and can then be pulled forward clear of

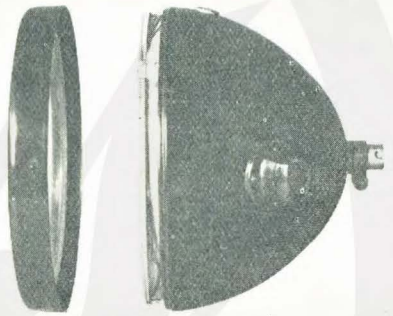


FIG. 104.—THE LATEST PATTERN C.A.V. HEADLAMP WITH A "BAYONET" FIXING FOR THE FRONT GLASS.
The latter is secured by small pins in the rim, which fit into slots on the body, the front then being rotated clockwise until it is locked by the spring clips. To remove the front it is rotated anti-clockwise and then drawn forward. The milled-edged and slotted screw below the extension of the bulb-holder locks the focus adjustment, and a bayonet fixing is used for the cable terminal, in place of a second locking screw in the alternative pattern.

the lamp. To refit it, the "pip" on the rim must be approximately an inch towards the left of the other (or the arrow that much to the left of the centre), before the rim can be pushed on—evenly all round—and then turned to the right until the "pips" are in line again, or the arrow is central.

The front of some C.A.V. headlamps is held by two hinge-pins; both of the latter should preferably be removed, for though it is possible to hinge the front glass forward after removing one pin or the other, it is usually easier to remove and refit the rim to the body when both pins are taken away. If difficulty is experienced in removing the rim, a screwdriver can be inserted between the halves of the hinges to prise these apart; but it should not be used elsewhere, owing to the likelihood of the thin metal of the rim being

buckled. In other C.A.V. headlamps the removal of the front glass is effected in a manner similar to that mentioned as applying to the Lucas.

CLEANING THE REFLECTORS.

If the reflectors of the headlamps should become dusty or tarnished, great care should be taken in cleaning them to avoid making scratches. The highly polished surfaces are extremely sensitive, and dust should be removed with a soft cloth very lightly applied.

On no account should ordinary metal polishes be used on the reflectors; it will scratch the surface and lower the lighting efficiency. If they become tarnished, a soft and clean chamois leather or a piece of Selvyt should be used with a small quantity of jeweller's rouge. But normally the reflectors will not tarnish, and the only form of cleaning they will need is a careful dusting and then a light polish with a soft chamois leather.

ELECTRICAL FAULTS AND REMEDIES.

Reference has already been made to some of the defects that can develop in the electrical equipment, and though it is well that the owner should be aware of their possible occurrence and of others, it can be said that every item of the equipment has now been brought to such a state of perfection that troubles are rarely experienced, so long as the driver gives due attention to the replenishment of the battery, and does not use the engine-starter unduly in proportion to the periods during which the battery is under charge. If the battery be replenished with distilled water regularly (as specified on page 170) and the starter is reasonably used, it is highly improbable that any of the following faults or other troubles will be experienced until the car has been in use for some years. The possible cause or causes in each case is specified under the individual defect.

DYNAMO NOT CHARGING (AMMETER NOT REGISTERING).

Charging switch "off."
Fuse wire "blown" (melted).
Engine speed too low.
Dynamo belt slipping (on *11 h.p.* "Standard).

DYNAMO CHARGING ERRATICALLY.

Belt slipping (on *11 h.p.* "Standard").
Loose terminals on dynamo or in switchboard.

Commutator brush tight in holder.
Commutator greasy or dirty.
Commutator worn or rough.
Insulating strips of commutator too high in relation to copper segments.
Loose connection on battery.
Loose fuse wire.

LAMPS GO OUT SUDDENLY.

Broken wire or loose connection on battery or in switchboard.
Switch moved to "off" position.
Bulb filament "blown" (new bulb required).

LIGHT DIMINISHES.

Battery run down.
Short-circuit in one of the cables.
(To detect the existence of a "short," turn off all lamps and look at the ammeter to see whether it registers a discharge. To trace in which circuit the short is occurring, switch off the headlights and note whether side light improves; if not, put on the headlights and switch off the sidelights, then noting whether the former improve. The fault will be in the lamp circuit that must be switched off to improve the light in the other lamps.)

LIGHTS FLICKER.

Loose connection in switchboard, on battery or elsewhere.
Lamp-holder contacts faulty.
(Note whether steadiness is secured by pressing the bulb into firmer contact with the spring plungers in the holder. If so, a little more solder may be needed on the bulb "pips," or a cure may be effected by an exchange of bulbs with another lamp.)

BRILLIANCE OF LIGHT VARIES WITH SPEED OF CAR.

Battery connection loose or broken.

A POOR AS DISTINCT FROM A DIM LIGHT.

New bulb required.
Lamp out of focus.
Dirty reflector or bulb.
Battery nearly exhausted.
Lamp bracket bent, throwing beam up or down too much.

ENGINE STARTER WEAK.

Battery nearly exhausted, or acid level low.
Loose terminal on battery or elsewhere.
Motor commutator dirty, greasy or badly worn.
Engine partially seized or oil too thick owing to low atmospheric temperature.

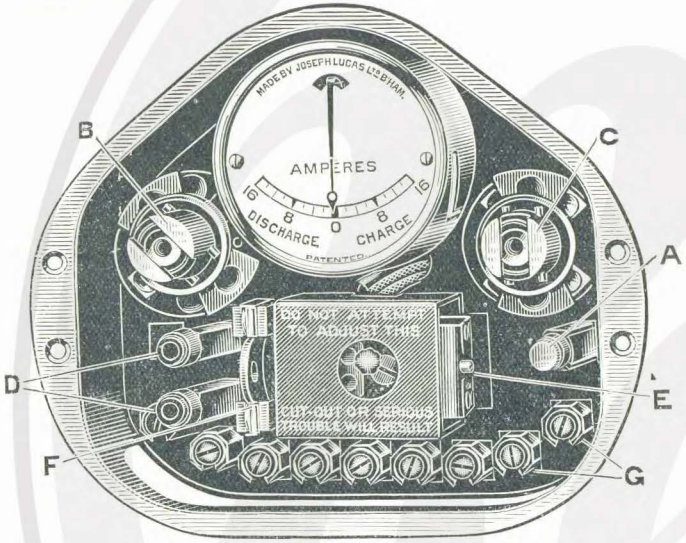


FIG. 105.—LUCAS SWITCHBOARD ON 11 H.P. "STANDARD," WITH COVER PLATE REMOVED.

A—Carton containing spare fuse wire.
B—Dynamo and magneto switch.
C—Switch for lamps.
D—Sockets for inspection lamp adapter.
E—Automatic cut-out.
F—Fuse-holder.
G—Terminals of various cables.

STARTER PINION FAILS TO ENGAGE.

Loose connection on starter switch.
Pinion stiff on its shaft (oil required).

STARTER PINION REMAINS ENGAGED.

Lubricate shaft and release the pinion by rotating the flywheel backward.

REPLACING A FUSE.

On the *11 h.p.* "Standard" the fuse is made accessible by removing the screws that pass through the centre of the ignition

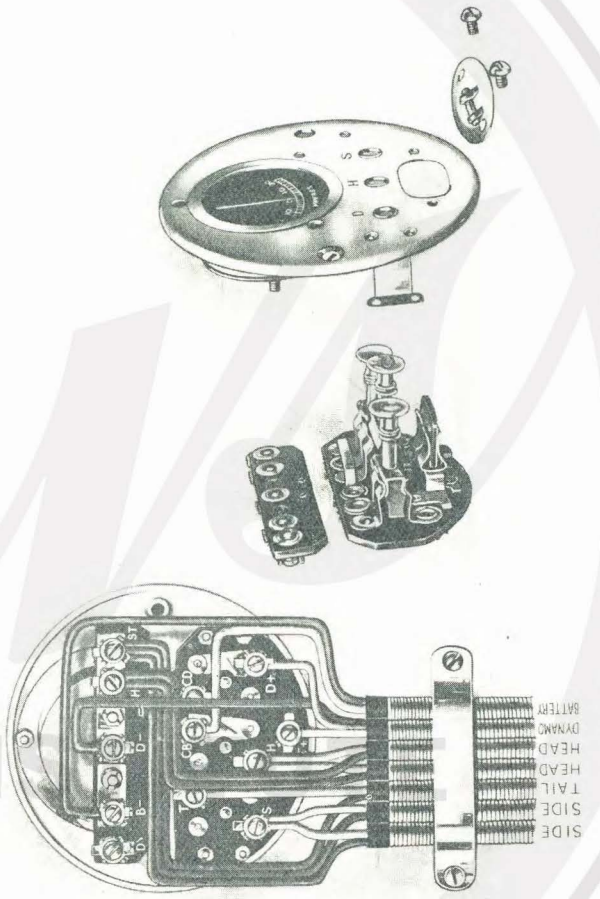


FIG. 106.—THE C.A.V. SWITCHBOARD OF THE 14 H.P. "STANDARD."
On the left is a rear view showing the terminals and cables; in the centre are the switch plungers, removed from the front cover; the latter is seen on the right with the combined fuse cover and spare fuse holder detached.

and dynamo switch levers. The latter must be drawn off, after which the front plate of the switchboard will come away, exposing the terminals, etc., within. The fuse wire in use is attached to a fibre plate supporting brass clips; between the flexible ends of the latter the fuse is arranged, serving to connect the "forks," or split brackets, into which the fuse holder slides. Spare wire is contained within a carton to the left of the ammeter.

When a new fuse is fitted, or the old one inspected, care should be taken to note that it is firmly held or pinched by the holder when the latter is pushed into place.

On the *14 h.p.* "Standard" the fuse holder is exposed by the removal of the oval plate secured by two screws below the three switch plungers. The same plate also forms a receptacle in which several lengths of spare fuse wire are stored. When refitting this plate, care should be taken to ensure that the strip of fibre, originally in place to prevent the spare wire from falling into the switchboard interior, is refitted with the screws passing through the hole at each end. If the spare wire drops inside the board, it may short-circuit one or other of the terminals and cause trouble.

