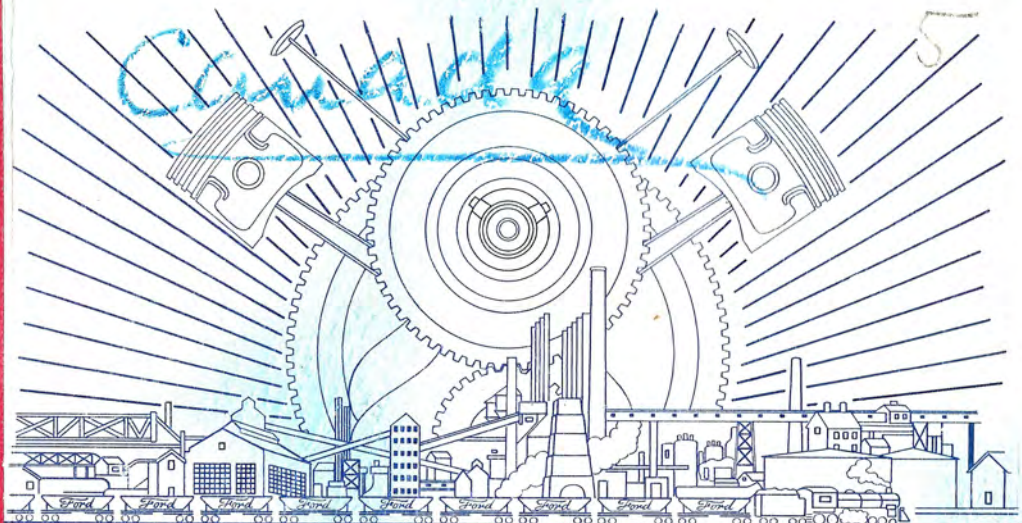




Service Handbook

REF 1901



Ford Motor Company of Canada

LIMITED

WINDSOR

ONTARIO

RECEIVED

NOV 29 1940



MERCURY



Service Handbook

NOV 22 1940

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Ford Motor Company of Canada
LIMITED

WINDSOR, ONTARIO

FOREWORD

This Service Handbook has been prepared especially for those engaged in the business of rendering service to Ford, Mercury and Lincoln-Zephyr owners. Whether your work consists principally in the sale of gasoline, oil and other supplies, or handling of lubrication and other maintenance services, the information it contains should be helpful to you.

From the Table of Contents on pages 5 and 6, you will notice that this booklet contains information on most of the minor service operations and replacements you may be called upon to perform from time to time.

No attempt has been made to cover repair procedures on major assemblies such as engine, transmission, or rear axle. The Mechanical Service Bulletin as issued by the Ford Motor Company of Canada, Limited, includes such information and where such information is required it is recommended that the Mechanical Service Bulletin be purchased.

Use of the information herein will enable you to avoid lost time and reduce those delays which sometimes discourage customers and cause loss of valuable business.

The information throughout this handbook is applicable to all Ford V-8 Passenger and Commercial cars and trucks, and Mercury and Lincoln-Zephyr passenger cars, except where reference is made in individual items to specific models.

As manufacturers of Ford cars, commercial cars and trucks, and of Mercury and Lincoln-Zephyr cars, we are interested in seeing that owners are assured of satisfactory service. Through a better knowledge of these cars and trucks, we believe you will be able to make your services more satisfactory to these owners, and since they are your customers as well as ours, the better they are satisfied, the more frequently they will return to you and the more of their business you will enjoy.

SERVICE DEPARTMENT

Ford Motor Company of Canada, Limited.

FORD EXCHANGE PLAN

Ford, Mercury, and Lincoln-Zephyr cylinder assemblies can be exchanged under the famous Ford Exchange Plan which has been in effect for several years. The reconditioned cylinder exchange consists of the cylinder block complete with internal moving parts, and in the case of Lincoln-Zephyr cylinder assemblies the cylinder heads also are supplied. Auxiliary units such as the carburetor, generator, etc. are not included in the cylinder exchange but are considered as separate units, which are removed and overhauled when the reconditioned cylinder is installed.

The following items, in addition to reconditioned cylinders, may also be exchanged. The cost is usually less than for overhauling similar parts, and saves time.

- Brake Shoes
- Generator Armatures
- Fuel Pumps (Ford and Mercury only)
- Clutch Pressure Plate Assemblies
- Shock Absorbers.

The same expensive equipment, and the same methods used to manufacture the parts originally, are employed in the reconditioning operations. Reconditioned cylinders and all other reconditioned parts must pass the same inspections and tests as new parts.

The Ford Exchange Plan is a major feature in the economy of operation of Ford cars and trucks, Mercury and Lincoln-Zephyr cars. All exchange items are available from any Authorized Ford Dealer.

Service Handbook

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"GENUINE" FORD PARTS

Ford cars and trucks, Mercury and Lincoln-Zephyr cars always have been outstanding in value. There are two chief reasons for this. First, the high quality of materials used to make the parts. Second, the precision with which the Genuine Ford Parts are made.

Expense never has been spared in developing and producing materials of highest possible quality. Ford used alloy steel before the days of the Model "T" car. It was more expensive but the parts were stronger and not so heavy. Today Ford uses 36 different kinds of steel to get the most suitable kind for every part.

Many new materials are used in manufacturing Genuine Ford parts. Ford metallurgists and chemists are at work constantly to improve the quality of the materials that go into the building of Ford cars and trucks, Mercury and Lincoln-Zephyr cars. A few examples of these are the cast alloy steel crankshaft, the cast alloy camshaft, the hard-surfaced push rods, and new bearing alloys.

The Ford Motor Company of Canada, Limited, have millions of dollars invested in the newest types of machinery that turn out parts with extreme accuracy. This equipment holds dimensions of many parts within one ten thousandths part of an inch. The limits on Genuine Ford piston pins, for instance, are one ten-thousandths of an inch.

Another very important factor in the manufacture of Genuine Ford Parts is their careful inspection at all times to ensure their utmost accuracy.

Much of the high performance of Ford cars and trucks, Mercury and Lincoln-Zephyr cars, depends upon the precision of the parts. No distinction ever is made between production parts and service parts. There is only one standard of Ford precision—the highest in the industry.

All inspection gauges and equipment are checked constantly. This adds greatly to the cost of manufacture but this accuracy is insisted upon.

For precision Ford uses Johansson Gauge Blocks—the world's standard of linear measurement. These blocks measure to an accuracy within two millionths of an inch. The Johansson division of the Ford Motor Company, Detroit, Michigan, U.S.A., manufacture these gauge blocks and more of them are in use in Ford plants today than in any other plant in the world.

The standards have never let down on parts for past model vehicles. Quality often has been raised. For example the new heat-treating processes now used for the Model "A" pistons give them better wearing qualities than the original pistons had. Model "A" valves now are made of a material which is absolutely warp-proof under the heat of today's engine fuels.

It is no secret that some Ford parts are made by other manufacturers. Ford Motor Company of Canada, Limited believes in sharing it business with others. But a good percentage of practically all parts are made in the Ford plant. Regardless of where they are manufactured, all Genuine Ford Parts are made from materials that meet exacting Ford specifications. They must conform to Ford precision limits. They must pass rigid Ford inspections and tests. Only then do they become Genuine Ford Parts—and only then can you buy them from Ford dealers or authorized Ford garages.

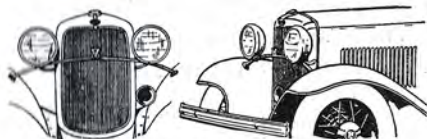
Most Ford owners know that it pays to use Genuine Ford Parts—others are fast finding it out. Many look for a Genuine Ford Parts sign hanging outside a dealer's premises or a garage before they drive in.

To give Ford owners prompt, satisfactory service, authorized Ford dealers and independent garages carry an adequate stock of Genuine Ford Parts on hand at all times. It avoids delays.

Service Handbook

MODEL IDENTIFICATION

1932



Model "18," Ford Passenger Car
V-8 Engine Approx. Weight, Std. Fordor, 2512 lbs.
106" Wheelbase Length, Bumper to Bumper, 165.5"
113.54" Springbase Width, overall, 67.4"

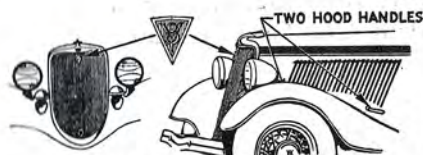


Model "B," Ford Passenger Car
4 Cyl. Engine Approx. Weight, 2496 lbs.
106" Wheelbase
113.54" Springbase

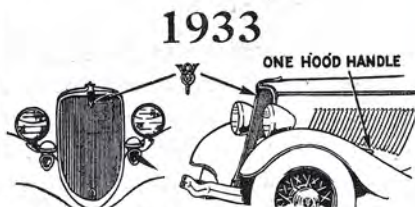


Model "BB," Ford Truck
4 Cyl. Engine
131 1/2" W.B.—Approx. Wgt., 131 1/2" Stake, 4271 lbs.
157" W.B.—Approx. Weight, 157" Stake, 4513 lbs.

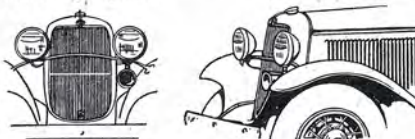
1934



Model "40," Ford Passenger Car
V-8 Engine Approx. Weight, Std. Fordor, 2675 lbs.
112" Wheelbase Length, Bumper to Bumper, 175.9"
119.54" Springbase Width, overall, 67.4"



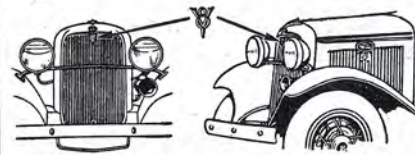
Model "40," Ford Passenger Car
V-8 Engine Approx. Weight, Std. Fordor, 2675 lbs.
112" Wheelbase Length, Bumper to Bumper, 175.9"
119.54" Springbase Width, overall, 67.4"



Model "46," Ford Commercial
4 Cyl. Engine Approx. Weight, Pickup, 2514 lbs.
112" Wheelbase
119.54" Springbase



Model "BB," Ford Truck
V-8 Engine
131 1/2" W.B.—Approx. Wgt., 131 1/2" Stake, 4235 lbs.
157" W.B.—Approx. Weight, 157" Stake, 4545 lbs.

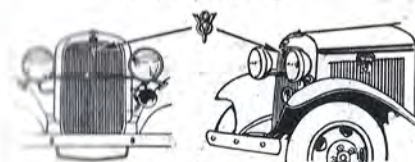


Model "46," Ford Commercial
V-8 Engine Approx. Weight, Pickup, 2514 lbs.
112" Wheelbase
119.54" Springbase

Service Handbook

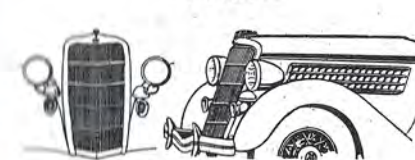
MODEL IDENTIFICATION

1934 (Cont'd)



Model "BB," Ford Truck
V-8 Engine Approx. Weight, 131 1/2" Stake, 4363 lbs.
131 1/2" & 157" W.B. Ap. Weight, 157" Stake, 4667 lbs.

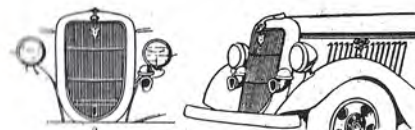
1935



Model "48," Ford Passenger Car
V-8 Engine Approx. Weight, Std. Fordor, 2849 lbs.
112" Wheelbase Length, Bumper to Bumper, 182.75"
123.13" Springbase Width, overall, 69.5"



Model "50," Ford Commercial
V-8 Engine Approx. Weight, Pickup, 2714 lbs.
112" Wheelbase
123.13" Springbase



Model "51," Ford Truck
V-8 Engine
131 1/2" W.B.—Approx. Wgt., 131 1/2" Stake, 4624 lbs.
157" W.B.—Approx. Weight, 157" Stake, 4851 lbs.

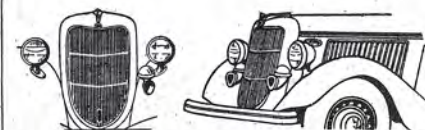
1936



Model "H," Lincoln-Zephyr
V-12 Engine Approx. Weight, Sedan, 3400 lbs.
122" Wheelbase Length, Bumper to Bumper, 202.5"
133" Springbase Width, overall, 73"



Model "68," Ford Passenger Car
V-8 Engine Approx. Weight, Std. Fordor, 2845 lbs.
112" Wheelbase Length, Bumper to Bumper, 182.75"
123.13" Springbase Width, overall, 69.5"



Model "67," Ford Commercial
V-8 Engine Approx. Weight, Pickup, 2645 lbs.
112" Wheelbase
123.13" Springbase



Model "51," Ford Truck
V-8 Engine
131 1/2" W.B.—Approx. Wgt., 131 1/2" Stake, 4624 lbs.
157" W.B.—Approx. Weight, 157" Stake, 4851 lbs.

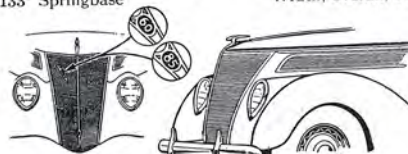
Service Handbook

MODEL IDENTIFICATION

1937

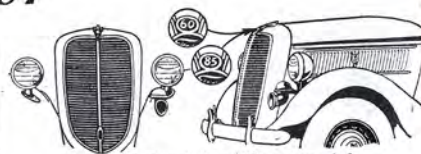


Model "HB," Lincoln-Zephyr
V-12 Engine Approx. Weight, Sedan, 3490 lbs.
122" Wheelbase Length, Bumper to Bumper, 203"
133" Springbase Width, overall, 73"



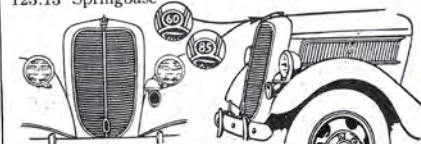
Model "78," Ford Passenger Car
85 HP, V-8 Engine Approx. Weight, Std. Fordor, 2761 lbs.
112" Wheelbase Length, Bumper to Bumper, 179.5"
123.13" Springbase Width, overall, 69.7"

Model "74," Ford Passenger Car
60 HP, V-8 Engine Approx. Weight, Fordor, 2543 lbs.
112" Wheelbase Length, Bumper to Bumper, 179.5"
123.13" Springbase Width, overall, 69.7"



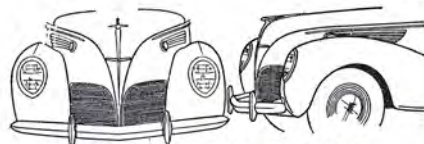
Model "77," Ford Commercial
85 HP, V-8 Engine Approx. Weight, Pickup, 2705 lbs.
112" Wheelbase
123.13" Springbase

Model "73," Ford Commercial
60 HP, V-8 Engine Approx. Weight, Pickup, 2508 lbs.
112" Wheelbase
123.13" Springbase

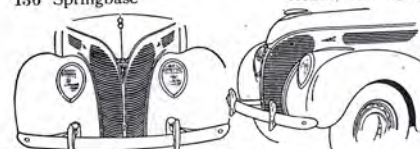


Model "79," Ford Truck
85 HP, V-8 Engine
134" W.B.—Approx. Weight, 134" Stake, 4619 lbs.
157" W.B.—Approx. Weight, 157" Stake, 4874 lbs.

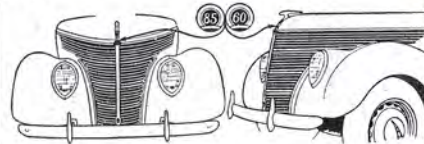
1938



Model "86H," Lincoln-Zephyr
V-12 Engine Approx. Weight, Sedan, 3560 lbs.
125" Wheelbase Length, Bumper to Bumper, 210"
136" Springbase Width, overall, 73"



Model "81A," Ford DeLuxe Passenger Car
85 HP, V-8 Engine Approx. Weight, DeLuxe Fordor, 2876 lbs.
112" Wheelbase Length, Bumper to Bumper, 189.25"
123.13" Springbase Width, overall, 69.69"



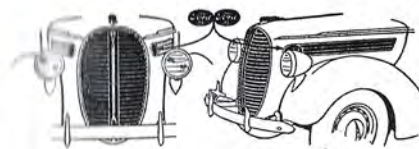
Model "81A," Ford Passenger Car
85 HP, V-8 Engine Approx. Weight, Std. Fordor, 2800 lbs.
112" Wheelbase Length, Bumper to Bumper, 183.7"
123.13" Springbase Width, overall, 69.5"

Model "82A," Ford Passenger Car
60 HP, V-8 Engine Approx. Weight, Std. Fordor, 2579 lbs.
112" Wheelbase Length, Bumper to Bumper, 183.7"
123.13" Springbase Width, overall, 69.5"

Service Handbook

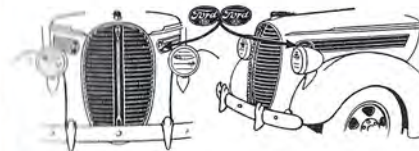
MODEL IDENTIFICATION

1938 (Cont'd)



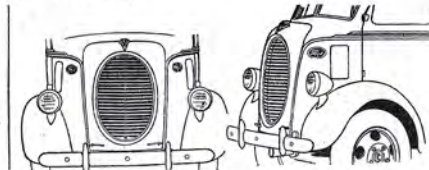
Model "81C," Ford Commercial
85 HP, V-8 Engine Approx. Weight, Pickup, 2791 lbs.
112" Wheelbase
120.13" Springbase

Model "82C," Ford Commercial
60 HP, V-8 Engine Approx. Weight, Pickup, 2633 lbs.
112" Wheelbase
120.13" Springbase



Ford Truck, 85 HP, V-8 Engine

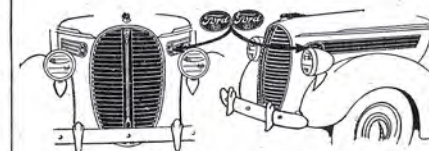
Model	Wheelbase	Approx. Weight with Stake Body
"81T"	134"	4669 lbs.
"81TT"	57"	5008 lbs.
"81TT" (School Bus Chassis)	191"	
"81TT" (Dump Chassis)	134"	5069 lbs. (with Dump Body, Closed Cab & auxiliary springs)



Ford Cab-Over-Engine Truck*, 85 HP, V-8 Engine

Model	Wheelbase	Approx. Weight (Chassis & Cab)
"811W"	101"	3773 lbs.
"81W"	134"	3848 lbs.
"817W"	157"	3915 lbs.

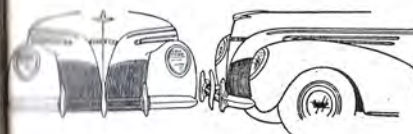
*1938 units have single arm on each half of windshield.



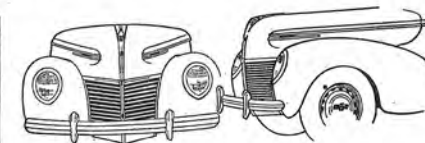
Model "81Y," Ford Tonner
85 HP, V-8 Engine Approx. Weight, with Express Pickup Body, 3717 lbs.
122" Wheelbase

Model "82Y," Ford Tonner
60 HP, V-8 Engine Approx. Weight, with Express Pickup Body, 3535 lbs.
122" Wheelbase

1939



Model "96H," Lincoln-Zephyr
V-12 Engine Approx. Weight, Sedan, 3620 lbs.
125" Wheelbase Length, Bumper to Bumper, 210"
130" Springbase Width, overall, 73"

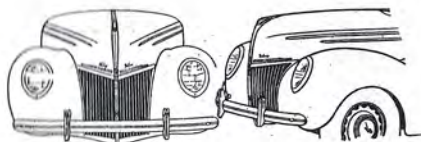


Model "99A," Mercury
95 HP, V-8 Engine Approx. Weight, Town Sedan, 3013 lbs.
116" Wheelbase Length, Bumper to Bumper, 194.14"
127.13" Springbase Width, overall, 72.05"

Service Handbook

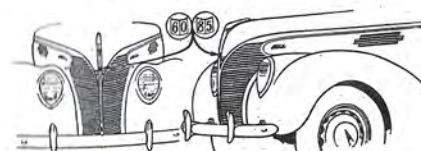
MODEL IDENTIFICATION

1939 (Cont'd)



Model "91A," Ford DeLuxe Passenger Car

85 HP, V-8 Engine Approx. Weight, Fordor, 2898 lbs.
112" Wheelbase Length, Bumper to Bumper, 188.62"
123.13" Springbase Width, overall, 69.69"

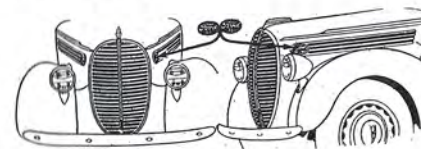


Model "91A," Ford Passenger Car

85 HP, V-8 Engine Approx. Weight, Fordor, 2850 lbs.
112" Wheelbase Length, Bumper to Bumper, 188.62"
123.13" Springbase Width, overall, 69.69"

Model "922A," Ford Passenger Car

60 HP, V-8 Engine Approx. Weight, Fordor, 2623 lbs.
112" Wheelbase Length, Bumper to Bumper, 186.11"
123.13" Springbase Width, overall, 69.69"

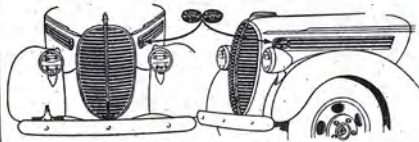


Model "91C," Ford Commercial

85 HP, V-8 Engine Approx. Weight, Pickup, 2730 lbs.
112" Wheelbase
123.13" Springbase

Model "922C," Ford Commercial

60 HP, V-8 Engine Approx. Weight, Pickup, 2572 lbs.
112" Wheelbase
123.13" Springbase

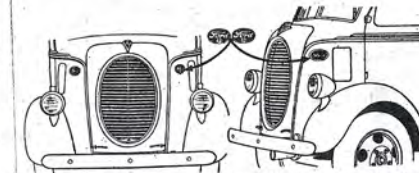


Ford Truck, 85 HP, V-8 Engine

Model	Wheelbase	Approx. Weight with Stake Body
"91T"	134"	4669 lbs.
"917T"	157"	4906 lbs.
"911T" (School Bus Chassis)	191"	
"91U" (Dump Chassis)	134"	4931 lbs. (with Dump Body, Closed Cab & auxiliary springs)

Ford Truck, 95 HP, V-8 Engine

Model	Wheelbase	Approx. Weight with Stake Body
"99T"	134"	4675 lbs.
"997T"	157"	4915 lbs.
"991T" (School Bus Chassis)	191"	
"99U" (Dump Chassis)	134"	4940 lbs. (with Dump Body, Closed Cab & auxiliary springs)



Ford Cab-Over-Engine*, 85 HP, V-8 Engine

Model	Wheelbase	Approx. Weight Chassis & Closed Cab
"911W"	101"	3703 lbs.
"91W"	134"	3778 lbs.
"917W"	157"	3845 lbs.
"911Z" (Dump Chassis)	101"	

Ford Cab-Over-Engine*, 95 HP, V-8 Engine

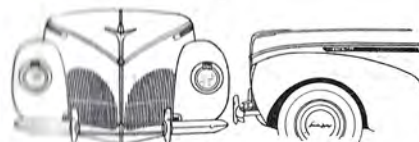
Model	Wheelbase	Approx. Weight Chassis & Closed Cab
"991W"	101"	3710 lbs.
"99W"	134"	3785 lbs.
"997W"	157"	3845 lbs.
"991Z" (Dump Chassis)	101"	

*1939 units have two arms on each half of windshield.

Service Handbook

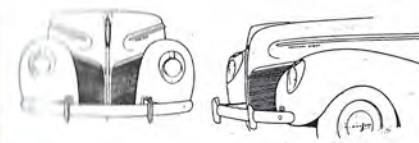
MODEL IDENTIFICATION

1940



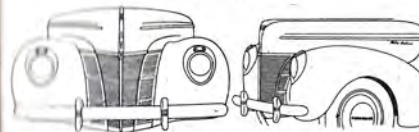
Lincoln Zephyr Model "06H"

V-12 Engine Approx. Weight, Sedan, 3800 lbs.
125" Wheelbase Length, Bumper to Bumper, 209.5"
136" Springbase Width, overall, 73.38"



Mercury Model "09A"

95 HP, V-8 Engine Approx. Weight, Town Sedan,
3090 lbs.
116" Wheelbase Length, Bumper to Bumper, 195.75"
127" Springbase Width, overall, 72.05"



Ford Deluxe Model "01A"

85 HP, V-8 Engine Approx. Weight, Fordor,
2945 lbs.
112" Wheelbase Length, Bumper to Bumper, 190.86"
123.13" Springbase Width, overall, 69.5"



Ford Passenger and
Commercial

Model "01A"

85 HP, V-8 Engine Approx. Weight, Fordor,
2925 lbs.
112" Wheelbase Length, Bumper to Bumper, 190.86"
123.13" Springbase Width, overall, 69.5"

Model "022A"

60 HP, V-8 Engine Approx. Weight, Fordor,
2625 lbs.
112" Wheelbase Length, Bumper to Bumper, 190.86"
123.13" Springbase Width, overall, 69.5"

Model "01C"

85 HP, V-8 Engine Approx. Weight, Pickup,
2860 lbs.
112" Wheelbase
123.13" Springbase

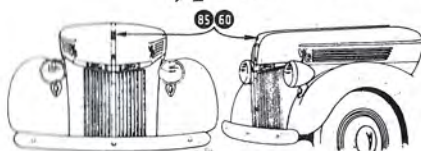
Model "022C"

60 HP, V-8 Engine
112" Wheelbase
123.13" Springbase

Service Handbook

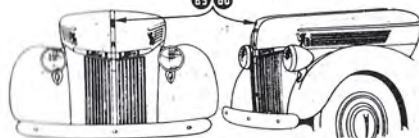
MODEL IDENTIFICATION

3/4 Ton 1940 (Cont'd) Truck



Model	Engine	Wheelbase	Approx. Weight with Express Pick-up Body
01D	85 HP	122"	3272
02D	60 HP	122"	3086

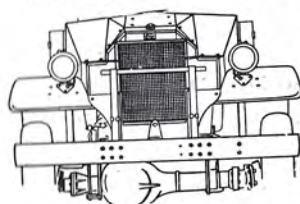
1 Ton



Model	Engine	Wheelbase	Approx. Weight with Express Pick-up Body
01Y	85 HP	122"	3443
02Y	60 HP	122"	3257

Bus

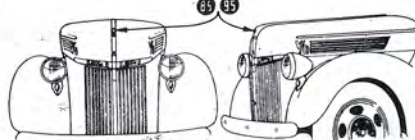
Model 09B Rear Engine Bus Chassis
95 HP Engine Wheelbase 148 1/2"



D.N.D. Vehicles

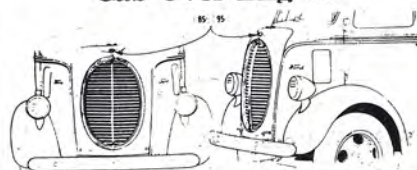


MODEL	DRIVE	WHEEL-BASE	CAPACITY	H.P.
F-8	4 x 2	101"	8 cwt.	95
F-15	4 x 2	101"	15 cwt.	95
F-30-S	4 x 4	134 1/4"	30 cwt.	95



Model		Wheelbase	Approx. Weight with Stake Body	
85 HP	95 HP		85 HP	95 HP
01T	C09T	134"	4641	4641
018T	C098T	158"	4962	4962
01U	09U	134"	4826	4826
C016T	C096T	176"		
014T	094T	194"		

Cab Over Engine



Model		Wheelbase	Approx. Weight Chassis and Closed Cab	
85 HP	95 HP		85 HP	95 HP
011W	C091W	101"	3795	3795
01W	C09W	134"	3878	3878
018W	C098W	158"	3924	3924

MODEL	DRIVE	WHEEL-BASE	CAPACITY	H.P.
F-60-S	4 x 4	134 1/4"	3 Ton	95
F-60-H	6 x 4	160 1/4"	3 Ton	95
F-GT	4 x 4	101 1/4"		95

Service Handbook

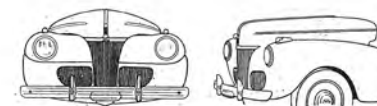
MODEL IDENTIFICATION

1941



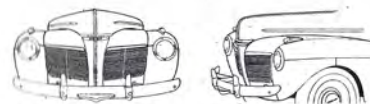
Lincoln Model "16H"

V-12 Engine Approx. Weight, Fordor 3936 lbs.
125" Wheelbase Length, Bumper to Bumper, 209.82"
Width, overall, 73.38"



Ford Deluxe Model "11A"

85 H.P. V-8 Engine Approx. Weight, Fordor 3121 lbs.
114" Wheelbase Length, Bumper to Bumper, 194.34"
125" Springbase Width, overall, 73.12"



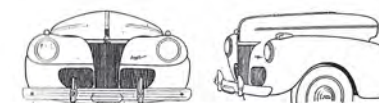
Mercury Model "19A"

95 H.P. V-8 Engine Approx. Weight, Town Sedan 3221 lbs.
118" Wheelbase Length, Bumper to Bumper, 200.61"
Width, overall, 73.12"



Commercial

Model	Engine	Wheelbase	Length Bumper to Bumper	Overall Width	Weight
11C	85	112"	190.15"	72.14"	2745
19C	95	112"	190.15"	72.14"	



Ford Super Deluxe Model "11A"

85 H.P. V-8 Engine Approx. Weight, Fordor 3146 lbs.
114" Wheelbase Length, Bumper to Bumper, 194.34"
125" Springbase Width, overall, 73.12"

3/4 Ton

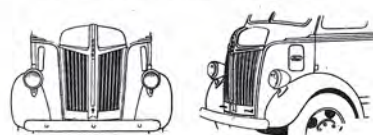
MODEL	ENGINE	WHEELBASE
11D	85	122"
19D	95	122"

MODEL IDENTIFICATION

1941 (Cont'd)

1 Ton

Cab Over Engine



MODEL	ENGINE	WHEELBASE	APPROX. WEIGHT WITH EXPRESS PICK-UP BODY
11Y	85 HP	122"	3442
19Y	95 HP	122"	

Truck

MODEL		WHEELBASE	APPROX. WEIGHT CHASSIS AND CLOSED CAB	
85 HP	95 HP		85 HP	95 HP
111W	191W	101"	3547	3547
11W	19W	134"	3705	3705
118W	198W	158"	3701	3701

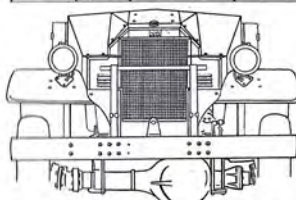
Bus

Model 19B Rear Engine Bus Chassis

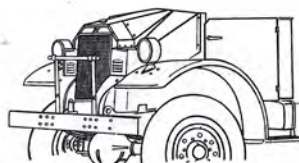
95 HP Engine

Wheelbase 148½"

MODEL		WHEELBASE	APPROX. WEIGHT WITH STAKE BODY	
85 HP	95 HP		85 HP	95 HP
11T	19T	134"	4461	4461
118T	198T	158"	4787	4787
11U	19U	134"	4833	4833
116T	196T	176"		
114T	194T	194"		



D. N. D.
Vehicles



MODEL	DRIVE	WHEEL-BASE	CAPACITY	H.P.
F-8	4 x 2	101"	8 cwt.	95
F-15	4 x 2	101"	15 cwt.	95
F-15-A	4 x 4	101"	15 cwt.	95
F-30-S	4 x 4	134¼"	30 cwt.	95

MODEL	DRIVE	WHEEL-BASE	CAPACITY	H.P.
F-60-S	4 x 4	134¼"	3 Ton	95
F-60-H	6 x 4	160¼"	3 Ton	95
F-GT	4 x 4	101¼"		95

LUBRICATION

The types of Lubricants best suited to ensure long life of all moving and reciprocating parts of cars and trucks as well as the mileage periods at which lubrication should be performed are determined by manufacturers only after taking into consideration numerous factors of major importance. Several of these are listed in the following.

- Tests and recommendations of major oil companies who are continually working in conjunction with vehicle manufacturers to determine the most suitable type of lubricants for specific purposes.
- Results of scientific testing and exhaustive research both in laboratories and in field tests.
- Consideration of the peculiar design of part or parts concerned.
- Consideration of load and the type of load to be carried.
- The type of finish on various parts as well as the metals used in manufacture, which features make lubricant a matter of particular importance.

It is obvious from the foregoing that the manufacturers recommendations are the most authoritative, accurate and correct available and should be followed in preference to any other recommendation made by any other company or individual.

Probably the most currently discussed point of controversy on the subject of lubrication is the question of engine oil recommendations. Regardless of the manufacturers recommendations specified in new vehicle owner instruction books, on lubrication charts, service bulletins, etc. some car dealers, service garages and filling stations apparently consider it advisable to make their own recommendations, which in numerous instances are at variance with those of the manufacturer.

The successful selling of service is in a large measure dependent upon the volume of lubrication business available and as this may best be retained by adhering to the manufacturers recommendations, this procedure should invariably be followed.

Engine Oil



Oil Level Gauge

Fig. 1

To avoid over-filling it is important not to add oil while the engine is running, or immediately after the engine has been stopped. The reason for this is that a considerable quantity of oil is suspended in the circulating system and until this has had sufficient time to drain into the oil pan, the gauge will not accurately register the amount of oil in the engine. This is illustrated in Figures 3 and 4 which show the oiling systems used in V-8 engines, and Lincoln-Zephyr engines respectively.

Engine oils of the following viscosity numbers are recommended for use in the various temperature ranges indicated.

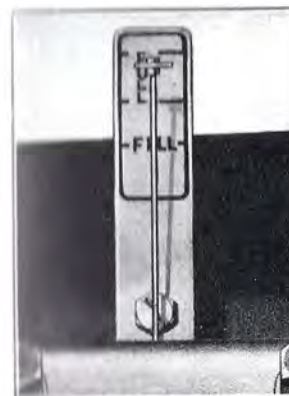
Prevailing Temp. Range	S.A.E. Viscosity No.
Average above 90°.....	40
Minimum above 32°.....	30
Minimum above 10°.....	20 or 20W
Minimum above -10°.....	10 or 10W
Lower temperatures	10W plus 10% Kerosene

Operating conditions will necessarily modify these recommendations inasmuch as the intermittent driver will find it necessary to use an oil one or two grades lighter than the continuous operator. The grades recommended above are for average conditions of operation.

On all Ford V-8 cars and trucks and Mercury cars the level of the oil in the crankcase should be kept between the "full" and "danger" marks on the oil level gauge. (Refer Fig. 1). It is not necessary to add oil until level drops to danger point.

On all Lincoln-Zephyr cars a "float" type oil level indicator is used as illustrated in Figure 4. When the oil pan is full the oil level indicator will be just below the "full" mark—Refer Figure 2. Any excess oil which raises the indicator above this point will be quickly consumed.

To avoid over-filling it is important not to add oil while the engine is running, or immediately after the engine has been stopped. The reason for this is that a considerable quantity



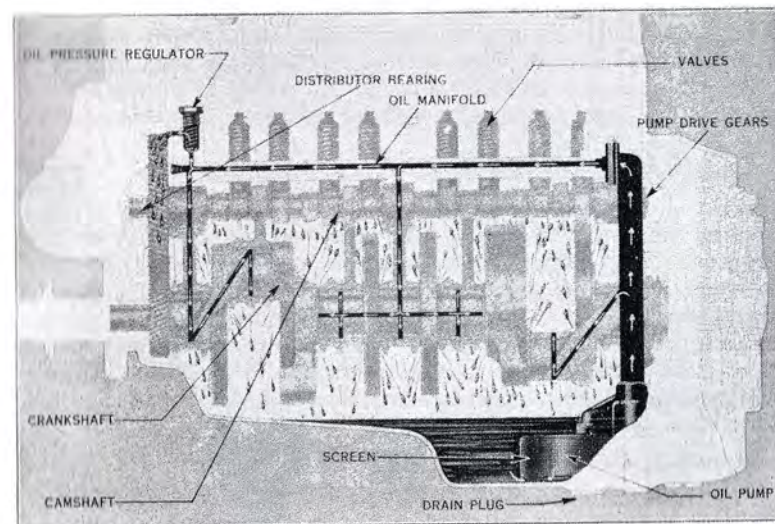
Oil Level Float

Fig. 2

Deterioration of engine oil, under normal operating conditions, should not be anticipated in less than 2000 miles of operation, however, during cold weather operation deterioration may occur at a very low mileage. As deterioration, during cold weather, is

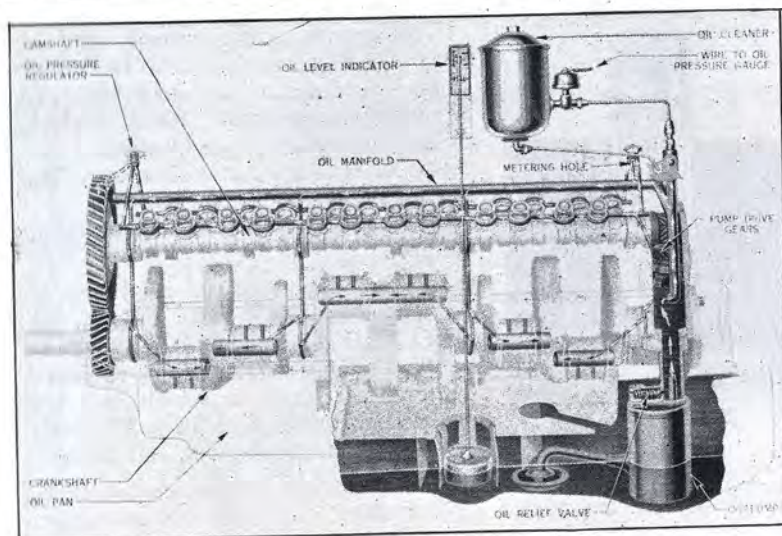
The engine oiling systems used in Ford V-8, Mercury, and Lincoln-Zephyr engines incorporate the most advanced engineering principles which include drilled crankshafts for positive lubrication of both main and connecting rod bearings. No external pipes or connections are used in these engine oiling systems.

It is recommended the engine oil be changed every 2000 miles, OR MORE OFTEN IF OIL BECOMES DETE-RIORATED, unless engine is equipped with an oil filter, in which case the instructions outlined on Page 27 should govern the frequency of oil changes.



Oiling System—Ford V-8 Engines

Fig. 3



Oiling System—Lincoln-Zephyr Engines
Fig. 4

usually attributable to one of two conditions, (details of which are outlined hereunder) owners must be constantly alert and have engine oil inspected at short mileage intervals, to ensure against operating the engine with deteriorated oil in the crankcase.

Dilution of Engine Oil

Dilution (thinning) of engine oil is almost invariably attributable to excessive use of the carburetor choke causing incomplete burning of all fuel entering the combustion chamber and resulting in raw fuel passing into the crankcase, where it mixes with the oil. The crankcase ventilating system used on the Ford V-8 engine greatly reduces the danger of excessive dilution occurring under normal operating conditions, however, in case of repeated short runs in severe cold weather this condition can occur. **When dilution occurs engine oil must be replaced.** Always flush crankcase before adding new oil.

Condensation Occurring in Crankcase

The theory of condensation is well known. Warm humid air striking a cold surface will cause particles of moisture to form on the surface. Condensation in the crankcase may result from either one or both of the following conditions:

1. Prior to the engine reaching efficient operating temperature, a variable amount of moisture and/or raw gasoline may accumulate in the combustion chamber. Moisture results from combustion in a cold chamber; the raw gas is unburned fuel, due to excessive choking. Both the moisture and gasoline may, unless the engine warms up very quickly, seep past the piston into the crankcase.
2. Moisture and raw gas deteriorate the oil and remain in solution in the lubricant, until the engine is operated at a high temperature for sufficient time to evaporate both the moisture and the gasoline. The vapors resulting from evaporation are exhausted at normal operating temperatures through the engine ventilating system. If, however, the engine is operated for extensive periods without reaching normal operating temperature, the presence of moisture and raw gas will permanently deteriorate the oil to an extent that adequate lubrication is not supplied to pistons and bearings, resulting in premature wear, failure, and possibly a frozen oil pump.

This moisture in the crankcase gradually causes a sludge to form, the lubricating qualities of which are practically nil. When this condition occurs the oil must be drained, crankcase flushed and new oil added.

Corrosion of Motor Parts Owing to Deteriorated Engine Oil

Moisture which enters the crankcase with unburned gasoline, contains a variable volume of corrosive acid.

This acid will cause etching of piston pins, bearings and other engine parts having highly polished surfaces.

Continued operation of the engine with such a lubricant will cause inestimable damage.

The following recommendations are made to all owners:

1. Use only good quality engine fuels and lubricating oil.
2. Use carburetor choke as little as possible.
3. Run the engine at idling speeds as little as possible.
4. Have condition of oil checked at frequent intervals during sub-zero temperatures.
5. Change engine oil when diluted or deteriorated regardless of mileage.

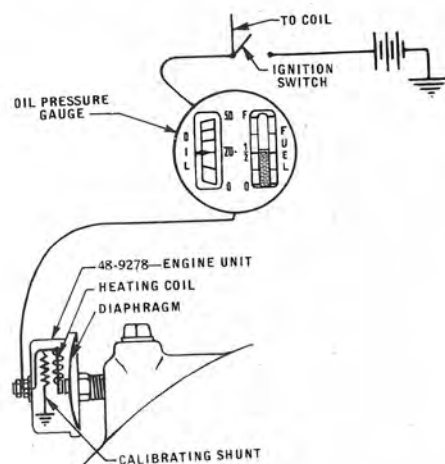
Oil Pressure

The normal oil pressure on all cars and trucks is 30 pounds with the oil at engine operating temperature. The pressure will be higher when the engine is cold.

Failure of the oil gauge to register generally indicates insufficient oil and the supply should be checked immediately.

Oil Pressure Gauge

The electric type oil pressure gauge was adopted in 1935 and while the appearance of the dash unit has changed since that time with the various models, the operating principle of the gauge remains the same.



Oil Pressure Gauge

Fig. 5

allowing current to pass through a heating coil formed around the bi-metal arm. Refer Figure 5. Due to the heat from this coil, the bi-metal distorts to the point where the contact is opened. The bi-metal then cools and bends back to its original position, which again closes the electrical circuit. This cycle of opening and closing is thus repeated continuously. At a normal contact pressure of 25 pounds per square inch, this frequency amounts to approximately 120 cycles per minute.

The electric oil pressure gauge consists of two units, the engine unit and the gauge unit, which is located in the instrument panel. A wire connects these units, and the circuit is completed through the car battery and ignition switch. Refer Fig. 5.

The engine unit contains a diaphragm which deflects varying amounts proportional to the pressure of oil in the line. When the diaphragm is deflected, an electrical circuit is closed through a contact on a bi-metal arm,

Connected in series with the heating coil of the engine unit is a similar coil formed around a bi-metal arm in the gauge unit. As heating takes place in the engine unit, heating also takes place at the same time in the gauge unit, causing the bi-metal arms in each unit to distort simultaneously. By linking the gauge pointer to the gauge unit bi-metal arm, the amount of distortion and, therefore, the measure of oil pressure is recorded on the dash unit.