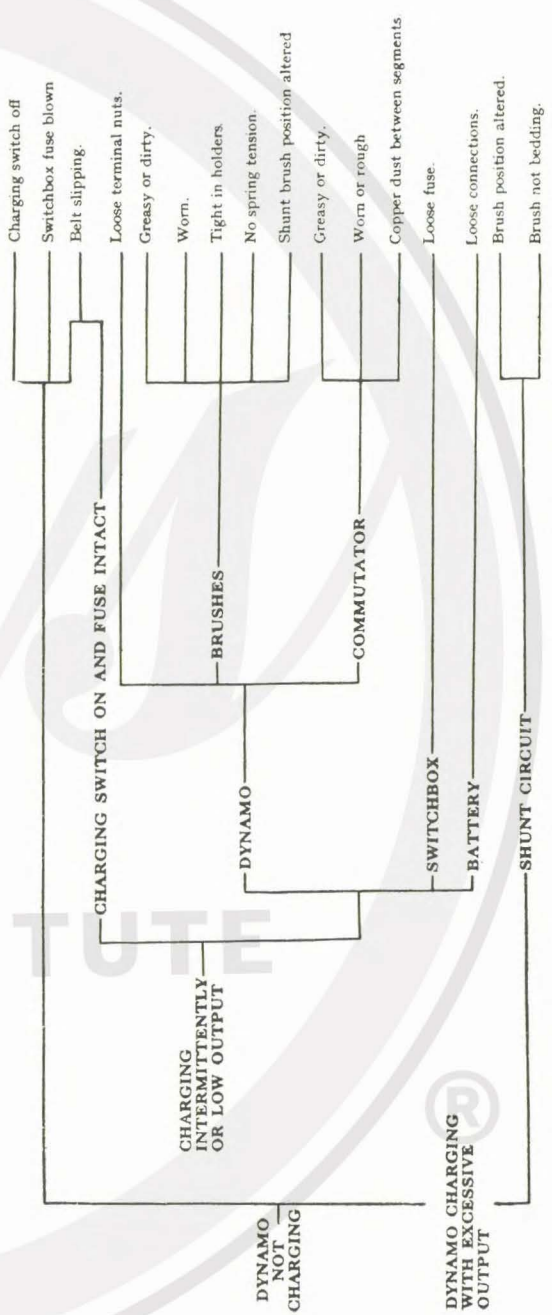


FIG. 107.—FAULT-FINDING TABLE RELATING TO POSSIBLE IRREGULARITIES OF THE DYNAMO.

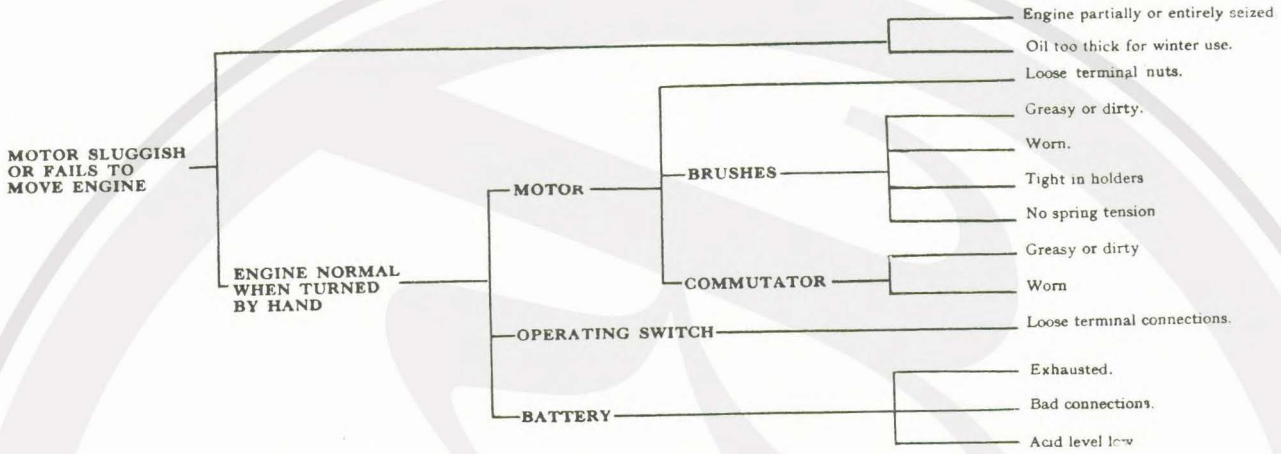


FIG. 108.—FAULT-FINDING TABLE CONCERNED WITH THE STARTING MOTOR.

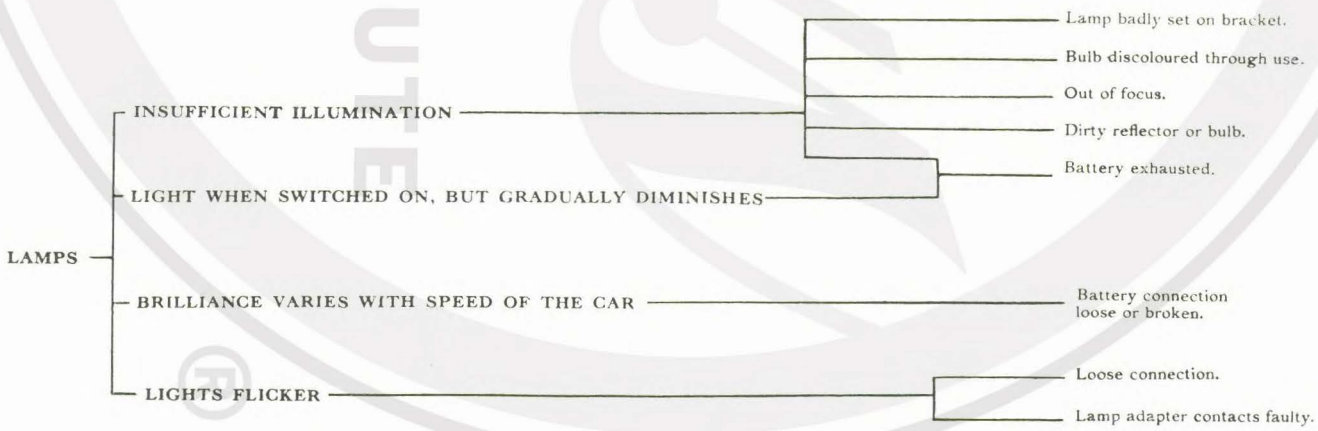


FIG. 109.—FAULT-FINDING TABLE DEALING WITH DEFICIENCIES OF THE LAMPS.

CHAPTER XXXII

COSTS OF RUNNING AND UPKEEP

One of the characteristics of "Standard" cars in which the manufacturers justly take pride is in regard to the low cost of upkeep and running expenses in general, for there is no doubt that either the *11 h.p.* or the *14 h.p.* model will bear comparison with favourable results on that account with other makes of similar passenger capacity, performance, and comfort.

Unfortunately, however, it is impossible to state definitely what amount per annum or per mile will represent upkeep costs as applied to all cases. The cost per mile, for instance, is to a very large extent dependent upon the annual mileage, because of the "fixed" charges (such as garage rent, taxation, insurance, etc.), which are the same per annum, irrespective of the distance covered by the particular car.

Then, too, there are several factors that enter into annual and mileage costs that are known only to the individual owner. The class of road (good or bad) on which the car is usually run, the nature of the district (hilly or flat), the average load and speed, and last—but not least—the driving methods employed and the amount of care devoted to upkeep. All of these appreciably affect the costs of running. It is possible, nevertheless, to give an approximate idea of expenses concerned with each model, on the assumption that a given mileage per annum will be covered, that the conditions of running will be normal, and that the driving methods and care bestowed upon maintenance work will be reasonable. It must also be assumed that the owner will attend himself to the lubrication of the car and the required adjustments of the brakes, etc.

On that basis the following tables can be held as showing approximately how much the actual running and upkeep costs will amount to; they have foundation in the experiences of a number of users, whose ability as drivers and mechanics varies considerably, and whose demands upon their cars are also dissimilar.

In addition to the items specified in the following tables, something must be added for interest on capital and for depreciation. Interest on capital can be put down at 5 per cent on the value of the car. Depreciation will vary according to the mileage and the care bestowed upon the chassis and bodywork; on the basis of

UPKEEP COSTS OF 11 H.P. "STANDARD"

(Average of Three Years' Running)

Four-seated open car; average load three adults; stored in private garage; used mainly in moderately hilly and undulating districts with fair roads. Value £235.

	Annual Mileage.	
	5,000.	10,000.
	£ s. d.	£ s. d.
Insurance ("Tariff" Rate)	12 15 –	12 15 –
Car Tax	12 – –	12 – –
Driving Licence	5 –	5 –
Petrol, 35 m.p.g.	11 – –	22 – –[1]
Oil	18 –	1 16 –
Tyres (Balloon, 28 × 4·95 m.)	8 7 9	16 15 6[1]
Repairs and Renewals (Average of 3 years)	10 – –	20 – –
	55 5 9	85 11 6
Cost per Mile	2·65d.	2·05d.

UPKEEP COSTS OF 14 H.P. "STANDARD"

(Average of Three Years' Running)

Five-seated open car; average load four adults; stored in private garage; used mainly in moderately hilly and undulating districts with fair roads. Value £345.

	Annual Mileage.	
	5,000.	10,000.
	£ s. d.	£ s. d.
Insurance	15 15 –	15 15 –
Car Tax	14 – –	14 – –
Driving Licence	5 –	5 –
Petrol, 28 m.p.g.	13 10 –	27 – –[1]
Oil	1 – –	2 – –
Tyres (Balloon, 30 × 5·25 m.)	12 – –	24 – –[1]
Repairs and Renewals (Average of 3 years)	10 – –	20 – –
	66 4 –	103 – –
Cost per Mile	3·11d.	2·47d.

[1] At prices current when tables were prepared.

5,000 miles per annum 12½ per cent is a fair allowance, and 17½ per cent for 10,000 miles.

The cost of tyres has been estimated on the assumption that each cover will average 10,000 miles, and that at the end of the latter mileage a new air tube will be required. In regard to repairs and renewals, it is highly probable that in the first twelve months the cost will be considerably less than the figures quoted ; in fact, apart from very small items, repairs may be practically nil, though here, again, a great deal—if not everything—will depend upon the individual owner. There is really no need for expert assistance in connection with the essential work of upkeep, but if the owner calls in or visits a repairer on each occasion any little adjustment is needed, the cost of "repairs" will naturally mount up.