As the oil pressure increases, causing greater deflection of the diaphragm in the engine unit, a greater distortion of the bi-metal arm is required to open the heating coil circuit. In other words, both heating coils are operating for longer intervals of time than at the lower pressure. This, of course, causes greater distortion of the bi-metal arm in the gauge unit and a higher oil pressure is registered.

The accuracy of the instrument is assured by the use of temperature compensating shunts which are calibrated at time of assembly.

The following procedure will permit diagnosis of the cause of an inoperative gauge unit:

1. Short out the engine unit by grounding the wire leading to the engine unit. Use a wire with clip terminals for this purpose. Clip one end to terminal screw of the engine unit and the other end to the ground.
2. Turn on the ignition switch. If the gauge unit now registers, then the gauge unit and wiring are O.K. and the engine unit is the source of the trouble and should be replaced. In making this test, turn off the ignition switch as soon as the gauge unit reaches the 30 lb. mark. Never short out the engine unit with the ignition switch on, except momentarily. This subjects the gauge unit to the full six volts of the electrical system, and will cause it to burn out if left in this manner for any period of time.
3. If the gauge unit fails to register with the engine unit shorted out and ignition switch on, then check the wiring and connections. If these appear O.K., then replace the gauge unit and check again.
4. The following may be used for locating the possible cause of trouble:

GAUGE OPERATION

PROBABLE CAUSE

Erratic action of gauge unit pointer
If gauge does not register accurately
Gauge unit registers with ignition
switch on and motor not running

Engine unit
Engine unit
Short circuit

5. The short in the circuit will probably be located in the wiring or the gauge unit. A short usually results in the burning out of the gauge unit, necessitating replacement.

Air Cleaners and Engine Oil Conditioning Equipment

Air enters the combustion chambers of the engine as a part of the fuel through the carburetor and intake manifold. It is generally known and appreciated that excessive and abnormal wear of reciprocating engine parts will be somewhat in proportion to the amount of abrasives entering the combustion chambers with the engine fuel. Obviously, therefore, it is desirable to remove all abrasives from the air entering the carburetor and this is accomplished through the installation of suitable air filtering equipment. This procedure is generally referred to as air cleaning.

"Engine oil conditioning" generally has to do with a process of filtering the engine oil to remove sediment, acids, water, gasoline, etc., from the engine oil, thereby precluding the possibility of trouble occurring as a result of operating the engine with deteriorated engine oil.

From the foregoing it is obvious that "air cleaning" and "engine oil conditioning" are entirely different. As an engine oil conditioner will not filter the air stream entering the carburetor, and similarly as an air filter will not remove injurious and deteriorating elements from the engine oil, it will readily be appreciated that neither type of equipment will provide both results.

Various types of air cleaning and engine oil conditioning equipment have been used on Ford cars and trucks and complete details thereof are outlined in the following.

Standard Air Filter and Silencer

The air filter illustrated in Figure 6 is suitable for passenger and commercial cars and trucks operated only on paved or hard surfaced roads.



Air Filter and Silencer

Fig. 6

This air cleaner should be cleaned after each 2,000 miles of operation (or oftener if necessary) to prevent clogging which will effect engine performance and increase fuel consumption. To clean, remove top cover and filtering unit. It is unnecessary to remove complete unit from the carburetor. Wash filter unit in gasoline. Dry thoroughly, preferably with an air hose. Then submerge filter unit in a good grade of engine oil and allow to drip

dry before reinstalling. Do not oil the felt in the top cover.

Oil Bath Air Cleaner

Oil bath air cleaners are intended for cars or trucks operating in areas where dust and gravel roads are predominant. All Ford oil bath air cleaners are over 99% efficient. However, as it is desirable to have cleaners of different capacity for different types of operation, there are three types used. Sizes and capacities are detailed herebelow.

Hat Type—one pint capacity.

This cleaner is illustrated in Figure 7. The dust trapping capacity is approximately one pound. Generally used on passenger and commercial cars operating mostly on pavement but partially on gravel roads. Not generally used on trucks.

Hat Type—two pint capacity.

This cleaner is identical in appearance to the one pint capacity cleaner illustrated in Figure 7 but has a dust trapping capacity of



Oil Bath Air Cleaner—"Hat" Type
Fig. 7

approximately two pounds. It is generally used on passenger and commercial vehicles operated mostly on gravel and dust roads, also for trucks operated mostly on paved roads and occasionally on gravel and dust roads.

These hat type cleaners should be cleaned as follows:

Remove cleaner from carburetor. Disassemble cleaner. Remove oil and sediment from reservoir. Rinse screen

in gasoline. Blow all parts dry. Fill reservoir to indicator line with oil of same SAE viscosity rating as is used in the engine. Reassemble cleaner. Reinstall cleaner on carburetor.

Vertical Type—three pint capacity.

This cleaner illustrated in Figure 8 has a dust trapping capacity of approximately 3 pounds. It is generally used on cars or trucks operated in heavy dust or gravel road areas also on such classes of service as contracting jobs, gravel hauling, etc.

To clean this filter remove oil reservoir and drain oil and sediment. Wash reservoir with gasoline and blow dry. Fill reservoir to indicator line with oil of same SAE viscosity rating as is used in the engine. Reassemble reservoir to cleaner.

Engine Oil Conditioner

Engine oil conditioners are designed to remove sediment, acids, water, gasoline, etc. from the engine oil. This is accomplished through the use of a filtering cartridge. The life of the cartridge is dependent mostly on the type of service in which the unit is



Oil Bath Air Cleaner—"Vertical" Type
Fig. 8

operated and consequently no fixed mileage period can be recommended for replacement of the cartridge. After a period of service the cartridge will become completely filled with sediment and will necessarily require replacement. The life of the cartridge may, however, be considerably lengthened through periodically draining the water and sludge from the housing through the drain plug provided at the bottom of the housing.

As long as the oil remains clear it may safely be assumed that the cartridge is in good

condition, but when the oil commences to appear blackish, it is time to replace the cartridge. There is no economy in using the cartridge after it is clogged with sediment.

It is unnecessary to change the engine oil in a vehicle equipped with an engine oil conditioner (except for seasonal changes to lighter or heavier viscosity) as long as the oil remains in good condition. The oil level, however, must be checked and oil added as required.

When installing a new cartridge use new gaskets supplied and remove top and bottom protection from the cartridge before installing. Screw the cartridge tightly in the cover, then seat the cover squarely on the shell. Replace the cross bar and tighten the screw by hand only. Start the motor and check for oil leaks at all connections. Tighten if necessary.

General Lubrication

Lubrication and maintenance charts which appear on pages 31 to 35 inclusive (Figures 9, 10, 11, 12 and 13) give complete

Service Handbook

information in connection with lubricants recommended for various locations on cars and trucks.

These services are divided into three groups:

1. Points requiring attention every 1000 miles.
2. Points requiring attention every 2000 miles.
3. Points requiring attention each Fall and Spring, or every 5000 miles, whichever occurs first.

Special attention is called to the following suggestions:

Fittings and Filler Plugs

Every fitting should be wiped clean before grease gun is applied or before removing filler plugs.

Distributor

An oil cup is provided on distributor housing for oiling the forward bearing of the distributor shaft. This oiler is accessible from the left side of the engine. The bearing at the rear of distributor shaft is automatically lubricated from interior of the engine and requires no attention.

Distributor cam lobes should be lubricated every 5000 miles. It is recommended Ford M-4601 distributor cam lubricant (or petroleum jelly) be used.

Water Pumps

Water pumps on models subsequent to 1936, receive oil from the engine, consequently no periodic lubrication is required.

Rear Axle, Transmission and Steering Gear

Use only highest quality lubricants of the correct specifications.

Front and Rear Wheel Bearings

Front and rear wheel bearings should be removed and cleaned and repacked with wheel bearing lubricant only. Ford M-4664 Wheel Bearing Lubricant or its equivalent is recommended. Details of procedure will be found on pages 41 and 42.

Front and Rear Springs

Due to special design of all Ford, Mercury and Lincoln-Zephyr passenger car front and rear springs, it is essential that only special spring lubricant be used.

Service Handbook

Ford Spring Lubricant M-4628-B or other special lubricants meeting the specifications of M-4628-B are recommended. Do not use chassis lubricant under any circumstances as this makes springs too flexible when first applied, but rapidly dries out and clogs lubricant grooves in leaves.

Clutch Throwout Bearing

A pre-lubricated type clutch throwout bearing is used on all passenger and commercial cars and no lubricant is necessary.

On buses and some heavy duty trucks a lubricated type bearing is used which requires chassis lubricant each 1000 miles. Lubricant is applied through an external fitting on clutch housing.

Universal Joint

Universal joint lubricant (cylinder oil soda soap grease) should invariably be used on bushing type universal joints, as used on all Ford Passenger and Commercial cars, and Mercury and Lincoln-Zephyr Passenger cars.

Extreme pressure lubricant, SAE-140 viscosity, should invariably be used on needle bearing type universal joints, as used on all truck models.

Shock Absorbers

Only genuine Ford shock absorber fluid M-4633-B should be used for replenishing fluid in instruments.

Body Parts

Oil door hinges at frequent intervals with dripless type lubricant.

Door striker plates, dovetails, bumpers and check straps as well as engine hood bumpers (and lacings where used) should be lubricated with an impregnated wax lubricant.

Lubrication of Rubber Parts

Rubber parts generally will deteriorate very rapidly if ordinary lubricating oils or greases are used as a lubricant.

As outlined in the preceding sub-heading "Body Parts", door bumpers, engine hood bumpers, etc., should be lubricated with an impregnated wax lubricant and under no circumstances should any other type of lubricant be used on these parts.

Service Handbook

Other than the foregoing, the rubber parts used on cars and trucks will usually not require any lubricant and the longevity of such parts will be increased if no lubricant is used.

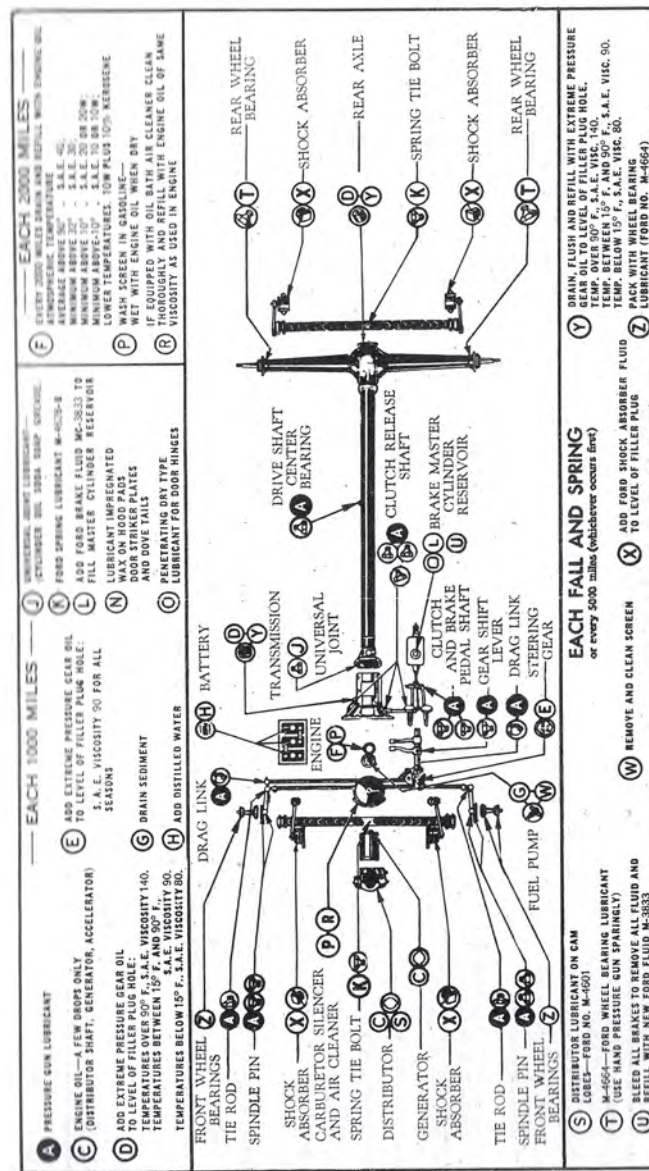
Occasionally, however, squeaks may develop owing to friction between steel and rubber, and in such cases application of a penetrating type special rubber lubricant will overcome the difficulty. In stubborn cases rock the vehicle back and forth to work the lubricant into place.

Extreme Pressure and Hypoid Lubricants

Various types of "Extreme Pressure" and "Hypoid" lubricants currently being marketed, are compounded with different bases such as "Lead"—"Sulphur", etc. As lubricants having these different bases will not mix it is essential to add the same lubricant as in use.

In cases where the type of lubricant previously used is not known, or where lubricant is being drained for complete refilling, always drain thoroughly, then use Kerosene or a light flushing oil for flushing out the housing, to ensure thorough removal of old lubricant.

Service Handbook



Lubrication and Maintenance Chart—Ford V-8 and Mercury Passenger and Commercial Cars. Fig. 9

WHEELS AND TIRES

Wheels

Pressed steel wheels have been used on all Ford Passenger and Commercial cars and Mercury and Lincoln-Zephyr cars since 1936. Steel spoke wheels were used on units prior to 1936. It is essential that wheels are absolutely true and properly balanced to insure safety, particularly at high speeds. Consequently if a wheel becomes damaged due to accident or abuse, replacement of the wheel should invariably be made rather than attempting repairs.

Always examine the wheels before mounting on the hub to make sure the countersunk holes, where the ball face of the wheel nuts seat are free from dirt. In the case of dual wheels, the face of the disc on both wheels, where they bear together, and the hub flange, must be clean.

When wheels are changed it is advisable to always apply a very small amount of lubricant to the studs and the countersunk holes in the wheels to reduce friction when tightening the wheel nuts.

Two types of retaining rings, namely "split" and "continuous" have been used on Ford Truck wheels. These retaining rings are not interchangeable. Instructions for removal will be found under sub-heading "Trucks" on page 39.

Wheel Nuts

Wheel nuts used on all passenger and commercial cars are right hand thread. On Trucks, however, the wheel nuts on the right wheels have right hand threads and are distinctly marked with the letter "R", whereas the nuts on the left wheels have left hand threads and are marked with the letter "L". This is to prevent the wheel nuts from becoming loose due to forward motion of the truck. Wheel nuts on truck should be checked frequently to insure they are tight. Particular attention should be given to tightening these nuts when the truck is operated often in reverse gear. **Wheel nuts should be tightened at the end of the first 50 to 100 miles on a new truck.**

Removing and Mounting Wheels on Hubs

On passenger and commercial cars the tire may be removed from the wheel without removing the wheel from the hub. It will, however, usually be found more convenient, and safer, and will take less time to first remove the wheel from the hub.

When installing either of the front wheels it is helpful to have another person apply the foot brake in order to hold the brake drum in a fixed position.

The wheel should be positioned over the studs so the balance mark on the tire (refer sub-heading "Mounting Tire" on page 38) is as near as possible to the balance notch on the brake drum. This is especially important in the case of front wheels.

Dual wheels used on trucks are of the double cap nut type. The inner wheel must be installed and inner wheel nuts tightened securely before installing the outer wheel. Wheel nuts should invariably be tightened with the truck jacked up.

When tightening dual wheel nuts on trucks, the outer nuts must be backed off at least two full turns before attempting to tighten the inner nuts.

Removing and Mounting Tires

As the procedure of removal and mounting the tires is entirely different on "drop centre" and "retaining ring" type wheels as used on cars and trucks respectively, details of these operations are dealt with individually hereunder.

Passenger and Commercial Cars

To Remove Top Bead: Deflate tube completely. Remove valve cores to accomplish this if necessary.



Removing Top Bead
Fig. 14



Removing Bottom Bead
Fig. 15

Service Handbook

Loosen both beads from rim ledges, using tire iron if necessary.

Push valve stem into tire. Stand on tire with feet about 15 inches apart opposite valve stem and force bead off bead seat into drop centre part of rim. Refer Figure 14.

Insert two tire irons about 8 inches apart between bead and rim flange on each side of the valve stem, and pry a short length of the bead over the flange, as shown in Figure 14.

Leave one tire iron in position and follow around rim with one iron to remove remainder of bead. Then remove tube. With 5.50-16 and 6.00-16 tires used on Ford cars, the tire can be entirely removed without removing inner tube. However, it may be found more convenient to remove tube before removing inner bead of tire.

To Remove Other Bead: Stand wheel in upright position with bead in drop centre part of rim at bottom. Insert tire iron between bead and rim flange at top of wheel. Pry wheel out of tire as shown in Figure 15.

Caution. Care should be taken that the soft rubber edge on the inner edge of the tire bead is not damaged by the tire iron, as such damage will have a tendency to chafe the inner tube. It is advisable to coat the outside of the beads (and inside where possible) with soft soap, which will assist in removing the bead over the edge of the rim, and also protects the inner edge of the bead.



Applying Bottom Bead
Fig. 16



Applying Top Bead
Fig. 17

Mounting Tire: Inflate tube until barely rounded out and insert in casing. **See that balancing mark on casing is next to valve stem.** Before mounting casing use soft soap on tire beads. Place tire on rim, guiding valve through valve hole.

Service Handbook

To Apply Inner Bead: Push inner (bottom) bead down into drop centre part of rim at valve and force remaining portion of bead over rim flange. A tire iron may be needed to pry last portion of bead over the flange. See Figure 16. Always keep as much of the bead as possible in the rim well when applying.

To Apply Outer Bead: Insert tire iron on side of wheel opposite valve stem between outer bead and rim flange. Pry bead over flange. Holding this iron in position, continue prying with other iron, working around rim until bead is in place. Refer Figure 17.

Before inflating the tire, push the valve stem into the casing as far as possible to make sure that the tube is not pinched under the tire bead. **Do not let go of the stem while doing this.**

Inflate slowly to not more than 2 pounds pressure and work casing back and forth to make sure that tire is centered on rim on both sides. This "centering" can be assisted by bouncing tire after approximately 15 pounds of air pressure has been added. Then finish inflation of tire. Proper position of the tire is indicated by the molded line on the side of the tire being equally spaced from the rim at all points.

Trucks

To Remove Tire Retaining Ring: The tire tool should be inserted in the slot provided in the rim flange at point "B" shown in Figure 19. Pry ring until the cutaway portion nearest the tool slot spans the outside diameter of the rim flange.

Continue to pry the remainder of this half of the ring from the gutter by moving toward the opposite cut-away portion until ring is in position shown in Figure 18.

The ring and tire can then be removed.



Fig. 18



Fig. 19

Service Handbook

To install Tire:—After applying the tire and tube in the usual manner to the wheel, the retaining ring is placed in position for assembly as shown in Figure 18.

The two cutaway portions opposite each other on the inner diameter of the ring (refer "A", Figure 18) are placed so as to span the rim gutter flange. Then the ring is forced into the gutter at point "C" as far as possible. Refer Figure 18.

The locking ring can then be drawn into the gutter by tapping at point ("B" Figure 19), or by use of a tool as a lever. This forces or draws the ring outward and downward over the rim flange and into the gutter.

The final application is accomplished by striking the locking ring at the point where it still spans the gutter flange at the point of contact. This point of contact will progress toward the cutaway portion farthest from the starting point ("B" Figure 19). Figure 20 shows the method of progressive application of the ring.



Fig. 20

Important

Make certain that the inside diameter of the ring has passed completely over the outside diameter of the gutter flange into the groove of the gutter before inflating tire.

Recommended Tire Inflation Pressures

Passenger and Commercial			Trucks		
Tire Size		Pressure	Tire Size		Pressure
5.25 x 18	4 ply	35	6.00 x 17	6 ply	45
5.50 x 17	4 ply	32	6.00 x 20	6 ply	45
5.50 x 16	4 ply	30	6.50 x 20	6 ply	50
6.00 x 16	4 ply	30	7.00 x 17	6 ply	45
6.00 x 16	6 ply	35	7.00 x 17	8 ply	55
6.00 x 18	4 ply	30	7.00 x 20	8 ply	55
6.00 x 18	6 ply	35	7.50 x 17	8 ply	55
6.50 x 16	6 ply	35	7.50 x 20	8 ply	55
7.00 x 16	4 ply	28	30 x 5	8 ply	75
			32 x 6	8 ply	75
			32 x 6	10 ply	80
			32 x 7	10 ply	85

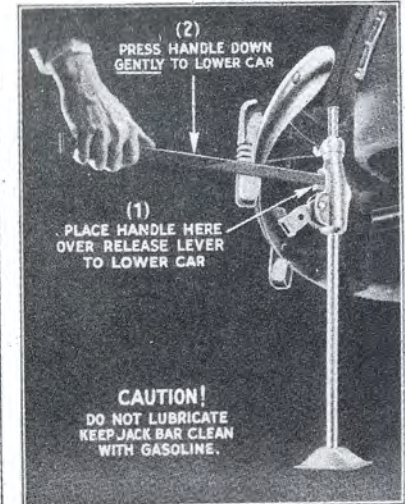
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Jacks and Operation

Three types of jacks are used. A friction "bumper" type jack is supplied for all passenger cars. Operation is described in illustrations Figures 21 and 22.



Raising Car
Fig. 21



Lowering Car
Fig. 22

A "screw" type jack having a hinged extension type handle is supplied for all commercial cars.

A "ratchet" type jack is supplied for all trucks.

The operation of the "screw" and "ratchet" type jacks is obvious. Care, however, must be exercised to insure that the jack is positioned so the axle sits securely on the jack pad.

Wheel Bearing Adjustment and Lubrication

Front Wheels

Front wheel bearings of all cars and trucks are removed, assembled and adjusted as follows:

Remove hub cap (both outer and inner), cotter and wheel bearing nut, washer and outer bearing. (Be sure brakes are

Service Handbook

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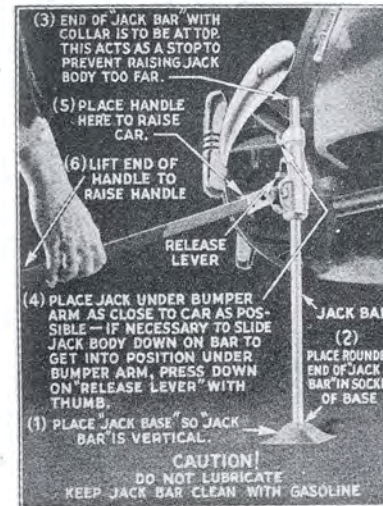
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Passenger and Commercial			Trucks		
Tire Size		Pressure	Tire Size		Pressure
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6.00 x 18	4 ply	30	7.00 x 20	8 ply	55
6.00 x 18	6 ply	35	7.50 x 17	8 ply	55
6.50 x 16	6 ply	35	7.50 x 20	8 ply	55
7.00 x 16	4 ply	28	30 x 5	8 ply	75
			32 x 6	8 ply	75
			32 x 6	10 ply	80
			32 x 7	10 ply	85

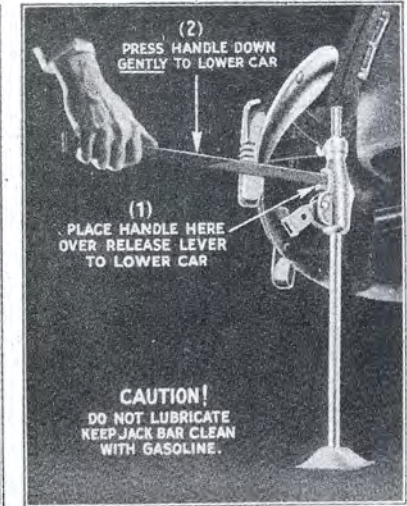
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Wheel Bearing Adjustment and Lubrication

Front Wheels

Front wheel bearings of all cars and trucks are removed, assembled and adjusted as follows:

Remove hub cap (both outer and inner), cotter and wheel bearing nut, washer and outer bearing. (Be sure brakes are

can be adjusted or removed. With the two bearing nuts removed, the rear hub and bearings can be removed.

Now wash out all old lubricant with clean kerosene then dry thoroughly with air hose and repack with wheel bearing lubricant. Ford M-4664 wheel bearing lubricant or its equivalent is recommended.

When reinstalling the hub and bearings, the bearing nut should be run up just barely snug with the wrench provided, and then backed off one-eighth to one-sixth turn to provide clearance.

Be sure to lock the adjusting nut in place with retainer, and outer nut.

When reinstalling the axle shaft, be sure the gasket is in place and the cap screws are backed off sufficiently.

Install the tapered cones and lock washers.

Draw the axle shaft flange up tight at two studs directly opposite each other. This will permit the cones to centralize the axle shaft.

Tighten all of the axle shaft flange nuts.

Then (on Regular and C. O. E. Trucks), retighten the cap screws just enough to prevent their becoming loose. Remove cap screws from flanges on $\frac{3}{4}$ or 1 Ton Trucks.

Axle shaft flange nuts must be kept tight at all times.

BRAKES

Principle of Hydraulics

In order to thoroughly understand and be able to explain the operation of hydraulic brakes to owners it is necessary to be familiar with several of the characteristics of hydraulics.

In this section the subject of hydraulics is discussed in general and the conclusions arrived at apply to any brake system using this method of actuating the brakes.

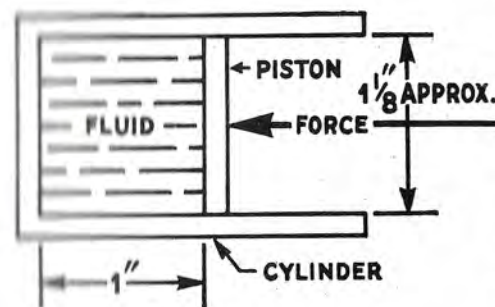
The stopping of an automobile depends on:

- A. The co-efficient of friction between the tires and the road.
- B. The co-efficient of friction between the brake lining and the drum.
- C. The degree of self-energization of the shoes.
- D. The effort applied to the shoes.

The above applies to all brakes whether they are actuated by cables, rods, or hydraulics. At this time we are interested chiefly in the distribution of the effort applied to the brake shoes.

The first fact that must be recognized is that for all practical purposes liquids can be considered as not compressible and since they cannot be compressed, hydraulic pressure usually represents a pressure applied to the liquid.

If you had a cylinder full of liquid and a piston similar to the one shown in Figure 24, and if force were applied to the piston in the direction indicated by the arrow, neither the piston nor the liquid would move. The only result would be that whatever effort would be applied to the piston would be transferred through the liquid and against the cylinder walls.



Hydraulic Brake Cylinder and Piston

Fig. 24

For convenience we have assumed the piston to be approximately $1\frac{1}{8}$ inch in diameter, or a piston having an area of one square inch. Area is equal to the radius squared multiplied by 3.1416.

Since in this case the pressure is being applied to one square inch it is easy to calculate the pressure in pounds per square inch being exerted against the cylinder walls.

Assuming a pressure of 100 lbs. were applied to the piston in the direction indicated by the arrow, this 100 lb. pressure being applied against one square inch, the resulting hydraulic pressure would be 100 lbs. per square inch.

However, in this case since the liquid cannot be compressed the piston would not move and if the pressure were removed from the piston again nothing would happen. The only result would be that the liquid would no longer be exerting pressure on the cylinder walls.

On the other hand if the cylinder were full of air, since air

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is elastic, it would permit movement of the piston and with the pressure removed would move the piston back to its normal position.

With a liquid in the cylinder, when no movement of the liquid is possible, the hydraulic pressure is exactly equal to the pressure applied.

On the other hand where movement of the liquid is possible the pressure cannot exceed the resistance to its movement. Or if movement in several directions is possible and if the resistance to the movement is different in the several lines, the pressure in the entire system will not exceed the pressure necessary to overcome the lesser resistance.

At all times the pressure in all parts of the hydraulic system is equal and cannot exceed either the pressure applied or the pressure necessary to move the liquid, whichever is the lesser.

The system shown in Figure 25 is similar to the system used to actuate automobile brakes and can be used to illustrate the application of hydraulic principles already discussed.

The job to be done is to transfer movement or pressure applied to the pedal to the brake shoes and is accomplished as follows:

The pedal is longer on one side of its fulcrum point than it is on its other side (compare dimensions "A" and "B", Figure 25). In this case the ratio is 7 to 1 (it could be almost any ratio depending on the amount of movement possible and the pedal pressure desired).

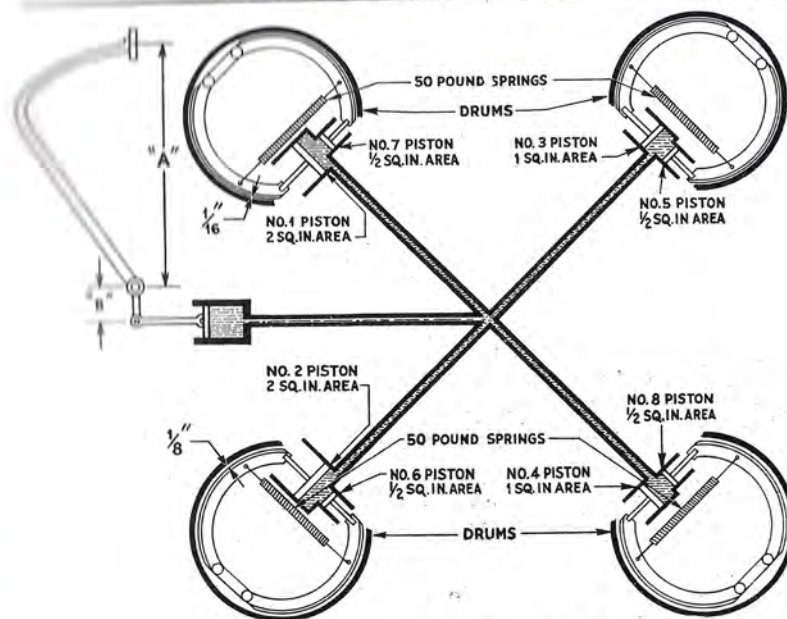
The result of this is that when the pedal is moved seven inches the piston is moved only one inch; consequently if no movement of the liquid were possible, and 100 pounds pressure were applied to the pedal, a pushing force of 700 pounds would be exerted against the piston.

In the case illustrated since the area of the piston is one square inch with 700 pounds pressure exerted on it, a pressure of 700 pounds per square inch would be created in the system.

To determine the hydraulic pressures created with pistons of various areas, multiply the area by the applied pressures.

For the sake of convenience we will assume that the piston in this system has an area of one square inch, (for actual sizes as used, see the specification section of this book) which would result in a hydraulic pressure in pounds per square inch exactly equal

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Simplified Drawing of Hydraulic Brake System

Fig. 25

to the effort applied to the piston. Incidentally this piston and cylinder will be referred to as the "master" cylinder or piston.

At the end of each of the four lines double cylinders are shown, each having two pistons acting in opposite directions. These will be referred to as "wheel" cylinders or pistons.

Each of these pistons are held in release position by a retracting spring, and for the purpose of illustrating several points various areas for these pistons are used. These areas are not necessarily the same as used in the actual system.

When movement of the master piston is started the pressure created is applied equally to all parts of the system.

This pressure cannot exceed the resistance to the movement of the liquid, and since in the larger wheel cylinder the pressure is being applied to a two-inch area, 25 pounds pressure per square inch would develop a pushing force of 50 pounds, which is the pressure required to overcome the resistance of the 50 pound spring.

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Since pistons 1 and 2 each have an area of two square inches, and each has a 50 pound spring to work against, both would start to move with a pressure of 25 pounds per square inch.

However, since the brake shoe at piston No. 1 has only 1/16 inch clearance it would come to its stop against the drum first. The pressure would still remain at 25 pounds and as additional movement is given to the fluid, piston No. 2 would continue to move until its shoe also reached its drum. Until shoe No. 2 did reach its drum the pressure in the entire system could not exceed 25 pounds per square inch.

After shoe No. 2 reached the drum the pressure would immediately increase to 50 pounds per square inch since pistons 3 and 4 each have an area of one square inch and 50 pounds working on a one square inch piston would overcome the resistance of the 50 pound spring.

The pressure in the entire system would remain at 50 pounds per square inch until pistons 3 and 4 would have reached the limit of their travel.

Pistons 5, 6, 7 and 8 each having an area of 1/2 square inch, would require a pressure of 100 pounds per square inch in order to have sufficient pushing force to lengthen the 50 pound spring.

During the time these pistons were moving the pressure in the entire system would be 100 pounds per square inch, and could not exceed that amount until such time as all of the movement has been stopped by the pistons reaching the limit of their travel.

To quickly review what would happen in the hydraulic system illustrated: When the pedal is moved, movement of the fluid is started and the wheel pistons would move out in this order; pistons 1 and 2, then pistons 3 and 4 and lastly pistons 5, 6, 7, and 8 would move out together. During this time the pressure on the fluid could not exceed the resistance to its movement. For this reason the pressure necessary at the pedal would be slight—only 1/7th of the hydraulic pressure.

Now, however, with all movement stopped if pressure is exerted against the pedal, that pressure multiplied by the leverage of the pedal (in this case 7 times) would be the pressure applied through out the system.

In other words if a pressure of 150 pounds were applied to the pedal, a 1050 pound pushing force, ($150 \times 7 = 1050$) would

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be exerted against the master piston and since in this case the master piston has an area of one square inch a pressure of 1050 pounds per square inch would be created in the entire system.

This pressure would be exerted equally against all of the wheel cylinders. However, since the wheel cylinders have different areas the results would be different.

In the case of pistons 1 and 2 having an area of two square inches, 1050 pounds per square inch acting on two square inches would develop a pushing force of 2100 pounds on the brake shoe.

Pistons 3 and 4 (one square inch area) would have a pushing force of 1050 pounds. Whereas pistons 5, 6, 7 and 8 would each have a pushing force of only 525 pounds since they have an area of only 1/2 square inch.

Thus we see that even though the hydraulic pressure is always equal in all parts of the system, the pushing force can be varied by the use of various sizes of wheel cylinders.

The front ends of the front wheel brake cylinders are larger than the front ends of the rear wheel brake cylinders on Ford cars. These are the ends that apply the most effective braking action, since they operate the front brake shoes on both front and rear wheels. The diameter of the cylinders is such that 55 per cent of the braking force is applied to the front wheels and 45 per cent to the rears under all conditions. Its particular value is to permit easier, faster stops with less pedal pressure, and with less chance of sliding the wheels under adverse driving conditions, or in emergencies.

The system used to illustrate this explanation can be compared to the system actually used.

Each of the four lines could represent a line going to each wheel.

Each of the wheel pistons could be pushing a brake shoe against the drum. The amount of movement possible at each of these pistons would represent the clearance between the lining and the drum. Also by using stepped cylinders at each wheel the pushing force could be distributed differently to the two shoes.

By using larger cylinders at the front wheels more pressure could be exerted against the front brakes.

To further compare the hydraulic system we have used for the purpose of this explanation, with what actually is used, Figure 26 illustrates the master cylinder actually used.

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Master Cylinder

The master cylinder actually is a pump, since the return of the fluid from the lines is retarded, and the fluid in the cylinder is replenished, from a reservoir.

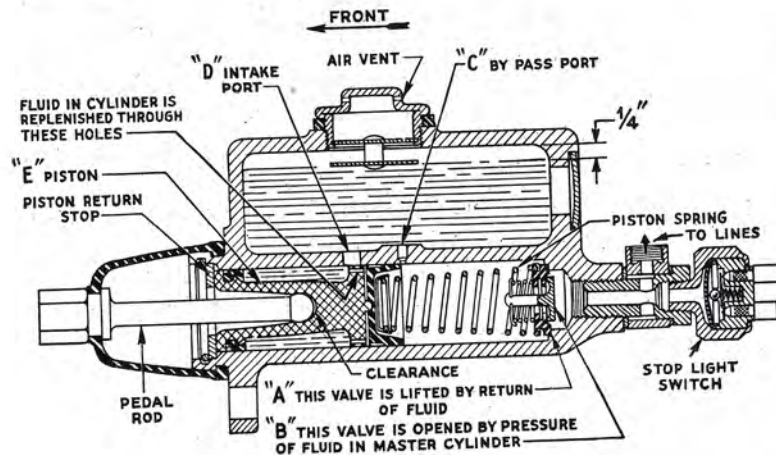
The piston is shaped like a spool, and the space around the centre is maintained full of fluid from the reservoir through the intake port "D"—refer Figure 26.

As the piston is moved by the pedal rod the fluid in the cylinder passes through the "by-pass" port "C" into the reservoir. However as the piston continues to move the rubber cup covers this hole.

From this time on the pressure is whatever is required to overcome the resistance of the brake shoe retracting springs and expand the shoes out to the drums.

The movement of the fluid out of the cylinder is through the one-way valve, refer "B" Figure 26, which is opened by the movement of the fluid.

After the brake shoes are out against the drums the pressure is exactly equal to the effort applied to the piston in the master cylinder.



Hydraulic Brake Master Cylinder

Fig. 26

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When the stop is completed the brake pedal is returned to its normal position by a pedal retracting spring, and the master piston is returned to its stop by the piston spring illustrated in Figure 26.

This same spring in its endeavor to hold valve "A" Figure 26 closed, and the normal resistance of the lines to the rapid return flow of the liquid to the master cylinder, both tend to retard the return of the fluid that has been pumped into the lines, thus creating a vacuum in the cylinder.

When this vacuum is created in the cylinder the rubber cup collapses and fluid is drawn into the cylinder through the six holes in the piston head.

Hydraulic pressures are merely equal to whatever pressure is applied, and when the applied pressure is removed the hydraulic pressure no longer exists.

In this case when the foot is removed from the brake pedal the only applied pressure is the pressure exerted on the fluid by the brake shoe retracting springs returning the shoes to their normal release position against the stops provided.

As previously stated the resistance of the lines to the return flow of the fluid, and the tension of the master piston spring opposing the opening of the valve "A", both tend to retard the return of the fluid from the lines; and when the piston has returned to its stop some of the fluid is still in the lines and is being returned by the brake shoe retracting springs. However, as the piston moved to its stop, additional fluid was drawn into the cylinder from the reservoir, and as the cylinder is already full the excess fluid from the lines returns to the reservoir through the by-pass port "C".

The by-pass port being very small still further retards the return of the fluid.

If the clearance between the linings and the drums were excessive so that even with a full stroke of the pedal no effective pressure was applied to the brake shoes, a second stroke of the pedal could be made and additional fluid could be pumped into the lines before the shoes could retract, until an effective pressure was applied to the shoes.

Of course, if excessive clearance existed the brake should be adjusted to reestablish the pedal reserve.

Even so it is possible in going down a long grade with the

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brakes applied that the heat generated at the brake drums would cause them to expand away from the shoes and the pedal reserve would continue to decrease. In this case a second stroke of the pedal would pump additional fluid into the lines permitting effective pressure to be applied to the shoes and would reestablish the pedal reserve.

This pumping action, of course, is only possible if the reservoir has sufficient fluid in it to prevent air instead of fluid being pumped into the lines.

The by-pass port "C" serves an additional purpose other than merely to permit the return of the fluid from the lines. In normal position this hole is always open and prevents a build-up of pressure due to expansion of the fluid, and conversely prevents a loss of pedal reserve due to contraction of the fluid. To clarify this point: each time the brakes are applied considerable heat is generated at the drums and some of this heat is transferred to the fluid, which by expansion increases in volume. Now if the by-pass port "C" were not open the brake shoes would not be able to return to their stop owing to the increased volume of the fluid in the system.

After several stops the fluid would expand until the shoes could not retract at all and they would drag. From this point on the generation of heat and its transfer to the liquid would be very rapid, and the brake shoes would set tight against the drums, so tight in fact that the engine would labor and eventually stall.

The by-pass port can be covered by the master cylinder cup if the pedal rod is adjusted so that no lash exists.

The normal release position for the piston is against the 2188 stop washer and in this position the rubber cup is clear of the by-pass port. If the pedal rod were adjusted without lash the rod would act as a stop for the piston and the rubber cup could cover the by-pass hole blocking the only means the fluid has of passing back to the reservoir when its volume increases due to heat expansion.

The above difficulties are prevented or remedied by adjusting the pedal lash.

This by-pass hole could also be obstructed by the cup if it had swollen due to the presence of mineral oil in the system, or the use of other than alcohol or M-3833 brake fluid in cleaning the parts.

The displacement of the master cylinder being small, prevents

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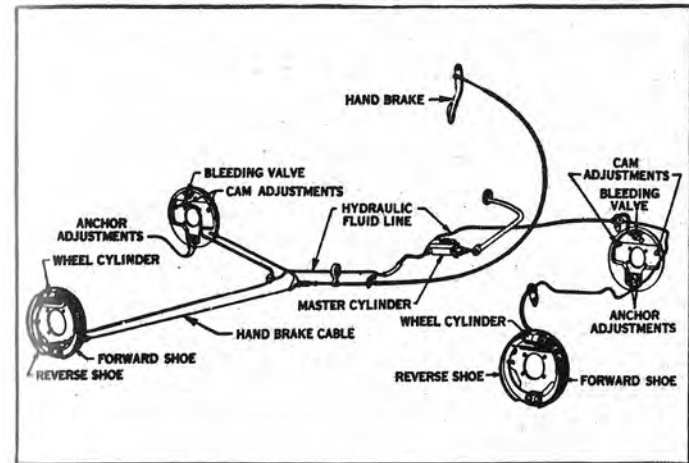
the building up of effective pressures if air, which is compressible, is present in the system. The presence of air in the system results in a spongy brake pedal, and loss of pedal reserve, and it is important that air be kept out of the system.

If clamps are used on the wheel cylinders when brake shoes or the retracting spring is being removed air will not enter the system.

At any time when any of the lines are disconnected air of course will enter that particular line and it will be necessary to remove the air from the system. This operation is referred to as bleeding.

In addition to air entering the lines when they are disconnected air will enter the system if the fluid in the reservoir is allowed to get low. This obviously is the owner's fault in not maintaining the level of the fluid by periodic replenishment.

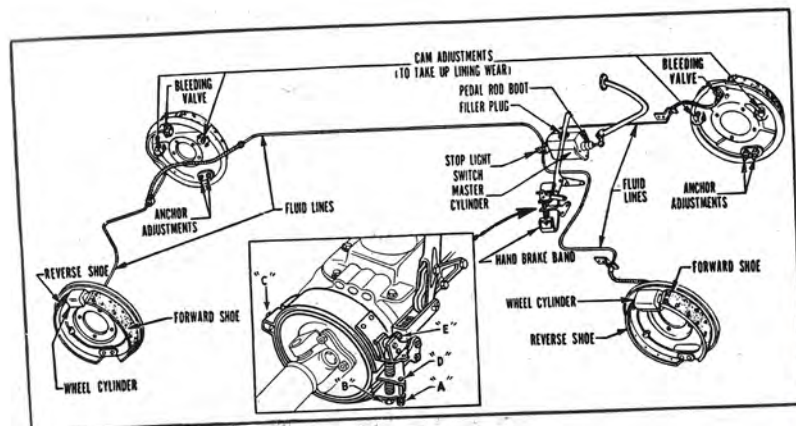
If air enters the system at one line, generally speaking, it will only be necessary to bleed the one line. On the other hand, if an excessive amount of air has entered through the master cylinder or if the fluid in the system is of a doubtful quality, the entire system should be bled.



Brake System
Ford Passenger and Commercial Cars and Mercury Passenger Cars

Fig. 27

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Brake System—Regular and Cab-Over-Engine Ford Trucks
Fig. 28

A small amount of air entering the master cylinder will automatically bleed itself after the reservoir has been refilled.

Care of Hydraulic System

While braking systems of all Ford cars and trucks and Mercury and Lincoln-Zephyr passenger cars are similar in general design, there are a number of differences of interest to service stations.

All cars and trucks are now equipped with hydraulic service brake systems. The master cylinder is located under the steel flooring, with the reservoir filler plug accessible through an opening in the floor near the brake pedal. On Cab-Over-Engine trucks the filler plug is only accessible from underneath the truck, under rear edge of cab.

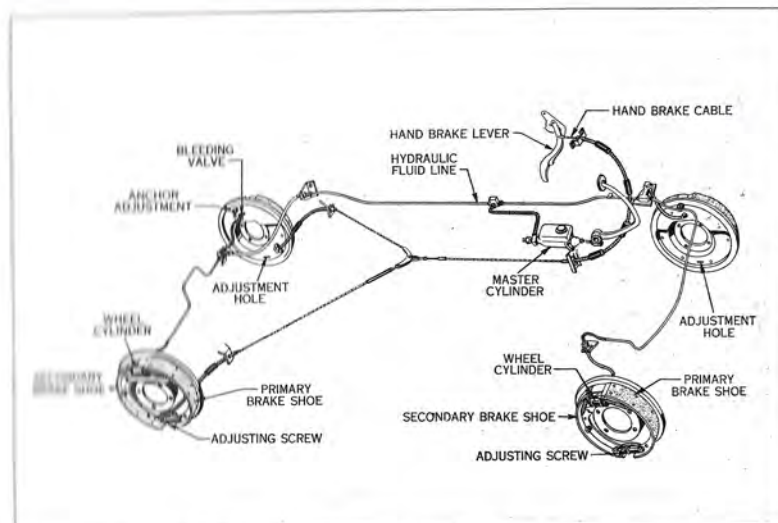
The brake system of Ford Passenger and Commercial cars and Mercury Passenger cars, is illustrated in Figure 27.

Figure 28 illustrates Regular and Cab-Over-Engine Ford Trucks. The 1-Ton is similar to Figure 27, except for hand brake lever position.

Figure 29 illustrates the brake system used on Lincoln-Zephyr Passenger cars.

The wheel cylinders are of the double piston type, each piston actuating one of the two brake shoes at each wheel.

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Brake System—Lincoln-Zephyr Passenger Cars
Fig. 29

The forward shoe exerts the most force in braking the car when moving forward. The rear shoe is most effective when the car is moving backward.

The handbrake lever on all vehicles, except the Regular and C.O.E. Trucks, actuates the service brake shoes on the rear wheels by means of steel cables. On Regular and C.O.E. Trucks, the handbrake lever operates a completely independent brake on the drive shaft.

Important

The master cylinder must be kept filled to within one-quarter inch of the top with brake fluid of the kind designed for brakes of this type. Ford brake fluid M-3833 is especially recommended, as other fluids may contain mineral oils or other materials which will injure the rubber parts in the system or have corrosive action.

Every 5000 miles, or each Fall and Spring, whichever occurs first, all fluid should be thoroughly drained (bled) from the entire system, and new fluid (Ford No. M-3833) added to refill.

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Before removing master cylinder filler plug to check level of brake fluid, be sure to clean all dirt away from around plug and away from floor opening as a small particle of foreign material may otherwise fall into reservoir when plug is removed.

Insufficient fluid in the reservoir will result in air getting into the hydraulic system, and eventually impair the effectiveness of the brakes.

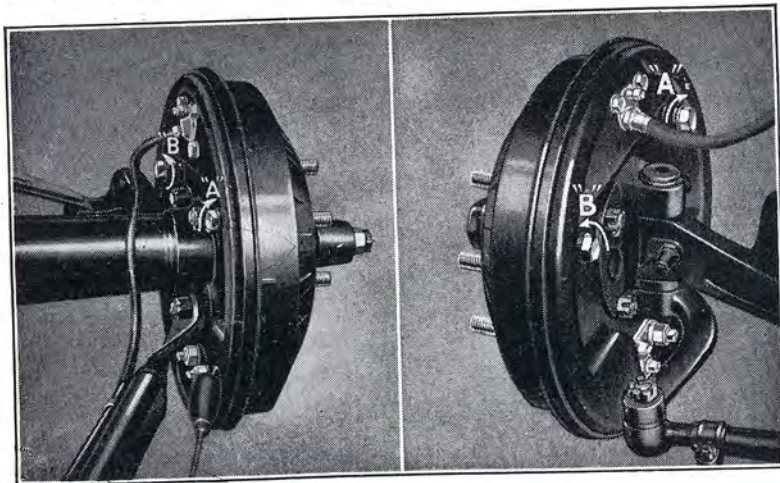
Air in the system will cause the brake pedal to become "spongy" in action, necessitating a "bleeding" operation to refill the system. This should be done only by qualified mechanics.

Brake Adjustment

To assure proper brake operation it is recommended that this important service be performed only by mechanics who have been trained on the servicing of these brakes. However, for the purpose of making an emergency adjustment, should the necessity arise, proceed as follows:

Ford Passenger and Commercial Cars and Trucks And Mercury Passenger Cars

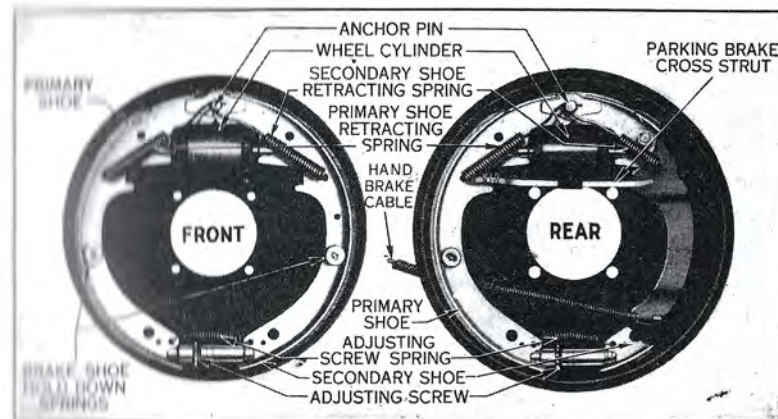
Make sure hand brake is in fully released position. Then at each wheel:



Ford Passenger and Commercial Car and Truck Brake Adjustment
Rear Brakes are shown on Left, Front on Right

Fig. 30

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Lincoln-Zephyr Passenger Car Brake Adjustment

Fig. 31

1. Jack up until tire clears floor.
2. Turn brake shoe cam adjusting bolt in direction of arrow "A" (refer Figure 30), until forward brake shoe is solid against the drum and wheel cannot be turned by hand.
3. Back off bolt slightly so wheel can be turned by hand without brake dragging.
4. Adjust the reverse brake shoe cam adjusting bolt in direction of arrow "B", (refer Figure 30).

While Figure 30 shows the Passenger Car brakes the same type of adjusting bolts are provided in all Ford Trucks.

Lincoln-Zephyr Passenger Cars

Make sure hand brake is in fully released position and then at each wheel:

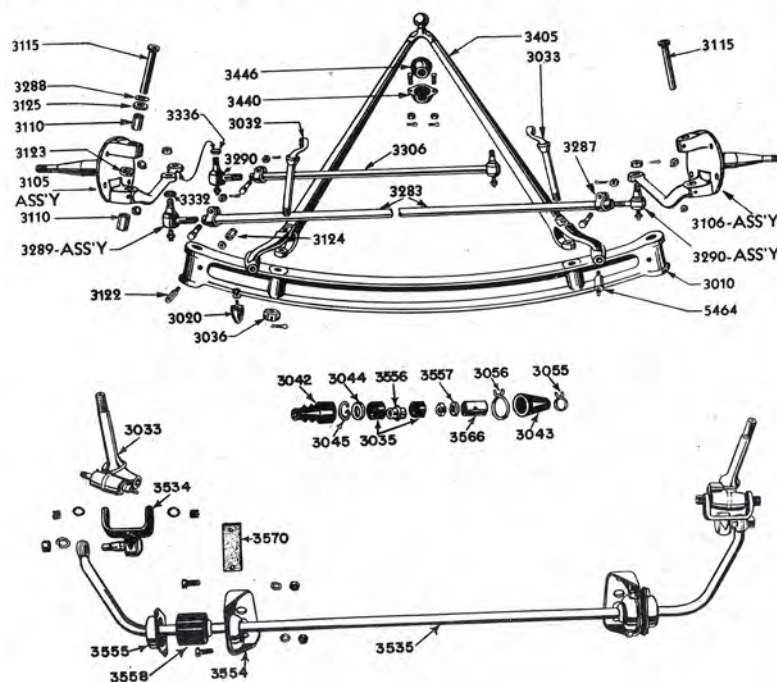
1. Jack up until tire clears floor.
2. Remove cover from adjusting hole in brake backing plate (refer Figure 29).
3. Use a screw driver through adjusting hole to turn adjusting screw (refer Figure 31), downward until a brake drag is noted when the car wheel is turned by hand.
4. Back off adjusting wheel 14 notches.
5. Replace adjusting hole cover and lower wheel to floor.

Service Handbook

FRONT AXLE

An I-beam type front axle is used on all Ford Passenger and Commercial cars and trucks and Mercury and Lincoln-Zephyr Passenger cars. Truck axles are of heavier construction and greater tensile strength than those used in passenger models. (Refer Figure 32).

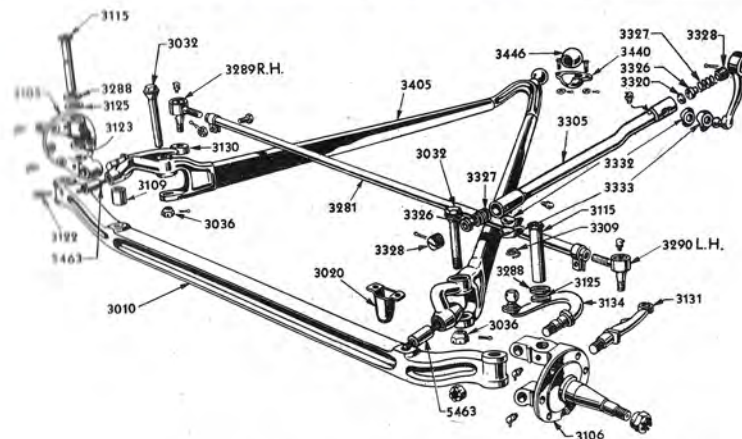
On all passenger and commercial cars the front axle is held rigidly in position by the radius rods and consequently caster angle which is built into the axle and radius rod will remain permanently correct unless either becomes bent through accident or abuse. With the exception of straightening the axle I-beam there is no



Car Front Axle Assembly—(Numbers illustrated are Basic Part Numbers)

Fig. 32

Service Handbook



Truck Front Axle Assembly—(Numbers illustrated are Basic Part Numbers)

Fig. 33

service necessary on the front axle or radius rod. If the axle I-beam becomes bent it may be straightened, cold, with the use of approved equipment for this purpose. The radius rod if bent or damaged should be replaced rather than repaired.

Truck front axles on models prior to 1939 were identical in design to those used on passenger cars and the foregoing information also applies to these models. These axles are illustrated in Figure 33.

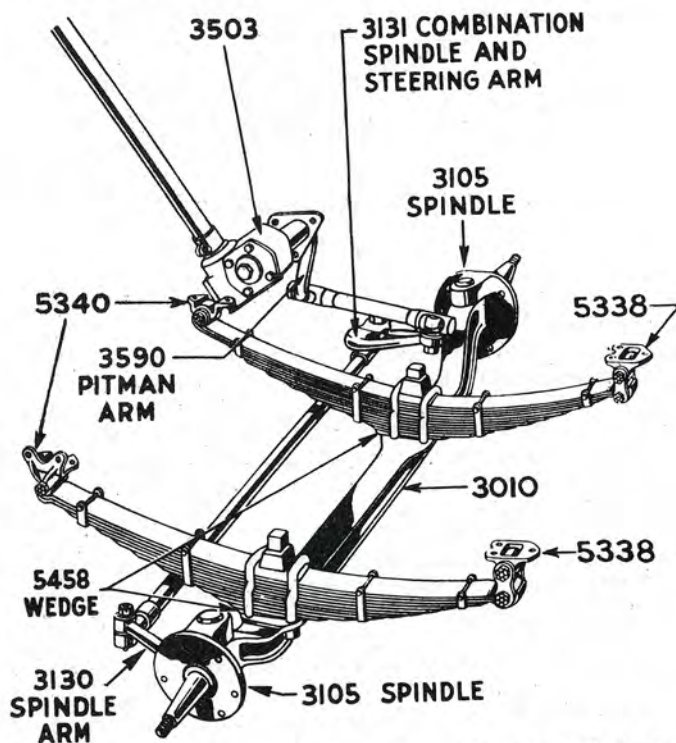
On 1939 C.O.E. model trucks and all 1940 and 1941 model trucks, longitudinal semi-elliptic type springs are used, as illustrated in Figure 34.

In this design the caster angle is retained through the correct location and assembly of the springs to the spring pads on the axle beam, and will remain correct unless the axle is bent due to accident or abuse, or unless the spring clamp nuts loosen, allowing the axle to shift on the springs.

Since the caster angle is maintained in the manner described above, it follows that compressing the front springs will change the caster angle. This is provided for, however, in the design of the axle and steering and will not affect operation unless the

springs take a permanent set or sag. Where this condition occurs replacement of the spring should be made with heavier springs, or additional caster wedges should be added between the spring and the axle. If caster wedges are being installed make certain the spring tie bolts extend through the wedge to anchor the spring in correct location on the axle pad.

Details of caster angle for different models will be found in specifications section.



Truck Front Axle Assembly—(Numbers illustrated are Basic Part Numbers)

Fig. 34

STEERING

Many factors enter into the steering control of cars and trucks and as a thorough understanding of these factors usually is not possible except as a result of study of the principles of steering geometry, no attempt will be made in the following paragraphs to enter into a discussion of such features. Rather, only those items requiring adjustment and periodic service will be dealt with.

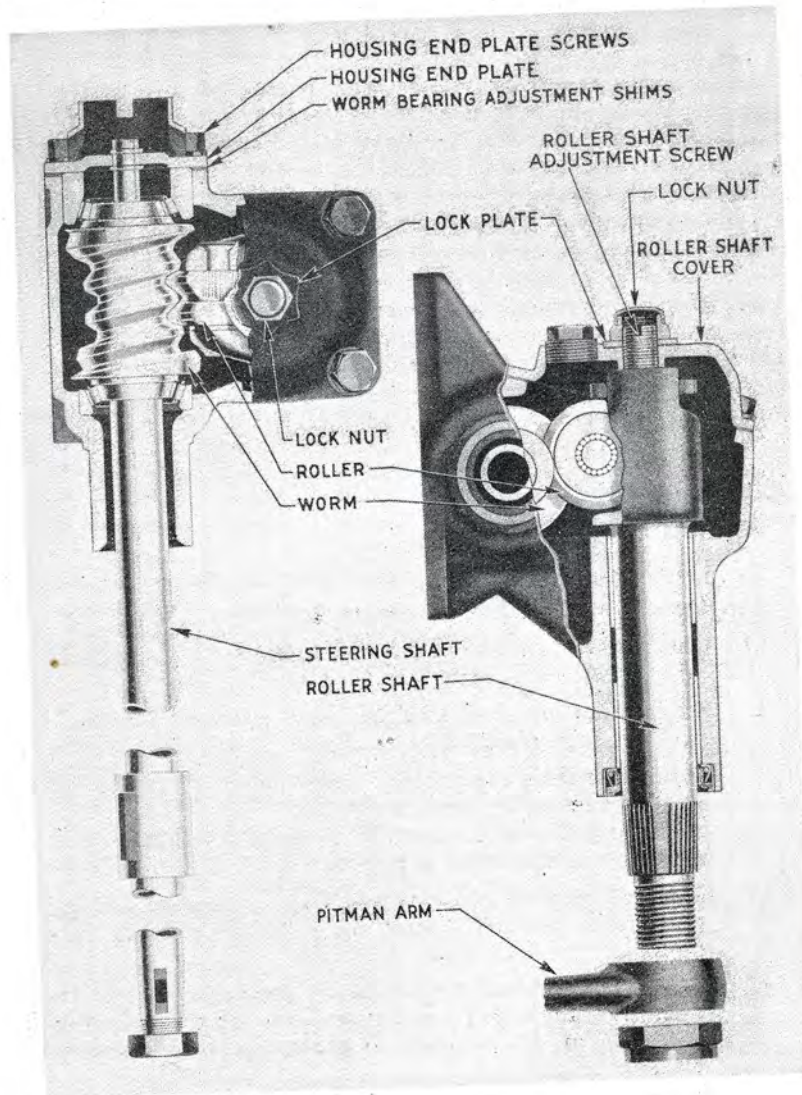
Steering Gear

A "worm and roller" type steering gear has been used on all Ford passenger and commercial cars and trucks and Mercury and Lincoln-Zephyr cars since 1937. This type of steering gear is illustrated in Figure 35.

Detailed instructions covering adjustment of the steering gear are outlined in the following.

Adjustment

- Jack up front wheels.
- Check tie rod, drag link, wheel bearings, etc. for looseness.
- Disconnect drag link at pitman arm end.
- Check steering wheel to be sure there is no binding. (See "Alignment of Steering Gear" if binding exists.)
- Set steering wheel in straight ahead position, remove lock nut and lock plate. (Refer Figure 35.)
- Turn roller shaft adjustment screw enough to remove excess play between roller teeth and worm.
In making this adjustment, it is important that play only be removed, and there is no unnecessary tightness.
- Replace lock plate and lock nut, making sure the lock plate is in locked position against the roller shaft cover, before tightening the lock nut.
- Turn steering wheel approximately one turn to right from straight ahead driving position and hold steering wheel with one hand in this position to prevent it from turning in either direction.
- Use the other hand to grip the steering column just below the steering wheel hub, so that side of index finger barely touches lower end of hub.



Steering Gear Assembly
Fig. 35

- J. While holding the steering column as above, have someone else move Pitman arm back and forth vigorously. This will enable any end play in worm bearing to be felt at steering wheel hub.

Be sure end play is felt and not confused with play or movement of steering column.

If end play exists, the worm bearings should be adjusted as covered below.

- K. With drag link disconnected set the front wheels in straight ahead position and steering wheel at mid position of its complete travel or turning limits (unless steering shaft has been twisted this will be at the centre locking position).

Adjust drag link so that it is exactly the right length to connect the steering arm and pitman arm without changing position of either front wheels or steering wheel.

- L. Road test car, making sure that steering wheel is at mid position, when car is traveling straight ahead and that all adjustments are O.K. Steering wheels have a mark on their hub indicating mid-position. This mark should be directly in front of the centre line of steering column when car is traveling straight ahead.

Alignment of Steering Gear

The steering gear is aligned by following the procedure given below.

Loosen both screws holding the steering column bracket to the instrument panel.

Loosen 3 screws that hold the steering gear housing to frame.

Tighten the bracket to panel screws.

Tighten the housing to frame screws.

This procedure should relieve any distortion or misalignment in the complete assembly.

Adjustment of Steering Gear Worm Bearings

Loosen four housing end plate screws, approximately $\frac{1}{8}$ " (refer Figure 35). Use a knife to separate the first shim, passing blade all the way around between shims, care being taken not to mutilate the remaining shims.

In production, the following size shims are being used in varying amounts .0025", .005", .010", according to the amount of readjustment required.

Remove only one shim at a time between inspections. Care should be taken not to set up stiffness in worm bearings.

Revolve steering wheel to determine if any stiffness exists. If stiffness is present, too many shims have been removed.

Removal of Pitman Arm

Whenever removing the Pitman arm it is important and necessary to use a Pitman arm puller. If a puller is not used considerable damage may be done to the worm and roller or other parts. Never use a hammer.

Steering Control

Other than the steering gear adjustment described in the foregoing paragraphs, there is little or no service which can be performed on the steering gear, with exception of "toe-in" adjustment as described below.

Checking the front axle for wheel alignment, caster, camber and king pin inclination are operations which should be performed only by trained men using approved equipment.

Toe-in Adjustment

The toe-in adjustment is accomplished by shortening or lengthening of the tie rod which single adjustment establishes toe-in adjustment for both front wheels. Toe-in specifications for various models are listed in specification section of this book.

Lubrication

Details of steering gear lubrication are shown on lubrication charts on pages 31 to 35 inclusive.

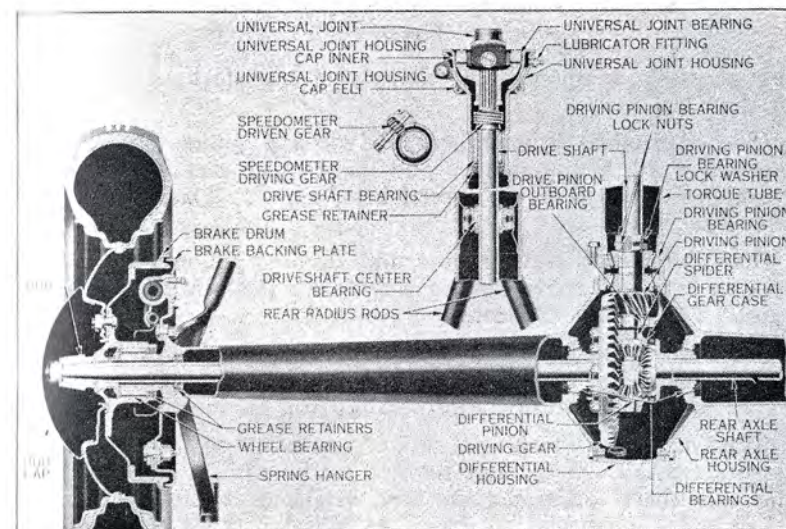
REAR AXLE

Types

All Ford passenger and commercial cars and Mercury and Lincoln-Zephyr passenger cars are equipped with a $\frac{3}{4}$ floating rear axle incorporating full torque tube drive.

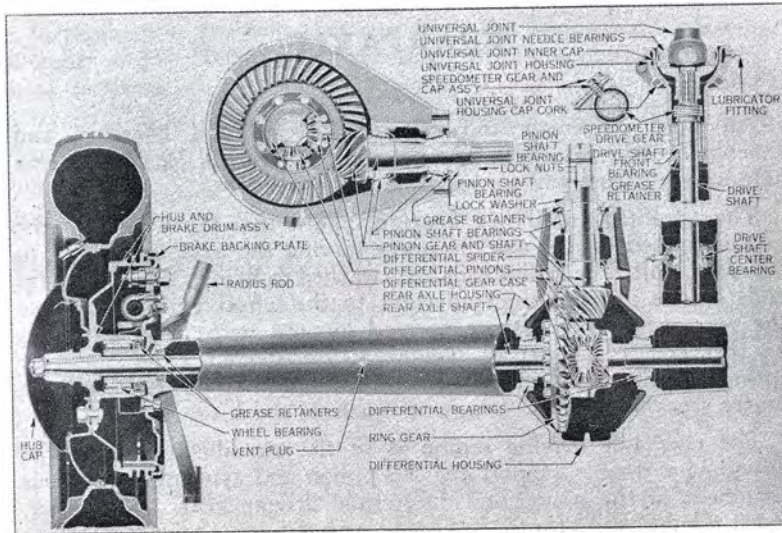
The advantage of the $\frac{3}{4}$ floating type is that the weight of the unit is carried on the axle housings leaving the axle shafts free to drive the unit. The radius rods are attached to flanges near the outer ends of the axle housings adjacent to the wheel bearings. Since the rear spring perches are formed integral with the outer ends of the axle housings, all weight is transferred from the rear spring to the outer ends of the housings, thereby relieving the centre section of the housings of much of the load.

The rear axle driving pinion is of the straddle mounted type providing a double support for the pinion and assuring continuous alignment of the pinion and differential driving gear. The differential side gears are forged integrally with the axle shafts eliminating



Rear Axle Assembly—Ford Passenger and Commercial Cars and Mercury Passenger Cars

Fig. 36



Rear Axle Assembly—Lincoln-Zephyr Passenger Cars
Fig. 37

the necessity of splines and simplifying manufacture and repair of the axle.

The differential driving gear and driving pinion on all axles used in Ford V-8 passenger and commercial cars and Mercury passenger cars, are of the "spiral bevel type". This axle is illustrated in Figure 36.

The differential driving gear and driving pinion on all axles used in Lincoln-Zephyr passenger cars since 1938 are of the hypoid type. This axle is illustrated in Figure 37.

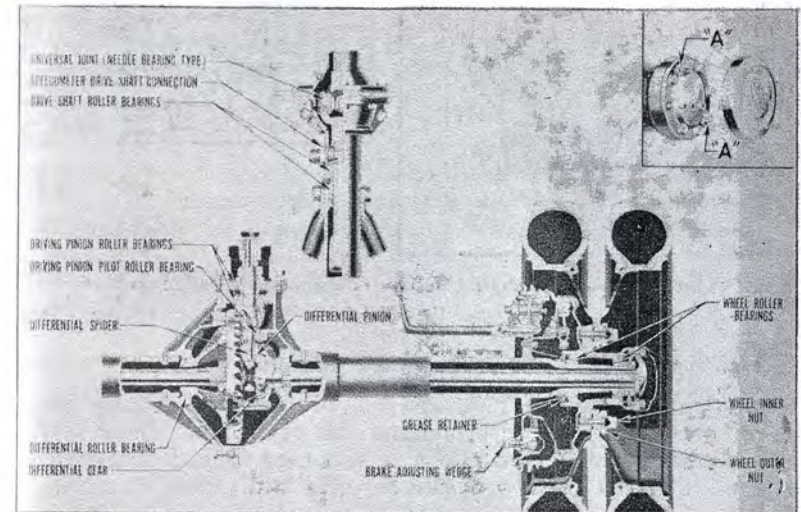
All Ford trucks produced from 1934 to 1939 inclusive, excepting 1939 model 3-ton units, were equipped with the full floating spiral bevel gear type rear axle incorporating full torque tube drive.

With this type of axle all weight carried on the rear spring is transferred through the axle housing to the wheels. This relieves the axle shafts of supporting any weight or taking end thrust. Their sole function is to drive the wheels. Thus they are not subjected to bending stresses so possibility of axle shaft failure is extremely remote. Should a shaft fail the wheel cannot come off because it is mounted on bearings on the outside of the axle

housing. The truck and its load can be towed. An axle shaft can be replaced without jacking up the truck or taking the axle apart.

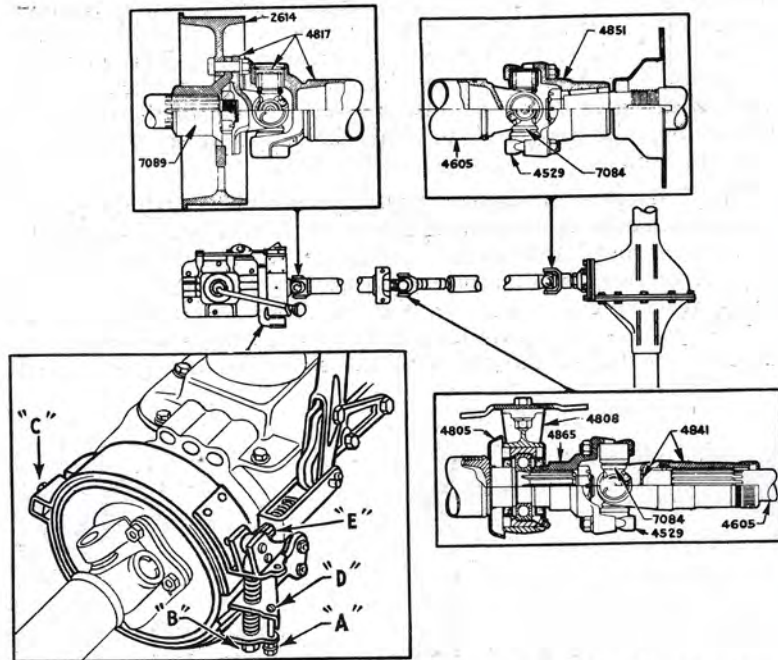
An important feature of Ford full floating axles which contributes to their high power transmitting efficiency, is a straddle mounted pinion. There are two large tapered roller bearings oppositely positioned in front of the pinion and another roller bearing in back of the pinion for extra support. This prevents the pinion from springing away from the ring gear when driving strain is excessive. A bronze thrust plate in back of the ring gear directly opposite the pinion prevents the ring gear springing away from the pinion.

The differential is supported on tapered roller bearings placed at equal distances from the ring gear so as to distribute load equally on each bearing. Differential spiders are fitted with four pinions in place of two, as is customary on many axles. Axle shafts are forged from special manganese steel and have a tensile strength of 180,000 pounds per square inch. Axle shaft flanges which bolt to the hub are forged integral with the shaft eliminating the need



Truck Rear Axle Assembly
Fig. 38

for splines which might wear and in time cause looseness. Adapters or washers with tapering sides are used on each axle flange stud. They wedge between the studs and the flange and thus prevent looseness and wear. Wheel hubs are mounted on tapered roller bearings.



Truck "Open" Type Driveshaft (Numbers illustrated are Basic Part Numbers)
Fig. 39

This type of rear axle is illustrated in Figure 38.

1940 and later model trucks are equipped with full floating spiral bevel gear rear axle incorporating an open type drive shaft. A straddle mounted type pinion is also used to maintain perfect alignment of the differential driving gear and pinion.

This type of axle, with the exception of the open type drive shaft, is identical to that used in 1934 to 1939 models inclusive and which is illustrated in Figure 38.

On trucks equipped with the open type drive shaft, with the exception of $\frac{3}{4}$ and 1 ton models, the hand brake is mounted on the rear of the transmission main shaft and brakes the rear wheels through the drive shaft and rear axle. For this reason it is extremely important to prevent damage to the truck and also the possibility of personal injury, that both a front and a rear wheel be blocked to prevent movement of the truck whenever a wheel or hub is being removed. Otherwise even with the hand brake applied, forward or backward movement of the truck would be possible through the differential driving gears.

The open type drive shaft, as well as the mounting of the hand-brake on the rear of the transmission, are illustrated in Figure 39.

On 1939 to 1941 model 3-ton trucks, a two speed axle is used. With a two speed axle there are available eight forward speeds and two in reverse. This provides gear ratios to fit various load and road conditions resulting in greater economy of operation.

This two speed axle is of the full floating type with straddle mounted pinion and other features of design similar to the full floating truck axle, except that a simple planetary gear train is used to obtain double reduction for the lower ratios. Special axle shafts having a greater tensile strength are also used.

Repairs

As considerable special equipment is required for disassembling and reassembling rear axles, it is recommended repairs should be performed only by competent repair men having the necessary equipment.

Lubrication

Details of rear axle lubrication are outlined on page 30, and on lubrication charts on pages 31 to 35 inclusive.

FRAME

Ford Passenger and Commercial Cars And Mercury Passenger Cars

The frame of the Ford V-8 passenger and commercial cars and Mercury passenger cars embodies many features of design which add to its rigidity and in turn aid in minimizing body flexure, besides improving steering, steadiness and car control. The X-members are continued the full length of the frame channels which retain the wide spacing they have at the rear of the chassis to a point well forward on the frame, providing a substantial support for the body under the driver's seat. This also gives added stiffness at the ends of the frame and assists toward ensuring steering steadiness. In addition to the full length of the X-members from the points where they meet the side channels to the spring cross members, they form box sections of exceptional stiffness.

The front cross member is large and rigidly attached to the side channels. Extensions from this member provide strong support for the radiator. Side members on Club Convertible and Station Wagon models are of a heavier type than used in closed passenger cars.

On 1941 models frame rigidity is further increased by a 9" deep box centre section welded into the "X" member and the use of four channel section braces between the frame "X" member and side members.

Lincoln-Zephyr Passenger Cars

Lincoln-Zephyr closed body construction is a distinct departure from conventional design. There is no separate chassis, or body. A single unit, designed as an integral whole, replaces the two. This unit-body-and-frame embodies the kind of construction used in what engineers call "rigid structures", such as bridges, airplane fuselages, the Marconi tower and the much discussed light-weight streamlined railroad trains.

In such rigid structures, numerous strong, light pieces, arranged in the form of trusses, are used instead of a few heavy and bulky members. With the same total weight, much greater strength can be obtained. "Stress analysis" makes it possible for engineers to predetermine the exact size of every individual piece within the structure in order to sustain a certain load. The load that each

piece must carry—with an ample margin of safety—is accurately calculated long before the structure is built.

The unit-body-and-frames of Lincoln-Zephyr closed types are built on exactly the same principles—assemblies of individual members welded together into strong units. Many light pieces of steel have been assembled by welding into a virtual bridge, which is far stronger than when single beams or frame side-members are used.

The result of body construction of Lincoln-Zephyr closed types is that their inherent strength is greater. They are more capable of resisting any of the forces to which an automobile body may be subjected.

Here is another very important point, Lincoln-Zephyr closed body models are really cradled between the axles. This applies to the whole car and not just the body or frame as might be the case in a conventional type vehicle.

Since the body structure—which also constitutes the chassis—is technically a "rigid structure", the entire assembly moves as a unit when the car passes over road irregularities. There is virtually no deflection and no bending of any portion of the body. It is mounted on the springs only at two points, which further diminishes twisting stresses.

This truss-type unit-body-and-frame is one of the most important features of the Lincoln-Zephyr cars.

Trucks

All $\frac{3}{4}$, 1, $1\frac{1}{2}$, 2 and 3-ton Ford truck frames have the same general rugged design. Frame material (except in 176" 2 and 3-ton trucks) is medium high carbon pressed steel with an elastic limit of 42,000 pounds per square inch. The 2-ton 134" dump truck, 194" school bus chassis, and all 3-ton truck frames, except the 101" C.O.E. model, are heavily reinforced. Frame side member material in the 176" 2 and 3-ton truck is special high tensile steel alloy having an elastic limit of 54,000 pounds per square inch. The frame is also reinforced.

All side members are deep, of heavy gauge and have wide flanges. Frame cross members also are made from heavy gauge steel and are designed for high strength. A sufficient number of cross members are used on each chassis to ensure high rigidity and exceptional reliability.

Frame side members on the 101, 134, 158, 176 and 194 inch chassis are straight along the top. Those on the 122 inch chassis

have a slight kick-up (2") over the rear axle to secure lower loading height.

Frame reinforcements are inside channels .13" thick, of high tensile steel alloy with an elastic limit of 54,000 pounds per square inch. They are securely welded to the inside of the frame side member and extend from the front spring rear hanger to 10½" past the rear spring front hanger, the frame reinforcement therefore being in the zone of greatest stress.

SPRINGS

Passenger and Commercial

Transverse type front and rear springs are used on all passenger and commercial cars. On all models 1935 to 1941 inclusive, the front spring is mounted ahead of the front axle and the rear spring mounted back of the rear axle. This provides a longer "spring base" than the wheelbase of the car. One of the major advantages of transverse springs is the reduction in unsprung weight.

Trucks

Transverse type front springs were used on all trucks 1934 to 1939 inclusive with the exception of 1939 C.O.E. models. On these latter models, and on all later model trucks two longitudinal front springs of the semi-elliptic type are used.

The use of this type of spring facilitates servicing of the engine since it simplifies removal of the engine oil pan, makes the crankcase more readily accessible and thereby reduces the time required to perform such service operations. Figure 34 page 60 illustrates longitudinal semi-elliptic type springs.

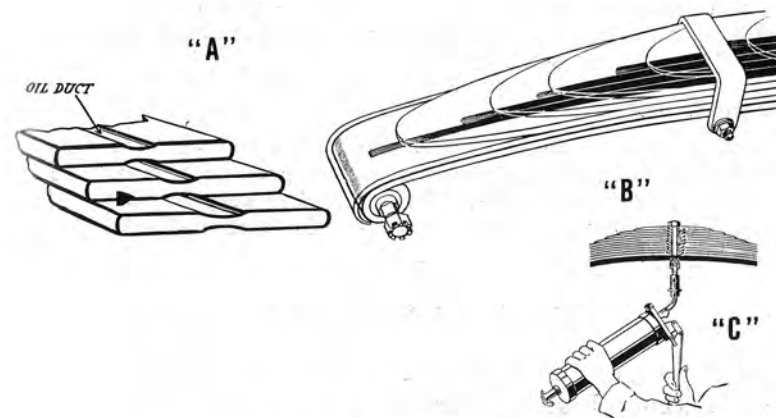
Rear springs of all truck models are the semi-elliptic type mounted lengthwise of the chassis on the outside of the frame side members.

Auxiliary springs when used on the heavier model trucks provide reserve capacity for heavy loads. This makes it possible to have sufficient flexibility in the main rear springs to produce good riding qualities of the unit when lighter loads are carried.

Lubrication

The transverse type front and rear spring assemblies as used on all passenger and commercial cars are designed to permit pressure lubrication. Illustration "A" Figure 40, shows in detail the lubricant grooves provided in the spring leaves while illustration "B"

Figure 40, shows the length of the grooves in the various leaves which ensure lubrication of the entire length of each spring leaf. Illustration "C", Figure 40, shows the course of the lubricant through the lubricator fitting, the slots in the tie bolt nut and spring leaves and then along the grooves in the leaves.



Method of Spring Lubrication

Fig. 40

This is the direct opposite of the conventional method of spraying springs on the outer edges of the leaves and is one of the major features contributing to the riding quality of the springs.

The specifications of M-4628-B Ford spring lubricant were adopted to ensure thorough lubrication and maximum spring efficiency. The talcum in the lubricant prevents the oil from being forced out between the leaves while the asbestos is intended to fill low spots on the leaves and act as an anti-friction medium. As tests and experiments have proven conclusively that M-4628-B Ford spring lubricant is most suitable, it is essential that only this lubricant or its equivalent, purchased from reputable suppliers, be used for lubricating these springs. Other types of lubricants are unsuitable, will not provide correct lubrication and will in all probability considerably reduce the spring efficiency.

All springs used on all truck models are lubricated by spraying with penetrating oil. It is advisable to ensure thorough lubrication,

to periodically remove the weight of the body and chassis from the springs (by lifting front or rear of the body with a hoist), which will permit easier penetration of the lubricant between the leaves.

Spring shackle studs used on all passenger and commercial cars are of the oilless type and require no lubrication, while those used on most truck models are provided with lubricator fittings. For details of lubrication of the latter, refer to lubrication charts on pages 33 to 35 inclusive.

Spring Covers

Both front and rear springs on 1940 Ford Deluxe, 1941 Super Deluxe, and Mercury passenger cars are equipped with metal covers for better retention of spring lubricant and to keep out water and dust. They thus assist in maintaining the ease and smoothness of spring action.

RIDE STABILIZER

Ford Passenger and Commercial Cars And Mercury Passenger Cars

All 1940 and later model Ford and Mercury passenger cars and some 1940 model Ford commercial cars, are equipped with a new design ride stabilizer. This stabilizer consists of a flexible heat-treated bar mounted transversely at the forward end of the chassis frame, ahead of the front axle. The bar extends across the chassis frame and is attached to both side members with steel brackets. Rubber bushings are used in the brackets. The ends of the bar extend rearward and are supported in swivels fastened to the front axle.

The purpose of the ride stabilizer is to minimize roll and side sway on turns, to stabilize the forward end of the car when driving in a stiff quartering wind, and to provide more firm steering control and riding comfort over rough, choppy roads. As long as both ends of the front axle move up and down equally, the bar remains inactive, the ends merely moving up and down equally. But when one wheel drops into a rut or rises over a bump, the bar must "wind-up" or twist offering a restrictive or torsional reaction, and at the same time tending to make the other end of the axle rise or fall similarly. This reduces the amount of unevenness between the two, so that the front end of the car remains in a more level

position and does not sway from side to side as much as it would without the bar. The action is similar when the car rounds a turn, the bar tending to prevent the car from swaying sidewise, keeping it more nearly level regardless of the speed of the car. The bar also permits use of the vertical spring shackles employed with the new longer front spring, since it supplies the necessary sidewise stabilizing effect, which the angle mounted shackles previously provided.

Lincoln-Zephyr Passenger Cars

Two stabilizers are used on Lincoln-Zephyr cars. A transverse stabilizer is connected between the body-frame unit and the front axle. Its purpose is to prevent side movement of the front axle from affecting steering. In addition to the transverse stabilizer, a torsion-bar type anti-sway stabilizer is used. It consists of a flexible heat-treated steel bar mounted crosswise of the body-frame unit ahead of the front axle with arms extending rearwards. The arms are connected to the front axle by two links. Rubber bushings are used in the brackets attaching the bar to the side channels of the body-frame unit. This stabilizer reduces sidesway and improves the riding qualities of the car. The two stabilizers combine their action to provide complete control of front axle movement and to minimize the effect of cross winds, sharp turns or rough, choppy roads on either steering control or riding comfort.

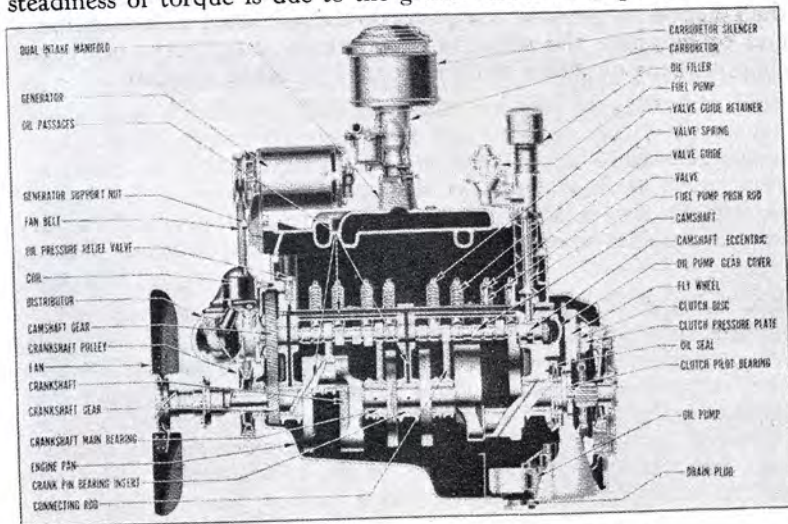
ENGINE

Ford consistency in design is fully manifest in similarities between the 85 h.p. and 95 h.p. V-8 engines and Lincoln-Zephyr 12 cylinder engines. They are all similar in basic design. All embody the many exclusive features that have been responsible for making these types of engines economical to operate and to maintain. Only in their relative sizes are there any important differences between them.

Although the 85 h.p. engine has the same basic design as when introduced, improvements have been made continually in materials, in manufacturing processes, and in auxiliary units such as carburetors, distributors, water pumps, generators and starters. All such changes have resulted in improved economy—fewer maintenance requirements—better performance and longer life.