CHAPTER XXXIII

CARE OF TYRES

One of the items concerned with running costs, wherein the careful driver can economize to no small extent, is that relating to tyre repairs and renewals. In the first place, the life of a tyre is very largely dependent upon the maintenance of the correct inflation pressure, for if a tyre be run under-inflated the "cords" of the cover are excessively bent or flexed, and, rubbing against one another, give rise to friction which, in turn, causes chafing of the strands and a premature burst.

With balloon tyres, inflation pressures are even more important than in the case of the high-pressure variety, for the reason that a reduction of a given extent in pounds per square inch represents a much bigger percentage drop ; the comparatively few complaints that have been made as to short mileage-life of balloon tyres are nearly all due to neglect and carelessness in regard to inflation pressures.

It is, however, impossible for anyone to judge the pressure of a tyre by mere inspection of it as the car stands, loaded or unloaded ; the use of an efficient gauge is essential, and, as mentioned in an earlier chapter, it is advisable to apply it to each of the tyres at least once a week, no matter whether the car has been used or has stood in its garage since the pressures were previously tested. Practically all air tubes are slightly porous, hence their tending to lose air pressure, even although they are stationary.

The correct tyre pressures vary according to the individual car, and are dependent upon the actual size of the tyres and the laden weight, but it should not be surmised that the total weight of the car and its load is equally divided between the back and front wheels ; that is not the case, for the laden weight of the rear tyres is considerably greater than that of the front ones.

In the interests of economy it is highly desirable that the owner of a new car should at the earliest opportunity run it on to a public weighbridge and have its laden weights taken. For that purpose the car should carry its usual complement of passengers, and should first be weighed with the front wheels only resting upon the weigh-bridge and then with the rear wheels only in position. It is important to note, however, that the *laden* weights are required, for, unless the passengers are aboard when the weights are taken,

considerable discrepancy will occur if the inflation pressures are then calculated.

The following tables will serve as a rough guide in connection with the balloon tyre sizes fitted to "Standard" cars, but it should be noted that the weights given assume that in two-seaters half of the weight of the front passengers and the whole of that of the occupants of the dickey seat are carried by the back axle, and that in four and five-seaters and saloons the total passenger weight is

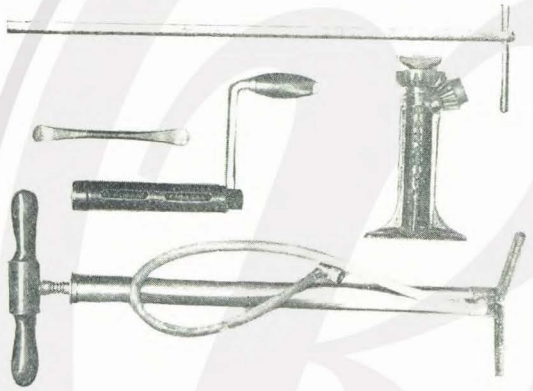


FIG. 110.—THE EQUIPMENT OF THE 11 H.P. "STANDARD" FOR SPARE WHEEL AND TYRE REMOVAL.

At the top is the jack handle, the jack being below on the right. In the centre is the "magazine" wheel brace, which retains the nuts as they are unscrewed and holds them ready for replacement. On the left is the tyre lever for Dunlop balloon tyres, and below is the tyre pump.

proportioned as to two-fifths on the front axle and three-fifths on the rear one. But this basis in either case can only be viewed as approximate, for the weight distribution depends not only upon the way in which the car is loaded, but also upon the weight of the individual passengers. It should be repeated, therefore, and emphasized, that the only way in which to obtain knowledge as to the correct inflation pressures of any car is to have its laden weights taken, and then to consult the tyre manufacturer's table of loads and pressures. The third table herewith shows the pressures recommended by the Dunlop Rubber Co. in connection with their balloon tyres as fitted to "Standard" cars.

DRIVING METHODS.

Next to consideration of inflation pressures, the most important factor in tyre life is the way in which the car is driven. Violent

TABLE I

TYRE SIZES AND WEIGHTS OF 11 H.P. "STANDARD" CARS

MODEL.	BALLOON TYRE SIZE.	WEIGHTS WITH PASSENGER LOAD OF 40 STONES.	
		Front Axle.	Rear Axle.
"Canley" Two-seater . .	28 × 4·95 in.	9 cwt.	10¾ cwt.
"Kenilworth" Four-seater .	28 × 4·95 ,,	9¼ ,,	10½ ,,
"Coleshill" Two-seater . .	27 × 4·40 ,,	9 ,,	10¾ ,,
"Kineton" Four-seater .	27 × 4·40 ,,	9¾ ,,	10½ ,,
"Piccadilly" Saloon . .	28 × 4·95 ,,	10¾ ,,	12 ,,

TABLE II

TYRE SIZES AND WEIGHTS OF 14 H.P. "STANDARD" CARS

MODEL.	BALLOON TYRE SIZE.	WEIGHTS WITH PASSENGER LOAD OF 40 STONES.	
		Front Axle.	Rear Axle.
"Leamington" Two-seater .	30 × 5·25 in.	11 cwt.	14 cwt.
"Warwick" Five-seater .	30 × 5·25 ,,	12 ,,	13½ ,,
"Special" Five-seater . .	32 × 6·20 ,,	12 ,,	13¾ ,,
"Pall Mall" Saloon . .	32 × 6·20 ,,	12 ,,	16 ,,
"Portland" Saloon . .	30 × 5·25 ,,	11½ ,,	14 ,,

TABLE III

DUNLOP BALLOON TYRE LOADS AND PRESSURES

SIZE OF TYRE.	WEIGHT PER AXLE LADEN.	INFLATION PRESSURE.
27 × 4·40 in.	8 cwt.	22 lb. per sq. in.
	10 ,,	25 ,, ,,
	11 ,,	27 ,, ,,
	12 ,,	29 ,, ,,
	13 ,,	31 ,, ,,
28 × 4·95 in.	10 ,,	22 ,, ,,
	12 ,,	24 ,, ,,
	13 ,,	26 ,, ,,
	14 ,,	28 ,, ,,
	15 ,,	30 ,, ,,
30 × 5·25 in.	12 ,,	21 ,, ,,
	13 ,,	23 ,, ,,
	14 ,,	25 ,, ,,
	16 ,,	28 ,, ,,
	18 ,,	32 ,, ,,
32 × 6·20 in.	14 ,,	20 ,, ,,
	16 ,,	24 ,, ,,
	18 ,,	28 ,, ,,
	20 ,,	32½ ,, ,,

braking is bad for the tyres; so are fast cornering, the sudden engagement of the clutch, and driving fast over bad or newly metalled roads. It is "showy" to dash up to a corner or a stopping place, and decelerate rapidly by the violent application of the brakes; but it is expensive, and if persisted in as a regular thing may well ruin a pair of back tyres in, say, 4,000 to 5,000 miles, where otherwise they would run double the distance. Fast cornering causes the tyres to slip on even dry surfaces and stresses the walls of the covers, and is an uneconomical policy for that reason, while sudden engagement of the clutch and fast driving over rough roads cause the tyres to "spin" and grind away their rubber in a comparatively short mileage.

CUTS AND GASHES IN THE TREADS.

Inspection should be made at almost every opportunity to note whether cuts or gashes have been made in one or other of the tyre treads, and also to see whether any flints, nails or other "puncture fiends" are embedded in the rubber. If cuts are in evidence, they should be filled up with one of the proprietary brands of "tyre stopping," the directions attached to the collapsible tubes or tins, as to cleaning and preparing the fault, being strictly followed.

When nails and other tyre enemies are found, they should be removed at once, for it is undoubtedly the case that neglect to observe that precaution is responsible for at least 50 per cent of punctured air tubes. Flints and other puncturing objects do not penetrate through the cover at once; they may remain in the tyre for days before being driven into the air tube; but they may penetrate at any time, so it is advisable always to remove them immediately they are seen. Hence the need for making frequent careful inspections, supplemented by a more or less casual scrutiny as the car stands, waiting a few minutes for its passengers, for instance.

CHAPTER XXXIV

TOURING AND MOTOR ORGANIZATIONS

A SPECIAL volume might be written on motor touring without exhausting the subject, but a few hints founded upon practical experience may be given here.

First of all, the car owner, especially if he intends to tour in Great Britain, and even more particularly if foreign tours are in mind, should join one of the national organizations, viz., the Royal Automobile Club and the Automobile Association. Each of these bodies is of untold assistance to its members who undertake motor tours, and of very considerable help in the ordinary course of motor use. Both have special departments giving advice gratis on all matters connected with motoring, provide free legal defence in certain classes of prosecutions, and in connection with British and foreign tours give most comprehensive itineraries and advice, with information covering hotels, routes, places and points of interest and beauty. Upon request, in fact, they will prepare and forward plans of alternative tours, covering any length of time, and the motorist touring abroad is "shepherded" at every point where assistance might be required—at ports of embarkation, at the Customs, etc., while both bodies have agents in many Continental centres.

THE ROYAL AUTOMOBILE CLUB.

R.A.C. membership is of two classes—ordinary and associate. The former is mainly attractive to the London and home counties car owner, giving use of the magnificent clubhouse in Pall Mall and the country clubhouse at Woodcote Park, near Epsom, Surrey, as well as all other benefits on the road and elsewhere. Associate membership includes the use of the associates' headquarters at the London clubhouse, and is primarily intended for provincial motorists, though metropolitan car owners are equally admissible.

The annual subscription of an associate member is two guineas. Free legal defence is provided in the case of a police court summons for any offence created solely by the ownership or driving of a private car, and the Club will send an experienced solicitor to appear for the defendant and pay the solicitor's fees and all his out-of-pocket expenses.

Another function of the Club and a benefit attached to associate membership, as well as being available to ordinary members, is the posting of uniformed guides on main roads, whose duty it is to assist members in every way possible. The Club has also inaugurated what is known as the "Get-you-home scheme," the idea of which is to assist members as much as possible in the event of a breakdown. Vouchers are issued which, when presented or sent to the nearest repairer, request him either to convey the member and his passengers to his home or destination (if either of the latter is within 20 miles), or, alternatively, to tow the car to its home (within a distance of 10 miles) or to the repairer's depot. The idea in fact is, as conveyed by the title of the scheme, to enable the member to get home with the least delay and inconvenience, the expense being borne by the Club. The address of the Royal Automobile Club is Pall Mall, S.W.1, with several provincial branches and numerous associated provincial clubs.

THE AUTOMOBILE ASSOCIATION.

So far as total membership is concerned, the Automobile Association is the most important in the country, having a membership of considerably over 250,000 direct subscribers. It possesses great resources and influence, and looks after the interests of its members carefully and comprehensively. The A.A. has a very large number of road patrols, many of them continuously on duty during the whole of each 24 hours, who are instructed to render every assistance in the case of accident or breakdown, and to look after the interests of members in every possible way.

Free legal defence is another benefit attached to A.A. membership. There is an engineering department, giving advice in the selection of cars or the repairing of them, and a touring section giving advice and assistance in regard to both British and foreign tours. Numerous other benefits are also available to members. The annual subscription is two guineas, the head office being at Fanum House, New Coventry Street, London, W.C.2, with branch offices in a great many towns and cities.

PREPARING FOR A TOUR.

Having decided upon the route and obtained a supply of maps covering the area to be included (the half-inch Bartholomew series can be recommended), the intending tourist should give thought to the preparation of his car well in advance of the starting day. Leaving the overhaul of tool kit and spare parts, the making of

brake adjustments, the lubrication of every chassis detail, and the arrangements for carrying luggage until a day or two beforehand sometimes leads to important points being overlooked, and even to unpleasantness among the party. Nothing is more galling to the passengers, some of whom possibly arrive from more or less distant places at an appointed hour, to find the owner unprepared, still tinkering with spanner or screwdriver, or using oil can or grease gun. As bad, or worse, is it for all concerned to find at the last moment that somebody's luggage cannot be accommodated, for lack of space on the car; unless, therefore, experience tells what amount of luggage can be carried without inconveniencing the passengers, it is as well to arrange for each passenger, a few days in advance, to send to the garage the container—suitcase or what-not—that he or she proposes to take. Then every item can be tried on the car at once, and, if necessary, additional straps or waterproof coverings can be obtained before the starting day. Do anything to avoid delay, recrimination, difficulty or unpleasantness on account of the luggage. Have full knowledge (and let the other passengers know) well beforehand of what can be taken and what must be left behind. Failure to do so may result in one or more members of the party losing a great deal of anticipated pleasure in the trip, because of being short of luggage or of certain kinds of clothing.

On the subject of clothing, make sure that everybody shall start off well provided with something warm and something to keep out the wet. So easily a tour can be spoiled by some, if not all, of the party feeling chilly or damp, if a cool or a wet spell of weather is experienced. Far better to have too much warm clothing than not enough; even at midsummer distinctly cold days sometimes occur, and a party can become very cold and "unhappy," sitting for several hours on end, during a long day's run.

OVERHAULING THE CAR.

If the car has been conscientiously attended to in the ordinary course, there will not be much in the way of overhauling to be done in anticipation of a tour. But additional care should be taken to ensure that every moving part is properly lubricated; the oil sump should be drained off and a fresh supply of lubricant given; the oil filters in the *14 h.p.* model should be cleaned, and the petrol filters in both types. An inspection (and if necessary a replenishment) of the gearbox and back axle lubricant should be made. The tyres should be examined, and any that are likely to collapse suddenly

should be left at home for use on short runs later, new ones being used instead. Start the car "well shod"; delays for tyre renewals and repairs are galling on tour—more so than at other times—and it may even happen that the local dealer is out of stock of the size required if a cover should burst.

It is as well to take a spare half-gallon tin of engine oil, in case an oil leak should develop miles from the nearest source of supply. The spare tin of petrol should be examined to make quite sure its contents have not leaked away or been "borrowed"—as has been known to occur, the owner being unaware of the fact until he wanted his spare petrol in an emergency.

Make certain the tool-kit is complete, and accessible without disturbing all the passengers or their luggage. But let it be stored where it will not form a temptation to the nefarious at public and hotel garages. Arrange the wheel-changing outfit—jack, brace, etc.—where it can be reached in a few moments; avoid the lengthy delay and inconvenience that so often occurs, when a puncture is experienced, while a search is made for the jack, its handle or the wheel-nut brace. Do not store it where its removal will necessitate some of the passengers getting out of the car, on a pouring wet day maybe.

Replenish the battery with distilled water, and ensure that the grease gun and oil can are fully charged. Inflate all the tyres to the correct pressure, bearing in mind that if a few hundredweights of luggage is carried, the pressure should be higher than usual.

If only one spare wheel is carried, buy an additional air tube and take it on tour. Two punctures in a day—or even in an hour—are by no means unknown, and it is much easier to change the second tube than to repair it by the roadside.

MOTOR TRUNKS FOR TOURING.

Too much care cannot be taken to ensure that the luggage is kept dry and clean on tour. Ordinary suitcases and trunks will not resist rain or dust, and if they are used they should be completely encased with waterproof sheeting, arranged around them after the containers are in place.

But undoubtedly the pleasure of touring is greatly enhanced when the bulk of the luggage is in the form of rainproof or dustproof trunks. The latter are specially made for motor touring, and have an additional and peculiar advantage in the ease with which the units can be removed or put in place on the car. The most convenient form of "grid" trunk (to be carried on the rear carrier)

consists of a casing which holds from two to four suitcases; the casing is left attached to the car when a stopping place is reached, a "door" or a lid being opened and the suitcases drawn or lifted out, without straps or other means of security being touched. Similar "trunks" are made for the roof of closed cars and others for the running boards, though the grid type is generally favoured.

Do not have a larger number of individual packages than can be helped. A big assortment of small units is difficult to fix in place and to protect, while the securing of each one without fear of its becoming detached *en route* is often a difficult and lengthy process.

Finally, bear in mind, when estimating the luggage accommodation, that at the last moment it is nearly always found that from one to half a dozen small items have been overlooked. Cameras, luncheon and tea baskets and such-like impedimenta occupy a lot of space in the aggregate, and if they are forgotten until everything else is aboard, the stowage of them may result in several passengers being rendered uncomfortable and cramped. Let everybody have as much leg-room as possible, for it is distinctly tiring to sit all day with one's limbs or body immovable.

SPARES FOR THE CAR.

It is clearly impossible and impracticable to take on the car a spare of every item that might fail on tour, and practically the only parts that need be carried are a couple of spare sparking plugs and one extra valve complete with spring, cup, and collet. The assortment of nuts and bolts included with each car should be taken; a few feet of thick copper wire is useful in many emergencies, and a roll of insulating tape, supplemented by a cake of Windsor soap, will serve well as a means of temporarily repairing a broken petrol or oil pipe—as well as for other purposes.

CHAPTER XXXV

POINTS OF LAW FOR THE "STANDARD" OWNER

APART from the licensing regulations referred to in Chapter II, it is distinctly advisable that the motorist should have knowledge of certain points of law, and of how to protect his interests in certain eventualities.

THE STORAGE OF PETROL.

It is not generally realized that, unless a garage is at least 20 ft. from any other building or a public highway, it is unlawful to store motor spirit in receptacles apart from the tank or tanks on the car, unless special provision is made, and a licence is obtained from the local authority. But, if the garage is that distance from another building, 60 gal. in 2 gal. cans may be kept, though that maximum includes the petrol in the car tank. Fifty gallons may be kept in a steel barrel or drum, but notice must be given to the local authority of an intention to do so.

LIGHTING REGULATIONS.

A car must carry two white lights in front indicating its extreme width, a red light at the rear, and a white light to illuminate the rear number plate. Any number of additional lights may be carried, but it is illegal to use a movable "searchlight" that can be directed to one side or the other while the car is moving. "Spot-lights," attached to the windscreen, have been judged as unlawful by magistrates in some districts.

Front lamps must be lit within one hour after sunset, but the back number plate must be illuminated within half an hour of sunset.

SPEED LIMITS.

At the time of going to press the maximum legal speed of cars is still 20 m.p.h., excepting where special speed limits (usually 10 m.p.h.) are in force. But there is a prospect of the legal limit being removed, and "driving to the public danger" made a still more serious offence.

Special speed limits are indicated at each end of the length of

road concerned by a sign, consisting of a white ring, with a plate below giving the maximum permitted speed.

It should be remembered that the mere fact that the ordinary or a special speed limit was not being exceeded, is not a "good defence" when a motorist is charged with reckless or negligent driving; he must regulate his speed at all times according to the prevailing conditions, and in some circumstances even 5 m.p.h. may be held to be reckless driving, even where the legal limit is actually 20 m.p.h.

IN CASE OF ACCIDENT.

A motorist is legally bound to stop if an accident occurs in which his car is directly or indirectly involved, no matter whether a pedestrian, other vehicle, cyclist or a dog is concerned. He is also obliged to give his name and address to the injured party or to some person acting in the interests of the latter.

When an accident occurs, or when he is stopped and charged with an offence by a police constable, the motor driver should at once endeavour to obtain the names and addresses of witnesses who could give evidence on his behalf. He should also make notes as to the conditions prevailing at the time of and before the accident or alleged offence, and even go so far as to take measurements of the wheel tracks of the car and of other vehicles involved (if any), of the width of the road, of signs of brake application, and of any other feature that might have effect upon the question of liability or guilt. The number of the other car (if one is involved) should be taken, and the name and address of the driver secured.

If the car is insured, the insurance company should be notified at once of any accident and all the circumstances relating to it, and it is extremely important to remember that whether the car and its owner are insured, or not, neither the driver nor the passengers should admit liability, especially if there is a possibility of a claim being made for damages. In fact, it is one of the essential conditions attached to car insurance policies that the insured shall in no case admit liability, or make any offer of compensation, without the written consent of the company.

UNATTENDED CARS.

It is illegal to permit a car to stand unattended in any public place with the engine running, and it may not be left without the driver having taken "due precautions against its being started in his absence."

In the majority of towns and cities the police have allotted various spaces for the parking of cars for short periods, where they may be left unattended. But it should be noted that as a rule there is a time limit, and if a car remains unmoved or unattended for more than, say, two hours, there is a possibility of its owner or driver being summoned for obstruction, as though it were left at some place not allocated to the parking of cars.

The police in various towns are by no means alike in their attitude towards cars left unattended for a few minutes in the streets, or with one or more people aboard while a companion attends to some business. In certain places cars are not allowed to stand in business thoroughfares more than two or three minutes; in others a limit of 20 minutes is enforced. It is always well to be on the safe side in strange towns, therefore, and to make inquiries of the police or shopkeepers as to the nature of the local rules and regulations.