Why Eight and Twelve Cylinders?

An eight-cylinder or twelve-cylinder engine produces a steadier, smoother flow of power than engines with fewer cylinders. This steadiness of torque is due to the greater number of power strokes

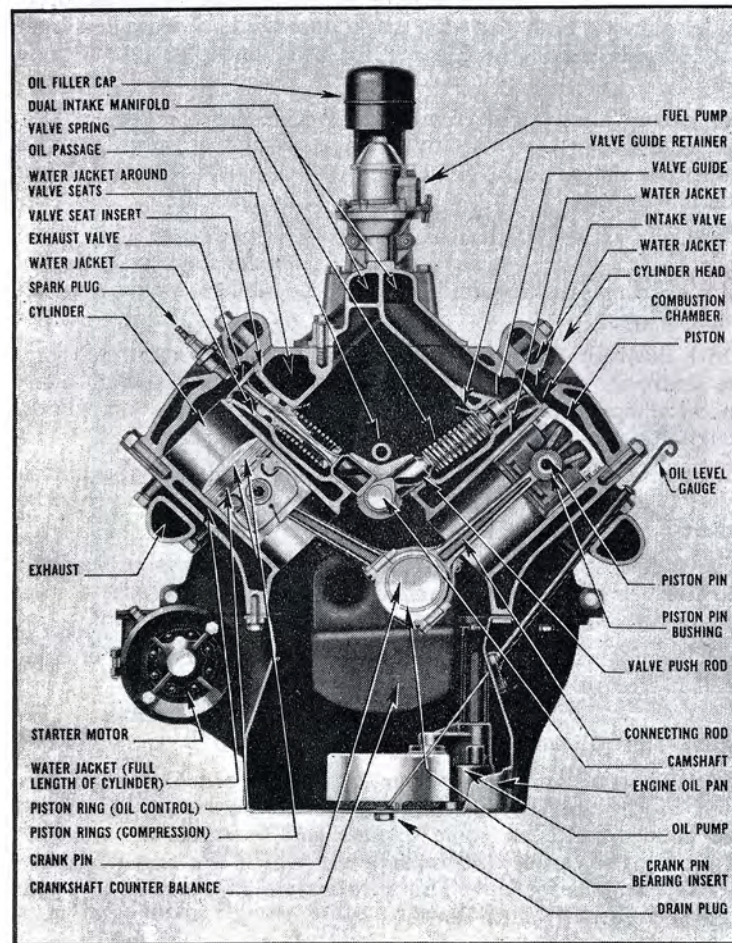


Longitudinal Sectional View of 85 h.p. Engine

Fig. 41

[76]

per revolution. Each succeeding power impulse starts long before the previous one has ended. Thus the power impulses are overlapping.



Cross Sectional View of 85 h.p. Engine

Fig. 42

[77]

Why a V-Type?

V-type engines are compact. They make it possible to have more cylinders in a shorter engine length. This is an important consideration in both car and truck operation, because less space for the engine means more space for body and passengers, or for pay-load.

For example, in the 85 h.p. Ford V-8 engine the crankshaft is only 26.03" long, yet has an average weight of more than 2.5 pounds per lineal inch, which means exceptional strength and rigidity.

The short crankshaft has less tendency to twist and whip than a longer shaft. Being more rigid it is subject to less deflection. Fewer bearings are required and the possibility of bearing misalignment is reduced.

Dual down-draft carburetor and dual intake manifold assure more uniform distribution of fuel to the cylinders—an aid to economical operation. Each carburetor throat feeds four cylinders through its own separate intake manifold.

Because of the V-type design the Ford eight-cylinder and Lincoln-Zephyr twelve-cylinder engines develop higher power in proportion to their overall weight.

The fact that a type of engine that formerly was expensive to build has been made simple and economical to operate, is a recognized engineering achievement.

Longitudinal and cross sectional views of the Ford V-8 engine are illustrated in Figures 41 and 42.

Engine Torque and Horsepower

Engine torque and horsepower rating of Ford V-8 engines are shown in the specification section of this book. In addition to these figures, however, some owners and operators are interested in knowing the torque and horsepower which the engine develops at various engine speeds. This information in chart form is illustrated in Figures 43 and 44.

Engine Torque

Engine torque is the amount of twisting force produced by an engine. The unit of measure is the pound-foot which represents the force of one pound acting in a circular direction on the end of

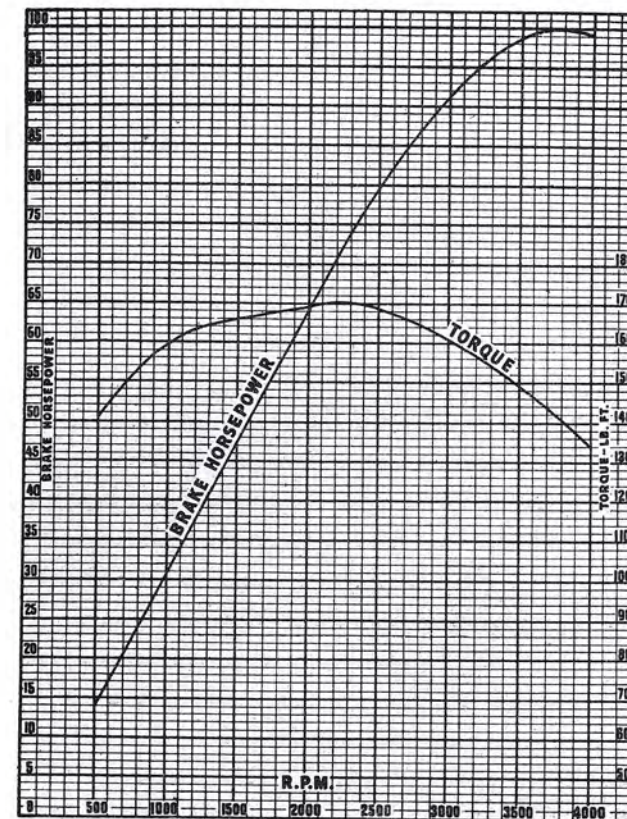


Fig. 43

an arm one foot long. The machine used for measuring engine torque is a dynamometer. The curves in Figures 43 and 44 show the amount of torque produced by the engines throughout their speed ranges. Torque figures in pounds-feet are shown on the right hand vertical scale and engine revolutions on the horizontal scale at the bottom of the chart.

Horsepower

Horsepower is the measure of the rate at which engine torque is produced—the time rate of doing work. One horsepower is

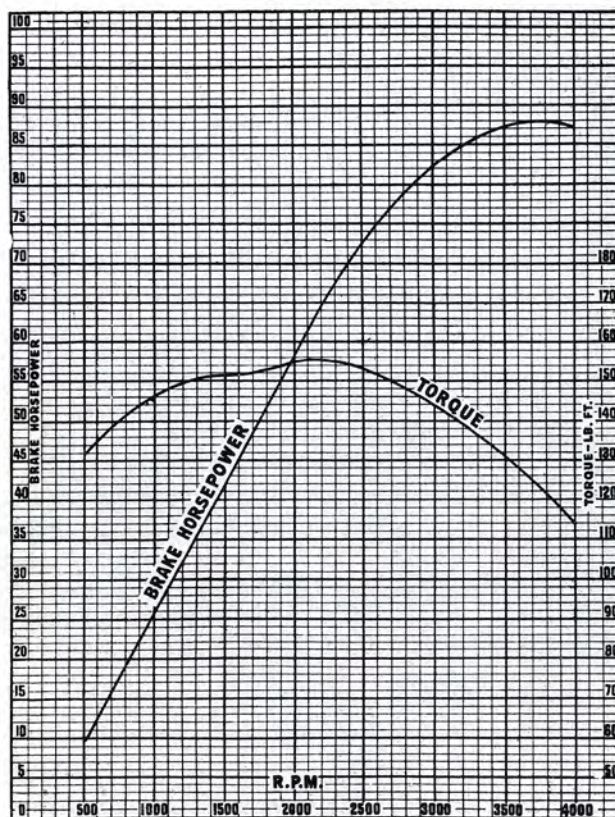


Fig. 44

the effort required to do 33,000 pounds-feet of work in one minute (to lift 33,000 pounds one foot in one minute). Horsepower is determined from engine torque and the speed at which it is developed.

Starting the Engine

Be sure that the gear shift lever is in neutral position.

Depress accelerator pedal slightly.

Turn the ignition switch lever "ON". Press starter button on lower left side of instrument panel and, if the engine does not

instantly start, pull out the choke control located on the instrument panel. While the engine is cranking, push choke control in until it is about three-quarters open.

The engine will usually start in a few seconds. Longer periods of cranking with choke button out should be avoided as the engine may be flooded in which case it is necessary to pull the hand throttle button all the way out and crank the engine with the switch still on. When the engine starts, release the starter button and close the throttle at once. Then move the choke button to a point which gives the smoothest running position. The choke button should be pushed all the way in as soon as the engine runs smoothly.

In extreme cold weather it is advisable to keep the clutch released until the engine starts. By keeping the clutch released while the engine is cranking, the starter motor is relieved of the extra load resulting from turning the transmission gears in the stiffened lubricant. When starting the engine the choke button may be kept fully out until the engine starts as the auxiliary valve in the choke butterfly will open and permit sufficient air to enter so that the engine will continue to run. However, as soon as the engine starts the choke should be pushed into best running position. When the engine runs smooth it should be pushed all the way in.

Engine Performance

Many contributing factors enter into the operation of the engine, and when endeavoring to correct the performance of the engine, it is necessary to take into consideration everything that may affect performance.

Such a condition as a weak spark at the spark plugs might indicate a faulty coil. However, the voltage of the car battery, the condition of the breaker points or condenser, the insulation of the various high tension wires, all must be taken into consideration before the coil is condemned, as their faults, if any, will reflect in the lowered output of the coil.

Such features as soft tires, wheels out of alignment, dragging brakes, chassis not properly lubricated, incorrect wheel bearing adjustment, all add to the load on the engine, and these points must be taken into consideration in tuning up your car.

Engine Trouble on the Road

If the engine doesn't start it is probably due to one of the following causes: The engine has been flooded with gasoline, the ignition system is failing to provide a spark at the spark plugs, or gasoline is not reaching the carburetor.

If the engine is flooded, pull the throttle button all the way out. Without turning on the ignition switch, crank the engine for 30 seconds with the starter to exhaust the rich gases.

To determine whether or not a spark is being delivered to the spark plug, hold spark plug wire approximately $\frac{1}{4}$ inch away from the cylinder head as the engine is cranked with starting motor. If a spark is noted from each of the wires, the trouble is not likely to be with the ignition system.

If sufficient gasoline is not reaching the carburetor the trouble is probably due to some obstruction in the fuel line, or the supply is low. Remove the fuel pump cover and clean the screen and sediment chambers.

Engine Tune-up

The many factors affecting performance all must be taken into consideration if peak performance is to be obtained. This is only possible if a planned procedure which takes all of these factors into consideration is followed. In addition to the consideration of each factor affecting performance, it likewise is important that they be considered in their proper order.

A good example of this would be if the coil output were tested first, the test would be apt to indicate a defective coil while actually the cause of the lowered output of the coil would be caused by the battery connection.

The condition of the coil can only be judged after those factors affecting its output are known to be correct.

The following procedure has been so arranged that where one factor affects the performance of some other unit that factor is corrected before the unit affected is tested.

Tune-up Procedure

- Install fender door and seat covers.
- Check compression of each cylinder. All spark plugs must be removed and the throttle must be wide open when this test is being made. Crank the engine with the starter until

the needle on the compression gauge stops advancing. If a variation of more than 10 lbs. compression is indicated on one or more cylinders, then cover the top of the piston with oil to seal the piston rings and re-test. Turn the motor with the starter for three or four seconds after injecting oil in the cylinder before inserting gauge to recheck compression. If this procedure has corrected the reading the loss of compression is at the rings. If this procedure has not corrected the reading the trouble is at the valves. As you cannot satisfactorily tune an engine with low or uneven compression, this test should invariably be made before the customer leaves your premises, so that he can authorize any additional work necessary.

Normal compression for all engines is determined by the following formula—

Atmospheric pressure multiplied by (×) compression ratio plus (+) atmospheric pressure.

Atmospheric pressure is variable depending on altitude, and the chart illustrated in Figure 45 should be used in determining correct atmospheric pressure.

For example—atmospheric pressure at 2000 feet is 13.5, thus normal compression would be computed by multiplying 13.5 by 6.3 and adding 13.5 ($13.5 \times 6.3 + 13.5 = 98.55$).

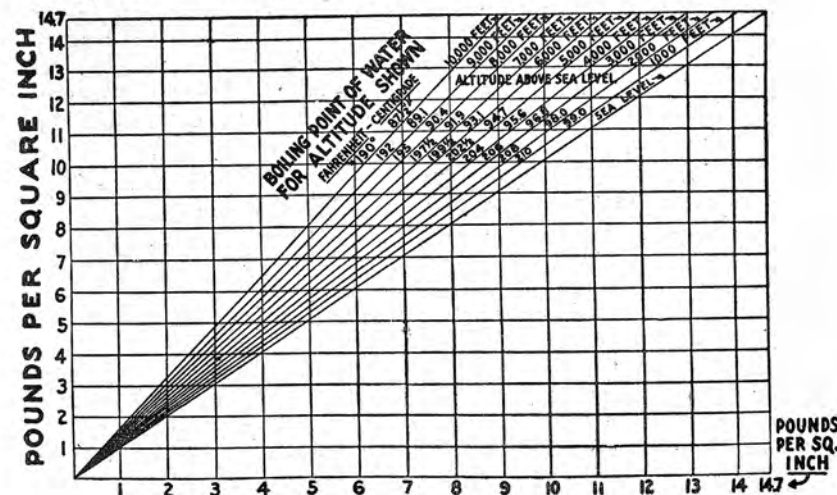


Fig. 45

Any reading below normal can be corrected. Good judgment, however, should be used when making your recommendations. A variation of not more than 10 lbs. compression between individual cylinders is not usually detectable in the operation of the engine.

A reading of 10 lbs. or more over normal indicates excessive carbon which has increased the compression ratio and will probably cause pinging.

- (c) Remove and clean spark plugs on suitable cleaner.
- (d) Set spark plug gap at .025" for Ford V-8 engines—.028" to .030" for Lincoln-Zephyr engines. On 1941 model trucks set spark plug gap at .032". **No more no less.**

In setting spark plug gap never bend centre electrode. The gap between spark plug points will increase under normal driving conditions approximately .001" to .0015" for every 1000 miles of driving. An increase of more than .003" over manufacturer's specifications is detrimental to engine performance, and to the distributor, coil and condenser. Spark plugs should be cleaned, checked and adjusted every 3,000 miles in the case of heavy duty truck service or high speed passenger car use. Every 5,000 miles when operated generally below normal highway speeds.

- (e) Test spark plugs to determine if they will fire evenly under high compression. (It is essential a fully charged battery be used when making tests.) Spark plugs with gap correctly set should fire evenly under 120 lbs. air pressure. The efficiency of the spark plugs may be determined by referring to the schedule shown below:

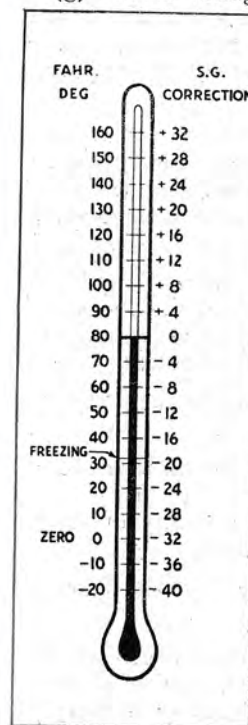
If Spark Plug Fires Evenly at Maximum Pressure of—	Spark Plug is % Efficient
120 lbs.	100%
115	95
110	90
105	85
100	80
95	75
90	70
85	65
80	60
75	55
70	50

- (f) The battery which is the heart of the ignition system, also connections, must be in perfect condition if maximum engine performance is to be obtained.

Clean top of battery and battery connections including both ground straps.

Test specific gravity of electrolyte. When checking gravity it is important the temperature of the battery be taken into consideration. Refer to battery temperature correction chart, illustrated in Figure 46.

- (g) Check voltage of each cell.



Battery Temperature
Correction Chart

Fig. 46

Check high rate discharge of each cell. Poor battery connections create resistance in the circuit between the generator and battery. This condition will cause the generator voltage to increase until the resistance is overcome. This increased voltage may result in any or all of the following conditions.

1. Shorten the life of lamp bulbs.
 2. Cause burning and pitting of the distributor points.
 3. Cause overheating and thereby shorten the life of the generator armature.
- (h) Remove the distributor and inspect breaker points. If points are badly burned or pitted they should be replaced. (Do not replace distributor points unnecessarily.)

Premature failure of distributor points is usually attributable to:—

1. Faulty condenser or the condenser being improperly grounded.
2. Poor battery connections.
3. Incorrect spark plug gap.

Set breaker points to the correct gap. On 1932-1936 model Ford V-8 distributors set the gap to .012" to .014". On 1937 and later model Ford V-8 distributors, and all Lincoln-Zephyr distri-

butors: set the gap .014" to .016". Be sure the advance lock screw is tight and the coil assembled tightly to the distributor housing, when making this adjustment, otherwise a false reading will result.

Test breaker arm spring tension. 22 to 27 oz. is correct for all Ford V-8 engine distributors—20 to 24 oz. for Lincoln-Zephyr distributors. On distributors having separate breaker point springs, it is advisable to replace the breaker points rather than endeavor to correct by bending the springs.

Time the distributor using distributor timing fixture. The distributor cannot be accurately timed unless a distributor timing fixture is used and it is essential that this operation be performed by a trained individual having the required equipment.

Check the condenser for short circuit using a 110 volt circuit test lamp. (Condenser may be checked in this manner only for a short circuit. The efficiency of the condenser may only be checked with the use of a Laboratory Test Set or similar equipment.)

Connect the negative wire to the coil terminal and the positive wire to the base of the distributor at the condenser ground lug location. Allow to stand for five minutes to raise the temperature. (Use a fully charged battery.)

NOTE—Proceed with Operation "J" while the coil temperature is rising.

Test the coil by grounding screw driver on the base of the distributor, holding the screw driver tip $\frac{3}{8}$ " from rotor tip. Rotate distributor shaft and watch intensity of spark. If weak, the condenser should be replaced.

Recheck and if not O.K. replace the coil. If the spark is still weak replace the rotor and recheck.

The foregoing procedure covers individual check of the condenser, coil and rotor. In proving which is at fault one or more parts may have been replaced unnecessarily. Original condenser and coil may now be rechecked by reversing the procedure and rechecking alternately with new condenser and coil.

Lubricate distributor cam and vacuum brake using M-4601 special Ford distributor cam lubricant.

- (i) Install distributor on motor and check wiring. Start motor and hold spark plug wire $\frac{3}{8}$ " from the cylinder head. If spark occurs regularly with motor operating at a speed equivalent to 8 m.p.h., the wire is O.K. Make this same test on all wires. If spark is found to be weak or missing on any one wire, cross with the next wire on the distributor plate. Connect No. 1 to No. 2 position and No. 2 to No. 1 position. If No. 2 wire is O.K. on No. 1 terminal plate, then No. 1 wire should be removed from the conduit and checked separate from the conduit for broken or weak insulation. The same method of cross checking may be applied to all wires. (Both wires used in cross checking must be disconnected from plugs.)

Contact points on the distributor terminal plates and the distributor rotor, also spark plug wire terminals and distributor terminal plate contact point sockets, should be free from corrosion.

- (j) Drain the sediment from the fuel pump.

Remove and clean fuel pump screen.

Inspect fuel pump cover gasket before reinstalling cover. This is important as a perfect seal is required at this point if the fuel pump is to function satisfactorily.

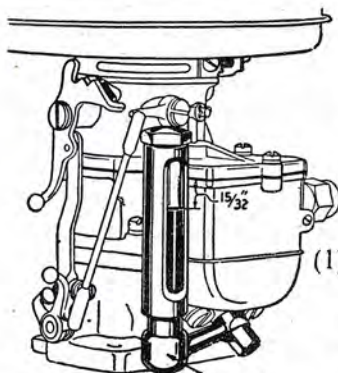
Check fuel pump vacuum. At idling speed gauge should show minimum of 10" vacuum. After engine is stopped the vacuum should drop gradually to zero, in not less than one minute.

Check fuel pump pressure. Reading of from $1\frac{1}{2}$ to $2\frac{3}{4}$ lbs. is satisfactory. If correct reading is not secured install new fuel pump diaphragm spring. Do not cut the spring to reduce the pressure.

Reading below $1\frac{1}{2}$ lbs. will limit maximum engine performance. Readings above $2\frac{3}{4}$ lbs. will raise the fuel level in the carburetor resulting in low gas mileage.

Disconnect fuel line to pump, remove gas tank cap and blow through fuel line to check for obstructions. On cars equipped with hydrostatic fuel gauge, check air vent by replacing cap and using a tire pump to force air through fuel line. (Do not use high air pressure on the fuel line without removing filler cap, as otherwise damage may occur.)

- (k) Clean air silencer screen. If equipped with oil bath air cleaner, check level and condition of oil in the reservoir. Drain the carburetor bowl. If necessary to use wire in drain hole to loosen the sediment, remove the carburetor, completely disassemble and clean out, using compressed air in all passages. (Do not use a wire to clean out jets.) Check fuel level in carburetor.



Testing Fuel Level
Fig. 47

Fuel level in 1932-1933 single throat carburetors is measured by removing the cover. Level should be $13/16$ " below top edge of bowl. Fuel level in all carburetors used since that time is checked by the use of a fuel level gauge as illustrated in Figure 47.

- (l) Check oil level. (If the oil level is low, or if the oil is deteriorated, the owner should be informed.) Complete details in connection with the procedure of recommending engine oil changes to the owner will be found on pages 18 to 21 inclusive.

- (m) Check radiator hose connections and water pumps for leakage.

Check cooling fluid in the radiator. If low inspect the cooling system for leaks. If the radiator is leaking inform the owner. If anti-freeze is being used check the condition and advise the owner if further protection against freezing is required.

- (n) Start the engine and warm up thoroughly.

NOTE—While engine is warming up check brakes, toe-in and wheel bearing adjustment, also inflate tires to recommended pressure. (These operations are part of the engine tune-up as they affect the efficiency and performance of the engine.)

- (o) Tighten intake manifold screws.

Stop any leaks at manifold connection or windshield wiper and distributor vacuum lines.

- (p) Tighten cylinder head stud nuts.

- (q) Set the throttle to run engine at fast idle. If throttle screw on carburetor is set to idling speed of 5 to 7 miles per hour in high gear, a penny inserted between the throttle adjusting screw and stop will give the correct speed for adjusting the carburetor.

Adjust the carburetor to the highest vacuum. Normal vacuum at sea level should be between 18" to 20". The vacuum reading will be lower at higher altitudes. At 3000 feet the vacuum will be from 15" to 17".

- (r) Road test. If the engine pings under load tighten vacuum brake to remove the ping. If the engine does not ping under load, back off the vacuum brake until the engine does ping, then tighten only sufficiently to remove the ping.
- (s) With the car in high gear driving at 5 to 7 miles per hour, gradually apply the brakes and at the same time open the throttle to maintain this speed. Continue to increase the load until each impulse of the engine can be felt. If the engine misses (and the procedure outlined above has been carefully followed), the trouble is probably attributable to a valve sticking, which condition may not have existed during the compression test; or it may be due to loss of compression owing to insufficient clearance between the push rods and valve stems when the engine is warm.

The cylinder in which the valve trouble is occurring may be determined by road testing (at low, normal, or high speeds, as required) with one spark plug wire removed from plug and grounded. Starting at No. 1 plug, drive in high gear (on seven cylinders) at the speed at which trouble occurs. If irregular firing (other than that caused by No. 1 wire being disconnected) does not occur when No. 1 wire is disconnected, the trouble is in No. 1 cylinder. If irregular firing, (other than that caused by No. 1 wire being disconnected), is noticed, the trouble is not in No. 1 cylinder and the test should be continued.

If the valve giving trouble is located prior to all cylinders being tested, continue the test on all cylinders, as other valves may be similarly effected yet only give trouble at normal and/or high speeds. The sequence of tests should be 1-5-4-8-6-3-7-2, which of course is the same as the firing

order of the cylinders. On Lincoln-Zephyr cars the sequence of tests should be 1-4-9-8-5-2-11-10-3-6-7 and 12.

- (t) Check lights for burnt out bulbs.
- (u) Remove fender, door and seat covers.
- (v) Clean windshield and windows.
- (w) Clean steering wheel, gear shift lever and brake lever.
- (x) Clean upholstery, if soiled during "Tune-up".
- (y) Clean door handles, hood handles and any other part of car that may have become marked during "Tune-up".

TRANSMISSION

Passenger

Finger Tip Gearshift

All 1940 and 1941 model passenger cars are equipped with finger tip gear shift with the shifting lever mounted on the steering post. The lever is so arranged that it normally remains between the two most used gears, namely, in the neutral position between second and high gears. For low or reverse positions it is lifted and pulled backwards or pushed forward respectively, as desired. Shifting from low to second, therefore, involves only pushing the lever forward as it automatically crosses the neutral spot and proceeds to the second gear position. Shifting into high then involves only pulling the lever backward into the engaged position. The shifting mechanism is entirely mechanical, requiring no booster or other auxiliary mechanism for its operation.

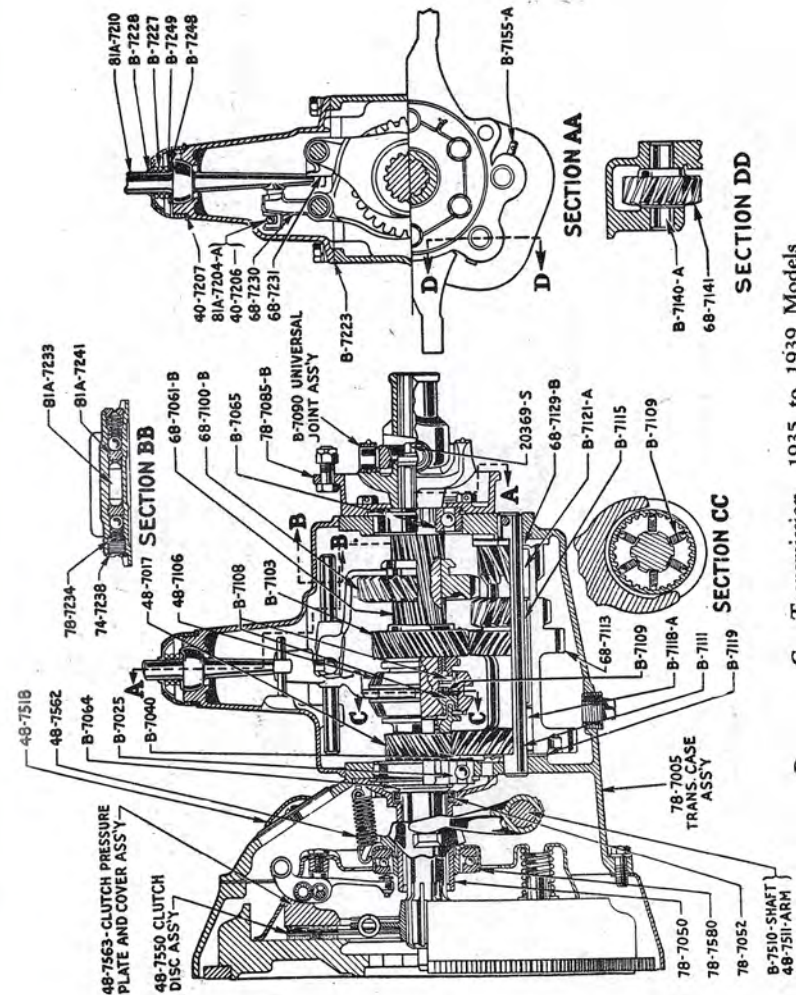
A special feature of the linkage connecting the shifting lever shaft with the transmission, is that it is equipped with rubber bushings to prevent sounds from being telegraphed into the body.

Silent Helical Gears

The transmissions in all cars are equipped with helical gears for all speeds making them of the "all silent gear" type. The first and reverse gears when moved by the shifter lever travel on a helically splined shaft with the curve or twist of the splines corresponding with the amount of twist of the gear teeth.

Blocker Type Synchronizer

The transmissions in all 1940 and 1941 model cars are equipped with what is termed a "blocker type synchronizer". This type of



Passenger Car Transmission—1935 to 1939 Models
Fig. 48

synchronizer is an improvement over the former type in that second and high "gears" cannot be engaged until they are synchronized exactly, whereas formerly it still was possible to clash them through exceptionally careless shifting. The gears are "blocked out" of engagement until they are precisely synchronized, hence the name "blocker type". The name does not refer to any difficulty of engagement as has erroneously been assumed by some prospects. In fact engagement is ordinarily no different than formerly under ordinary driving conditions. It is only when the driver tries to force them into too rapid engagement that there is a momentary delay in completing the shift, in order to give the gears time enough to become fully synchronized and thus avoid clashing. This is the same type of synchronizer that was used previously in Lincoln-Zephyr cars.

Figure 48 illustrates the three speed transmission used in all Ford V-8 passenger and commercial cars and Mercury passenger cars between 1935 and 1939 inclusive, and in 1940 and 1941 model commercial cars.

Figure 49 illustrates the three speed transmission used in all 1940 and 1941 model Ford V-8 passenger cars. The transmission used in 1940 and 1941 model Lincoln-Zephyr cars is basically similar to this transmission.

Truck

3/4 and 1 Ton Trucks

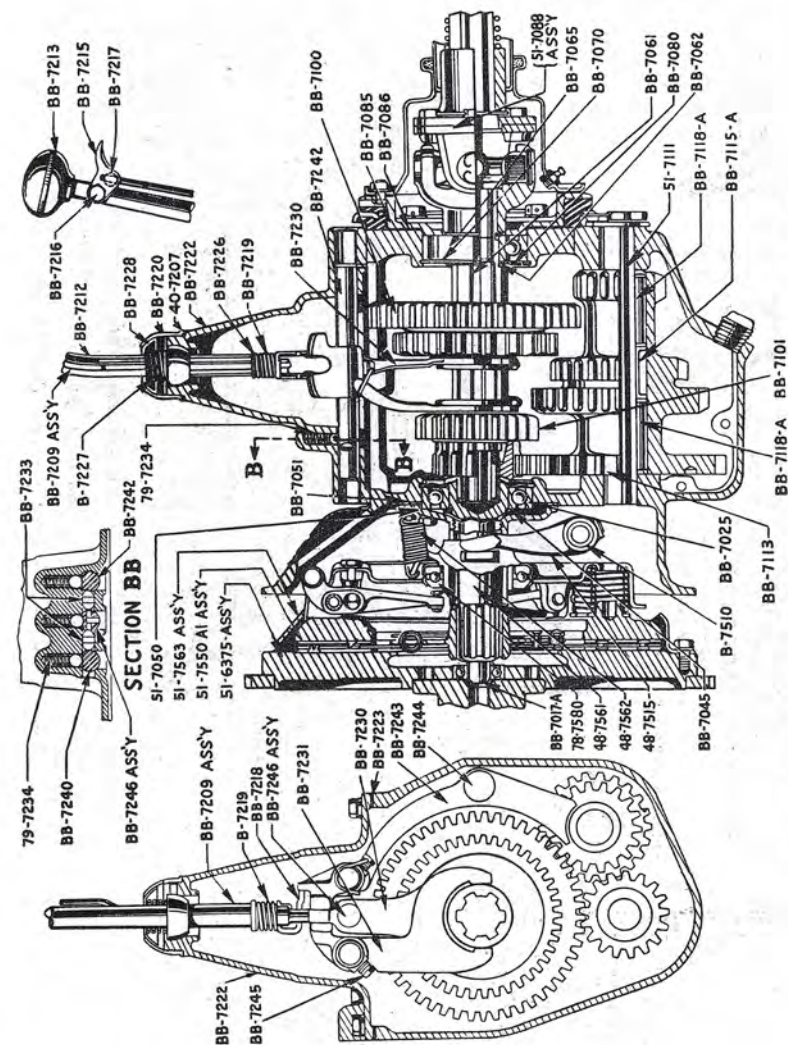
This transmission has silent helical gears for countershaft drive, also constant mesh second speed gears. Low and reverse gears are straight tooth type. A synchronizer is provided for second and high speed gears only. This type of transmission is illustrated in Figure 50.

A four speed transmission identical to that illustrated in Figure 51 is available for 1 ton trucks as an option at extra cost.

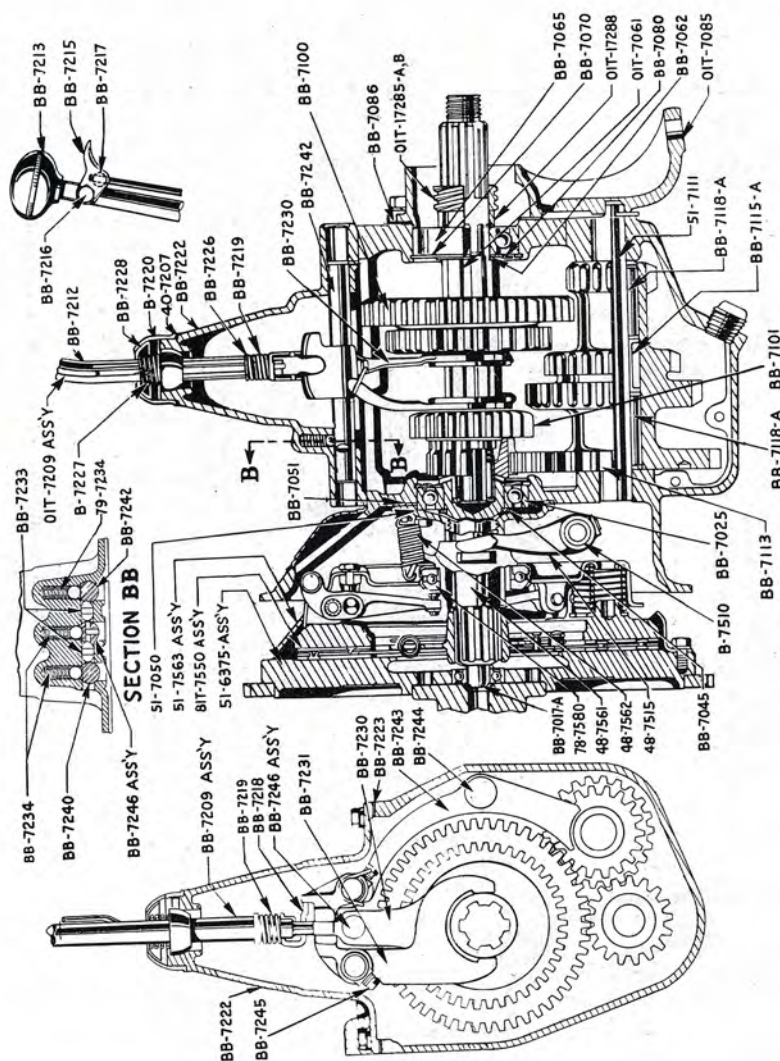
1½, 2 and 3 Ton Trucks

A four speed transmission is used in these units. All gears are straight tooth type having wide tooth faces which provide large contact area. The transmission case is provided with an S.A.E. standard six bolt power take-off opening.

All transmission gears and main shafts are forged from chromium steel which is oil hardened. These parts receive careful heat treat-



11½, 2 and 3 Ton Truck Transmission—Trucks prior to 1940
Fig. 51



1½, 2 and 3 Ton Truck Transmission—1940 Models
Fig. 52

ment which provides gear teeth and splines with maximum strength and longevity. Large ball bearings support the main drive gear and the rear of the main shaft and a straight roller bearing is used on the front of the main shaft, also at each end of the countershaft gear assembly. Having the entire gear train that is used in any forward speed mounted on roller and ball bearings reduces friction and assures maximum power transmitting efficiency.

As outlined on page 69, 1940 and 1941 model trucks except $\frac{3}{4}$ and 1 ton models are equipped with a hand brake mounted on the rear of the transmission main shaft. Other than a change in the main shaft to provide for the mounting of the hand brake, four speed transmissions used prior to, and those used during, 1940 are practically identical in design and construction. The four speed transmission as used on all trucks prior to 1940, except $\frac{3}{4}$ and 1 ton models is illustrated in Figure 51. The four speed transmission having the hand brake drum on the rear of the main shaft as used on all 1940 and 1941 model trucks except $\frac{3}{4}$ and 1 ton, is illustrated in Figure 52.

Repairs

As considerable special equipment is required for disassembling, repairing and reassembling transmissions, it is recommended that repairs be performed only by competent repair men having the necessary equipment.

Lubrication

Details of transmission lubricants and recommended mileage periods are shown on lubrication charts on pages 31 to 35 inclusive.

CLUTCH

Engines in all cars and trucks are equipped with semi-centrifugal type single plate clutches. These clutches are noted for their exceptional ability to stand up in hard service, also for their easy pedal action.

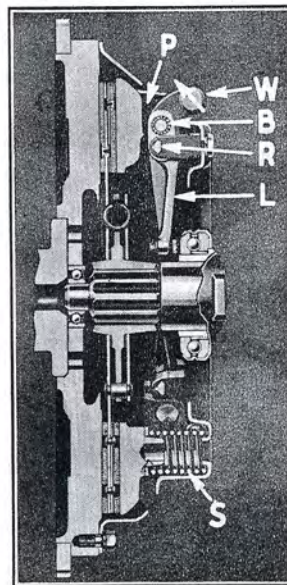
The centrifugal force principle is utilized to supplement the pressure exerted by the clutch springs and clamp the clutch disc more tightly between the pressure plate and the rear face of the flywheel. Thus the torque or power transmitting capacity of the clutch is far in excess of the maximum engine torque. The additional pressure which is automatically applied as the engine speed is increased, not only prevents the clutch from slipping when delivering full engine torque, but reduces the amount of slippage during clutch engagement. This minimizes wear on the clutch disc facings and increases their life.

Because pressure on the clutch plate is automatically increased the pressure of the clutch springs is relatively low. This makes it possible to have easy pedal action. The clutch pedal can be depressed with little effort at gear shifting speeds.

Friction in release lever action is reduced by mounting the levers on the pressure plate with needle roller bearings. Flywheel and pressure plate surfaces which come into contact with clutch facings are extremely smooth and finished to minimize facing wear. Spring steel segments between the clutch disc and the rear facing help to cushion the engaging action. This prevents grabbing and ensures smooth starting.

Clutch pilot bearings and release bearings are of the pre-lubricated type to provide long service and low maintenance.

The clutch is illustrated in Figure 53. "L" is one of the three release levers with weighted outer end "W". Each lever is mounted on the pressure plate with needle roller bearings as illustrated at "B". Levers are also attached to clutch cover by pin and roller pivot type bearing, as illustrated at "R". As engine speed increases centrifugal force causes the weighted end of the lever to attempt to assume a position in the vertical plane passing through "R" and they move forward in the direction of the arrow, exerting increased pressure against the clutch plate "P". At "S" is shown one of the nine clutch pressure plate springs.



Clutch Assembly

Fig. 53

In all cars and trucks the clutch housing and transmission case are cast integral. This assures correct alignment at all times of the clutch and transmission with the engine. Figures 48 to 52 illustrating the various types of transmissions, also illustrate sectional views of the clutch in its correct related assembly to transmission.

Adjustment

The clutch pedal travel adjustment must be maintained at all times. The amount of movement can easily be determined by moving the clutch pedal down with a slight hand pressure.

The travel will gradually lessen as the mileage on the vehicle increases owing to normal wear. Driving with the foot resting on the clutch pedal will result in clutch slippage and premature wear, also necessitating more frequent adjustment.

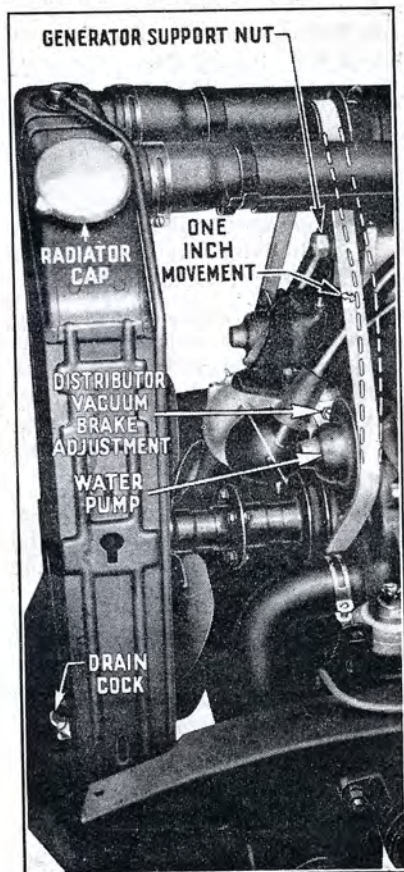
Adjustment is made through decreasing the length of the clutch pedal adjusting rod as necessary to provide correct free travel of the clutch pedal.

Specifications of the correct travel for various models will be found in the Specification Section of this book.

COOLING SYSTEM

Removal of Radiator Cap

To remove the radiator cap it is necessary on all 1937 and later models first to lift the engine hood. A pressure locking type catch is used on the radiator cap. It is removed by turning counter-clockwise as far as possible, then pushing down as far as possible and continuing to turn until cap comes off.



Generator Belt Adjustment
Fig. 54

Generator Belt Adjustment

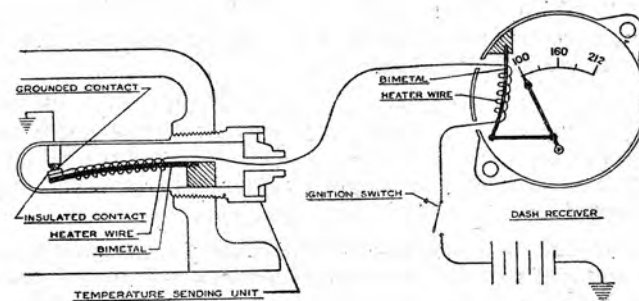
The generator belt is used to drive the water pumps and generator on all 1940 and 1941 model units, and 1939 model Deluxe passenger units only. All previous car and truck models had the fan mounted on the generator pulley and driven also by the fan belt.

Correct adjustment of the belt for tightness is essential to prevent slippage and abnormal wear. The belt is correctly adjusted when 1" movement with the thumb and finger is possible at a point midway between the generator and water pump pulley, as illustrated in Figure 54.

Electric Water Temperature Gauge

All Mercury cars and all Lincoln-Zephyr cars use an electric type water temperature gauge to indicate to the driver the temperature of the water in the cooling system of the car. These gauges use the same basic idea of operation as the oil pressure and fuel level gauges described on pages 22 and 113 respectively.

One notable difference, however, exists in that with the water temperature gauge dash unit, the smaller the current the higher the reading. These were designed this way due to the fact that most of the time the car is operated under normal temperatures and of course the smaller current consumption is desirable.



Operation With Low Temperature
Fig. 55

When the current is turned off (ignition switch off) the bimetal is straight as in Figure 56 and the reading is to the right at 212°F. This does not mean that the water temperature in the cooling system is at 212° F. but merely that the gauge is turned off and that a reading of 212° F. is the normal reading when the gauge is off.

When the ignition switch is turned on the temperature indicator likewise is turned on and the current passes through both the dash unit and the engine unit.

The engine unit normally is grounded, however, as the current passes through the engine unit to the ground, heat is generated in the engine unit coil which causes the bimetal to bend, breaking the ground contact.

This, of course, stops the flow of current which in turn permits the bimetal to cool and return to its original position and the ground contact is again established and the cycle is again repeated.

The same amount of current passes through both the engine and the dash units since they are connected in series with each other. This current causes the bimetal in the dash unit also to heat, causing the pointer to be pulled over to the left, as shown in Figure 55.

Service Handbook

When the engine is started and is permitted to run, the temperature of the water increases. This water passing around the engine unit warms it, and the heat from the water supplements the heat generated by the current passing through the engine unit coil, thus reducing the amount of current necessary to make the bimetal draw away from the ground contact.

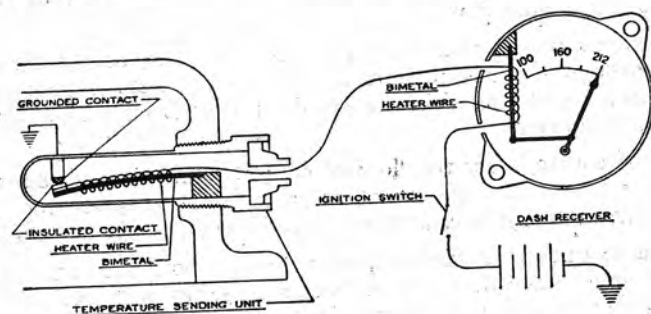
With less current flowing through the engine unit, less current likewise flows through the dash unit.

With less current flowing through the dash unit, the deflection or bending of the bimetal in the dash unit is less, the instrument pointer is not pulled as far to the left, and the temperature indicated by the dash unit is higher than originally indicated when the switch was first turned on.

At each increase of temperature of the cooling system water, less current is required to draw the engine unit bimetal away from its ground, and likewise less current flows through the dash unit. This results in less deflection of the dash unit bimetal and higher readings.

Figure 55 is a schematic drawing showing both the engine and the instrument board units and the maximum bending of the bimetal in the instrument board units as would be true with low temperatures at the engine unit.

Figure 56 is a schematic drawing showing both units and the minimum bending of the bimetal in the dash unit as would be true with the cooling system water at the boiling point or with the current turned off.



Operation With High Temperature

Fig. 56

Service Handbook

The following procedure is recommended to determine whether the dash unit or the engine unit is at fault in the event the gauge is inoperative.

This is accomplished by substituting a fuel gauge tank unit for the water temperature engine unit.

1. Ground a new fuel gauge tank unit to the car.
2. Connect the fuel gauge tank unit to the wire normally connected to the water temperature engine unit.

Turn on ignition switch.

Do not let this wire touch the engine when the ignition switch is turned on, as this will subject the dash unit to the full battery voltage and damage the instrument.

3. With the float of the tank unit at the bottom of its movement the gauge should read at hot end of the scale (212°F).
4. Move the float up to the top position, the dash unit should then read at the cold end of the scale (100°F).
5. If reaction is correct, as outlined in paragraphs 3 and 4 above, dash unit and wire are O.K. and trouble exists elsewhere.
6. If the car is radio equipped and has a condenser installed at the engine unit, check the condenser for being shorted. If the condenser is shorted, it will cause the dash unit to over-read.
7. If the wire connecting the two units is grounded, it will cause the dash unit to over-read.
8. If the dash unit is O.K. as checked above, and wire is known to be good, yet the dash unit does not indicate the temperature, then the engine unit is at fault and should be replaced.
9. Replacement with a new unit is the only practical way of servicing either the dash or the engine unit.

Care of the Cooling System

Proper servicing of the cooling system is necessary to maintain maximum efficiency.

The cooling system at all times must be kept full of cooling fluid. It is a good plan to form the habit of inspecting and filling the radiator, if the latter is necessary, at the time of adding oil or gasoline. When an inspection for the amount of coolant in the system is made, the engine should first be warmed up to operating temperature so there will be no over-filling and subsequent loss of cooling fluid. (Do not add water unnecessarily.)

If the engine should become overheated due to lack of sufficient cooling fluid in the system, or should the cooling liquid be lost out of the system due to overheating from some other cause, never pour cold water or anti-freeze into the radiator until the engine has cooled off, as such action may result in cracking the cylinder head or the cylinder block.

To keep the cooling system functioning properly, the radiator core must be kept free of mud, dust and insects at all times, in order to permit maximum circulation of air around the tubes.

The less fresh water which it is necessary to add to the system, the better. All ordinary water deposits a certain amount of scale in the system, so the more water added, the greater deposit and consequent need of cleaning.

The Major Causes of Cooling System Troubles

The most common trouble is clogging of the water passages in the radiator and engine block with rust. This rust formed in the water jackets of the cylinder block and carried into the radiator by circulation, prevents the water from being adequately cooled and reduces circulation. If allowed to remain in the radiator the rust deposits will eventually reduce circulation almost entirely, resulting in abnormally high temperatures. Similarly this rust will build up in the water jackets causing inefficient cooling of the cylinder heads and block.

Rust is formed by the presence of oxygen in the cooling fluid, the oxygen having a corrosive effect on the metals of the cooling system. We cannot control the amount of oxygen in the cooling fluid but we can control the amount of oxygen that enters the system in other ways. Excess oxygen may be drawn into the system through leaks of the water pump, hose connections, etc. and this excess oxygen will speed up formation of rust.

The presence of lime in the cooling fluid will cause a hard scale to form. This scale impairs the efficiency of the cooling system in exactly the same manner as does rust. As lime is present in nearly all water, care must be exercised to ensure that water having as little lime content as possible be used.

A loose cylinder head nut or a damaged gasket may allow exhaust gases to enter the cooling system, which may form strong corrosive acids when allowed to mix with the coolant, thereby greatly accelerating the formation of rust.

Any grease entering the cooling system will act as a binder and will only tend to accelerate the building up of rust formation in the water passages and prevent proper circulation.

As the rust formation builds up and prevents normal dissipation of heat, the engine becomes overheated and the cooling fluid boils, and may be forced out the overflow pipe. Enough fluid may be lost in this way to cause the level in the cooling system to become dangerously low.

Overheating of the engine may cause serious damage and necessitate major repairs. Regular attention will ensure efficient operation.

Rust Prevention

During summer driving it is essential that special ingredients called "inhibitors" be added to the water in the cooling system to retard the corrosive action of the water on the cooling system metals. Rust and corrosion inhibitors produced by reputable manufacturers are available and if used according to the manufacturer's directions, satisfactory results can be expected. For Winter driving it is advisable to select a reputable anti-freeze with the inhibitors compounded in it.

Cleaning the System

The cooling system will require periodic cleaning to remove accumulations of rust, scale, grease and dirt. This is particularly necessary in the Fall, before the use of anti-freeze and in the Spring to prepare for driving during the hot months of the Summer.

A reliable cleaning compound that will have a dissolving action on rust and at the same time will emulsify or cut the grease, is necessary. Care must be used in the selection of the cleaner as some of them contain strong acids or caustics which will react to the detriment of the metals of the radiator core, cylinder head and other cooling system parts. A number of reliable products are on the market and the directions given with them by their manufacturers should be carefully followed. Following the use of a cleaning preparation, the cooling system should be pressure flushed with an air and water flushing gun.

Thermostats

All gasoline engines have a known operating temperature range that will give maximum efficiency and economy. To reach this temperature range as soon as possible and to maintain it while

running, two thermostats are incorporated in the engine cooling system.

The function of these thermostats is to restrict the flow of water to the radiator until the efficient operating temperature range is reached and then to slowly open allowing just enough flow to constantly maintain this temperature. This assures a short "warming-up" period for the engine during winter operation and the ideal operating temperatures for efficiency throughout the year regardless of weather or atmospheric temperatures.

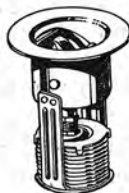
Prior to 1940 two types of thermostats were used on Ford and Mercury models, both of which used a bimetal coil to operate the valve. This coil of bimetal is anchored at one end on a shaft and the other end is fastened to the butterfly valve. In these thermostats the coil consists of two layers of metals of widely different expansive qualities when subjected to temperature variations. These two metals are bonded together and with a temperature change, the natural tendency is for one metal to elongate more than the other so that a bending or deflection results. This in turn causes the butterfly valve to open and close.



Bi-Metal, Hose Mounted
"A"



Bi-Metal, Head Outlet Mounted
"B"



Bellows
"C"

Fig. 57

Prior to 1937 a barrel type thermostat, as illustrated at "A", Figure 57, was used. This thermostat was assembled in the radiator inlet hose. This type of thermostat is used on all Lincoln-Zephyr cars.

With the introduction of the 1937 model Ford vehicles a new type of thermostat was introduced which was mounted in the cylinder head outlet. This thermostat was identical in operating principle to the barrel type previously used. It is illustrated at "B" Figure 57.

During 1940 a third type thermostat was released for production on all Ford and Mercury models. This thermostat is shown at "C" Figure 57. The valve in this unit is operated by the expansion of a fluid in the bellows chamber.

Extreme care is taken in testing Ford thermostats before they leave the factory and they can be depended upon to give long and accurate service, if reasonable care is exercised in handling before and during assembly in the car.

The types of thermostats illustrated at "A" and "B" Figure 57 above are designed to start opening at 145° F. and to be fully open at 180° F. The bellows type thermostat illustrated at "C" Figure 57 is designed to start opening at 155° F. and to be fully open at 180° F.

In checking thermostat operation the following features should be taken into consideration.

- A. In early models the clamp around the thermostat, used to hold it in position in the hose, could be too tight, causing valve to stick.
- B. Hose line thermostats installed upside down. This can occur only in models prior to 1937 as there is a flange at the top of the thermostats starting with 1937 models for mounting in the outlet casting of the cylinder head.
- C. Cylinder head outlet thermostats not held securely in place. The shoulder in the inside of the hose provides a means of holding the thermostat tightly in position. If the hose is not forced down tightly on the outlet there will be sufficient room to permit the thermostat to rock, allowing water to bypass. In addition, this rocking action strikes the coil supports against the sides of the head outlet casting which may in time affect the characteristics of the thermostat.
- D. Dirt and pieces of rubber hose becoming imbedded on edge of the butterfly, holding the valve either open or closed.
- E. Failure to expel all air from the cooling system when filling the radiator. This may be overcome by running the engine a few minutes and then adding additional water to the cooling system, after the thermostats have opened allowing the air to escape.
- F. With low-boiling point anti-freeze solution, such as alcohol, it is important to watch the liquid level in the radiator and to replace the evaporated solution, as necessary.

Thermostat Testing

When the cooling system is opened up for flushing purposes, make a practice of checking the thermostats. This can easily be accomplished by heating a container of water and suspending the thermostat in the water. As the temperature rises to the specified

opening temperature of the thermostat, as recorded by a thermometer in the water, check to see whether or not the thermostat valve opens.

If the thermostat is opening at too low a temperature, too high a temperature, or is sticking, it should be replaced. A thermostat that opens too soon will cause the engine to operate at too low a temperature—if it opens too late or is sticking, the engine is apt to overheat. Thermostats should be tested twice a year even though there may be no apparent overheating. The car should never be operated without thermostats.

Anti-freeze

Anti-freezes should be selected for winter use which will assure safe and efficient engine operating temperatures under all driving conditions, as well as provide dependable protection against freezing down to the lowest temperatures likely to be encountered. The following information will assist in selecting the anti-freeze best suited to individual driving conditions. The available commercial materials for preparing anti-freeze solutions for automobile radiators are: Ethylene Glycol, Denatured Ethyl Alcohol, Methanol (synthetic wood or methyl alcohol) and Distilled Glycerine.

It is essential that the anti-freeze material be chemically treated to obtain the maximum protection against corrosion damage to cooling system metals by water, and against rust formation that might clog the cooling system. As the use of a rust inhibitor in conjunction with an anti-freeze already containing an inhibitor, will usually result in one inhibitor neutralizing the other, it is essential that no inhibitor be added to anti-freeze solutions already containing an inhibitor.

Due to the possibility of contamination in service it is strongly recommended that anti-freeze solutions be discarded after one winter's use.

Servicing the Cooling System for Winter Driving

Before installing anti-freeze the cooling system should be inspected and if necessary, serviced, to be sure that it is clean, leak-tight and in proper working order.

After the anti-freeze is installed the system should be inspected regularly to be sure that no leaks have developed. To avoid overflow loss of solution, care should be exercised to see that the radiator is not overfilled. Make necessary additions only when the cooling system is warmed up to operating temperature.

Cylinder head nuts should be tightened, or gaskets replaced if necessary, to avoid solution leaking into the engine, or exhaust gas blowing into cooling system. Anti-freeze or water mixed with engine oil in large quantities will form heavy sludge that may cause lubrication failure, gumming and serious damage to the engine.

The water pump should be repaired if it shows any leakage and to prevent air from being drawn into the cooling system which may cause foaming, rust, overheating and other difficulties.

Anti-freezes should be used in accordance with the instructions and in proportions recommended by the anti-freeze manufacturers.

It is a good precaution to have the solution tested from time to time to avoid the possibility of freeze-up from undetected loss of anti-freeze protection.

Anti-freeze Materials

Ethylene Glycol

To avoid loosening of any rust already in the system and the difficulty of securing and maintaining leak-tight connections, only Ethylene Glycol, which is treated to prevent these conditions, should be used.

Ethylene Glycol anti-freeze preparations such as "Prestone", "Protexall", "Frost Cop", etc. are chemically treated to prevent rust loosening and creepage, and to protect the cooling system for one winter's driving season against rust formation and corrosive action on metals by the water used in mixing the solutions.

Ethylene Glycol and Glycerine

Ethylene Glycol and distilled glycerine anti-freeze are in first cost more expensive than alcohol. However, they are not lost by evaporation and because of their high boiling points there should be no overflow losses of solution from boiling in any properly conditioned engine and cooling system. Therefore, the only evaporation loss is water and only water need be added to maintain the proper solution level in the radiator. Any solution lost mechanically, such as by leakage, must be replaced by additional anti-freeze solution of the same strength as the original filling. Solutions of these materials are not in themselves injurious to car finish, although the heat of the solution may affect the finish.

Alcohol

Denatured Ethyl Alcohol and Methanol are extensively used for anti-freezing solutions, and are not injurious to the materials used in the cooling system.

There are two principal objections to the alcohols. These materials may be lost through the overflow pipe in the form of solution, and also to some extent by evaporation, if the cooling system temperature reaches the boiling point of the solution, especially upon slowing down or shutting off the engine after a hard run during mild winter weather. Unless the solution in the radiator is tested periodically and sufficient anti-freeze added to replace losses, the engine or radiator, or both, are likely to be damaged by freezing or overheating. The car finish is damaged by contact with alcohol solutions or vapors and any material accidentally spilled on the finish should be flushed off immediately with a large quantity of clean cold water.

Other Anti-freeze Solutions

Salt solutions such as calcium chloride, magnesium chloride, sodium silicate, etc. may cause serious corrosion of cooling system metals and are not recommended. Honey, glucose and sugar solutions and oils are not satisfactory for anti-freeze use in automobile cooling systems.

Testing Anti-freeze Solutions

Anti-freeze testers are available on the market which are equipped with both a thermometer and a hydrometer and carry a correction chart which permits the correct reading of the freezing protection at any temperature of solution between -60°F . and 160°F .

Testers will correctly read only the type of anti-freeze for which they are designed. Individual types are available for denatured ethyl alcohol, methanol, ethylene glycol and glycerine.

If a regular hydrometer is used to determine the freezing protection, the test must be made at the temperature for which the hydrometer is calibrated. If the solution is warmer or colder it must be brought up to this temperature or large errors will result. In some cases these errors may be as much as 30°F .

Anti-freeze Charts

The charts illustrated in Figures 58 and 59 show the percentage of anti-freeze preparations required to provide freezing protection at various temperatures. In preparing these charts radiator capacities were omitted and it is, therefore, necessary to determine the capacity of the entire cooling system on the car or truck being serviced in order to arrive at the actual amount of anti-freeze solution required.

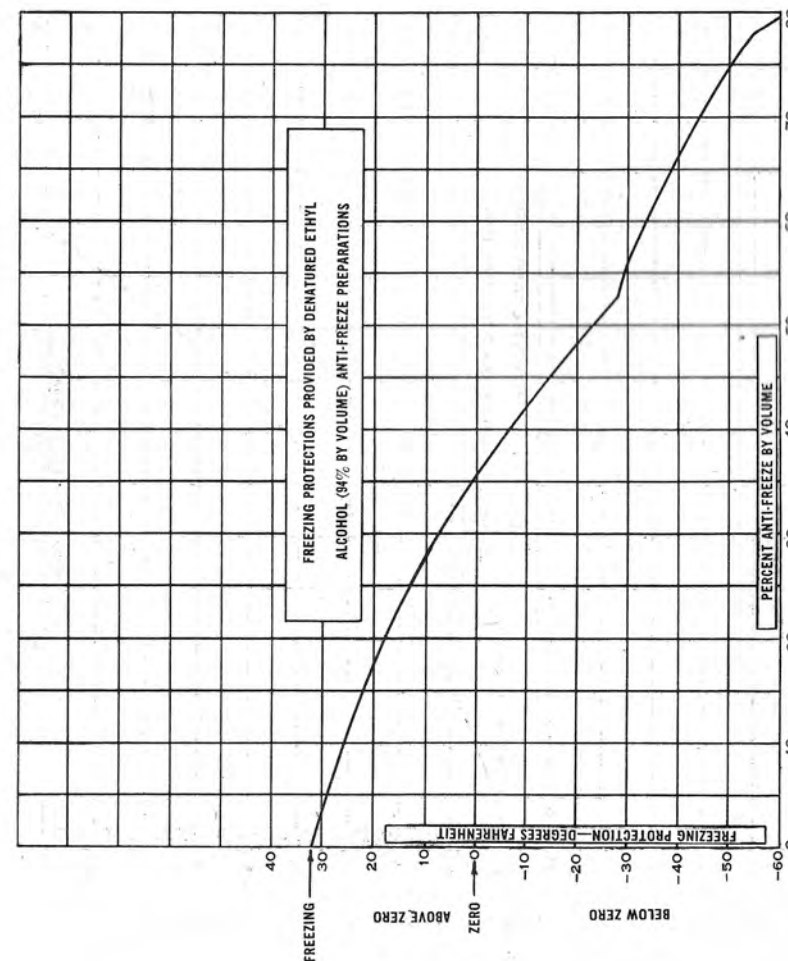


Fig. 58

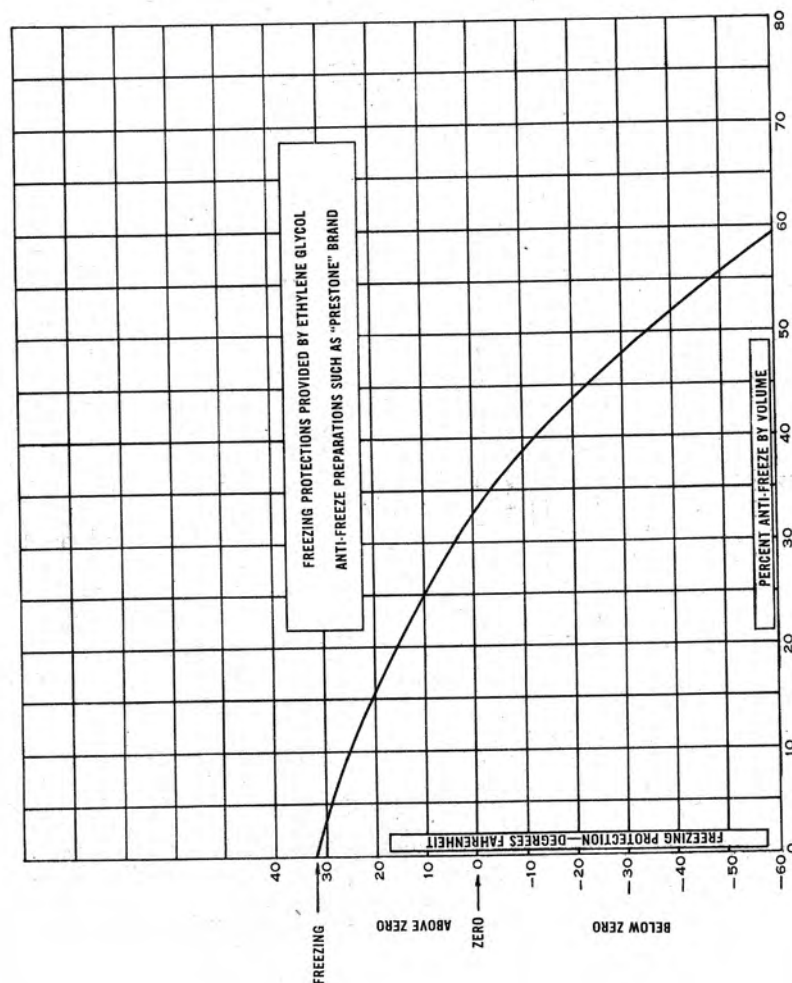


Fig. 59

FUEL SYSTEM

The fuel system consists of the fuel tank, fuel pipe, fuel gauges, fuel pump, carburetor and intake manifold. The air filter or air cleaner while not actually being a part of the fuel system, may sometimes be referred to as such. For the purpose of ready reference each of these assemblies will be dealt with individually in the following.

Fuel Tank

Fuel tanks used on all models are of Terne plate and electrically welded throughout. A drain plug is provided in the bottom of the tank to permit draining of sediment, etc. The tank fuel gauge unit is described under sub-heading Fuel Gauges below.

Fuel Pipe

A fuel pipe carries fuel from the fuel tank to the fuel pump. It requires no servicing unless it becomes clogged in which case it may be disconnected at both ends and cleaned out by application of air at one end.

Fuel Gauges

Two electrical type gauges have been used in the fuel system on all models since 1936, as illustrated in Figures 60 and 61, and Figure 62. (Previous to 1936 a hydrostatic type gauge was used.) A tank unit which is assembled into the fuel tank and a dash unit mounted in the instrument cluster, which registers amount of fuel in the tank. These gauges operate only when the ignition switch is turned on.

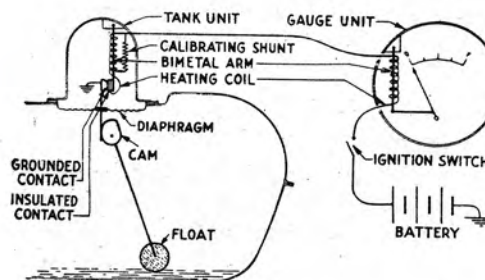


Fig. 60

These gauges operate only when the ignition switch is turned on.

Operating principle and service instructions are outlined in the following:

Operating Principle

When tank is empty as in Figure 60 the two contacts in the tank unit are just touching. With the ignition switch on, current flows through the circuit warming up the heating coil which causes the bi-metal to bend. This bending of bi-metal in the tank unit opens the contacts and circuit is broken. The heating coil then cools and the bi-metal returns to its former position. Contact is then again made and the procedure is repeated.

Since both heating coils are in the same circuit, a similar slight bending of the bi-metal in the gauge unit occurs, which is just sufficient to make the needle register zero.

When the tank is filled, as in Figure 61, the action of the float and cam pushes the grounded contact against the insulated bi-metal contact, bending

the bi-metal in the tank unit. If the ignition switch is "on", the action described in the preceding paragraph occurs, but because the bi-metal is under strain a much greater amount of current is required to bend the bi-metal sufficiently to break contact in this position. A similar greater bending of the bi-metal in the gauge unit occurs and this action pulls the needle over to the "full" point.

The movement of the needle in any position caused by the make and break of the circuit is so minute that it cannot be detected.

Because the bi-metals heat and cool slowly, any sudden change in fuel level caused by driving over rough roads, etc. are dampened out and a steady reading of the average level in the tank is given.

The cycle of opening and closing is repeated continuously. With the tank half full of fuel this frequency amounts to approximately 60 cycles per minute.

Service Instructions

Do not replace any unit until tests have been made which prove it to be defective or damaged. All units should be handled care-

fully. The gauge should never be subjected to the full six volt current as this may burn out the heater coil.

The only equipment needed to service the fuel gauge is two six foot lengths of insulated wire equipped with clip terminals at each end.

The best way of testing either the tank unit or the gauge unit is by comparison with units known to be O.K. Instructions for these comparison tests are as follows:

1. Disconnect the wire at the tank unit and connect it to a new tank unit. Ground the new tank unit to the car frame and turn on the ignition switch.
2. Move the float of the new tank unit from "empty" to "full" position and watch the action of the dash unit while doing this. (Allow 10 to 15 seconds for the gauge to read full scale.)

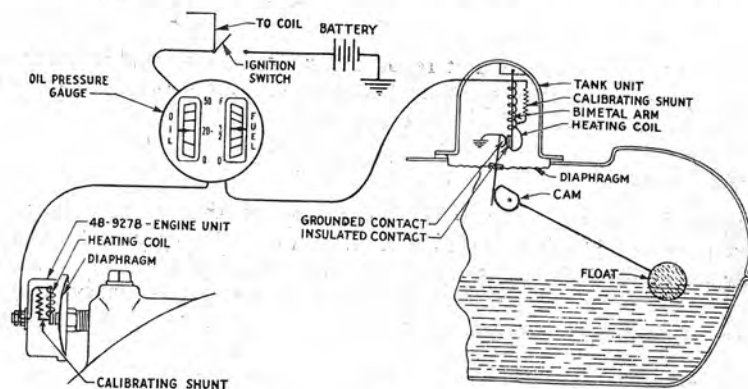


Fig. 62

3. If the gauge unit now registers correctly the original tank unit is damaged or defective and should be replaced, or it is improperly grounded, (because of paint or grease), and this should be corrected.
4. On the other hand the tank unit may be shorted. This would cause over-reading whenever the ignition switch was "on".
5. If equipped with a radio condenser which may be shorted, condenser can be checked by disconnecting wire leading from

it to the tank unit. If the gauge operates correctly with the condenser disconnected, then the condenser should be replaced.

NOTE—Use only standard Ford condensers. Any other may damage the fuel gauge.

6. If the gauge unit performs the same with a new tank unit as it did with the original tank unit, then check the wiring.
7. If wire connecting tank unit to gauge unit is broken or grounded, repair or replace. If both wiring and tank unit check O.K. then check the gauge unit.

To check the gauge unit—

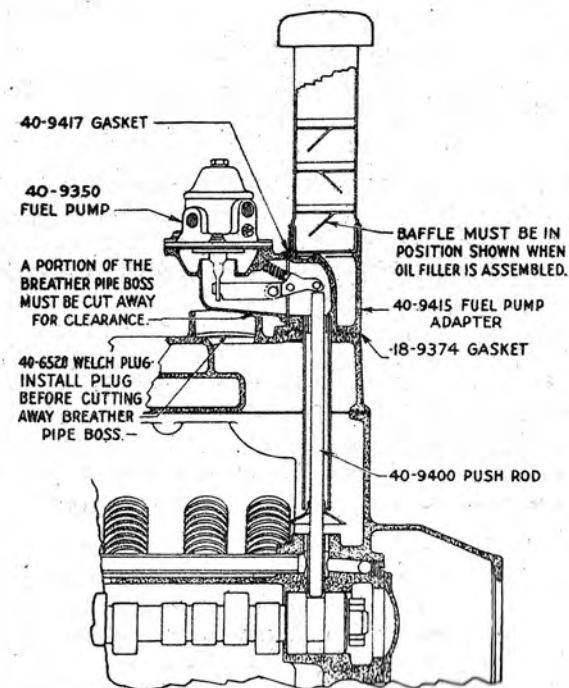
1. Disconnect wires from the gauge unit being checked and attach to new gauge unit. Turn on ignition switch.
2. If the new gauge unit reads correctly then replace the original gauge unit.
3. If the new gauge unit reads the same amount as the original gauge unit, then previous checks were not properly made or installation was O.K. to begin with.

Fuel Pump

The fuel pump is located at the rear of the intake manifold where it is readily accessible for servicing. An eccentric on the camshaft lifts the fuel pump push rod, thus actuating the rocker arm which in turn pulls the link and diaphragm assembly downward against the pressure spring. Refer Figure 63.

Operating Principle

On the suction stroke of the pump, fuel enters through the pump inlet into the sediment chamber and then passes through the strainer and inlet valve into the pump chamber. On the return stroke pressure spring pushes the diaphragm upward, forcing fuel from the pump chamber through the outlet valve and outlet line to the carburetor. When the carburetor bowl is filled the float in the carburetor will shut off the needle valve, thus creating a pressure in the pump chamber. This pressure will hold the diaphragm in the downward position until the carburetor requires additional fuel and the needle valve opens. The suction stroke is positive and the discharge stroke of the pump is spring operated.



Fuel Pump Operation

Fig. 63

The stroke of the diaphragm is proportionate to the amount of fuel required by the carburetor.

The pumps require no priming and little attention other than the keeping of all the connections tight and the draining of such water and sediment as may collect in the sediment chamber.

Fuel Pump Service Operations

Fuel pump inspections are an important part of the engine tune-up procedure. However, in addition to this the fuel pump may require repairs or replacements, even though a complete engine tune-up is not made.

Complaints

Complaints will usually be either that the fuel pump will not prime itself or that it does not supply sufficient fuel to the carburetor.

Failure to prime is apt to inconvenience the owner should the car run out of gasoline and then after adding gasoline to the tank, the fuel pump does not permit him to again start his engine.

Failure to supply fuel can be caused by a leaking or obstructed fuel line, a dirty screen, loose valve plug, dirty or warped valves, or worn or punctured diaphragm.

Regardless of the complaint the trouble will be revealed if you perform the following service operations.

Visual Inspection

1. Fuel leakage through the vent hole in the fuel pump body indicates leakage of the diaphragm.
2. Fuel leakage at the edge of the diaphragm is usually caused by loose cover screws which should be tightened. Also check inlet and outlet connections for leaks.

Drain Sediment

1. Use drain valve or screw to drain water and other foreign material from sediment chamber. To ensure thorough drainage it is advisable to loosen the cover screw sufficiently to permit air to enter the body of the pump.
2. When an excessive amount of water or sediment is found in the sediment chamber of the pump, it is advisable to also drain off from the fuel tank such water or sediment as has accumulated.

Reinstall drain plug (or screw) making sure that it is properly seated.

If drain is not properly seated air will enter at this point during the intake stroke preventing the pump from supplying sufficient fuel.

Clean Screen and Inspect

1. Remove fuel pump cover.
2. Remove and clean screen.
3. Remove any accumulation of sediment that has failed to drain from the sediment chamber.

4. If during previous operations leakage was found at the vent hole in the body of the fuel pump, examine diaphragm pull rod gasket and make sure nut is tight. If leakage has not been occurring at this point the diaphragm is either worn or punctured.
5. Examine both intake and exhaust valve for proper seating, being sure that valve plug gasket is in good condition and tight when reassembled.
6. Reinstall screen making sure gasket is in good condition.
7. Reinstall cover making sure gaskets are properly seated.
8. Make sure drain plug is tight.

Carburetor

The carburetors on all engines are of the dual down-draft type, each throat feeding four cylinders. Complete specifications of venturi and jet sizes used will be found in the specifications section of this book.

Two types of carburetors known as "Ford" and "Stromberg" have been used, and these are described under individual sub-headings on the following pages.

Ford Carburetor

The Ford type dual carburetor was first used on 1938 engines. It is a plain tube dual down-draft type and any mechanic understanding plain tube carburetors should have no difficulty with this model.

In this type all the main channels are carried in a removable nozzle bar, (refer Figure 65), which carries the idle tube and an aspirating nozzle. (Aspiration means the act of breathing.) The central portion of the nozzle bar forms the discharge nozzle. In this construction it is possible to locate the discharge nozzle in the centre of the air stream without having attaching brackets or bosses which interfere with the flow of air into the venturi.

The discharge nozzle proper is located in the smallest part of the venturi, refer Figure 64, is circular and of such diameter as to create a high suction at the end of the nozzle. This suction in addition to the atomizing holes in the nozzle helps to completely vaporize the fuel.

This dual carburetor can be considered as two carburetors built

into one unit. There is a separate set of venturi, idle tubes, nozzle bars, main metering system, idle system and throttle plates, one for each side. There is one accelerating pump with the fuel being divided at the pump discharge nozzle, shown in the insert Figure 67, one air chamber and one fuel chamber. There is one power valve which takes the fuel from the fuel chamber through one passage and divides the fuel evenly for each side.

In the following explanation one barrel is generally referred to unless mentioned otherwise.

Choke

The choke valve is mounted on a shaft located off centre in the air passage as shown in Figure 64. A torsion spring "S" tends to close the choke valve when the choke lever is moved to the choke position. There is a certain amount of free movement in the mechanism at part choke position, so that if the choke is partially closed to operate at a relatively low speed, the inrushing air at a higher speed will force the valve open and compensate for the increased speed.

This, however, does not mean that the car can or should be continuously operated with the choke control in part choked position. With full choke the valve is held in locked position by the control lever. If the choke is held in full closed position after the engine fires, a poppet valve or air bleeder "T" in the choke valve will open. This supplies enough air to keep the engine running and eliminate choke sensitivity.

The opening of the poppet valve and the rush of air flowing through it makes considerable noise, which should attract the owner's attention to the fact that the choke button is out and will continue to make this noise until the choke button is pushed either all the way in or to a part choke position.

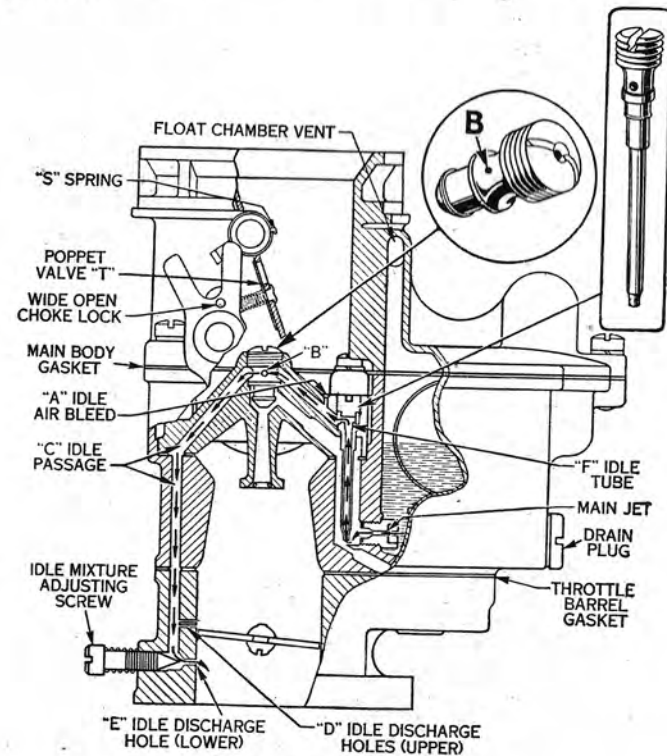
When the carburetor is choked, the throttle valve is automatically opened to the correct position for starting. For this reason it is neither necessary nor desirable for the operator to pull out the throttle button or pump the accelerator when starting.

In full choke position everything below the choke valve is subjected to intake manifold vacuum and the bulk of the fuel is supplied by the main discharge nozzle.

Figure 64 shows the idle speed adjusting screw and part of the choke mechanism.

Idle Fuel Supply

The fuel from the carburetor bowl passes through the main metering jet into the idle tube "F", as indicated by the arrow in Figure 64.



Idle Fuel Supply
Fig. 64

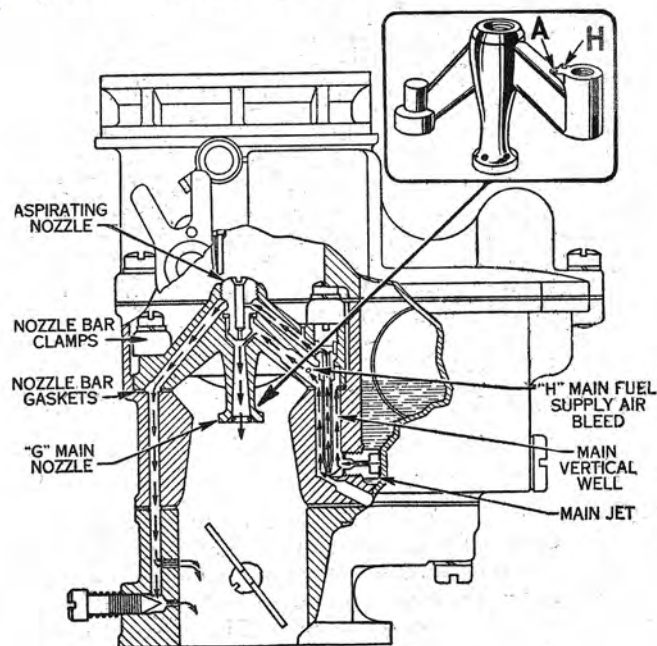
Air is introduced into the fuel stream by the idle air bleed "A" and a small additional amount of air is bled into the small hole "B" in the aspirating nozzle, refer insert Figure 64. The idle mixture goes around the aspirating nozzle by means of an undercut around its outside diameter as shown. The mixture then travels down the idle passages "C" to the idle discharge holes "D" and "E".

When the engine is set to a speed of 350 r.p.m. the mixture is

Service Handbook

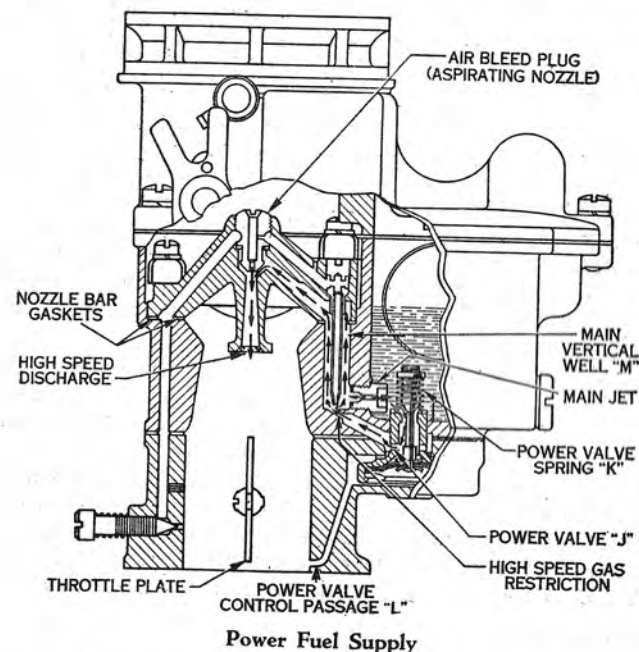
discharged out of the lower hole "E" only. As the throttle plate opens and the speed is increased, the upper hole "D" starts discharging. In this carburetor the lower holes only discharge from idle to about 450 r.p.m. The upper holes very gradually start discharging in addition to the lower holes from about 450 r.p.m. to 1250 r.p.m. The action and timing are such that the upper discharge holes gradually start to feed, reach a maximum at about 750 r.p.m. and then gradually become less effective as the main nozzle starts.

The lower discharge holes are provided with an idle mixture adjustment. Turning the needle out gives a richer mixture and in, a leaner mixture. The idle adjustment should be set for the highest and steadiest vacuum reading as described on page 83. The idle adjustment should not be jammed against the seat hard enough to groove the point. If this occurs the adjusting screws will have to be replaced in order to obtain a satisfactory idle adjustment.



Main Fuel Supply
Fig. 65

Service Handbook



Power Fuel Supply
Fig. 66

Main Fuel Supply

As the idle system becomes less effective the main nozzle "G" starts to deliver fuel. This occurs at about 900 r.p.m. Between 900 r.p.m. and 1250 r.p.m. there is a definite blend of the idle system and the main metering system. The power valve remains closed in this range and approximately up to 3800 r.p.m. except under load, which causes manifold vacuum to drop. In this range all the fuel passes through the main jets, as shown in Figure 65, up through the main vertical well and then up and around the idle tube. The main fuel is emulsified by air entering at the main fuel supply air bleed "H", which lightens the fuel and makes the mixture more responsive to throttle changes. The mixture is further emulsified by the aspirating nozzle as it starts down the main nozzle "G".

The nozzle bars are held in place by clamps and the channels sealed against leaks by the nozzle bar gaskets. In disassembling

and assembling these nozzle bars care should be taken to see that the gaskets are in place and in good condition and that the clamp screws are tight. When removing jets, be sure a screw driver which fits the slot is used. This will eliminate the danger of slipping and damaging the metering orifice.

The power valve "J" (shown in Figure 66), is operated by the vacuum below the throttle plate through passage "L" and the power valve spring "K". At idle, the vacuum is the highest and decreases as the load increases. The diaphragm (actuated by vacuum) holds the power valve on its seat until the vacuum drops to $8\frac{1}{2}$ to 9" of mercury where it is not high enough to resist the action of the spring. This point at level road running at a constant speed is approximately 3800 r.p.m.

Under load as in climbing hills, etc., the vacuum drops as it becomes necessary to open the throttle wider in order to maintain speed. When the vacuum drops to $8\frac{1}{2}$ to 9" of mercury the power valve is opened by the spring the same as when the engine speed exceeds 3800 r.p.m. on level road and the fuel then flows into the the power valve and channels and through the high speed gas restrictions into the centre or main vertical well "M", as shown by the arrow in Figure 66. This gives the additional fuel required for high speeds and for heavy loads at full throttle and low speeds.

Accelerating Pump

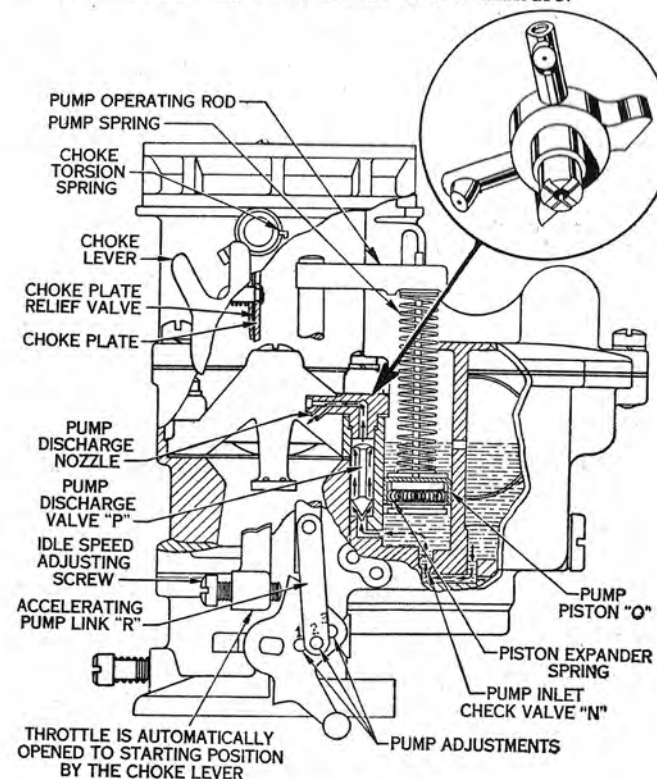
The accelerating pump is directly connected to the throttle and its function is to slightly enrich the mixture for rapid acceleration. Referring to Figure 67 fuel is drawn into the pump chamber through the pump inlet check valve "N" on the up-stroke of the pump piston (closing the throttle). When the throttle is opened the piston "O" moves down closing the pump inlet check valve and overcoming the weight of the pump discharge valve needle. The accelerating fuel then goes around the pump discharge valve "P" and out the pump discharge nozzle (refer insert Figure 67). Free movement against a spring load is provided in the pump piston stem and the pump operating rod to give a prolonged discharge when the throttle is opened suddenly.