TRAFFIC DRIVING.

When driving in towns and cities strict observance must be made of the signals and instructions of police constables on traffic control duty; they are autocratic, and any failure to observe their signals may result in the motorist being summoned. A plea that the traffic controller's signals were misunderstood or not seen is rarely a good defence; and for that reason it is always advisable to stop if any doubt is felt, and wait until a clear signal is given.

No driver is entitled to steer across the path of traffic approaching from the opposite direction, unless the driver of the nearest vehicle, or a traffic controller, signals permission. Strictly speaking, a driver who wishes to pull up on his offside of the road should proceed to an open space, where he can turn round and drive in the other direction until he brings his required stopping place on his left. But, subject to observance of the rights of approaching traffic when its line is to be crossed, the authorities in most towns do not insist upon the strict rendering of the rule being followed—the fact being that in certain circumstances it might cause more instead of less traffic delay or confusion.

IN CASE OF LEGAL PROCEEDINGS.

The motorist who is summoned by the police, or by a private individual for some alleged offence against the motor laws, is well advised to arrange to be legally represented at the court where the case will be heard. True, there are amateur lawyers among

motorists who are well able to defend a case with ability and success; but the average individual does not fall within that category.

Preferably, the car owner should be able to call upon the R.A.C. or the A.A. for free legal defence, by being a member of one or the other organization, for, apart from the fact that the two guineas annual subscription may be recovered and to spare by legal representation in only one case per annum, there is the advantage that the R.A.C. and A.A. lawyers are specialists in motor law, and are frequently able to put up a better defence than the "general practitioners" among the legal fraternity.

In any event, a summons should not be ignored. The magistrates have the power in that case to issue a warrant for the arrest of the individual concerned, and, if they do nothing more serious, are likely to impose a far heavier penalty for the "contempt of court" thus shown. The least that should be done is to write an explanatory letter to the clerk of the court or bench, offering in the case of conviction to send a cheque to cover the fine and costs. But unless a good defence can be made out in the case of minor offences, it is often better to plead "guilty," for many benches of magistrates have an unwritten rule to inflict heavier fines when a plea of "not guilty" and the subsequent defence are unsuccessful. But the car owner or driver is better advised to employ a solicitor in all cases where the alleged offence may be viewed seriously by the court.

GENERAL.

A car may not be driven backwards for a greater distance or time than—to quote the words of the regulation—"may be requisite for the safety or convenience of the occupants of the car and of the passengers and other traffic on the highway."

The driver may not be in such a position on the car as to prevent him from controlling it properly, or as will prevent him from obtaining a full view of the road and traffic ahead.

An exhaust cut-out and open exhausts are illegal; an efficient silencer must be in continuous use so long as the car has its engine running on a public road.

If one car tows another, the rear one must carry at the back a number plate with the registration letters and number applying to the front one. Legally, they must be viewed as one car for the time being.

CHAPTER XXXVI

MECHANICAL TROUBLES; THEIR CAUSE AND REMEDY

THE ills to which a car of any kind may be subject are many and various. Some of those that may develop in "Standard" cars have been specified in the foregoing chapters, and it will have been noted that the majority can be avoided by reasonable care and attention in matters concerned with lubrication, adjustment, and upkeep in general. Hereafter, appears in tabulated form a list of the main irregularities that may develop, the symptoms that may accompany each one and the cause. This list will form a guide to the novice among owners—

ENGINE FAULTS

FAULT.	SYMPTOM.	CAUSE.
Engine will not Start	Starter switch ineffective.	Battery run down.
		Starter pinion jammed.
		Engine oil too thick for winter use.
	Engine rotated by starter.	Ignition or petrol "off."
		Petrol tank empty.
		Choked petrol filter or carburettor jet.
		Autovac empty (in *14 h.p.* model).
		Throttle too far open or not open enough.
		Carburettor air-strangler inoperative.
		Ignition insufficiently advanced.
		Magneto defective.
		Sparking plug gap too wide or too narrow.
		Sparking plugs sooted or oily.
		Air leakage at carburettor flange.
Engine will not Accelerate . .	Stops when throttle is opened.	Main carburettor jet blocked.
		Compensating jet blocked.
	Popping in carburettor.	One or both jets restricted.
		Engine not warm enough.
		Partially choked petrol filter.
		Ignition insufficiently advanced.
		Detached or broken wire between magneto and sparking plug.
		Valve sticking from overlubrication.
	Black smoke from exhaust.	Carburettor flooding.
		Air-strangler closed.

ENGINE FAULTS—(*contd.*)

FAULT.	SYMPTOM.	CAUSE.
Engine Runs Erratically . . .	Fault occurs at all times.	Choked jet or jets.
		Faulty sparking plug.
		Restricted petrol filter.
		Magneto requires adjustment or cleaning.
		Tight valve.
	Fault occurs when accelerating.	Faulty sparking plug.
		Choked jet or jets.
		Restricted petrol filter.
	Fault occurs only when engine is running at high speed.	Restricted petrol filter.
		Faulty magneto adjustment.
		Weak valve spring.
Engine Taps and Knocks . .	Sounds heard when accelerating.	Excessive carbon deposit in cylinders.
		Ignition too far advanced.
	Sounds heard when car over-runs engine.	Loose engine bearing.
		Worn gudgeon pin of piston.
	Sounds heard at all times.	Too much valve clearance.
		Sticking valve.
		Melted or excessively worn engine bearing.
		Loose flywheel (very rare).
Engine Power Deficient . .	Defect constant.	Throttle or ignition controls bent or displaced.
		Valves need grinding.
		Insufficient valve clearance.
		Air-strangler in operation.
		Obstruction in petrol feed (choked filter or jet).
		Leaking cylinder head joint.
		One cylinder, or more, not firing.
		Insufficient oil in engine.
	Defect intermittent.	Partial or irregular obstruction in petrol feed.
		Sticking valve.
Engine Stops . .	Carburettor will flood.	Choked jet or jets.
		Loose jet.
		Magneto defective.
		Throttle disconnected and shut.
		Sticking valve.
	Carburettor will not flood.	Empty tank.
		Choked filter.
		Choked feed pipe.
		Leaking suction pipe between engine and Autovac or air leak in pipe between rear tank and Autovac (*14 h.p.* model).

TRANSMISSION FAULTS

Fault.	Symptom.	Cause.
Clutch Slipping	Engine accelerates without increasing speed of car proportionately.	Springs require tightening. No "lost motion" of pedal. Excessive oil (*14 h.p.* model). Excessive use of greaser on clutch shaft (*14 h.p.* model).
Gears Noisy	Difficult to engage from neutral.	Clutch lever adjustment faulty. Too much oil in clutch (*14 h.p.* model). Too much "lost motion" of pedal.
	Noisy when running.	Not enough oil or too thin a grade in gearbox. Worn gearshaft bearings.

STEERING FAULTS

Fault.	Symptom.	Cause.
Car Tends to Wander	Steering free.	Adjustment of worm gearing required. Loose coupling-rod joints. Punctured or insufficiently inflated rear tyre.
	Steering stiff.	Swivel axle pins unlubricated. Front tyre punctured or "soft." Front wheels out of parallel.

BRAKE FAULTS

Fault.	Symptom.	Cause.
Inefficient Braking	Pedal or lever has one-third or more of its range of movement unused.	Shoe liners unduly worn. Shoe and cam contact plates require renewal or repacking. Brake camshafts partially seized (lack of lubrication). Angle of camshaft levers needs resetting.
Brake Shoes do not Come "Off"	Brakes also weak in use.	Brake camshafts partially seized (lack of lubrication).

In addition to the foregoing, the following defects and causes may be specified—

RADIATOR WATER BOILING.

Excessive use of low gears; insufficient water in radiator; ignition retarded too much; carburettor flooding. Fan belt slipping (*14 h.p.* model).

CARBURETTOR FLOODS CONTINUOUSLY.

Needle valve sticking or bent; float punctured; grit on needle valve seating.

SMOKE FROM EXHAUST.

Too much oil in engine (blue smoke); too rich a mixture from carburettor, e.g. carburettor flooding, jet loose or air-strangler sticking in operation (black smoke).

POPPING IN CARBURETTOR.

Jet or jets partially or completely choked; engine cold; loose carburettor flange; ignition too far retarded; throttle opened too suddenly; inlet valve sticking.

BANGS IN SILENCER.

Defective sparking plug or magneto adjustment; sticking exhaust valve; mixture too weak (jet or jets partially or completely choked); ignition too far retarded.

OIL CIRCULATION INDICATOR AT "DANGER."

(*14 h.p.* model.)

Insufficient oil in engine; oil filters choked; coupling wire disconnected; air leak in suction pipe.

SQUEAKS FROM ENGINE.

"Idling" speeds maintained too long; lack of engine oil in sump; valve gear needs lubricating (*11 h.p.* model); fan bearing requires grease (*14 h.p.* model).

CLANKING FROM ENGINE.

Distribution chain requires adjustment; melted bearing (due to neglect to replenish oil sump as required).

THUDS FROM BELOW BODY.

Holding-down bolts loose.

DOORS DIFFICULT TO CLOSE.

Car standing on very uneven ground; latches require oil.

SQUEAKS FROM CHASSIS.

Neglected lubrication of springs, spring shackles, and brake joints; loose mudguard bolts.

CHAPTER XXXVII

SOME GENERAL HINTS

PRECAUTIONS AGAINST FROST.

UNLESS the car is stored in a heated garage the water in the radiator and elsewhere should be drained off when frosty weather is likely to occur, and also if the car is to be left for several hours in the open air while low temperatures prevail. A drain-plug for this purpose will be found at the bottom of the radiator; a small tap at the rear end of the engine (on the left of the crankcase in the *11 h.p.*, and on the back of the cylinder block on the *14 h.p.*) enables the cylinder jackets to be completely emptied.

A brick-built garage will usually prevent the water in the engine from freezing for twelve hours or so, but it is unsafe to leave a car with radiator, etc., unemptied for a longer period, or for even one night in a garage constructed of wood, plaster or sheet iron.

If the car is left in the open air for even an hour or so in very cold weather, the radiator and bonnet should be covered with thick rugs to retain the heat as long as possible, and prevent the freezing of the water; the latter may cause a cylinder or a radiator to crack or burst.

REPAIRING PUNCTURES.

Although a spare wheel is provided with "Standard" cars for use when a puncture occurs in the course of a journey, it is advisable to carry a repair outfit in case a second puncture should be experienced. The "Patchquick" outfits can be recommended, and contain full instructions as to applying a patch on a punctured tube. Bursts should be repaired by the vulcanizing process, and all large repair shops are equipped with the necessary plant for that purpose.

CARE OF BODYWORK.

Mud and dust should not be removed from the painted and varnished parts of the car without water—plenty of it—applied with a sponge free from grit. The use of a dry duster for this purpose will cause permanent blemishes in the form of scratches. A separate sponge should be kept for the undersides of the mudguards, as the grit which is there deposited may be conveyed to

the varnished panels and tops of the wings if the same sponge is used for all parts.

After the dirt has been sponged off (a hose is of considerable assistance) the panels should be dried with a damp chamois leather, though this treatment need not be given to the undersides of the mudguards.

Every effort should be made to keep lubricating oil, paraffin, tar, and benzol away from the painted and varnished parts, for all of these have ill-effect. If tar spots occur on the varnished parts, they should be removed as quickly as possible by first soaking them with butter or other animal fat for several hours. Benzol should not be used for this purpose, although it is effective in removing the tar, for the reason that it will also dissolve the paint and varnish.

PRESERVING THE UPHOLSTERY.

Leather upholstery can have its original qualities preserved to a very large extent by being occasionally treated with a "leather reviver." There are several proprietary brands available, and these are usually stocked by accessory dealers and garages. But a good means to this end is the saddle soap used by ostlers for preserving harness; it is applied on a damp sponge, being rubbed well into the leather, the latter subsequently being polished with a soft cloth.

A warning note may be sounded as to some varieties of leather revivers; they somewhat resemble dubbin, and if they are used in excess, or if the polishing process is not carefully and thoroughly carried out, the clothes of passengers may be soiled.

Cloth upholstery is vastly improved if occasionally it has a vacuum cleaner applied to it, or failing that a clothes brush. Grease marks and other causes of a soiled appearance are best removed with a rag moistened in benzol; petrol should be avoided for this purpose, as the heavier elements are of a somewhat greasy nature, and are prone to leave a permanent mark or a discoloured patch.

FOLDING THE HOOD.

When the hood is folded, great care should be taken to ensure that the flexible material is not pinched between any of the "sticks," or caught between the latter and the brackets on the body. The rubber buffers and hood fasteners should prevent rattles, but if the latter are noticed they should be traced and stopped without

delay, as any undue movement between the hood sticks is prone to result very quickly in a hole being chafed in the hood covering.

STORING SIDESCREENS.

When the sidescreens are stored away in the compartment provided behind the upholstery they should be quite dry; otherwise they will tend to become mildewed and the fabric to rot. If, however, they must be put back into their compartment immediately after use in wet weather, the first opportunity should be taken to remove them and allow them to dry in the open air.

TESTING THE BATTERIES.

Unfortunately, there is no entirely reliable method or means of testing whether the batteries are fully charged. Voltmeters are not dependable for this purpose unless they are used while current is being taken from the cells, and even then the instruments of this kind available to motorists are not dependable.

Hydrometers are often recommended for testing the condition of the battery. These consist of a glass tube, into which some of the solution from each cell successively is drawn by means of a rubber bulb or pump plunger; a series of variously coloured balls within the glass tube are supposed to indicate, according to which one floats or sinks, whether the battery is discharged, fully charged, or in some state in between. But experience shows that even this type of battery tester is not invariably to be depended upon; it indicates the density of the solution, which is, however, affected by the existing proportion of acid to water, as well as by the state of the cell in regard to the storage of electrical energy.

DO NOT SLAM DOORS.

If the car owner would avoid cracked and chipped paint on the doors and the bodywork adjacent to the latter, he will avoid slamming the doors of his car, and endeavour to ensure that his passengers shall be equally considerate. If the doors are disinclined to fasten without slamming, the probability is that a drop or two of oil is required on the latches and on the latch-plates secured to the doorposts.

TO PRESERVE THE NICKEL.

The nickel-plated parts exposed to the atmosphere tend to become "cloudy" if neglected, while rust will soon appear if they are exposed to moisture and allowed to remain wet until they dry

off naturally. Frequent cleaning is necessary to prevent the nickel from becoming cloudy, a form of deterioration that is permanent when once it appears. To avoid the need for frequent attention in that way the nickel-plated parts may be coated with a preservative; various proprietary compounds are available, but a drawback with most of these is that in course of time they tend to take a brown tinge and are difficult to remove.

A good plan is to dissolve approximately a cubic inch of car polishing wax in a teacupful of petrol or benzol, and to apply the resulting solution to the nickel with a fine camel-hair brush. The petrol will evaporate, leaving a thin film of wax that will harden in 24 hours, will preserve the nickel from the atmosphere or from moisture, and can be removed in a few moments at any time with a piece of rag moistened in petrol. It gives the nickel a somewhat cloudy appearance while it is serving its purpose, but upon removal it will be found to have preserved the original appearance of the plating.

CHAPTER XXXVIII

USEFUL INFORMATION AND TABLES

EQUIVALENT SPEEDS

Time for 1 Mile.		Speeds.	
Minutes.	Seconds.	Miles per Hour.	Kilometres per Hour.
1	0	60·00	96·51
1	5	55·43	89·10
1	10	51·42	82·73
1	15	47·99	77·21
1	20	45·00	72·40
1	25	42·36	68·14
1	30	40·00	64·36
1	35	37·89	60·96
1	40	36·00	57·92
1	45	34·29	55·16
1	50	32·73	52·65
2	0	30·00	48·26
2	20	25·71	41·36
2	40	22·50	36·20
3	0	20·00	32·18
3	20	18·00	28·96
3	30	17·14	27·58
3	40	16·36	26·32
3	50	15·60	25·18
4	0	15·00	24·13

APPROXIMATE EQUIVALENTS OF MILLIMETRES IN INCHES

Millimetres.	Inches.	Millimetres.	Inches.	Millimetres.	Inches.
1	$\frac{1}{25}$	51	2	95	$3\frac{3}{4}$
3	$\frac{1}{8}$	60	$2\frac{3}{8}$	100	$3\frac{15}{16}$
5	$\frac{3}{16}$	63	$2\frac{1}{2}$	102	4
6	$\frac{1}{4}$	65	$2\frac{9}{16}$	105	$4\frac{1}{8}$
8	$\frac{5}{16}$	68	$2\frac{11}{16}$	110	$4\frac{5}{16}$
13	$\frac{1}{2}$	69	$2\frac{25}{32}$	114	$4\frac{1}{2}$
16	$\frac{5}{8}$	75	$2\frac{15}{16}$	120	$4\frac{23}{32}$
19	$\frac{3}{4}$	76	3	130	$5\frac{1}{8}$
22	$\frac{7}{8}$	80	$3\frac{1}{8}$	140	$5\frac{1}{2}$
21	1	85	$3\frac{11}{32}$	149	$5\frac{7}{8}$
32	$1\frac{1}{4}$	90	$3\frac{9}{16}$	150	$5\frac{29}{32}$
38	$1\frac{1}{2}$				
44	$1\frac{3}{4}$				

N.B.—The equivalents above 50 mm. have been selected as applying to the bore and stroke of a large number of engines.

EQUIVALENTS OF KILOMETRES IN MILES

Kilometres.	Miles.	Kilometres.	Miles.	Kilometres.	Miles.
0·805	½	11·265	7	80·466	50
1·609	1	12·875	8	96·558	60
3·219	2	14·484	9	112·652	70
4·828	3	16·093	10	128·744	80
6·437	4	32·186	20	144·838	90
8·047	5	48·279	30	160·931	100
9·656	6	64·372	40		

EQUIVALENTS OF LITRES IN GALLONS

Litres.	Gallons.	Litres.	Gallons.	Litres.	Gallons.
4·4	1	27·2	6	90·8	20
9·0	2	31·8	7	136·3	30
13·6	3	36·3	8	181·7	40
18·1	4	40·8	9	227·1	50
22·7	5	45·4	10		

EQUIVALENTS OF DEGREES FAHRENHEIT AND CENTIGRADE

Fahr.	Cent.	Fahr.	Cent.	Fahr.	Cent.
32·0[1]	0[1]	59·0	15	100·4	38
33·8	1	68·0	20	104·0	40
35·6	2	77·0	25	122·0	50
41·0	5	86·0	30	212·0[2]	100[2]
50·0	10	95·0	35		

[1] Freezing point of water. [2] Boiling point of water.

TYRE SIZE EQUIVALENTS

65 mm. = 2½ in.
80 mm. = 3 ,,
85 mm. = 3¼ ,,
90 mm. = 3½ ,,
100 mm. = 4 ,,
105 mm. = 4⅛ in.
120 mm. = 4¾ ,,
135 mm. = 5¼ ,,
150 mm. = 6 ,,
700–710 mm. = 28 in.
760 mm. = 30 ,,
810–820 mm. = 32 ,,
880 mm. = 36 ,,

CONSTANTS FOR CONVERSION

Inches	× 25·399	=	millimetres.
Millimetres	× ·03937	=	inches.
Feet	× ·3048	=	metres.
Yards	× ·9144	=	metres.
Metres	× 39·37	=	inches.
Metres	× 3·2808	=	feet.
Kilometres	× ·6214	=	miles.
Miles	× 1·6093	=	kilometres.
Cubic centimetres	× ·0610	=	cubic inches.
Cubic inches	× 16·3862	=	cubic centimetres.
Kilogrammes	× 2·2046	=	pounds.
Pounds	× ·4535	=	kilogrammes.
Litres	× ·2201	=	gallons.
Gallons	× 4·5437	=	litres.
Kilogrammes per sq. centimetre	× 14·223	=	pounds per sq. inch.
Pounds per sq. in.	× ·0703	=	kilogrammes per sq. centimetre.

FORMULA FOR ASCERTAINING THE CUBIC CAPACITY OF AN ENGINE

$$D^2 \times N \times S \times \cdot 7854$$

where D = cylinder bore; N = number of cylinders; S = stroke.