The accelerating pump is provided with an adjustment for varying the quantity of the accelerating charge. This adjustment is made by changing the position of the pump link "R". The positions are marked 1, 2, and 3. Number 2 is the average setting; Number 1 the summer or hot weather setting; and Number 3 the extremely cold weather setting.

Failure of the accelerating pump is mostly due to dirt in the pump inlet check ball seat. This can be checked by removing the carburetor air horn and operating the pump with just a small amount of fuel in the bowl. If the check is leaking, air or fuel will bubble back into the fuel bowl from the inlet hole. When cleaning this seat care should be used in re-installing the pump piston to be sure the leather is not damaged.

Adjust Idle Jets

1. Remove and clean air silencer or air cleaner. A dirty silencer offers considerable restriction to the air coming into the carburetor and may result in too rich a mixture.



Acceleration Fuel Supply

Fig. 67

2. Stop any vacuum leaks as they will upset the fuel air ratio. This is important. Check particularly for leaks at the wind-shield wiper and distributor connections, or if the car or truck is equipped with vacuum operated accessories, be sure to check for vacuum leaks at these lines also. Tighten the intake manifold nuts to assure the manifold seating itself in the gasket.
3. Adjust one side of the carburetor at a time. Turn the valve in slowly until the engine begins to lag or run irregularly then slowly turn out until the engine begins to roll. Finally very slowly turn the adjustment in again just enough so that the engine runs smoothly for this speed. Correct adjustment is usually $\frac{3}{8}$ to $\frac{3}{4}$ turns open.
4. Follow the same procedure for the opposite side of the carburetor.
5. Adjust the accelerating pump stroke to suit the season on those carburetors provided with a means for making this adjustment.
6. Adjust the idle speed of the engine to a road speed equivalent to approximately 4 to 5 m.p.h.

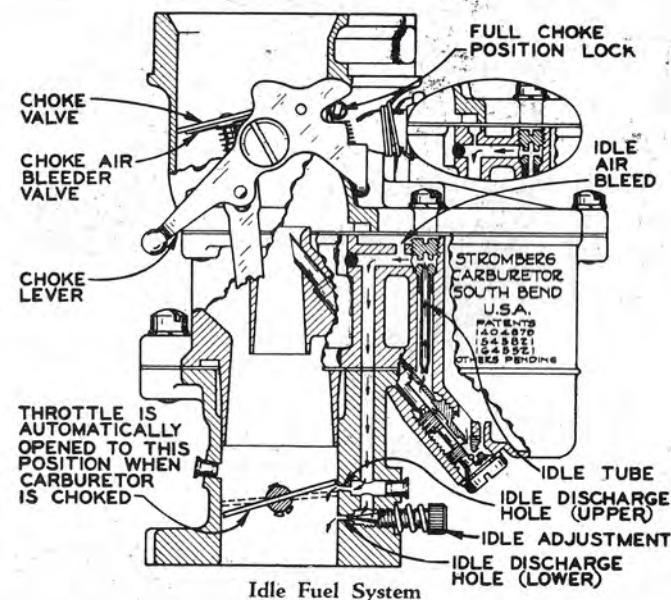
Stromberg Carburetor

While different models of Stromberg type dual carburetors have been used on various types of V-8 engines, they are sufficiently similar that the individual who understands the functioning of one can readily understand all the various models.

In conjunction with dual manifolding, the Stromberg dual down-draft carburetor was first used on the 1934 Ford V-8 engines.

These carburetors are of the plain tube type using an air bled main discharge tube and a double venturi (refer Figure 68). The secondary venturi is located above the primary venturi and, discharging below the point of greatest restriction in the primary venturi takes full advantage of the unbalanced pressures, or the difference in pressure at the two ends of the secondary venturi, i.e., atmospheric pressure at the upper end and the stepped-up vacuum at the lower end. In this way the rate or speed of the air flow is greatly increased.

The dual carburetor can be considered as two carburetors built into one compact unit. There is a separate set of venturi tubes, main metering system, idle system, throttle plate and pump dis-



Idle Fuel System
Fig. 68

charge nozzle for each barrel. These are fed with fuel by one accelerating pump, one fuel chamber and air through one air passage.

In the explanation that follows, one barrel is generally referred to unless mentioned otherwise.

Idling—Fuel Supply

The fuel from the carburetor bowl passes through the main metering jet into the idle tube as indicated by the arrows in Figure 68. Air enters the fuel stream at the idle air bleed and the mixture of fuel and air then travels downward to the idle discharge holes.

With throttle stop screw set so that throttle plate is open to a speed equivalent of 5 to 7 miles per hour, as indicated by the dotted lines, the lower discharge only is subjected to intake manifold vacuum. As the throttle is opened to increase the engine speed, the throttle plate is moved above the upper idle discharge hole and fuel mixture discharges from both idle holes.

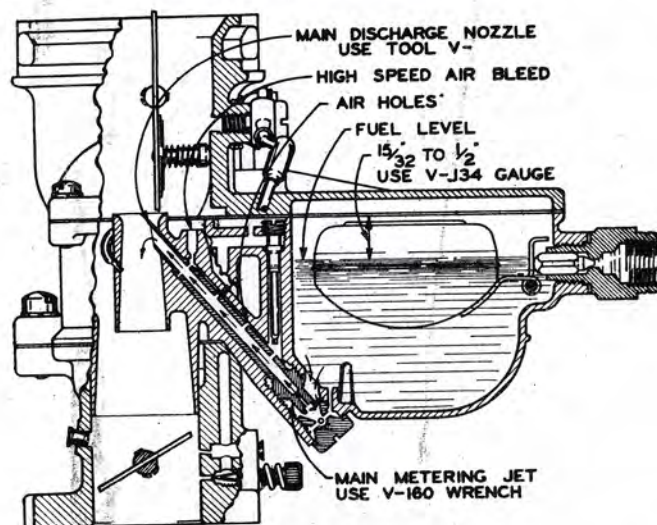


Fig. 69

The lower discharge hole is provided with an idle adjustment. Turning out the needle gives a richer mixture and turning in a leaner mixture. The idle adjustments should be set for the highest and steadiest vacuum reading possible. If idle adjustments have been damaged with a groove on the valve point, they should be replaced in order to obtain a satisfactory adjustment.

The procedure of idle adjustment for the Stromberg carburetors is the same as that for the Ford type carburetors, as outlined on page 126.

Main Fuel Supply

The idle system is in operation up to approximately 18 to 22 m.p.h. in which range the main metering system begins to function and furnishes fuel up to approximately 76 m.p.h. At this point the power jet also cuts in.

The fuel passes through the main metering jet into the main discharge tube where air is bled from the high speed bleeder into the fuel stream, (refer Figure 69). The air completely surrounds the main discharge nozzle and by entering it at several places forms bubbles to create an emulsion. This makes the fuel lighter

in weight and more responsive to throttle valve movement. The fuel from the idle tubes is also taken into the main nozzle.

The main discharge tube is held in position by the main metering jet. The metering jet should be assembled securely in the body, but without excessive pressure to avoid the possibility of causing the air bleed holes to close, resulting in too rich a mixture and poor low speed performance. The main nozzle was later designed to have two bleeder holes at the top instead of four holes.

When assembling the main nozzle, place it so that the discharge opening is in the vertical position as illustrated in Figure 69.

Accelerating Pump

An accelerating pump directly connected to the throttle is provided to slightly enrich the mixture for rapid acceleration.

Fuel is admitted to the pump cylinder through the pump inlet check valve. When the throttle is open the pump moves downward and the pressure on the gasoline closes the inlet check valve and opens the spring loaded valve of the power jet, permitting the fuel to be forced out through the accelerating pump discharge jet and nozzle. Free movement is provided in the pump lever assembly to prolong the discharge of the fuel when suddenly accelerating from closed throttle to part open position.

Starting in 1936 on Ford V-8 engine, the accelerating pump, was made adjustable and should be changed for winter and summer. In the winter a greater discharge from the pump is desirable; this can be obtained by assembling the accelerating pump rod at the position farthest from the center of the throttle stem. Assembling the pump rod in position nearest the centre of the throttle stem cuts down the accelerating pump discharge and is the summer adjustment.

If necessary to remove the pump piston, make certain on re-assembling that piston bears evenly on the entire circumference of the cylinder.

Power Jet

When the throttle is opened to a pre-determined position, the pump piston makes contact with the spring loaded valve of the power jet, holding the valve off the seat and permitting fuel to flow through the jet and the pump discharge nozzles. The additional fuel is required to richen the mixture for increased speed or operating under heavy load.

Choke

The choke valve is mounted on a floating stem that is located off-centre in the air passage. A spring connects the choke control lever to the valve stem, so that, when the choke control lever is in part closed position, the in-rushing air forces the choke valve open against the tension of the connecting spring.

This, however, does not mean that the car can or should be continuously operated with the choke control in part choked position. With full choke the valve is held in locked position by the control lever. If choke is held in full closed position after the engine fires, a poppet valve or air bleeder is incorporated in the choke valve to supply air to keep the engine running.

The opening of this poppet valve and the rush of air flowing through it, makes considerable noise, which should attract the owner's attention to the fact that the choke button is out, and will continue to make the noise until the choke button is pushed, either all the way in or to a part choke position.

When the carburetor is choked, the throttle valve is automatically open to the correct position for starting. For this reason it is neither necessary nor desirable for the operator to pull out the throttle button when starting.

In this position the throttle valve is directly opposite the upper idle discharge hole so that the stream of air passing around the throttle plate draws fuel for both upper and lower discharge holes. In full choke position everything below the choke valve is subjected to intake manifold vacuum and the bulk of the fuel is supplied by the main discharge tubes.

Air Filters and Cleaners

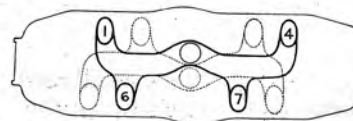
Complete details of the various types used and relative servicing instructions are outlined on pages 24 to 27 inclusive.

Intake Manifold

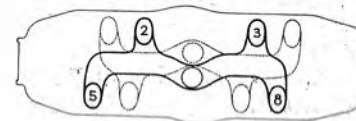
Each throat of the intake manifold feeds a group of four cylinders whose suction periods succeed each other at 180° intervals of crankshaft rotation. Consequently simultaneous suction of two cylinders on the same manifold is prevented and uniform fuel distribution to all cylinders is assured. This ensures maximum charge in each cylinder resulting in development of higher and more uniform power output from each cylinder. Fuel economy is

improved by the thermostatic control of the exhaust gases through the intake manifold heat jacket.

"A" Figure 70 outlines the intake manifold for the right hand barrel of the dual carburetor. This portion of the intake manifold supplies the fuel air mixture to cylinders 1, 4, 6 and 7.



"A"



"B"

Fig. 70

"B" Figure 70 illustrates the intake manifold for the left hand barrel of the carburetor, which supplies the fuel air mixture to cylinders 5, 8, 3 and 2.

With the exception of a small passage-way between the two manifold cores, at the windshield wiper and distributor vacuum brake connections, the two intake manifolds are entirely independent of each other and not connected.

These connected passage-ways at the windshield wiper and distributor vacuum brake connections, serve the purpose of steadying the vacuum at these points, giving the steady vacuum characteristics of an 8-cylinder engine. Had these two manifolds not been connected at these points, the vacuum for the windshield wiper, and the distributor vacuum brake, would be unsteady at low speeds, as with 4-cylinder engines.

ELECTRICAL SYSTEM

The electrical system is generally referred to as consisting of the Generator—Voltage Regulator—Battery Indicator or Ammeter—Battery—Starting Motor—Wiring and Primary and Secondary Ignition Circuit—and Lighting System. These items will be dealt with individually in the following.

Generator

The generator on all Ford V-8 passenger and commercial cars and trucks prior to 1938 was a three brush type, the charging rate manually adjusted by movement of the third brush. On 1938 and subsequent model Ford V-8 passenger and commercial cars and trucks, and Mercury and Lincoln-Zephyr passenger cars, a two brush type generator is used on which there is no adjustment. The charging rate is automatically controlled by means of a voltage regulator which will be dealt with later in this article.

The generator is air cooled by a fan built into the generator pulley and is rigidly mounted on a bracket which provides easy adjustment of the generator belt.

On all 1940 models the generator capacity has been increased considerably to provide additional current. Various pulley sizes are available for installation on units where operation demands a lower cut in speed and lower maximum output speed. Special generator equipment is also available for individual requirements such as police work, continued low speed operation, etc.

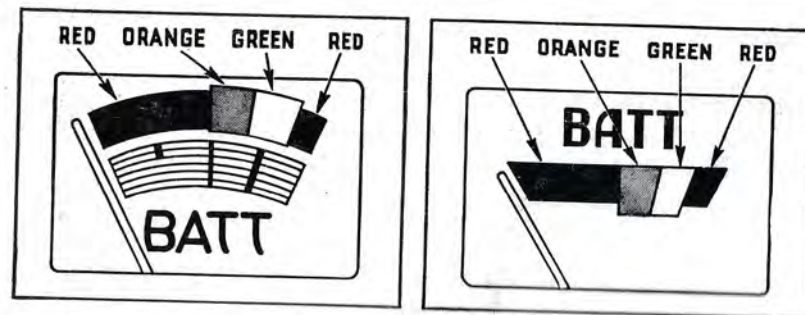
Complete details concerning generator pulley sizes and various types of generator equipment available will be found in the specifications section of this book.

Voltage Regulator

On all two brush type generators the generator output is controlled automatically by means of the voltage regulator. The voltage regulator is mounted on the front side of the dash. Failure of the voltage regulator to properly control the output of the current will necessitate replacement of this part. Adjustment or servicing of this unit should not be attempted except by an individual or shop having the necessary electrical equipment.

Battery Indicator

The battery indicator (illustrated in Figure 71) indicates the voltage of the battery and generator circuit. It is a protection



Battery Indicator Ford V-8 Cars Battery Indicator Ford Deluxe Cars
Fig. 71

against damage in the event of failure of the generator or voltage regulator.

The pointer should not at any time read above the green sector.

After turning on the ignition switch and before starting the engine, the pointer should rise at least to the orange sector if the battery is fully charged. In the event the indicator fails to reach this point after waiting approximately one minute, the condition of the battery should be checked.

Under normal driving conditions and with no load except the ignition current, the pointer should rise to and remain within the green sector.

If the indicator reaches the right hand red sector, this is an indication that the voltage in the circuit is too high, which may damage the light bulbs, wires or even the generator itself. If such a condition occurs the generator voltage as well as the operation of the voltage regulator should immediately be checked to preclude the possibility of damage.

Battery

A 6 volt, 17 plate, 120 ampere hour battery having a high cranking capacity, is used on all 1940 and 1941 models.

Complete details of batteries available through service, as well as those used as equipment on previous model cars and trucks, will be found in the specifications section of this book.

The battery is conveniently located under the hood of all models;

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except cab-over-engine trucks, and is instantly accessible for service operations.

Adding Distilled Water

The following procedure should be followed when adding distilled water to the battery:

Brush dirt from the top of the battery and remove the filler plug. It is essential that the dirt be removed from the filler plug and from the top of the battery prior to removing the filler plug, otherwise dirt might drop into the battery which would prevent correct operation of the vent plugs in the filler holes.

Remove vent caps and place them upside down on the top of the battery.

Make sure the vent holes are open.

If the specific gravity of the cells is to be tested, this operation should be done before water is added, as it is useless to test the specific gravity of any cell until at least one hour's operation of the unit after the addition of distilled water.

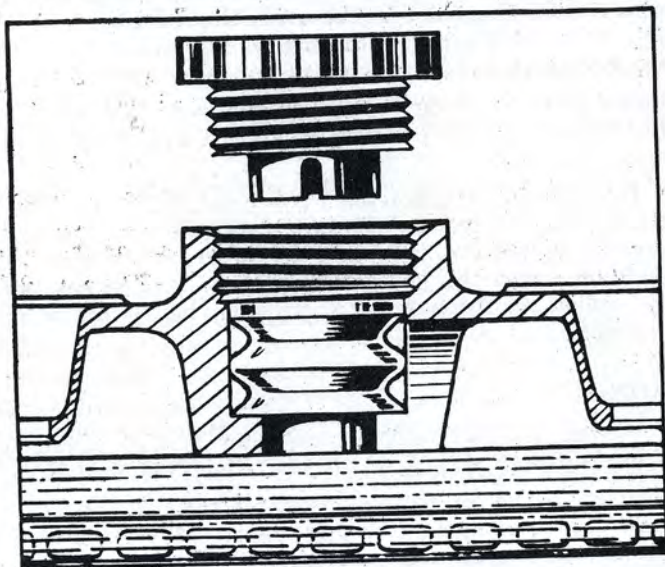


Fig. 72

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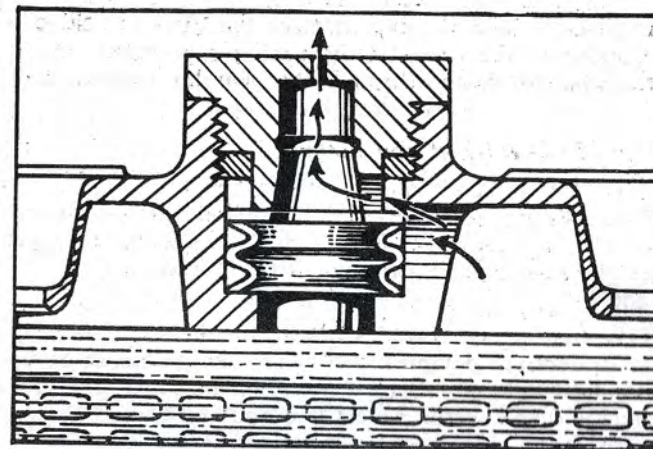


Fig. 73

It is of extreme importance that only distilled water be added to the battery and it should cover the plates at all times. A rapid loss of water in the battery usually is an indication of an excessive charging rate or a cracked cell.

When adding distilled water to the battery it is advisable to use a self-levelling syringe which automatically establishes the level at the correct distance above the top of the plates. With this type of syringe the water level is raised above the required height and being lighter than the electrolyte it remains on top of the electrolyte. When the bulb on the syringe is released the water above the small hole in the nozzle is drawn back into the syringe thus automatically establishing the correct level as controlled by the location of the small hole in the side of the nozzle.

During 1938 a valve was incorporated in the battery cell cover, which automatically establishes the correct level for the electrolyte.

When the cap is removed the air above the bottom of the filler neck is trapped and when the level of the electrolyte reaches the correct height, additional water cannot be added. Refer to the illustration in Figure 72.

Care should be exercised not to hold the valve down when adding water to the battery as this would defeat the purpose of the design of the valve and too much water could be added.

Figure 73 is a cross-sectional drawing of the cell cover with the cap in place. With the cap in place the valve is held down, thereby ventilating the cell as indicated by the arrows and permitting the gases to escape through the vent hole in the battery filler cap.

Testing Specific Gravity of the Battery

Providing all other conditions are satisfactory the specific gravity of the electrolyte in the battery is a direct indication of the state of charge of the individual cell being tested. In testing the specific gravity the following procedure should be adopted.

Take hydrometer readings of all three cells. If readings of 1225 or less are obtained the battery either needs to be recharged or replaced. Such a battery is only half charged and trouble is sure to result unless you find and correct the particular condition that caused the battery to run down.

If readings above 1225 and below 1250 are obtained, add distilled water if required and request the owner to return after a few hours' operation in order that an additional check may be made.

If readings above 1250 are obtained the battery is practically fully charged and in a condition suitable for continued operation.

If readings are the same in all three cells within 20 points it is an indication that the three cells are all in equal condition.

Rental Batteries

Since in normal operation the owner's battery became discharged it is reasonable to assume that there must be a reason for such discharge and that similarly there is no reason to assume that it will again become fully charged in the car.

If from the tests made there is no conclusive evidence that the battery should be discarded, then it should be removed from the unit and a rental battery installed.

When installing the rental battery the specific gravity of the rental battery should be recorded with chalk on the side of the case at the time of installation.

Also when installing the rental battery make a ground connection with all switches "off" then touch the negative connection to the battery negative post—if a spark is noted it is a positive indication

that a short exists that in all probability will run the battery down even with the lights, ignition, accessories, etc. all turned off. The short must be corrected or the rental battery may also give the customer trouble in a short space of time.

When the owner returns for reinstallation of the battery in his vehicle the specific gravity of the rental battery should again be checked and if the gravity has dropped over 10 points average or more per day it is a positive sign that more energy is being used than is being supplied to the battery, which is an indication that the cause of this abnormal withdrawal should be determined and corrected to prevent further trouble from this source.

Battery Connections

The battery connections as well as the body to engine and battery ground connections, must be kept clean and tight at all times, otherwise the generator voltage may increase beyond safe limits.

Starting Motor

The starting motor assembly is bolted to a reinforced section of the engine oil pan on the right hand side at the rear. It requires no lubrication and will normally provide service during the life of the vehicle, with the exception possibly of cleaning.

Starter Drive

A Bendix type starter drive is used to engage the starting motor pinion with the ring gear on the flywheel.

This type of drive is illustrated in Figure 74.



Fig. 74

Before reassembling a starter drive which has been removed for service, to the starting motor armature shaft, clean the shaft thoroughly by removing any rust, burrs or scoring. Then lubricate with a graphite grease or lubricating oil. After reassembly check the starter drive to be certain it is possible to compress the drive spring, and the gear and shaft portion of the

drive, longitudinally and that it fully returns to its original position when compression is released.

When reassembling the drive, lock washers should be properly bent to hold the spring screws in place—the tip of the washers must be bent upward to lock the screws. Old lock washers should be discarded and only new ones used in reassembly.

A slight distortion of the starter motor drive spring does not justify replacement, but if comparison with a new spring indicates the used spring has taken a permanent set or become badly distorted, then replacement is recommended.

Accidental contact of the starter while the engine is running, will not result in damage, but when starting the engine, if the engine starts then stops, always allow the engine to come to rest before re-engaging the starter, otherwise damage may occur.

Surplus oil, grease, or any dust on the drive shaft triple threads may interfere with normal meshing, particularly in cold weather. The starter drive can be cleaned while mounted on the starting motor by using a brush dipped in kerosene (not gasoline). After being thoroughly cleaned, the shaft can be left with kerosene coating or carefully lubricated with a few drops of very light engine oil.

Inspection of the starter drive and cleaning, if necessary, may well be a part of the winter "Tune-Up" program in territories encountering low winter temperatures.

Starter Button and Starter Switch

The starter button is located on the instrument panel and in turn controls a magnetic solenoid type of starter switch (mounted on the engine side of the dash), which engages the starting motor.

The starting switch is illustrated in Figure 75.

An auxiliary starting button is located at the bottom of the starter switch, (refer Figure 75), to facilitate cranking of the engine while repairs are being made.

Wiring

Electrical Values

Actually the few fundamental principles that one must know and appreciate in order to understand the wiring and electrical system, are comparatively simple.

All you need know of electrical science is the values with which



Fig. 75

you deal, the kind of connections you will have to make and a few simple facts about the flow of electricity.

The four values are:

Amperes—representing the strength of the current.

Volt—the pressure of the current.

Ohms—the resistance in the circuit.

Farads—the capacity value of the condensers. (Actually you will only deal with micro farads or fractions of micro farads.)

The laws governing the flow of electricity simply stated are as follows:

The strength of the current (amperes) flowing through a circuit will depend on the pressure (volts) and the resistance (ohms) of the circuit.

One ampere will flow through a circuit of one ohm resistance with one volt pressure.

Two amperes will flow through a circuit of one ohm resistance with two volts pressure.

Four amperes will flow through a circuit of one-half ohm resistance at two volts pressure.

Thus we see that the strength (amperage) of the current is controlled by the resistance (ohms) and the pressure (volts).

The strength of the current (amperes) multiplied by the resistance (ohms) will indicate the pressure (volts) of the current.

Likewise the voltage divided by the amperage will indicate the ohms resistance of the circuit, or, the voltage divided by the ohms resistance will indicate the amperes (strength of the current) flowing through the circuit.

Types of Circuits

The type of connections you will make in making various electrical system tests are:

Series connections—in which the test set is part of the particular circuit being tested.

Parallel connections—in which the test set is parallel to all, or a portion of the particular circuit being tested.

If you understand the four electrical values you can put this knowledge into practical use. It, however, is necessary that you understand the various electrical circuits in the car. This is not as difficult as it may appear.

The word circuit itself suggests a circle.

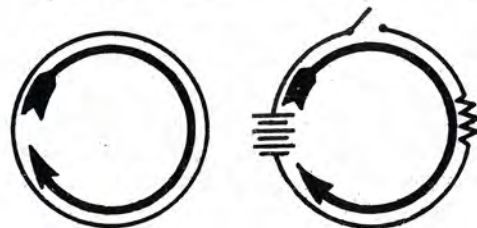


Fig. 76

or, to compare it to a circle, until the circle is completed.

Follow the arrow in Figure 76 around the circle and you will find that you return to the point where you started. In electrical circuits the circuit is not complete until a return to the source of power is provided.

By drawing in various electrical symbols it is an easy matter to change the circle into a drawing of an electrical circuit.

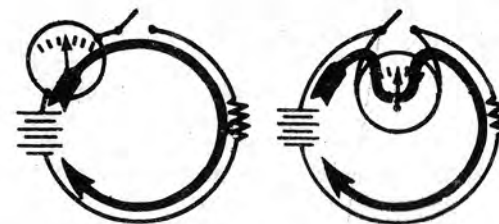


Fig. 77

Every circuit, of course, must have a source of electrical energy or power, so in making a simple circuit for the purpose of this explanation a battery is necessary.

Likewise in every circuit in the car electrical system a means of breaking the circuit

is provided, so a switch is necessary in our simple circuit.

Since, as mentioned on page 140, with a given voltage the strength of the current (amperes) is controlled by the resistance in the circuit and, since in every circuit on the car there is some resistance, a resistance is necessary in our simple circuit. (Refer Figure 76).



Fig. 78

In this simple circuit there is: a battery, a switch and a resistance all connected with wires so as to form a circle. The electrical current from the battery is available at the switch and when the switch is closed the current goes through the switch and the resistance, and returns to the battery, thus completing the circle or circuit. The resistance and the switch are both a part of the circle and whatever current passes through one likewise passes through the other. In this case the battery, switch and resistance are connected in series with each other.

If a meter were installed in the circuit as illustrated in Figure 77, it likewise would be in series with the battery, switch and resistance. All of the current flowing through the circuit would likewise flow through the meter. However, if the resistance of the meter were high, the installation of the meter would restrict the flow of the current.

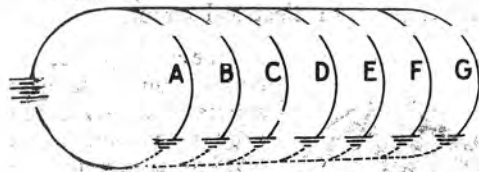


Fig. 79

necessary to disconnect one of the wires in order to put the meter in series.

A simpler way of connecting a meter in series in a circuit is to connect the meter to the two terminals of the switch as shown in Figure 77, the flow of current would be as indicated by the arrow.

In this case the meter is connected in series, the entire current passing through the meter. However, if with the meter thus connected the switch were closed, then two paths would be available for the current and the current would divide itself in proportion to the resistance of the two paths. Less current would pass through the meter with the switch closed than with it open, since part of the current would pass through the switch.

With the switch open, the meter would be in series with the battery and resistance.

With the switch closed, the meter would be in parallel to the switch and the reading would be lower than it was with the switch open. The amount of the reading would depend on the resistance of the switch.

Going back to the simple circuit, if an additional resistance were added, connected as shown in Figure 78, then resistances "A" and "B" would be parallel to each other and the current would divide itself in proportion to the resistance of each. In this case, we have two circuits, both controlled by the same switch, an ammeter connected across the switch would give total strength of current for both circuits.

Let's assume that resistance "A" is equal to one ohm, six volts divided by one ohm equals six amperes.

Assuming the resistance of "B" to be two ohms, six volts divided by two ohms equals 3 amperes.

Six plus three equals nine; with an ammeter connected across the switch a reading of nine amperes would be obtained.

These resistances represent different circuits or a circle within a circle. Actually the entire electrical system of the car is nothing more than a group of such circuits or circles. Starting with seven such circles it is an easy matter to change them into an actual simplified wiring diagram of the electrical system.

With a battery as a source of energy and knowing that every circuit is provided with a means of breaking the circuit, none of the circles are complete except when the switch is closed. Likewise every circuit in the car uses the engine, frame or body for a portion of the circuits. On wiring diagrams, connections to the engine, frame or body are indicated by ground symbols.

Where any circuit is grounded it is connected to all other circuits that are grounded, so in Figure 79 the ground connections are all connected with dotted lines.

The seven circles represent the following seven circuits in the car—starter circuit, horn circuit, cigar lighter circuit, ignition primary circuit, generator circuit, dome light circuit, and lamp circuit.

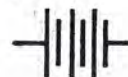
By adding the correct symbols for the various units in each of the circuits, this group of circles can be changed into a simplified diagram of the entire electrical system. Such simplified diagrams for the various circuits will be found later in this article.

How to Read the Wiring Diagrams

The flow of electricity is analogous or comparable to the flow of water. To assist in visualizing the flow of current through the various circuits, the Ford V-8 wiring diagrams have been simplified. In these diagrams the two sources of electrical energy, (the battery and the generator) have been positioned at the top of the page and the flow of the current is downward, making the flow of the electrical current easier to compare with the flow of water.

Various standard symbols are used in these diagrams to designate units of the electrical system and an understanding of these is necessary to facilitate study of the wiring diagram.

Battery



A three cell battery is indicated like this.

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Poles



This symbol always means positive.



This symbol is used to designate negative.

Switches



Simple switches are indicated like this.



Spring type switches such as horn button or stop light switch are indicated like this.

Ground

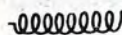


Circuits are usually completed through the chassis rather than through wires. Connections to the various units not insulated from the chassis are called ground connections and are indicated by this symbol.

Resistances

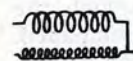


A non-inductive resistance such as the resistance unit used in the ignition circuit to reduce the amount of current flowing through the circuit is indicated by this symbol.



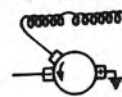
An inductive resistance is indicated like this. Note this same symbol is used to indicate the field coils of the generator and starting motor circuits shown below or any inductive resistance.

Induction Coil



An induction coil is shown like this. The primary winding and in this case the secondary winding is connected to the primary winding; this is true of all Ford ignition coils. On other types of ignition coils the one end of the secondary winding would be shown grounded.

Generator



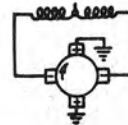
The three brush type generator is shown like this. The field coils are indicated by the coils at the top. The one end of the field coil windings is either grounded to the generator case or where a two rate relay is used it is grounded through the relay. The opposite end of the field windings is connected to the

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field brush; this is the brush that is moved to change the charging rate of the generator. (Note the two field coils are connected in series with each other.) The positive brush (+) is grounded to the generator case.

The lead from the armature brush (-) is connected to generator cutout.

Starting Motor



The starting motor is shown like this. The two positive brushes are grounded as shown. The current from the battery flows through the two field windings (which are in parallel to each other as shown) to the two negative brushes from which it goes through the armature windings to the positive and then to ground and the battery.

Fuse



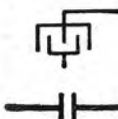
This symbol indicates a fuse such as is used to protect lamp circuits, etc.

Breaker Points



Breaker points are indicated like this whether they are breaker points in the distributor, horn, generator, cutout, oil gauge or any place where the circuit is automatically completed and broken by a circuit breaker.

Condensers



A condenser is always used in parallel to breaker points, either to prevent arcing at the points or to eliminate radio interference. This is the symbol usually used. In radio set diagrams a simpler symbol like this is often used to make the drawing less complicated. In most automotive wiring diagrams the more complicated condenser symbol shown above is used, as it is less apt to be confused with other symbols.

Bulbs



This indicates a single filament in a single contact type lamp bulb. A double contact bulb would have both ends of the filament connected to wires instead of having one end grounded.

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Wiring Diagrams

The various illustrations of wiring diagrams and electrical systems on the following pages can be of real assistance if intelligently used. Obviously they can be used to identify the various wires or circuits by the colours of the insulation. However, greater use than this is possible if you carefully study the wiring diagram when presented with a specific problem.

Headlights

The fender type headlights as illustrated in Figure 84 were used on all 1937 to 1939 passenger models inclusive. The Sealed Beam type light was adopted for all domestic production on 1940 models. Details of both types of lamps are outlined individually herebelow.

Fender Type Headlights

Starting with 1937 models the fender type headlights were adopted. This type of headlight is illustrated in Figure 84. These headlights are aimed by means of adjusting screws as shown in the illustration.

All of these headlights used either 21-21 or 21-32 candle power two filament bulbs of the prefocused type, and as long as accurately made bulbs are used the focus of the headlights requires no attention.

The focus of the bulb is controlled by the position of the light filament with regard to the reflector. Therefore, if the filament were to sag the light would be out of focus. This would change the shape of the beam pattern.

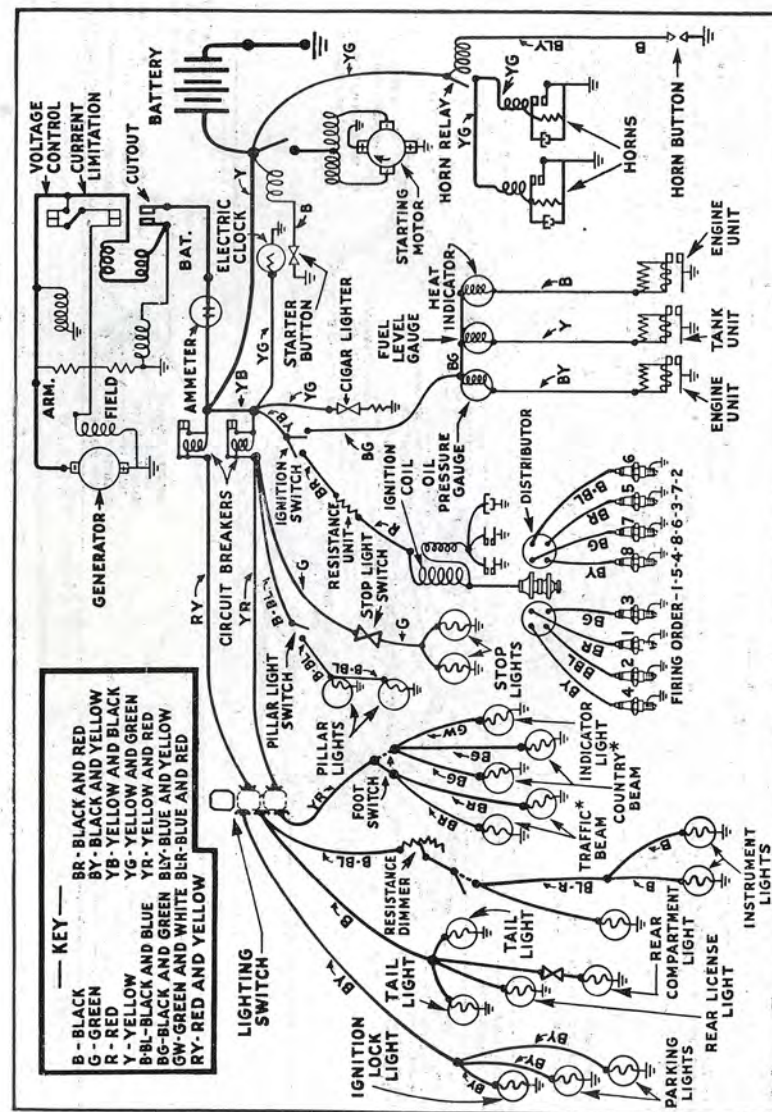
In cases where the beam pattern has changed the bulb should be replaced.

In all of these bulbs the "low beam" filament is directly above the high beam filament, this results in the traffic beam being deflected downward only.

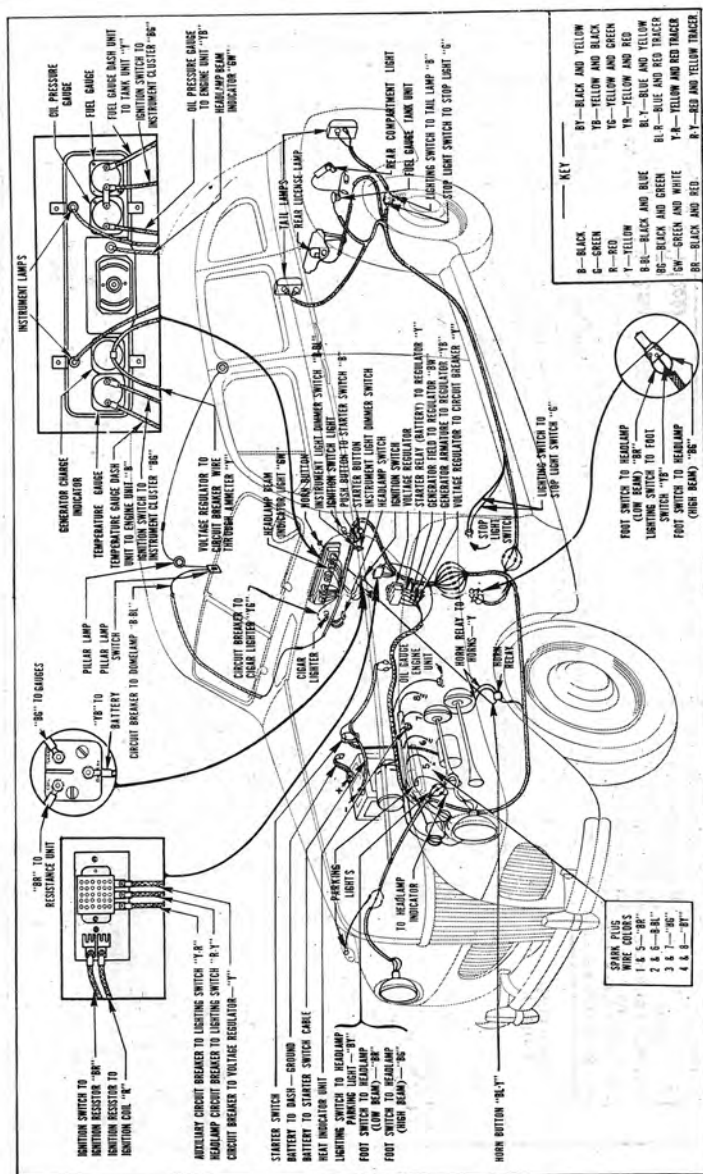
Alignment in all of these headlamps is correct when the high beam of light from these headlamps extends straight forward with the car empty.

Much can be done to keep up the efficiency of these lights by frequent cleaning of the inside surfaces, by replacing or cleaning the reflectors and by making sure that the correct bulb is used, and that the light is aimed correctly.

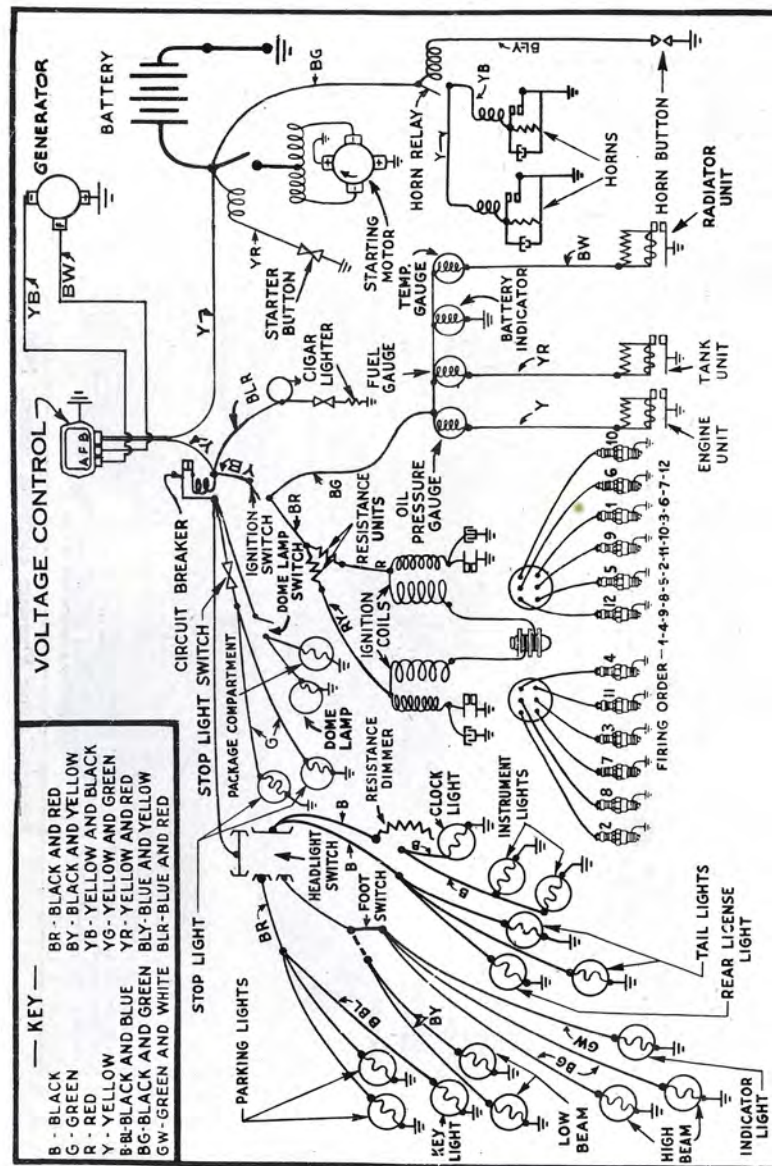
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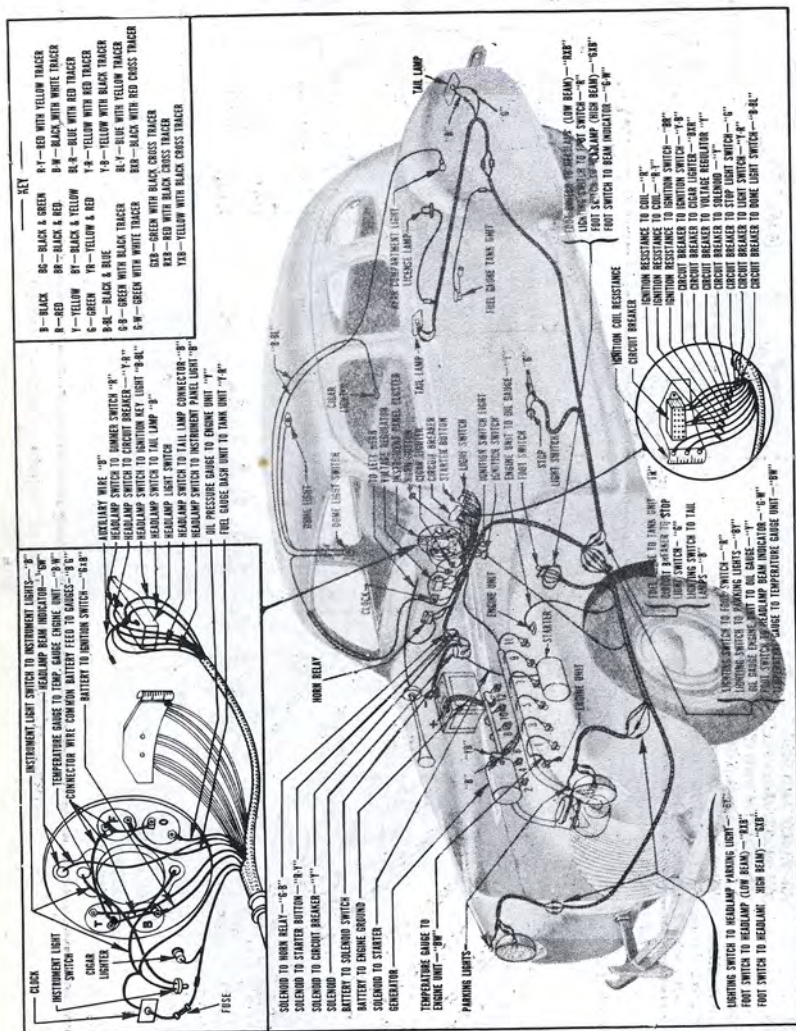
Simplified Wiring Diagram of Deluxe Ford V-8, 1940
Fig. 80



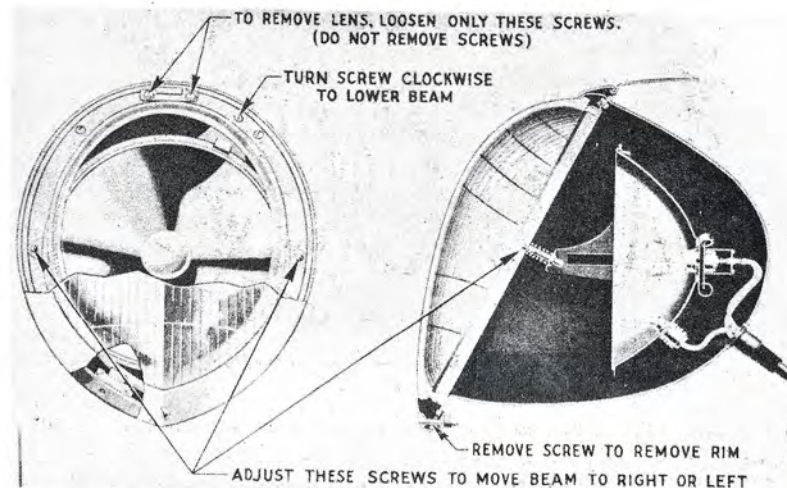
Deluxe Ford V-8 Phantom Electrical System, 1941



Simplified Wiring Diagram of Lincoln-Zephyr, 1940
Fig. 82



Lincoln-Zephyr Phantom Electrical System, 1940
Fig. 83



Fender Type Headlights—1937 to 1939 Models Inclusive

Fig. 84

When cleaning reflectors of the headlights dry powdered lamp-black and a soft flannel cloth should be used. Work the strokes radially from the outside edge of the reflector towards the centre.

Also, be sure to replace old gaskets. Wiring connections should be checked to see that all are secure. Lenses should be cleaned on the inside surface.

Sealed Beam Type Headlights

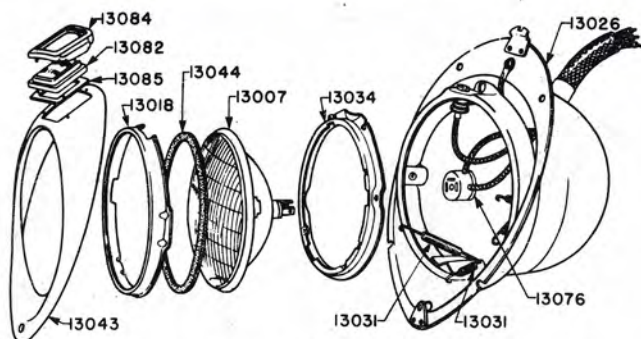
Starting with 1940 models, all cars and trucks adopted the sealed beam type of headlamp.

Passenger cars all use the fender type of headlight as shown in the illustrations. These fender type sealed beam headlights are aimed by means of the adjusting screws as shown in Figure 86.

While the various truck models likewise adopted the sealed beam headlight, the light since it is not built in is aimed by moving the entire headlight on its ball joint, as was true of previous truck models.

The sealed beam type of headlight uses a large bulb containing not only the country and traffic beam filaments but the reflector and lens as well.

These bulbs while more costly than the old type of bulb should



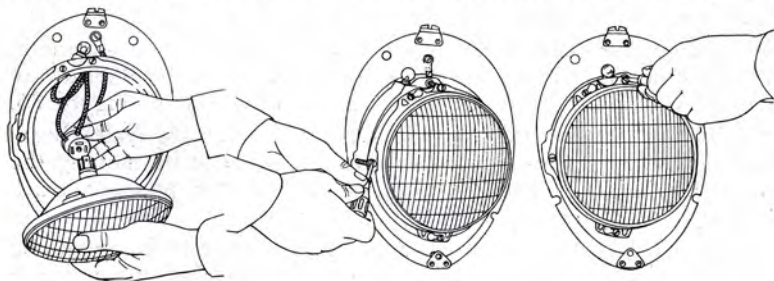
Exploded View of Sealed Beam Headlights
Fig. 85

last about three times as long. Thus the cost of maintaining the lights will not be any greater than was true before.

Since the reflector is built in, it is not exposed to the tarnishing effects of the atmosphere and these lights will continue to deliver a high quality light throughout their entire life.

As is true with all types of headlights, the brilliancy of a given light is dependent on the voltage under which it is operating, and it is even more important that the generator and battery circuits be maintained at all times, and that the battery is not allowed to become low in charge.

At a given voltage, the sealed beam headlight delivers nearly twice as much light as the previous 32 candle power bulb. For this reason, it is of the utmost importance that these headlights be correctly aimed at all times. Likewise it is extremely important



Removal and Adjustment of Sealed Beam Bulbs

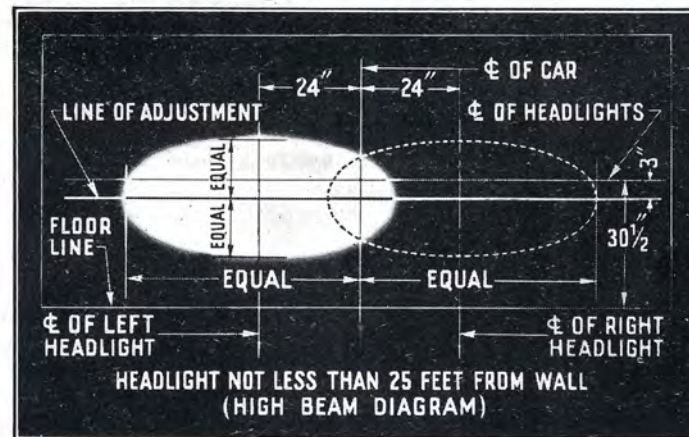
that the driver use the traffic beam when approaching a vehicle coming from the opposite direction.

Alignment is correct when the high beam of light from each headlight extends straight forward with the car empty. Refer Figure 87.

The wall shown in Figure 87 is 25 feet from the headlight lenses and at right angles to the centre line of the car.

With the high beam correctly aligned the lower beam will automatically be correct.

The lights are aimed up and down or sidewise by adjusting the screws as shown in Figure 86.



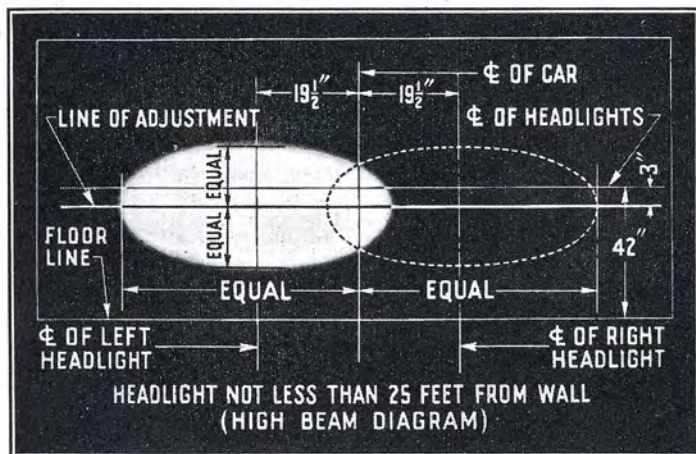
Headlight Alignment Chart—1940-1941 Model Passenger Cars
Fig. 87

The chart illustrated in Figure 87 is applicable to 1940 and 1941 model passenger cars whereas the chart illustrated in Figure 88 is applicable to 1940 and 1941 model trucks.

The bulbs in the sealed beam units are pre-focused and focusing requires no attention.

The country beam pattern is flat as was true with previous types of headlights. The traffic beam pattern however is nearly round and is deflected not only downwards but to the right as well.

The deflection of the traffic beam from the country beam amounts to 8 inches to the right and 6 inches down on a screen 25 feet ahead of the light.



Headlight Alignment Chart—1940-1941 Model Trucks

Fig. 88

Light Switches

The light switch, located on the dash on all 1940 and 1941 models, has two positions. When pulled out to the first position, it turns on the parking lights, instrument lights and tail lights. Pulling the switch out to its stop, turns on the headlights, instrument lights and tail lights.

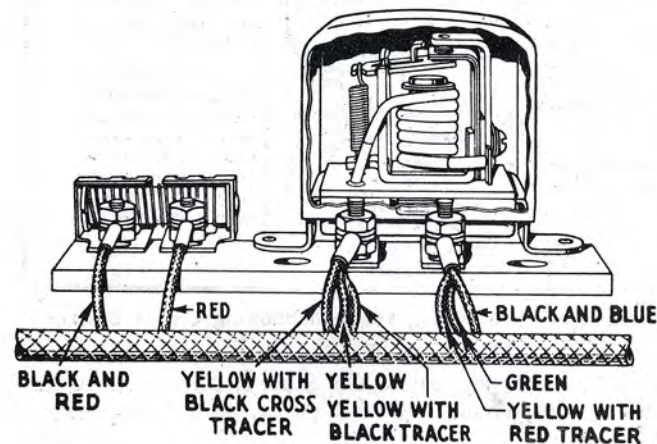
The light beam control switch, on the floor, at the left of the clutch pedal, raises or lowers the headlight beam as required for country driving or traffic driving. When the country driving beam is on, the indicator light on top of the instrument panel shows red. This small red light is located at the top of the speedometer dial on Lincoln-Zephyr and Mercury cars.

An instrument light rheostat switch is used in conjunction with the headlight switch. Turning the switch knob to the right increases the amount of light; to the left decreases the amount of light.

Light Circuit Breaker

Lincoln-Zephyr cars since their inception have used a circuit breaker in the light circuits rather than a fuse. The type of circuit breaker used on the Lincoln-Zephyr is illustrated in Figure 89.

This same vibrator type of light circuit breaker was also adopted

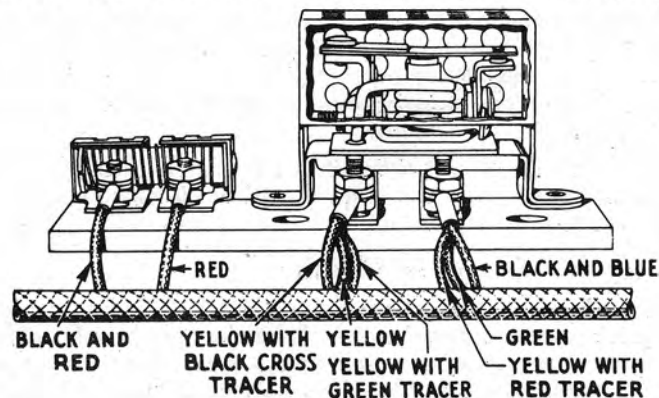


Vibrator Type Circuit Breaker

Fig. 89

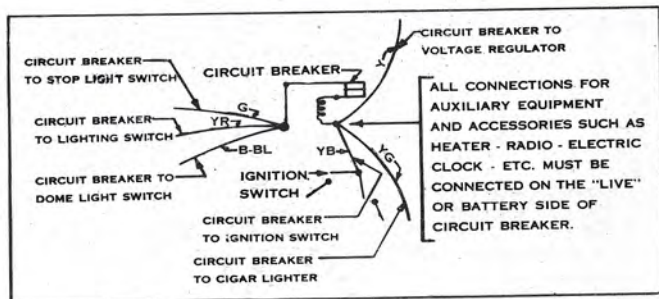
on partial production of 1939 models of Ford and Mercury cars and for trucks.

The vibrator type of circuit breaker as illustrated in Figure 89, has a magnetic winding in series with a pair of contact points. When the current becomes excessive as would be true in the case of a short circuit, the current through this magnetic winding would



Thermostatic and Magnetic Type Circuit Breaker

Fig. 90



Section of 1940 Wiring Diagram Showing Circuit Breaker
Fig. 91

be increased and the magnet would cause the points to open. This would break the circuit and the points would close by spring pressure.

The cycle explained above continues to repeat very rapidly with the result that the points vibrate making a buzzing noise audible to the driver.

The circuit breaker illustrated in Figure 90, used on all 1940 and 1941 models, is a combination of magnetic and thermostatic type.

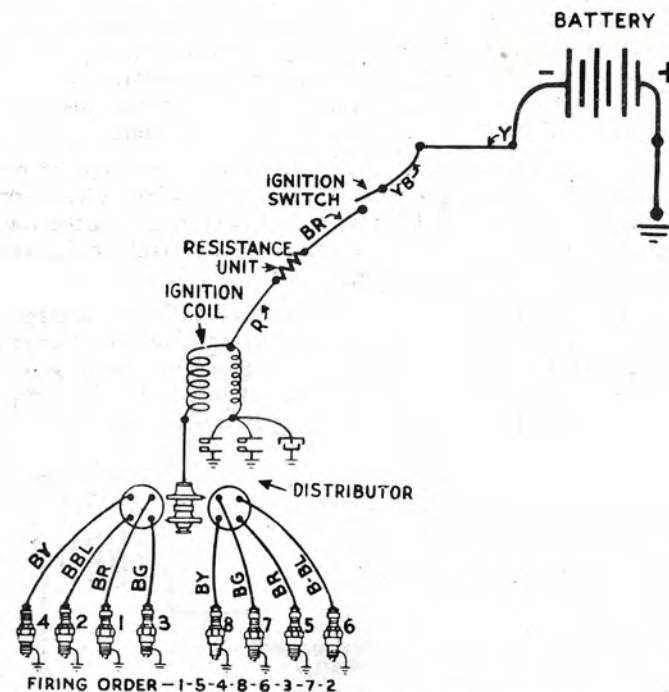
Figure 91 is an enlarged section of the wiring diagrams of the various 1940 models. It will be noted that the magnetic winding is in series with the points.

The top contact holder of the circuit breaker holding the upper point, Figure 91, is a steel bi-metal strip. When the load through the points exceeds 60 amperes the heat caused by the overload distorts the bi-metal strip bending it upward and the points open breaking the circuit.

The magnetic force of the coil in conjunction with the ordinary tension of the steel bi-metal strip, causes the circuit to remain closed until such an overload occurs.

Primary and Secondary Circuit

Under this subject the entire ignition system including the ignition coil, condenser and distributor will be dealt with only insofar as principles of operation are concerned. Any normal minor adjustments required to ensure efficient operation will usually be indicated and made during a complete tune-up procedure as outlined on pages 82 to 90 inclusive.



Ford V-8 and Mercury Ignition System
Fig. 92

Since the battery is the part of the ignition system which supplies electrical energy for the balance of the system, it must obviously be in a fully charged condition to ensure efficiency of the balance of the system.

Figure 92 illustrates the ignition system of the Ford V-8 and Mercury cars whereas Figure 93 illustrates the ignition system on Lincoln-Zephyr cars.

Ignition Coil

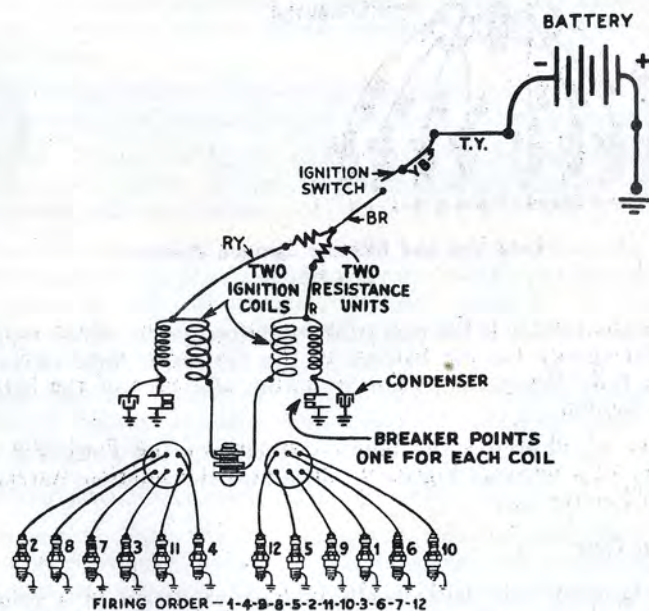
The ignition coils used on all automobiles consist of a primary and secondary winding insulated from each other and wound around a soft iron core which becomes magnetized when current passes through the primary circuit.

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When the primary current is interrupted by the opening of the breaker points, the magnetic field collapses which causes an Electro-Motive-Force in both the primary and the secondary windings. The E-M-F from the secondary discharges across the spark plug gap which ignites the fuel air mixture in the cylinders.

This high tension current must have sufficient voltage or pressure to jump the spark plug gap under the compressions encountered in the engine. Since the highest compressions are encountered under maximum load at the lower speeds, poor coil performance often is noticeable on acceleration.

While the high tension current must have sufficient voltage to jump the spark plug gap it is also important that the amperage be high enough to produce sufficient heat to ignite the mixture in the cylinder. It has been found that .5 (five tenths) milliamp is the lowest amperage that will consistently ignite the mixture.



Lincoln-Zephyr Ignition System

Fig. 93

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As the compression in the engine increases, the voltage automatically increases to overcome this added resistance.

As the voltage increases the amperage decreases.

Another requirement of the coil is that it be able to complete the cycle of its operation in the smallest amount of time possible. This is easy to appreciate when it is considered that at 85 miles per hour the Ford V-8 coil must deliver approximately 280 sparks per second with sufficient amperage to ignite the mixture in the cylinder. Fortunately at these speeds the compression of the engine is low. Nevertheless, speeds are a factor and must be considered in testing coils.

The Ford V-8 ignition coil is assembled on top of the distributor eliminating the necessity for several lead wires and the various connections that otherwise would be necessary.

The Lincoln-Zephyr coil consists of two separate ignition coils in a single case.

Sectional views of the ignition coils are illustrated in Figures 94 to 97 inclusive.

Condensers

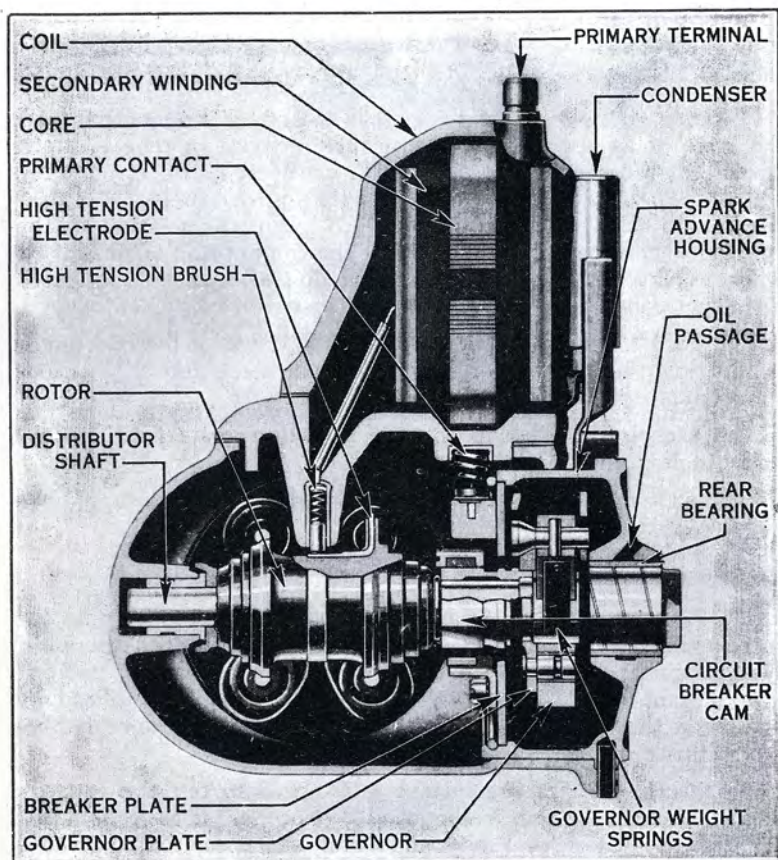
The high tension current from the coil is constant, whereas the current utilized by the breaker points in the distributor is periodic. This necessitates a means of condensing (in other words, storing) the constant flow of current from the coil until it is utilized by contact of the breaker points. The condenser as the name implies serves this purpose.

As special electrical equipment is required to test the capacity of a condenser, the only recommended procedure is to make a test through installation of a new condenser unless such equipment is available.

Distributor

The distributor used on the Ford V-8 cars and trucks is located at the front of the engine and is driven direct by the camshaft, thus eliminating many parts and the consequent back lash, etc.

The current for igniting the gas mixture in the cylinders is provided by the storage battery. The ignition coil transforms the low tension current to high tension current of sufficient voltage to bridge the gap between the points of the spark plugs. The circuit



Cross Sectional View of Distributor—Ford and Mercury

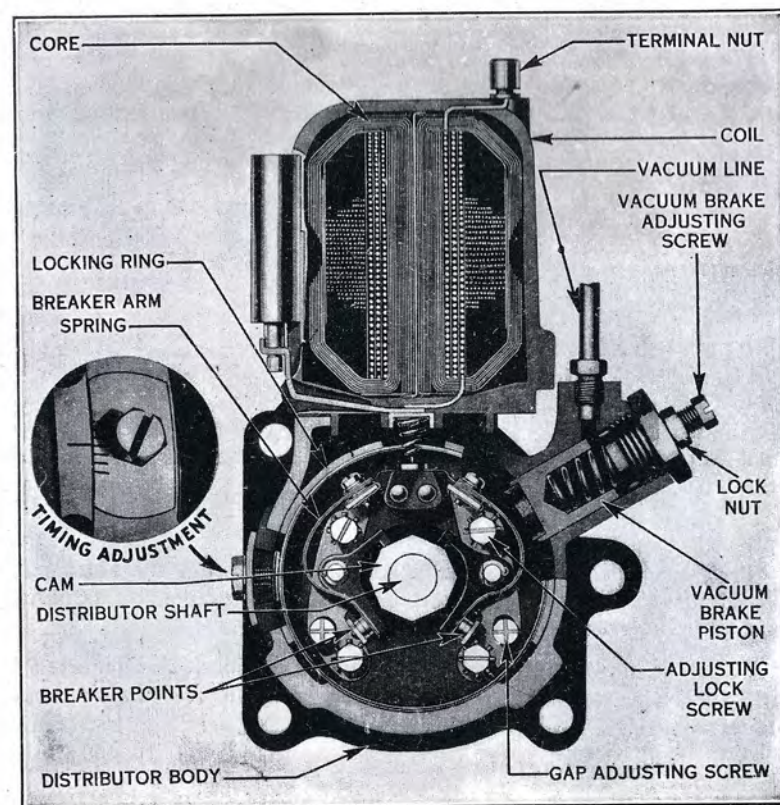
Fig. 94

breaker points interrupt the flow of low tension current at regular intervals, while the distributor rotor distributes the high tension current to each spark plug in proper firing order.

Sectional views of the Ford V-8 and Mercury distributor are illustrated in Figures 94 and 95. In no case is it advisable to remove the distributor without some positive indication that it is at fault, and as a distributor timing fixture is essential for correct

timing it is recommended in the event such a procedure is necessary that the work be performed only by a trained individual having the required equipment.

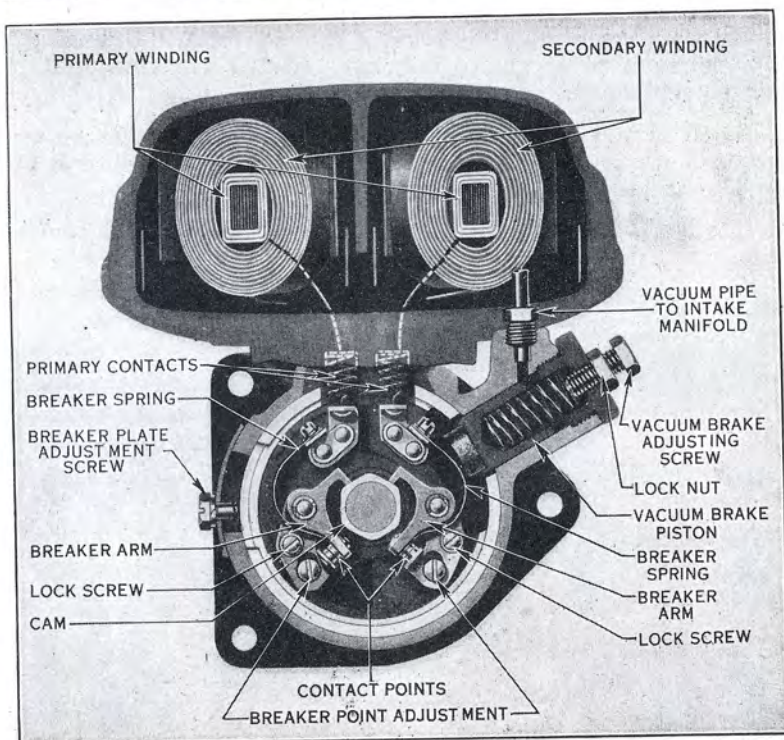
The Ford V-8 distributor is provided with a vacuum brake by means of which the spark is retarded under load in proportion to the engine load or power output.



Longitudinal Sectional View of Distributor—Ford and Mercury

Fig. 95

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Cross Sectional View of Distributor—Lincoln-Zephyr
Fig. 96

This vacuum brake provides a means of adjusting the automatic spark advance of the distributor, for various grades of gasoline, without disturbing the timing of the distributor.

To adjust the vacuum brake loosen the lock nut (refer Figures 94 and 95) and back off the adjusting screw until the engine pings under load.

Then tighten the adjusting screw just enough to remove the ping.

The Lincoln-Zephyr distributor is located at the front end of the engine and is driven direct by the camshaft. It is held to the cylinder front cover by three cap screws. Figures 96 and 97 illustrate sectional views of this distributor.

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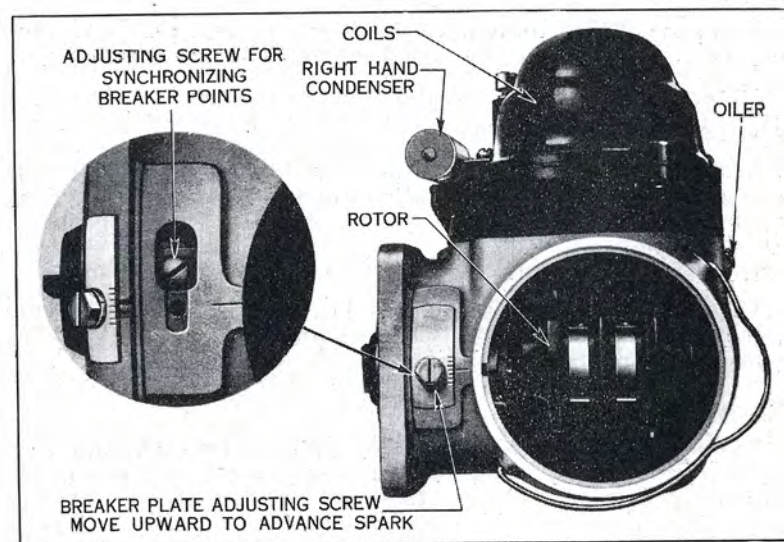
The driving coupling at end of the camshaft being slightly off centre, avoids the possibility of assembling the distributor to the engine at the wrong cycle of the engine.

For convenience when removing the distributor it is advisable to first remove the generator.

The spark timing is automatically advanced or retarded by centrifugal governor weights and springs. The vacuum brake automatically retards the spark timing in direct proportion to the load.

The breaker mechanism includes a six lobe cam, two sets of breaker points, and two condensers. The left breaker points (for left coil) have a stationary support while the support for the right hand breaker points is adjustable for synchronizing the points so that the cylinders fired by the right coil will fire in the correct angular relation to the cylinders fired by the left coil.

Two separate coils are encased in the coil unit on top of the distributor. Each requires a separate condenser and fires all of the cylinders on their side of the engine.



Longitudinal Sectional View of Distributor—Lincoln-Zephyr
Fig. 97

The rotor distributes the high tension current to the spark plugs. The 12 high tension terminals which are placed around the distributor plate are numbered. The wires from each of the terminals are connected to the spark plug on the cylinder which carries the corresponding number.

Lincoln-Zephyr cylinder numbering system is different from the method used on the V-8 engine. On the Lincoln-Zephyr all odd numbers are on the left hand block (right or left is as viewed from the driver's seat), all even numbers are on the right hand block. In both cases the smallest number is the forward cylinder.

The forward contact on the rotor carries the current from the left hand coil for distribution to cylinders Nos. 1, 3, 5, 7, 9, 11 in the left hand cylinder block, whereas the rear contact on the rotor carries the current from the right hand coil for distribution to cylinders 2, 4, 6, 8, 10, 12 in the right hand cylinder block.

Instruments

Electric Fuel Gauge

Complete details concerning the operating principles and procedure of servicing will be found on pages 113 to 116 inclusive under "Fuel System".

Electric Oil Pressure Gauge

Complete details concerning the operating principle and procedure of servicing will be found on pages 22 to 24 inclusive under "Lubrication".

Electric Water Temperature Indicator

Complete details concerning the operating principle and procedure of servicing will be found on pages 100 to 103 inclusive under "Cooling System".

Electric Battery Gauge

Complete details concerning the operating principle and procedure for servicing will be found on pages 132 and 133 under "Electrical System".

SHOCK ABSORBERS

Ford, Mercury and Lincoln-Zephyr shock absorbers operate entirely on the principle of hydraulic resistance. Shock absorber fluid is forced from one chamber to another by the movement of the lever arm. The working chamber is automatically kept full by the shock absorber fluid in the reservoir.

Normally, the only care shock absorbers require is replenishing the shock absorber fluid in the reservoir. The filler plug in the reservoir should be removed each Spring and Fall or at intervals of 5000 miles, whichever occurs first, and the reservoir filled to the bottom of the filler plug hole with Ford shock absorber fluid. Use only genuine Ford shock absorber fluid—substitute fluids, grease or oil should never be added to the shock absorber.

Be sure to remove all dirt from around the filler plug before removing the plug. If sand or dirt were to get into the reservoir, it might clog the vents and render the shock absorber inoperative and necessitate complete replacement.

Shock absorber fluid, like practically all fluids, is affected by changes in temperature. For this reason, shock absorbers should be adjusted to compensate for extreme temperature changes. A poorly adjusted shock absorber can have considerable effect upon riding qualities of the car whereas an adjustment which can easily be made (especially when the car is on the lubrication lift) may require no more than a 1/16 inch movement of the adjusting valve pointer.

Ford shock absorber fluid is less likely to be influenced by temperature changes than any other fluid and for this reason the use of genuine shock absorber fluid is most desirable. The use of genuine Ford shock absorber fluid will also avoid any chance of causing detrimental chemical action which may result from the mixing of other kinds of fluid.

While the basic principle of all of the shock absorbers is the same, several changes in valve characteristics represent the chief difference in the various models of shock absorbers used during the past several years. Likewise, changes have been made in the design of the packing.

During 1939 production the screw type packing gland was discontinued and was replaced by an automatic spring type packing

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gland that requires no attention. The construction of this type of shock absorber is illustrated in Figure 98.

On most previous types of shock absorbers the packing gland must be tightened manually and this service should be included in the services performed each Fall and Spring, likewise, this operation should be included when replenishing the fluid or when adjusting the shock absorbers.

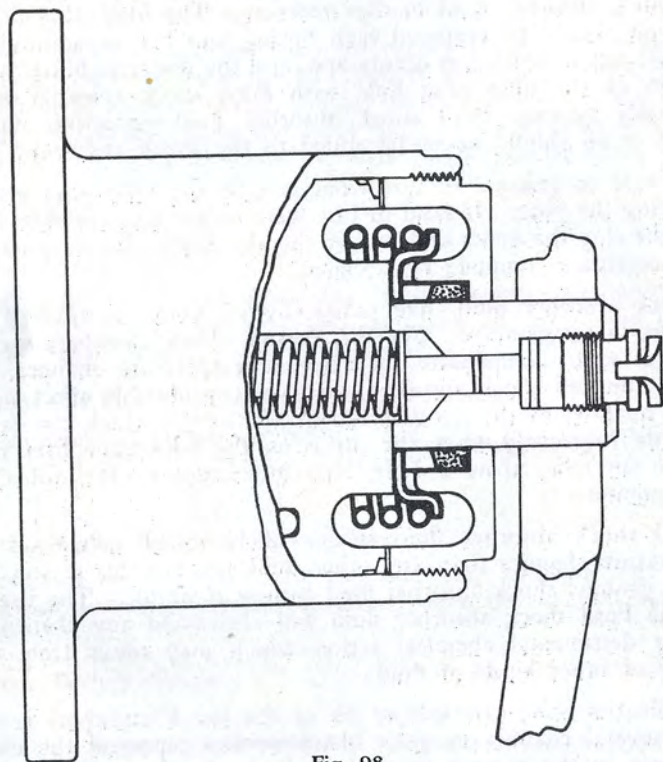
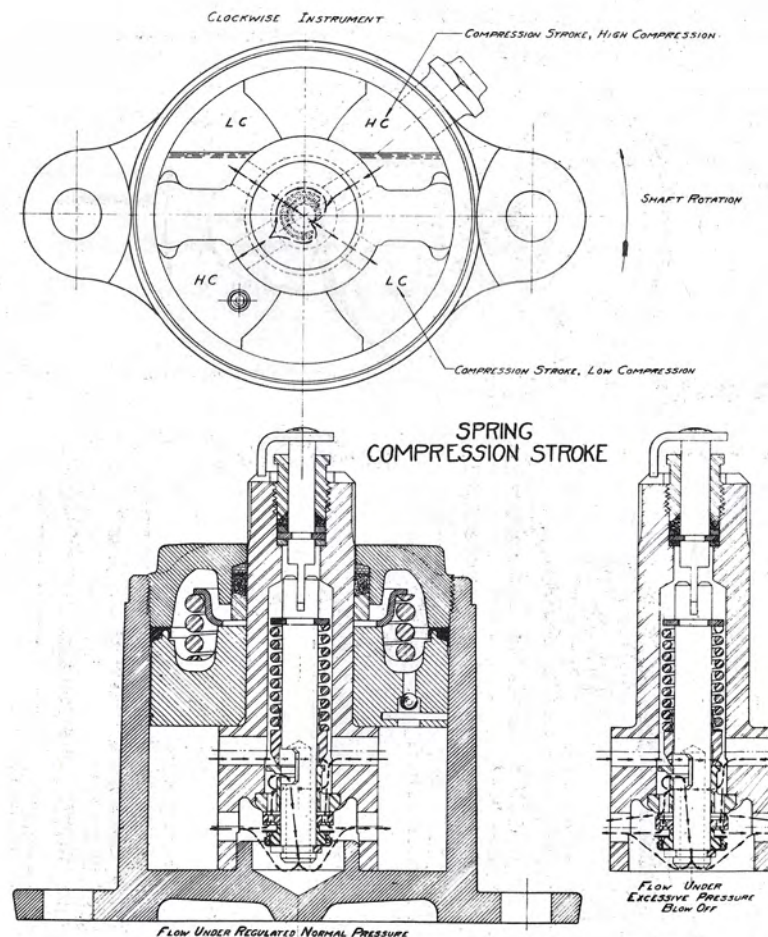


Fig. 98

In numerous instances it has been found that shock absorber leakage is due to the level of the fluid being too high.

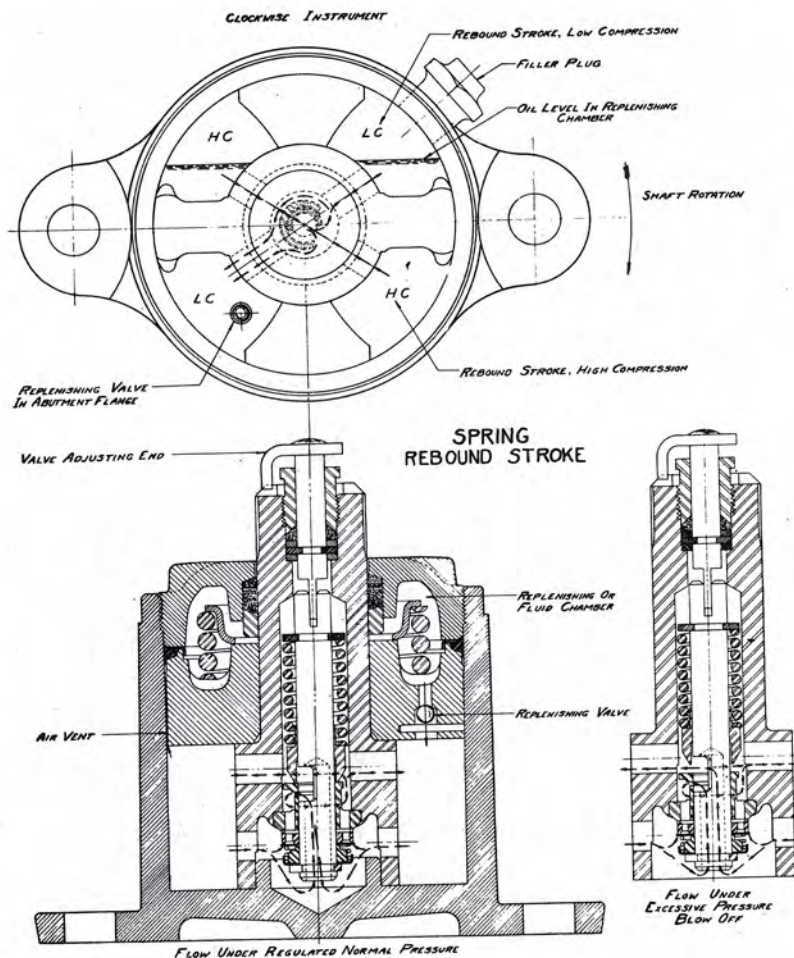
When shock absorbers are filled while they are still on the car, sufficient time should be allowed for the surplus fluid to run out

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Spring Compression Stroke

Fig. 99



Rebound Stroke

Fig. 100

the filler plug hole before the filler plug is inserted. This is extremely important as the correct functioning of the shock absorber depends upon the reservoir having the correct air space to absorb the excessive pressure which otherwise would force the fluid out of shock absorber through the packing.

When filling shock absorbers off of the car, it is important that the shock absorber be held in the same position that it would be if mounted on the car, and that the surplus fluid be permitted to run off.

Adjusting Shock Absorbers

The following method is recommended to ensure that the nature of the ride exactly suits each individual owner's desires, and also provides a method for the reestablishment of the quality of the ride where due to improper adjustment or neglect the ride is not satisfactory.

1. Check the inflation of the tires and either add or let out air to bring the pressure to exactly the recommended pressure. If you find that the pressure in the tires was higher than the recommended amount this fact alone might be the reason for the complaint on the ride.
2. Place the car on a hoist.
3. Examine the springs for evidence of lack of, or improper lubrication. Lubricate the springs with M-4628-B, special spring lubricant or its equivalent. This material acts as a polishing agent on the spring leaves in addition to being a lubricant, and is an extremely important factor in the quality of the ride.
4. Examine the spring shackle studs for indication of excessive wear or of the stud rubbing on the shackle link.
5. Check the level of the fluid in the shock absorber and add Ford shock absorber fluid as necessary. If fluid is allowed to become too low during operation there is a possibility of air being drawn into the working chamber destroying the resistance and efficiency.

Be sure to thoroughly clean around the filler plug before removing it from the shock absorber reservoir, otherwise dirt may drop in and later plug the small air vents that normally exhaust all air from the working chamber.

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6. Examine the shock absorbers for indications of leakage around the shaft.
7. On shock absorbers equipped with an adjustable packing gland, turn the packing gland in until it is tight.
8. Two types of shock absorber adjusting screws have been used as shown in Figures 101 and 102. These are dealt with individually hereunder as A and B.

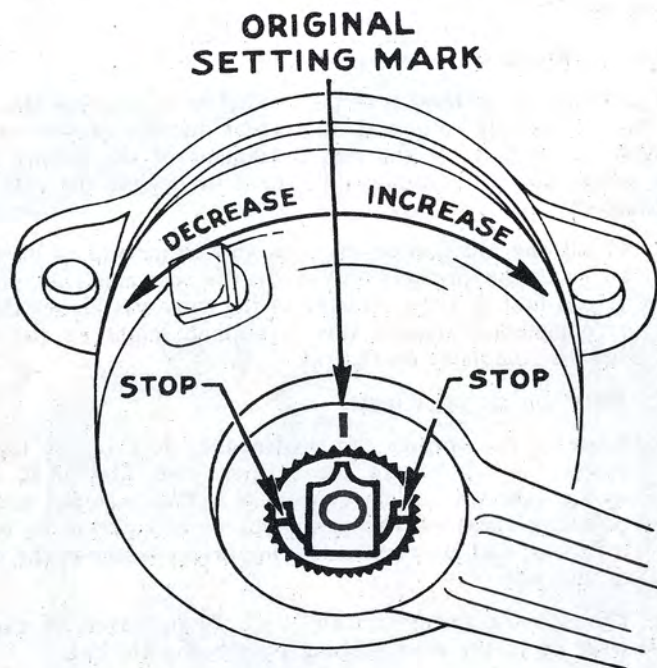


Fig. 101

- A. On shock absorbers having a pointer on the adjusting screw head as shown in Figure 101 observe the position of the pointer of all four shock absorbers with relation to the chisel mark on the arm which designates the original setting.