Example. To find cubic capacity of a four-cylinder 75 × 110 mm. engine—

$$75 \times 75 \times 4 \times 110 \times \cdot 7854.$$

R.A.C. (TREASURY) H.P. FORMULA

Measurement in Inches.

$$\frac{D^2 \times N}{2{\cdot}5}$$

Measurement in Millimetres.

$$\frac{D^2 \times N}{1613}$$

where D = cylinder bore; N = number of cylinders.

This formula assumes a constant piston speed of 1,000 ft. per minute and a mean effective pressure (M.E.P.) of 67·2 lb. per sq. in., both being admittedly much below the average of modern engines.

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LIGHTING-UP TABLE

Date	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.57	5.47	6.36	7.29	8.17	9. 4	9.18	8.48	7.45	6.38	5.34	4.54
3	5. 2	5.50	6.39	7.32	8.21	9. 6	9.17	8.45	7.40	6.33	5.30	4.53
5	5. 3	5.54	6.42	7.35	8.25	9. 8	9.17	8.41	7.36	6.28	5.26	4.51
7	5. 7	5.57	6.45	7.38	8.28	9.10	9.16	8.39	7.32	6.24	5.23	4.50
9	5. 9	6. 0	6.51	7.42	8.30	9.12	9.14	8.36	7.27	6.19	5.20	4.50
11	5.11	6. 4	6.54	7.45	8.34	9.13	9.12	8.33	7.22	6.15	5.16	4.49
13	5.15	6. 8	6.58	7.48	8.37	9.14	9.11	8.28	7.18	6.10	5.13	4.49
15	5.17	6.12	7. 1	7.51	8.40	9.15	9. 9	8.24	7.13	6. 6	5.10	4.48
17	5.20	6.16	7. 4	7.54	8.44	9.18	9. 7	8.19	7. 9	6. 1	5. 8	4.48
19	5.23	6.18	7. 9	7.57	8.47	9.18	9. 5	8.15	7. 4	5.57	5. 5	4.50
21	5.26	6.23	7.12	8. 1	8.49	9.19	9. 2	8.11	7. 0	5.53	5. 3	4.51
23	5.30	6.26	7.15	8. 5	8.51	9.19	8.59	8. 7	6.55	5.48	5. 1	4.52
25	5.33	6.30	7.19	8. 7	8.55	9.19	8.57	8. 2	6.51	5.45	4.59	4.53
27	5.36	6.33	7.21	8.12	8.58	9.19	8.54	7.58	6.46	5.41	4.57	4.54
29	5.41	—	7.24	8.15	9. 1	9.18	8.52	7.54	6.42	5.37	4.55	4.56
31	5.45	—	7.27	—	9. 3	—	8.50	7.49	—	5.35	—	4.57

The times given in the above table are calculated for London and the South-east of England. To obtain the approximately correct times for Liverpool and Midlands, add 10 minutes to the time in the table; for Scotland, add 8 minutes to the times in the table; and for Plymouth and the West of England, add 12 minutes to the times in the table.

For instance, on 15th March, lighting-up time is, in London, 7.1; Liverpool, 7.11; Glasgow, 7.9; and Plymouth, 7.13.

For "Summer Time" add 1 hour to the times in the table.

Rear lamps must be lit half an hour earlier than the times given.

DISTRIBUTORS AND AGENTS FOR "STANDARD" CARS

Distributors and area agents are shown in large type; local agents in smaller type.

METROPOLITAN AREA

ALBEMARLE MOTORS, 27 Albemarle Street, W.1.
ALLEN-BENNETT MOTOR CO., LTD., 8–11 Royal Parade, London Road, West Croydon.
AUSTEN & CO., Railway Approach, Lewisham, S.E.
AUTOVEYERS, LTD., 84 Victoria Street, Westminster, S.W.1.
BARKER & CO. (COACHBUILDERS), LTD., 66–67 South Audley Street, W.1.
BARNETT, PEMBROKE & SLATER, LTD., 38 Knightsbridge, S.W.
BONALLACK & SONS, 268 Romford Road, Forest Gate, E.7.
BROCKS (MOTORS), LTD., 102 Wigmore Street, W.1.
BRUTON MEWS GARAGE, LTD., 8, 10, 16, 18, and 20 South Bruton Mews, New Bond Street, W.1.
BURTON & TWEEDY, LTD., 18–19, Woodstock Street, New Bond Street, W.1.
CAITHNESS & CO., LTD., 65 Great Portland Street, W.1.
CAR & TYRE MART, 15 Long Acre, W.C.2.
CAR MART, LTD., 46–50 Park Lane, W.1.
CHAPMAN, A. W., LTD., Ranelagh Gardens, Hurlingham, S.W.6.
CITY CAR AGENCY, LTD., 34 Queen Street, Cannon Street, E.C.4.
THE CLOCK GARAGE, London Road, Enfield.
COMMERCIAL MOTOR WORKS, Bromley Road, Catford, S.E.6.
CONNAUGHT MOTOR & CARRIAGE CO., LTD., 121–122 Long Acre, W.C.2.
CROYDON AUTO SERVICE CO., 401 London Road, Thornton Heath.
CURTIS AUTOMOBILE CO., LTD., 18 Berkeley Street, W.1.
DUFF MORGAN, LTD., Flood Street, King's Road, Chelsea, S.W.3.
EAGLES & CO., 275 High Street, Acton, W.3.
F. O. C. H., LTD., 5 Heath Street, Hampstead, N.W.3.
GLENDOWER MOTOR CO., 3 Glendower Place, South Kensington, S.W.
GNAPP, G. CECIL, & CO., 4 Pickering Place (No. 3), St. James's Street, S.W.1.
GODFREY DAVIS & CO., 26 Albemarle Street, W.1.
GORDON WATNEY & CO., LTD., 31 Brook Street, W.1.
GRIFFITHS, HARRISON & CO., 1 Albemarle Street, W.1.
GRIMES, W. H., & CO., 24 Bruton Place, New Bond Street, W.1.
HARMAN, G., Muirkirk Road, Catford, S.E.6.
HARRIS' GARAGE, 161 and 163 High Street, Slough, Bucks.
HEDLEY MOTORS, LTD., 610, 612, 614 High Road, Chiswick, W.4.
HENLY'S, LTD., 91, 155, and 157 Great Portland Street, W.1.
HOLBROOK MOTOR CO., Hill Rise, Richmond, Surrey.
ILFORD MOTOR CO., 60 Cranbrook Road, Ilford.
JARVIS & SONS, LTD., Victoria Crescent, Wimbledon, S.W.19.
K. J. MOTORS, 30 Widmore Road, Bromley.
LAMB'S, LTD., Opposite Hoe Street Station, Walthamstow, E.17.
LAMB'S, LTD., 50 High Road, Wood Green.
LANGHAM MOTOR CO., LTD., Philharmonic Hall, 95*a* Great Portland Street, W.1.
LEVY'S GARAGE, 32 York Road, King's Cross, N.1.

THE LIGHT CAR CO., 331, 410–414 Euston Road, N.W.1.
LOVETT, GORDON, 45 The Mall, Ealing, W.5.
MARSHALL, B. S., LTD., 17*a* Hanover Square, W.1.
MEMBERY & HOLMES, LTD., 405 King Street, Hammersmith, W.6.
MOORE'S PRESTO MOTOR WORKS, LTD., 145 North End, Croydon.
MORTLOCK, W., Opposite "The Swan and Pyramids," North Finchley, N.12.
THE MOTORISTS' MUTUAL CO-OPERATIVE SOCIETY, LTD., 41 New Bond Street, W.1.
NICHOLL, W. G., LTD., 50–54 Whitcomb Street, Leicester Square, W.C.2.
NORMAN, C. G., & CO., 48*a* Gillingham Street, Victoria, S.W.1.
NORTH FINCHLEY GARAGE, Avenue Road, North Finchley, N.12.
OFFORD & SONS, LTD., 67 George Street, Baker Street, W.1.
OLYMPIA MOTOR CO., 1 Hammersmith Road, Kensington, W.14.
ORMOND MOTOR CO., 2–3 Ormond Yard, York Street, St. James's, S.W.1.
PASS & JOYCE, LTD., 373–375 Euston Road, N.W.1.
PHELPS BROS., 5 Prince's Mews, Hereford Road, Bayswater, W.2.
POHLMAN, CECIL, LTD., 77 Great Portland Street, W.1.
PRICE, L. A., & CO., 21 Chandos Street, Trafalgar Square, W.C.2.
PYTCHLEY AUTOCAR CO., LTD., 201–203 Great Portland Street, W.1.
RATCLIFFE BROS., 200 Great Portland Street, W.1.
RAWLINGS BROS., LTD., 87*a* Cromwell Road, South Kensington.
RED RIC'S, 68 High Street, Battersea, S.W.11.
RICKARDS, CHARLES, LTD., 12 Spring Street, Paddington, W.2.
ROBBINS, S. T., 96 and 98 Upper Richmond Road, Putney, S.W.15.
SAUNDERS, F. GEOFFREY, & CO., 76 New Bond Street, W.1.
SERVICE CO. (LONDON), LTD., 273–274, 289–293 High Holborn, W.C.1.
SHAW & KILBURN, LTD., 112–114 Wardour Street, W.1.
SMITH, F. G., MOTORS, LTD., Goodmayes, Ilford.
SOUTHGATE MOTOR WORKS & GARAGE, High Street, Southgate, N.14.
STANFORD & GRAY, LTD., Regent House, 233 Regent Street, W.1.
TAYLOR, H., & CO., LTD., 49–53 Sussex Place, South Kensington, S.W.7.
UNION MOTOR CAR CO., LTD., 19 Denbigh Street, Belgrave Road, S.W.1.
VANDERVELL, F. & P., LTD., Reservoir Garage, Kensington Place, Notting Hill Gate, W.8.
WATERS, W., & SONS, Hatfield, Herts.
WAUCHOPE'S, 9 Shoe Lane, Fleet Street, E.C.4.
WELLS, W. J., Central Garage, High Road, Woodford Green.
WHITELEY, WM., LTD., Queen's Road, W.2.
WILKINS, SIMPSON & CO., 11 Hammersmith Road, West Kensington, W.14.

ENGLISH PROVINCES, WALES, SCOTLAND AND IRELAND

ABERAYRON. D. M. Jenkins, Aeron Garage, Alban Square.
ABERDARE. A. J. Sheen, 18–27 Cardiff Street.
ABERDEEN. ROSSLEIGH, LTD., 383 Union Street.
ABERGELE. J. C. Pierce.
ABERYSTWYTH. The Aberystwyth Motor Co., Queen's Road.
ALDERSHOT. J. E. Lawes, Ltd., The Triangle.
ALLOA. Marr Place Garage.
ALRESFORD. T. C. Hankin, West Street.
ALTON. F. W. Kerridge, 32–36*a* High Street.
ALTRINCHAM. Jos. Richardson, Unity Garage, Dunham Road.
ANDOVER. THE WESSEX MOTORS, LTD., 49 Bridge Street
ARBROATH. D. Robbie & Co., Dislantoun Street.
ARUNDEL. Hammond & Sons, Market Square.

ASHBY-DE-LA-ZOUCH. Ashby Garage Co., Ltd., Wood Street.
ASHFORD. C. HAYWARD & SON, New Street.
ATHERSTONE. Atherstone Garage & Electrical Co., Song Street.
ATHERTON. Woodwards, Ltd., 10 Bolton Old Road.
AYLESBURY. AYLESBURY MOTOR CO., LTD.
BALA. E. Williams & Sons, Areing Street.
BALDOCK. Quenby Bros., 15 High Street.
BALLYHAUNIS. B. T. Lynch.
BALLYMENA. Dickey & Pinkerton, Ltd., Galgorm Road.
BANBURY. H. O. White & Sons, Station Garages, 62 Bridge Street.
BANCHORY. Alex Lamb, High Street.
BANFF. J. A. Gordon & Co., Central Garage.
BARNARD CASTLE. L. Smith, The Garage, 21 Galgate.
BARNSLEY. EYRE BROS., Eldon Street.
BARNSTAPLE. THE VICTORIA GARAGE, High Street.
BARNT GREEN. G. Williams.
BARROW-IN-FURNESS. G. Dunn, 11 Duke Street.
BATH. WHITING'S MOTOR WORKS, Barton Street.
BATH. Griffith Motor Garage, 49 Walcot Street.
BATLEY. BAGSHAW & SONS, LTD.
BEAMINSTER. The Beaminster Garage Co.
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BELFORD. Robinson & Co., High Street.
BERWICK-ON-TWEED. S. Young, Young's Garage, 190 Main Street, Spittall.
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BIRMINGHAM. P. J. EVANS, LTD., 81–91 John Bright Street.
BIRMINGHAM. Chas. E. Cope & Sons, 15 Upper Hagley Road.
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BISHOP'S STORTFORD. J. W. Whalley, London Road.
BISHOP'S WALTHAM. Rooke Loader & Co., Station Road.
BLACKBURN. H. Garstang, Ltd., Mincing Lane.
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BLAIRGOWRIE. A. D. Grassick.
BLYTH. J. Gallon, Park Garage.
BOGNOR. Mellers & Sons, Longford Road.
BOLTON. The Bolton Motor Co., Ltd., 3 Marsden Road.
BOROUGH GREEN. E. Grime & Co.
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BOURNEMOUTH. MOTOR MAC'S, LTD., Holdenhurst Road.
BRADFORD. A. FARNELL, 50 Manningham Lane.
BRADFORD. J. A. Goldthorpe & Co., 15 Sunny Bank Road, Bankfoot.
The Jowett Motor Manufacturing Co., Ltd., Grosvenor Road.
Stead & Allinson, Kensington Street Garage, 329 Kensington Street.
J. C. Smith & Son, Cipthorne Road.

BRADFORD-ON-AVON. E. W. Stone, Station Garage.
BRECON. Rich & Sons, Market Street.
BRIDGEND. R. H. Thomas, Queen Street Garage.
BRIDGNORTH. THE BRIDGNORTH GARAGE, LTD., High Street.
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BRIDLINGTON. F. G. Purdon & Sons, Springfield Avenue.
BRIDPORT. Edwards & Hann, Ltd.
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BRIGHTON. F. RAY & SONS, LTD., 66–68 Church Road, Hove.
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BUCKINGHAM. PHILLIPS & SONS, Chandos Street.
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BURNLEY. W. H. Harrison (Burnley), Ltd., The Motor House.
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BURY-ST.-EDMUNDS. Mann Egerton & Co., Ltd.
BUXTON. W. SANDERS (1920), LTD., Spring Gardens.
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CARLOW. Jackson's Garage & Motor Works.
CARMARTHEN. Bradbury Jones, Ltd., West Wales Garage.
CATERHAM. The Caterham Motor Co., Caterham Valley.
CAVAN. A. W. Gordon, Farnham Street.
CHELMSFORD. THE EASTERN AUTOS, LTD., London Road.
CHELTENHAM. H. E. STEEL, LTD., High Street.
CHESHAM. W. Foster, Ltd.
CHESTER The Dee Motor Co., Ltd., Foregate Street.
CHESTERFIELD. Cavendish Motors, Ltd., Holywell Street.
CHICHESTER. Adcock's Garage, East Street.
CIRENCESTER. H. E. STEEL, LTD., Dyer Street.
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COBHAM. P. C. & C. K. Chase, Ltd., Anyards Road.
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COLWYN BAY. Colwyn Bay Engineering Co., Ltd., Prince's Garage, Prince's Drive.
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COWES. Fountain Garage, Ltd., Railway Hill.
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CRAVEN ARMS. Station Garage.
CREWE. A. Cooke, 12–14 Nantwich Road.
CRIEFF. Crieff Motor Co., The Cross.
CROMER. The East Coast Garage Co.
CROWBOROUGH. J. E. H. Martin, Ltd., Beacon Garage.
CUPAR, FIFE. Albert E. Walton.
DARLINGTON. THE CLEVELAND CAR CO., LTD., Grange Road.
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DENBIGH. W. Edwards, The Garage, Townsend.
DERBY. A. R. ATKEY & CO., LTD., Beckett Street.
DERBY. J. Raynor, Rowditch Garage.
S. W. Thompstone, Great Northern Road.
DEREHAM. J. J. WRIGHT & SONS.
DEVIZES. WILLIS & SON, Central Garage, Market Place.
DOLGELLY. Merioneth Motor Co., The Garage.
DONCASTER. W. E. CLARK & CO., Station Road.
DONCASTER. J. A. Bassett & Sons, Elephant Garage, St. Sep Gate.
DORCHESTER. TILLEYS, 45 South Street.
DORE. Bookless Bros., Abbeydale Road.
DORKING. E. J. Baker & Co., High Street.
DOUGLAS. The Athol Motor Garage, Ltd., Hill Street.
DRIFFIELD. P. Richardson, Middle Street.
DROITWICH. E. W. Jones, St. George's Square.
DROYLESDEN. The Premier Garage, 107 Market Street.
DUBLIN. R. W. ARCHER & CO., Wentworth Place.
DUDLEY. The Dudley Garage & Motor Co., Castle Street.
DUNFERMLINE. Jas. Whitehead, Priory Lane.
DUMFRIES. Drysdale & Co. (Dumfries), Ltd., York Place Garage.
DUNDALK. Byrne & Maguire, Dublin Street.
DUNDEE. ROSSLEIGH, LTD., 23 Albert Square.
DUNGANNON. W. E. Hobson, Thomas Street.
DUNSTABLE. Scott & Sons, 39–41 High Street South.
EASINGWOLD. J. H. & F. Wilkinson, Ltd., Long Street.
EASTBOURNE. F. RAY & SONS, Seaside Road
EAST GRINSTEAD. The North Sussex Garage, Ltd.
EDINBURGH. ROSSLEIGH, LTD., 32 Shandwick Place.
EGHAM. The Egham Motor Co., High Street.
EGREMONT. J. F. STOUT'S MOTOR & CYCLE HOUSE.
ELGIN. D. & A. Duncan, City Motor Works.
ELLON. Neil Ross, Ellon Motor Works.
ELY. A. Cass & Co., St. Mary's Street.
EPSOM. Woodcote Motor Co., Ltd., High Street.
ERDINGTON. Jones Bros., High Street.
ESHER. LANKESTER ENGINEERING CO., "Wellands Garage," Portsmouth Road.
EXETER. MOTOR MAC'S (EXETER), LTD., Sidwell Street.
FAKENHAM. Southgates, Ltd.
FALKIRK. Thos. Laurie & Co., West End.
FAREHAM. Fareham Motor Engineering Works, 2 High Street.
FARNHAM. Swain & Jones, East Street.
FELTON. Jos. Jackson, High Street.
FENTON. TOM BYATT'S MOTOR GARAGE, Market Street.
FISHGUARD. W. Brown.
FLEET. Stevens & Sons, Fleet Coach & Motor Works.
FOLKESTONE. MARTIN WALTER, LTD., Sandgate Road.
FORFAR. R. Ballingall, 118 East High Street.
FOWEY. PAULS (ENGINEERS), LTD., Fore Street.
FRASERBURGH. W. J. Reid, High Street.
GAINSBOROUGH. BAINES BROS., North Street.
GALASHIELS. The Border Motor Co., Ltd., Market Street.
GARBOLDISHAM. S. Whiting, The Garage.
GARGRAVE. W. Gill & Son, High Street.
GARSTON. Portus & Rhodes, 77 St. Mary's Road.
GIRVAN. Lawson's Garage, Vicarton Street.
GLASGOW. G. GILMOUR, LTD., 231 Hope Street.
GLASGOW. Grosvenor Motor Works, 274–280 Shields Road.

GLASGOW. Hugh McKinnon, 23 Fitzroy Lane, Sandyford.
Rossleigh, Ltd., 107 Saint Vincent Street.
GLOUCESTER. H. E. STEEL, LTD., Westgate Street.
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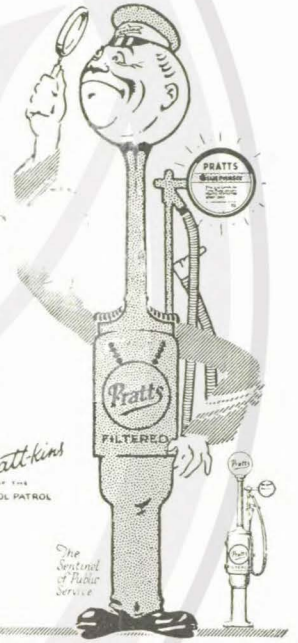

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