If the pointer is to the right of the mark at some wheels and to the left of the mark at other wheels it is a good plan to reset all four shock absorbers to the original setting; that is,

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with the pointer exactly at the original setting mark if the temperature is above freezing.

If on the other hand temperatures below freezing are anticipated set the pointer $1/16$ inch counter-clockwise from the original setting mark.

- B. On shock absorbers having a hexagon head on the adjusting screw as shown in Figure 102, turn adjustment in until the needle seats.

The average summer adjustment for this type of shock absorber is to then turn the rear shock absorber adjustment counter-clockwise $1/4$ turn and the front shock absorber $3/8$ turn.

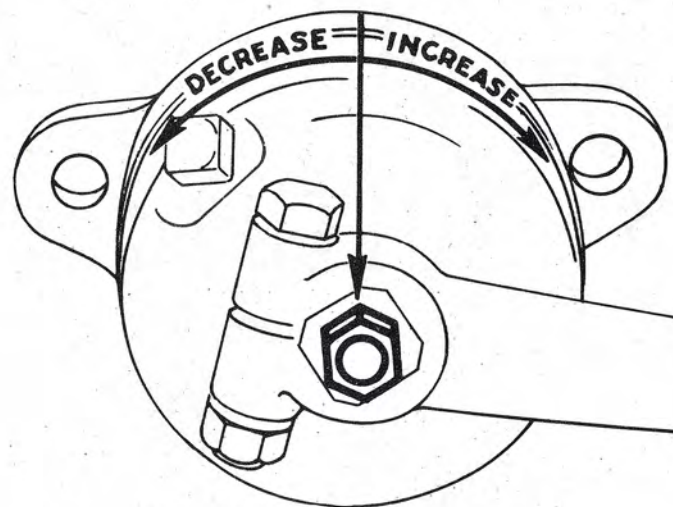


Fig. 102

The average cold weather adjustment is to back off the rear shock absorbers $5/8$ turn and the front $3/4$ turn.

All of these settings on either type are, of course, only approximate and can be easily changed to suit the individual preference of the owner and the conditions under which the car is operated, for example, the owner who drives at high speeds over rough roads would require greater shock absorber

resistance than the owner who drives at moderate speed over paved highways.

9. Test this adjustment on the road with the owner accompanying you if possible, since he is the one that must be satisfied.
10. Adjust to suit the individual owner's requirements. If the owner desires a freer action, the shock absorber adjustment should be turned counter-clockwise. (On shock absorbers having the pointer on the head of the adjusting screw as illustrated in Figure 101 a slight movement has considerable effect—turn not more than $1/32$ inch at a time between trials on the road.) Again try the quality of the ride on the road.
11. If, on the other hand, the owner feels that the spring action obtained by the average adjustment outlined above is too free, the shock absorbers should be adjusted by turning the adjusting screw clockwise and the car again tried on the road with the owner.

SPECIFICATIONS SECTION

Service Handbook

Wheel and Tire Specifications

WHEELS

Lincoln-Zephyr	Wheel Pressed Steel	Type Steel Spoke	Rim			Diameter Bolt Circle	Number of Bolts
			Size Inches	Drop Center	Retainer Ring Split Continuous		
1936 to 1938.....	Yes		16x4.0	Yes		10.25"	5
1939 and 1940.....	Yes		16x4.0	Yes		5.5"	5
Starting 1941.....	Yes		16x5	Yes		5.5"	5

Mercury

1939.....	Yes		16x4.0	Yes		10.25"	5
1940.....	Yes		16x4.0	Yes		5.5"	5
Starting 1941.....	Yes		16x5.0	Yes		5.5"	5

Ford Passenger and Commercial

1932.....		Yes	18x3.25	Yes		5.5"	5
1933 and 1934.....		Yes	17x3.25	Yes		5.5"	5
1935.....		Yes	16x4.0	Yes		5.5"	5
1936-9 (85 H.P.).....	Yes		16x4.0	Yes		10.25"	5
1937-9 (60 H.P.).....	Yes		16x3.5	Yes		10.25"	5
Optional 1936-9.....	Yes		18x3.62	Yes		10.25"	5
Starting 1940 (85 H.P.).....	Yes		16x4.0	Yes		5.5"	5
Starting 1940 (60 H.P.).....	Yes		16x3.5	Yes		5.5"	5

Truck and Cab-Over-Engine

1932 and 1933.....	Yes		20x5		Yes	6.875"	5
Starting 1934.....	Yes		20x5		Yes	8.0"	5
Optional Starting 1934.....	Yes		20x6		Yes	8.0"	5
	Yes*		20x7		Yes	8.0"	5
	Yes†		20x7		Yes	8.0"	5
	Yes		18x7		Yes	8.0"	5
	Yes		18x8		Yes	8.0"	5

¾ Ton

Starting 1940.....	Yes		16x5	Yes		10.25"	5
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1 Ton

Starting 1938—Std.....	Yes		17x5		Yes	6.875"	5
Opt.....	Yes		17x6		Yes	6.875"	5

*Dished 3½"

†Dished 5" for use with duals where tires 7.50x20, 8.25x20 or 34x7 are used.

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TIRES

Lincoln-Zephyr

	Tire Size	Ply	Inflation Pressure	Rim Width	Pounds Capac. Per Tire	Approximate Loaded Rolling Radius	Approximate Revolutions Per Mile	Road Clearance (Center of Rear Axle)
1936 to 1940.....	7.00x16"	4	28	4.0"	1200	13.87"	713	9.0"
Starting 1941.....	7.00x16"	4	26	5.0"	1145	13.90"	710	9.0"

Mercury

1939.....	6.00x16"	4	30	4.0"	915	13.15"	752	8.4"
1940 (Opt.).....	6.50x16"	4	26	4.0"	1050	13.69"	722	8.7"
Starting 1941.....	6.50x16"	4	24	4.0"	1050	13.69"	722	8.7"

Ford Passenger and Commercial

1932.....	5.25x18"	4	35	3.25"	1010	13.82"	723	9.0"
1933 and 1934.....	5.50x17"	4	32	3.25"	955	13.68"	730	9.0"
Starting 1935—85 H.P. (Except Station Wagon).....	6.00x16"	4	30	4.0"	955	13.15"	752	8.4"
Starting 1935—Station Wagon.....	6.00x16"	6	35	4.0"	1045	13.25"	746	8.4"
Starting 1937—60 H.P.	5.50x16"	4	30	3.5"	810	12.8"	772	8.0"
Optional Starting 1936 Oversize.....	6.50x16"	6	35	4.0"	1215	13.54"	730	8.7"
For extra road clearance.....	6.00x18"	4	30	3.62"	1000	14.34"	696	9.5"
For extra road clearance.....	6.00x18"	6	35	3.62"	1175	14.51"	688	9.7"

Truck and Cab-Over-Engine

Starting 1932—Front.....	6.00x20"	6	45	5.0"	1400	15.6"	636	
Rear (Single).....	32x6"	8	75	5.0"	1950	16.1"	620	8.6"
Optional Starting 1934.....	6.50x20"	6	50	5.0"	1700	16.1"	616	8.6"
	7.00x20"	8	55	6.0"	1950	16.8"	592	9.5"
	7.50x20"	8	55	5.0"	2200	17.3"	573	10.0"
	8.25x20"	10	60	7.0"	2650	17.9"	553	10.6"
	9.00x18"	10	65	8.00"	3000	17.8"	559	10.5"
	30x5"	8	75	3.75"	1700	15.7"	636	8.4"
	32x6"	10	80	6.0"	2200	16.7"	597	9.4"
	32x7"	10	85	7.0"	2550	16.6"	602	9.3"
	34x7"	10	85	7.0"	2800	17.6"	568	10.3"

¾ Ton

Starting 1940 Front.....	6.50x16"	6	36	4.5"	1215	13.54"	730	8.7"
Rear.....	7.00x16"	6	36	5.0"	1395	14.02"	710	8.1"

1 Ton

Starting 1938—Front.....	6.00x17"	6	45	5.0"	1210	14.1"	703	
Rear.....	7.00x17"	6	45	5.0"	1550	15.2"	654	9.3"
Optional Starting 1938.....	7.00x17"	8	55	5.0"	1725	15.3"	651	9.4"
	7.50x17"	8	55	6.0"	1950	15.8"	630	9.9"

Brake Specifications—Starting 1939

SERVICE BRAKES*

Type of Brake	Brake Actuation	DIAMETER OF CYLINDER PISTON		DIAMETER OF BRAKE DRUM		LENGTH PER SIDE		BRAKE LINING		THICKNESS		Service Brake Area (Sq. In.)
		FRONT WHEEL	REAR WHEEL	FRONT WHEEL	REAR WHEEL	MATE. FRONT WHEEL	MATE. REAR WHEEL	FRONT WHEEL	REAR WHEEL	FRONT WHEEL	REAR WHEEL	
		Forward Shoe	Reverse Shoe	Forward Shoe	Reverse Shoe	Forward Shoe	Reverse Shoe	Forward Shoe	Reverse Shoe	Forward Shoe	Reverse Shoe	
		Forward Shoe	Reverse Shoe	Forward Shoe	Reverse Shoe	Forward Shoe	Reverse Shoe	Forward Shoe	Reverse Shoe	Forward Shoe	Reverse Shoe	
Lincoln-Zephyr												
Starting 1939	Energizing	Hydr.	1.125"	1.125"	1.00"	1.062"	1.12"	1.12"	1.12"	1.12"	1.12"	1.68
Mercury												
Starting 1939	Non-Energ.	Hydr.	1.125"	1.00"	1.125"	1.00"	1.062"	1.12"	1.12"	1.12"	1.12"	1.62
Ford Passenger and Commercial												
Starting 1939	Non-Energ.	Hydr.	1.125"	1.00"	1.125"	1.00"	1.062"	1.12"	1.12"	1.12"	1.12"	1.62
Truck and Cab-Over-Engine												
Starting 1939	Non-Energ.	Hydr.	1.125"	1.00"	1.125"	1.00"	1.250"	1.14"	1.59"	1.15"	1.25"	3.03
1 Ton—1939												
Starting 1939	Non-Energ.	Hydr.	1.25"	1.00"	1.375"	1.25"	1.375"	1.25"	1.50"	1.25"	1.25"	20.2
1 Ton—1940												
Starting 1940	Non-Energ.	Hydr.	1.25"	1.00"	1.375"	1.25"	1.250"	1.12"	1.44"	1.53"	1.25"	186.8
3/4 Ton												
Starting 1940	Non-Energ.	Hydr.	1.25"	1.00"	1.25"	1.00"	1.250"	1.12"	1.27"	1.38"	1.01"	163

HAND BRAKES

Type of Brake	Brake Actuation	Drum Diameter	HAND BRAKE LINING			Total Brake Shoe Area (Sq. In.)	Service Brake Shoes Used for Hand Brake	Wheels Braked by Hand Brake	
			Material	Width	Thickness				
Lincoln-Zephyr									
Starting 1939	Energizing	Cable	12"	M & W	1.75"	0.21"	84	Yes	Rear
Mercury									
Starting 1939	Non-Energ.	Cable	12"	M & W	1.75"	0.20"	81.5	Yes	Rear
Ford Passenger and Commercial									
Starting 1939	Non-Energ.	Cable	12"	M & W	1.75"	0.20"	81.5	Yes	Rear
Truck and Cab-Over-Engine									
1939	Energizing	Rod	14"	W	1.50"	0.187"	120.75	No	Rear
Starting 1940	Non-Energ.	Cable	7.81"	W	2.5"	0.250"	60.5	No	Rear
1 Ton									
Starting 1939	Non-Energ.	Cable	14"	M	2.0"	0.268"	112.7	Yes	Rear

*All service brakes are four wheel, internal expanding with two shoes per wheel; drums cast alloy iron.
 †Primary shoe for Lincoln-Zephyr is shown in column headed "Forward Shoe." Secondary shoe is shown in column headed "Reverse Shoe."
 #M means Molded. W means Woven.

Brake Specifications—1932 to 1938

SERVICE BRAKES*

Type of Brake	Brake Actuation	DIAMETER OF BRAKE DRUM		MATERIALS		LENGTH PER SHOE		BRAKE LINING		THICKNESS		Total Service Brake Area (Square Inches)
		Front Wheel	Rear Wheel	Pri. Shoe	Sec. Shoe	Front Wheel	Rear Wheel	Front Wheel	Rear Wheel	Front Wheel	Rear Wheel	
Lincoln-Zephyr												
1936 to 1938	Energizing	Cable	12"	M	W	11.95"	11.95"	1.75"	1.75"	0.21"	0.21"	168
Ford Passenger and Commercial												
1932 to 1936	Non-Energ.	Rod	12"	W	W	13.25"	13.25"	1.75"	1.75"	0.185"	0.185"	186
1937 and 1938	Energizing	Cable	12"	M	W	13.25"	13.25"	1.75"	1.75"	0.185"	0.185"	186
Truck												
1932 to 1935	Non-Energ.	Rod	14"	W	W	17.75"	17.75"	2.5"	2.5"	0.25"	0.25"	355
1936 and 1937	Non-Energ.	Rod	14"	W	W	17.5"	17.5"	2.5"	2.5"	0.25"	0.25"	350
1938	Energizing	Cable	15.12"	M	W	18.41"	18.41"	2.5"	2.5"	0.25"	0.25"	368
Cab-Over-Engine												
1938	Energizing	Cable	15.12"	M	W	18.41"	18.41"	2.5"	2.5"	0.25"	0.25"	368
1 Ton												
1938	Energizing	Cable	12"	M	W	13.25"	18.41"	1.75"	2.5"	0.185"	0.25"	277

HAND BRAKES

Type of Brake	Brake Actuation	Diameter of Drum	MATERIAL		BRAKE LINING						Total Hand Brake Area (Sq. In.)	Service Brake Shoes Used by Hand Brake	Wheels Braked by Hand Brake	
			Pri.-Secondary Shoe	Sec.-Primary Shoe	LENGTH PER WHEEL		WIDTH		THICKNESS					
					Front	Rear	Front	Rear	Front	Rear				
Lincoln-Zephyr														
1936 to 1938	Energizing	Cable	12"	M	W	23.9"	23.9"	1.75"	1.75"	0.21"	0.21"	168	Yes	All
Ford Passenger and Commercial														
1932 to 1936	Non-Energ.	Rod	12"	W	W	26.5"	26.5"	1.75"	1.75"	0.185"	0.185"	186	Yes	All
1937 and 1938	Energizing	Cable	12"	M	W	26.5"	26.5"	1.75"	1.75"	0.185"	0.185"	186	Yes	All
Truck														
1932 to 1938	Energizing	Rod	14"	W	—	—	—	—	—	—	—	0.187"	120.75	No
Cab-Over-Engine														
1938	Energizing	Rod	14"	W	—	—	—	—	—	—	—	0.187"	120.75	No
1 Ton														
1938	Energizing	Cable	Front 12" Rear 15.12"	M	W	26.5"	36.82"	1.75"	2.5"	0.185"	0.25"	277	Yes	All

*All service brakes are four wheel, internal expanding with two shoes per wheel; drums cast alloy iron.

#Means M Molded. W means Woven.

Front Axle, Steering Gear and Alignment Specifications

Year and Model	FRONT AXLE*										STEERING GEAR									
	SPINDLE PINS EACH					TURNING RADIUS IN FEET RIGHT TURN					TYPE					ADJUSTMENTS				
	Taper Roller Wheel Bearings	Bronze Bushings	Roller Thrust Bearing	Spline Carrying Steering Arm	Radius Rods	Tread Inches	Standard Wheelbase	101" Wheelbase	134" Wheelbase	157" or 158" Wheelbase	Worm and Roller	Worm and Sector	Trapped Roller on Worm Shaft	Needle Bearings	Pinion Shaft	Worm End Play	Thrust Screw for Sector	Thrust End Play	Mech of Worm and Sector	Eccentric for Centerization of Tooth Contact
Lincoln-Zephyr																				
1936	2 0.8125"	2 1 R	Yes 55.47"	22	—	—	—	—	—	—	Yes No	2 Shims Yes Shims	No 18.4 17"	No 18.4 17"	No 18.4 17"	No 18.4 17"	No 18.4 17"	No 18.4 17"	No 18.4 17"	No 18.4 17"
1937	2 0.937"	2 1 R	Yes 55.47"	22	—	—	—	—	—	—	Yes No	2 Shims Yes Shims	No 20.2 17"	No 20.2 17"	No 20.2 17"	No 20.2 17"	No 20.2 17"	No 20.2 17"	No 20.2 17"	No 20.2 17"
Starting 1938	2 0.937"	2 1 R	Yes 55.47"	22	—	—	—	—	—	—	Yes No	2 Shims Yes Shims	No 18.4 18"	No 18.4 18"	No 18.4 18"	No 18.4 18"	No 18.4 18"	No 18.4 18"	No 18.4 18"	No 18.4 18"
Mercury																				
Starting 1939	2 0.8125"	2 1 R	Yes 55.75"	20	—	—	—	—	—	—	Yes No	2 Shims No Screw	No 18.2 18"	No 18.2 18"	No 18.2 18"	No 18.2 18"	No 18.2 18"	No 18.2 18"	No 18.2 18"	No 18.2 18"
Ford Passenger and Commercial																				
1932	2 0.8125"	2 1 L	Yes 55.75"	19.5	—	—	—	—	—	—	No Yes	2 Shims Yes Eccentric	Yes 13 17"	Yes 13 17"	Yes 13 17"	Yes 13 17"	Yes 13 17"	Yes 13 17"	Yes 13 17"	Yes 13 17"
1933	2 0.8125"	2 1 L	Yes 55.75"	20	—	—	—	—	—	—	No Yes	2 Shims Yes Eccentric	Yes 13 17"	Yes 13 17"	Yes 13 17"	Yes 13 17"	Yes 13 17"	Yes 13 17"	Yes 13 17"	Yes 13 17"
1934	2 0.8125"	2 1 L	Yes 55.75"	20	—	—	—	—	—	—	No Yes	2 Shims Yes Eccentric	Yes 15 17"	Yes 15 17"	Yes 15 17"	Yes 15 17"	Yes 15 17"	Yes 15 17"	Yes 15 17"	Yes 15 17"
1935	2 0.8125"	2 1 R	Yes 55.75"	20	—	—	—	—	—	—	No Yes	2 No 2 Shims No Screw	Yes 15 17"	Yes 15 17"	Yes 15 17"	Yes 15 17"	Yes 15 17"	Yes 15 17"	Yes 15 17"	Yes 15 17"
1936	2 0.8125"	2 1 R	Yes 55.75"	20	—	—	—	—	—	—	No Yes	2 No 2 Shims No Screw	Yes 17 17"	Yes 17 17"	Yes 17 17"	Yes 17 17"	Yes 17 17"	Yes 17 17"	Yes 17 17"	Yes 17 17"
Starting 1937	2 0.8125"	2 1 R	Yes 55.75"	19	—	—	—	—	—	—	Yes	2 No 2 Shims No Screw	No 18.2 17"	No 18.2 17"	No 18.2 17"	No 18.2 17"	No 18.2 17"	No 18.2 17"	No 18.2 17"	No 18.2 17"
Trucks																				
1932-4	2 1.00"	2 1 L	Yes 58.3"	—	—	24	30	—	—	—	No Yes	2 No 2 Shims Yes Eccentric	Yes 17 17"	Yes 17 17"	Yes 17 17"	Yes 17 17"	Yes 17 17"	Yes 17 17"	Yes 17 17"	Yes 17 17"
1935	2 1.00"	2 1 L	Yes 58.3"	—	—	24	30	—	—	—	No Yes	2 No 2 Shims Yes Eccentric	Yes 17 17"	Yes 17 17"	Yes 17 17"	Yes 17 17"	Yes 17 17"	Yes 17 17"	Yes 17 17"	Yes 17 17"
1936	2 1.00"	2 1 L	Yes 58.3"	—	—	24	30	—	—	—	No Yes	2 No 2 Shims Yes Eccentric	Yes 17 17"	Yes 17 17"	Yes 17 17"	Yes 17 17"	Yes 17 17"	Yes 17 17"	Yes 17 17"	Yes 17 17"
1937	2 1.00"	2 1 L	Yes 58.3"	—	—	26	30	—	—	—	No Yes	2 No 2 Shims No Screw	No 17 17"	No 17 17"	No 17 17"	No 17 17"	No 17 17"	No 17 17"	No 17 17"	No 17 17"
1938-9	2 1.125"	2 1 L	Yes 58.3"	—	—	26	30	—	—	—	No Yes	2 No 2 Shims No Screw	No 18.4 18"	No 18.4 18"	No 18.4 18"	No 18.4 18"	No 18.4 18"	No 18.4 18"	No 18.4 18"	No 18.4 18"
Starting 1940	2 1.125"	2 1 L	No 58.3"	—	—	25	29	—	—	—	Yes No	2 No 2 Shims No Screw	No 18.4 18"	No 18.4 18"	No 18.4 18"	No 18.4 18"	No 18.4 18"	No 18.4 18"	No 18.4 18"	No 18.4 18"
Cab-Over-Engine																				
Starting 1938	2 1.125"	2 1 L	No 62.8"	—	—	18.5	23.7	28.8	—	—	Yes No	2 No 2 Shims No Screw	No 18.4 18"	No 18.4 18"	No 18.4 18"	No 18.4 18"	No 18.4 18"	No 18.4 18"	No 18.4 18"	No 18.4 18"
1 Ton																				
1938-9	2 0.8125"	2 1 L	Yes 55.75"	21.5	—	—	—	—	—	—	Yes No	2 No 2 Shims No Screw	No 18.2 17"	No 18.2 17"	No 18.2 17"	No 18.2 17"	No 18.2 17"	No 18.2 17"	No 18.2 17"	No 18.2 17"
Starting 1940	2 0.8125"	2 1 L	No 55.75"	22	—	—	—	—	—	—	Yes No	2 No 2 Shims No Screw	No 18.2 17"	No 18.2 17"	No 18.2 17"	No 18.2 17"	No 18.2 17"	No 18.2 17"	No 18.2 17"	No 18.2 17"
¾ Ton																				
Starting 1940	2 0.812"	2 1 L	No 55.7"	22	—	—	—	—	—	—	Yes No	2 No 2 Shims No Screw	No 18.2 17"	No 18.2 17"	No 18.2 17"	No 18.2 17"	No 18.2 17"	No 18.2 17"	No 18.2 17"	No 18.2 17"

WHEEL ALIGNMENT

	CASTOR*		CAMBER‡		Camber Plus Side Inclination		Toe-In†	TOE-OUT ON 20° TURN			
	Max.	Min.	Max.	Min.	Max.	Min.		Regular Wheel-base	Trucks Wheelbase"		
									101'	134'	157' or 158'
Lincoln-Zephyr											
1936	9°	4½°	¾°	¼°	9°	8¼°	1/16" to 1/8"	23°	—	—	—
Starting 1937	6°	1½°	¾°	¼°	4¾°	4°	1/16" to 1/8"	23°	—	—	—

Mercury

Starting 1939	8°	4½°	1°	¼°	9°	8¼°	1/16"	23½°	—	—
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Ford Pass. & Com.

1932	9°	4½°	1°	¼°	9°	8¼°	3/8"	23½°	—	—
1933 to 1935	9°	4½°	1°	¼°	9°	8¼°	3/8"	23½°	—	—
Starting 1936	8°	4½°	1°	¼°	9°	8¼°	1/16"	23½°	—	—

Trucks

1932 to 1934	5°	3°	1°	¼°	9°	8¼°	3/8"	—	—	22½° 22¼°
1935 and 1936	5°	3°	1°	¼°	9°	8¼°	0A	—	—	22½° 22¼°
1937 to 1939	5°	3°	1°	¼°	9°	8¼°	0A	—	—	22½° 22¼°
Starting 1940	3½°	1°	1°	¼°	8°	7¼°	1/16"	—	—	22½° 22¼°

Cab-Over-Engine

Starting 1938	3½°	1°	1°	¼°	8°	7¼°	1/16"	—	23¾°	22½° 22¼°
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1 Ton

1938 and 1939	9°	4½°	1°	¼°	9°	8¼°	3/8"	23°	—	—
Starting 1940	3½°	1°	1°	¼°	8°	7¼°	1/16"	23°	—	—

¾ Ton

Starting 1940	3½°	1°	1°	¼°	8°	7¼°	1/16"	23°	—	—
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*Max. variation between wheels ¼". Limits shown are without load on vehicle.

†Max. variation between wheels ¼". Camber of R. H. wheel should never be greater than L. H.

‡Toe-in must be in proportion to camber. Use ratio of 1 to 10.

*Tolerance of ¼" is permitted between wheels.

*Toe-in increases with load. Set at zero when empty.

Rear Axle Specifications†

Gear Ratio	Pinion	Teeth	Tooth Back Lash	Pinion Bearing Adjust-ment	Axle Shaft Diam-eter	Tread with Std. Tires	Lubri-cant Capac-ity Pints	Type of Axle	Type of Gears	Drive Shaft	Number and Type of Bearings				
											Pinion	Flange	Intermediate	Wiper Hub	No. of Drive Shafts

Lincoln-Zephyr

1936.....	Std. 4.33	9	39	.010" Max	12-17	1.13"	58.25"	2.5 to 3	¾ Floating	Spiral bevel	Tubular	Straddle	2	1	2	1	Straight	1
1937.....	Std. 4.44	9	40	.010" Max	12-17	1.13"	58.25"	2.5 to 3	¾ Floating	Spiral bevel	Tubular	Straddle	2	1	2	1	Straight	1
1938 to 1941.....	Std. 4.44	9	40	.002-.004"	18-20	1.13"	58.25"	4.0	¾ Floating	Hypoid	Solid	Spread	2	None	2	1	Straight	2

Mercury

1938-1941.....	Std. 3.54	11	39	.010" Max	12-17	1.13"	58.25"	2.5 to 3	¾ Floating	Spiral bevel	Solid	Straddle	2	1	2	1	Straight	2
	Opt. 3.78	9	34	.010" Max	12-17	1.13"	58.25"	2.5 to 3	¾ Floating	Spiral bevel	Solid	Straddle	2	1	2	1	Straight	2

Road Passenger and Commercial

1932.....	Std. 4.11	9	37	.006-.010"	15-20	1.13"	58.25"	2.5 to 3	¾ Floating	Spiral bevel	Tubular	Spread	2	None	2	1	Straight	1
	Opt. 3.78	9	34	.006-.010"	13-20	1.13"	58.25"	2.5 to 3	¾ Floating	Spiral bevel	Tubular	Spread	2	None	2	1	Straight	1
1933 and 1934.....	Std. 4.11	9	39	.006-.010"	12-17	1.13"	58.25"	2.5 to 3	¾ Floating	Spiral bevel	Tubular	Straddle	2	1	2	1	Straight	1
	Opt. 4.33	9	39	.006-.010"	12-17	1.13"	58.25"	2.5 to 3	¾ Floating	Spiral bevel	Tubular	Straddle	2	1	2	1	Straight	1
1935 and 1936.....	Std. 4.11	9	37	.006-.010"	12-17	1.13"	58.25"	2.5 to 3	¾ Floating	Spiral bevel	Tubular	Straddle	2	1	2	1	Straight	1
	Opt. 4.11	9	37	.006-.010"	12-17	1.13"	58.25"	2.5 to 3	¾ Floating	Spiral bevel	Tubular	Straddle	2	1	2	1	Straight	1
	Opt. 4.33	9	39	.006-.010"	12-17	1.13"	58.25"	2.5 to 3	¾ Floating	Spiral bevel	Tubular	Straddle	2	1	2	1	Straight	1
	Opt. 3.78	9	34	.006-.010"	12-17	1.13"	58.25"	2.5 to 3	¾ Floating	Spiral bevel	Tubular	Straddle	2	1	2	1	Straight	1
	Opt. 3.54	11	39	.006-.010"	12-17	1.13"	58.25"	2.5 to 3	¾ Floating	Spiral bevel	Tubular	Straddle	2	1	2	1	Straight	1
1937 to 1941.....	Std. 3.78	9	34	.010" Max	12-17	1.13"	58.25"	2.5 to 3	¾ Floating	Spiral bevel	Solid	Straddle	2	1	2	1	Straight	2
	Opt. 3.54	11	39	.010" Max	12-17	1.13"	58.25"	2.5 to 3	¾ Floating	Spiral bevel	Solid	Straddle	2	1	2	1	Straight	2
60 H.P. (ex-cept Comm.)	Std. 4.11	9	37	.010" Max	12-17	1.13"	58.25"	2.5 to 3	¾ Floating	Spiral bevel	Solid	Straddle	2	1	2	1	Straight	2
	Opt. 4.11	9	37	.010" Max	12-17	1.13"	58.25"	2.5 to 3	¾ Floating	Spiral bevel	Solid	Straddle	2	1	2	1	Straight	2
60 H.P. (Comm. (1940))	Std. 4.44	9	40	.010" Max	12-17	1.13"	58.25"	2.5 to 3	¾ Floating	Spiral bevel	Solid	Straddle	2	1	2	1	Straight	2
	Std. 4.55	9	41	.010" Max	12-17	1.13"	58.25"	2.5 to 3	¾ Floating	Spiral bevel	Solid	Straddle	2	1	2	1	Straight	2

†All rear axles are torque tube drive with radius rods except trucks and 1 Ton starting 1940.

Rear Axle Specifications

Gear Ratio	Pinion	Teeth	Tooth Back Lash	Pinion Bearing Adjust-ment	Axle Shaft Diam-eter	Tread with Std. Tires	Lubri-cant Capac-ity Pints	Type of Axle	Type of Gears	Drive Shaft	Number and Type of Bearings				
											Pinion	Flange	Intermediate	Wiper Hub	No. of Drive Shafts

Ford Trucks

1932 and 1933.....	Std. 5.14	7	36	.008-.020"	12-16	1.562"	57.1"	7.0	¾ Floating	Spiral bevel	Tubular	Straddle	2	1	2	2	Straight	1
	Opt. 5.14	7	36	.008-.020"	12-16	1.562"	57.1"	7.0	¾ Floating	Spiral bevel	Tubular	Straddle	2	1	2	2	Straight	1
1934 to 1936.....	Std. 5.14	7	36	.008-.020"	12-16	1.562"	57.1"	7.0	¾ Floating	Spiral bevel	Tubular	Straddle	2	1	2	2	Straight	1
	Opt. 6.6	5	33	.008-.020"	12-16	1.562"	57.1"	7.0	¾ Floating	Spiral bevel	Tubular	Straddle	2	1	2	2	Tapered	1
1937 to 1941.....	Std. 6.67	6	40	.004-.016"	12-16	1.562"	57.1"	7.0	¾ Floating	Spiral bevel	Tubular	Straddle	2	1	2	2	Tapered	1
	Opt. 5.14	7	36	.004-.016"	12-16	1.562"	57.1"	7.0	¾ Floating	Spiral bevel	Tubular	Straddle	2	1	2	2	Tapered	1
	Opt. 5.83	6	35	.004-.016"	12-16	1.562"	57.1"	7.0	¾ Floating	Spiral bevel	Tubular	Straddle	2	1	2	2	Tapered	1

Cab-Over-Engine

1938 to 1941.....	Std. 6.67	6	40	.004-.016"	12-16	1.562"	57.1"	7.0	¾ Floating	Spiral bevel	Tubular	Straddle	2	1	2	2	Tapered	1
	Opt. 5.14	7	36	.004-.016"	12-16	1.562"	57.1"	7.0	¾ Floating	Spiral bevel	Tubular	Straddle	2	1	2	2	Tapered	1
	Opt. 5.83	6	35	.004-.016"	12-16	1.562"	57.1"	7.0	¾ Floating	Spiral bevel	Tubular	Straddle	2	1	2	2	Tapered	1

Truck Two-Speed Axle

1938 to 1941.....	Std. 5.83 & 8.11"	6	35	.006-.020"	8-12	1.562"	57.1"	16.	Full Floating	Spiral bevel	Tubular	Straddle	2	1	2	2	Tapered	1
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¾-Ton

Starting 1940	Std. 4.857	7	34	.004-.016"	12-16	1.25"	57.3"	3.0	Full Floating	Spiral bevel	Tubular	Straddle	2	1	2	2	Tapered	1
	Opt. 4.11	9	37	.004-.016"	12-16	1.25"	57.3"	3.0	Full Floating	Spiral bevel	Tubular	Straddle	2	1	2	2	Tapered	1
1940 60 H.P.	Std. 5.67	6	40	.004-.016"	12-16	1.25"	57.3"	3.0	Full Floating	Spiral bevel	Tubular	Straddle	2	1	2	2	Tapered	1

1 Ton

1938 to 1939	Std. 5.14	7	36	.008-.020"	12-16	1.562"	57.0"	7.0	Full Floating	Spiral bevel	Tubular	Straddle	2	1	2	2	Tapered	1
	Opt. 5.83	6	35	.008-.020"	12-16	1.562"	57.0"	7.0	Full Floating	Spiral bevel	Tubular	Straddle	2	1	2	2	Tapered	1
60 H.P.	Std. 6.67	6	35	.004-.016"	12-16	1.562"	57.0"	7.0	Full Floating	Spiral bevel	Tubular	Straddle	2	1	2	2	Tapered	1
Starting 1940-41	Std. 4.857	7	34	.004-.016"	12-16	1.25"	57.3"	3.0	Full Floating	Spiral bevel	Tubular	Straddle	2	1	2	2	Tapered	1
	Opt. 4.11	9	37	.004-.016"	12-16	1.25"	57.3"	3.0	Full Floating	Spiral bevel	Tubular	Straddle	2	1	2	2	Tapered	1
85 H.P.	Opt. 4.11	9	37	.004-.016"	12-16	1.25"	57.3"	3.0	Full Floating	Spiral bevel	Tubular	Straddle	2	1	2	2	Tapered	1
1940 60 H.P.	Std. 6.67	6	40	.004-.016"	12-16	1.25"	57.3"	3.0	Full Floating	Spiral bevel	Tubular	Straddle	2	1	2	2	Tapered	1

†1940 Truck, C.O.E., and 1 Ton have a cushion mounted coupling shaft ball bearing.

*A planetary gear train giving reduction of 1.39 to 1 supplements the bevel pinion and ring gear to obtain the reduction of 8.11. For example the 6-tooth pinion and 35-tooth ring gear gives a gear ratio of 5.83 to 1. Then when greater gear reduction is needed the planetary gears are used so the ratio of 5.83 is multiplied by the ratio of 1.39, giving the total final gear reduction of 8.11. (sun gear).

Service Handbook

Frame and Spring Specifications

FRAME

Lincoln-Zephyr

Starting 1936 to 1941..... (Frame is integral with body, making a modified arch truss type, all steel, welded structure)

Mercury

1939 and 1940.....	Yes	Yes	4	166.3"	5.5"	2.0"	0.11"		
1941.....	Yes	Yes	4	164.8"	5.5"	2.0"	0.15"		

Ford Passenger and Commercial

1932.....	No	No	2	148.4"	6.0"	2.0"	0.11"		
1933 and 1934.....	Yes	Yes	4	149.7"	6.0"	1.75"	0.11"		
1935 to 1940.....	Yes	Yes	4	157.3"	5.5"	2.0"	0.10"		
1941.....	Yes	Yes	4	164.8"	5.5"	2.0"	0.15"		

Ford Truck

1932-1934.....	131.5"	No	No	2	192.6"	7.0"	2.75"	0.21"	38"	94.9"
1935-1937.....	131.5"	No	No	2	218.1"	7.0"	2.75"	0.21"	38"	120.3"
1938-1939.....	131.5"	No	No	2	192.6"	7.0"	2.75"	0.21"	38"	101.2"
1940-41.....	131.5"	No	No	2	218.1"	7.0"	2.75"	0.21"	38"	126.7"
1932-1934.....	131.5"	No	No	2	204.4"	7.0"	2.75"	0.21"	34"	110.09"
1935-1937.....	131.5"	No	No	2	226.4"	7.0"	2.75"	0.21"	34"	133.04"
1938-1939.....	131.5"	No	No	2	192.1"	7.0"	2.75"	0.21"	34"	98.46"
1940-41.....	131.5"	No	No	2	216.1"	7.0"	2.75"	0.21"	34"	122.56"

Cab-Over-Engine

1938-1939.....	101"	No	No	2	170.4"	7.0"	2.75"	0.21"	34"	109.58"
1940-41.....	101"	No	No	2	203.4"	7.0"	2.75"	0.21"	34"	142.58"
1938-1939.....	101"	No	No	2	226.4"	7.0"	2.75"	0.21"	34"	165.58"
1940-41.....	101"	No	No	2	159.1"	7.0"	2.75"	0.21"	34"	98.46"
1938-1939.....	101"	No	No	2	192.1"	7.0"	2.75"	0.21"	34"	98.46"
1940-41.....	101"	No	No	2	216.1"	7.0"	2.75"	0.21"	34"	155.2"

1 Ton

Starting 1938.....	No	No	2	189.50"	6.0"	2.25"	0.19"	34"	96.21"
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¾ Ton

1940-41.....	No	No	2	189.50"	6.0"	2.25"	0.19"	34"	96.21"
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*Thickness is 0.11" for commercial and open passenger types.

SPRINGS

Front								Rear							
Number	Type	Strut Rod	Ride Stabilizer	Spring Covers	Mounted Ahead of Front Axle	Leaves Lubricated Through The Bolt	OillessType Shackles	Number	Type	Spring Covers	Mounted Behind Rear Axle	Leaves Lubricated Through The Bolt	OillessType Shackles		

Lincoln-Zephyr

1936.....	1 Transverse	No	No	Yes	Yes	No	Yes	1 Transverse	Yes	Yes	No	Yes
1937 to 1939.....	1 Transverse	No	No	Yes	Yes	Yes	Yes	1 Transverse	Yes	Yes	Yes	Yes
1940.....	1 Transverse	Yes	Yes	Yes	Yes	Yes	Yes	1 Transverse	Yes	Yes	Yes	Yes

Mercury

1939.....	1 Transverse	No	No	Yes	Yes	Yes	Yes	1 Transverse	No	Yes	Yes	Yes
1940.....	1 Transverse	Yes	Yes	Yes	Yes	Yes	Yes	1 Transverse	Yes	Yes	Yes	Yes

Ford Passenger and Commercial

1932 to 1934.....	1 Transverse	No	No	No	No	No	Yes	1 Transverse	No	Yes	No	Yes
1935 and 1936.....	1 Transverse	No	No	No	Yes	Yes	Yes	1 Transverse	No	Yes	No	Yes
1937 to 1939.....	1 Transverse	No	No	No	Yes	Yes	Yes	1 Transverse	No	Yes	Yes	Yes
1940.....	1 Transverse	No	Yes	Yes	Yes	Yes	Yes	1 Transverse	No	Yes	Yes	Yes

Truck

1932 to 1934.....	1 Transverse	No	No	No	No	No	2 Semi-elliptic	No	No	No	No	No
1935 to 1939.....	1 Transverse	No	No	No	Yes	No	2 Semi-elliptic	No	No	No	No	No
1940.....	2 Semi-elliptic	No	No	No	No	No	2 Semi-elliptic	No	No	No	No	No

Cab-Over-Engine

1938 to 1940.....	2 Semi-elliptic	No	No	No	No	Yes	2 Semi-elliptic	No	No	No	No	No
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1 Ton

1938 and 1939.....	1 Transverse	No	No	No	Yes	Yes	2 Semi-elliptic	No	No	No	No	No
1940.....	2 Semi-elliptic	No	No	No	No	Yes	2 Semi-elliptic	No	No	No	No	No

¾ Ton

Starting 1940.....	2 Semi-elliptic	No	No	No	No	Yes	2 Semi-elliptic	No	No	No	No	No
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*Strut rod to position rear axle. 1937 only. †No ride stabilizer used on 60 H.P. units. ‡Spring covers used on Deluxe models only. §Rubber insert type spring leaves used on a portion of production. ¶Covers not used on rubber insert type springs.

Service Handbook

Front						Rear					
Part Number	Length Eye to Eye Loaded	Width	No. of Lvs.	Load Rate*		Part Number	Length Eye to Eye Loaded	Width	No. of Lvs.	Load Rate*	

Lincoln-Zephyr

1936.....	Std. H-5310-A	40.5"	2.0"	13	300	H-5560-A	46.5"	2.25"	13	250	
1937.....	Spec. H-5310-B	40.25"	2.0"	13	330	H-5560-B	46.5"	2.25"	14	290	
1938 and 1939.....	Spec. H-5310-B	42.5"	2.0"	14	330	H-5560-B	48.5"	2.25"	15	250	
1940.....	86H-5310-A†	42.5"	2.0"	13	315	86H-5560-A†	46.5"	2.25"	14	250	
	86H-5310-B	42.5"	2.0"	14	340	86H-5560-B	46.5"	2.25"	15	260	
	86H-5310-C	42.5"	2.0"	15	375						
	86H-5310-A†	42.5"	2.0"	13	315	86H-5560-A†	46.5"	2.25"	14	250	
	86H-5310-B	42.5"	2.0"	13	280	86H-5560-B	46.5"	2.25"	13	230	
	*86H-5310-B	42.5"	2.0"	16	280	86H-5560-B	46.5"	2.25"	16	230	

Mercury

1939.....	78-5310-C	40.25"	2.0"	11	245	78-5560-C	46.5"	2.25"	12†	215	
1940.....	09A-5310-A	42.0"	2.0"	11	225	01A-5560-D	46.0"	2.25"	11†	180	

Ford Passenger and Commercial

1932.....	40-5310-C	32.6"	1.75"	12	400	40-5560-J	46.0"	2.25"	11†	230	
1933-34.....	40-5310-C	32.6"	1.75"	12	400	40-5560-F	46.0"	2.25"	11†	225	
1935-36.....	78-5310-C	40.3"	2.0"	11	245	78-5560-B	46.0"	2.25"	11†	180	
1937 (35 H.P.).....	78-5310-C	40.3"	2.0"	11	245	78-5560-B	46.0"	2.25"	11†	180	
1937 (60 H.P.).....	78-5310-B	40.3"	2.0"	10	215	78-5560-B	46.0"	2.25"	11†	180	
1938 and (85 H.P.).....	78-5310-C	40.3"	2.0"	11	245	78-5560-B	46.5"	2.25"	11†	180	
1939 (60 H.P.).....	74-5310-B	40.3"	2.0"	10	215	78-5560-A	46.5"	2.25"	10†	165	
1940 (85 H.P.).....	01A-5310-B†	41.8"	2.0"	10	185	01A-5560-C	46.5"	2.25"	10†	165	
1940 (60 H.P.).....	022A-5310-A†	40.3"	2.0"	10	215	01A-5560-C	46.5"	2.25"	10†	165	
1941.....	11A-5310	41.8"	2.0"	11	240	11A-5560	46.5"	2.25"	—	—	

Other Springs

1932 to 34.....	40-5310-C	32.6"	1.75"	12	400	B-5560-A	45.9"	2.25"	9	210	
						B-5560-B	45.9"	2.25"	10	180	
						B-5560-C	46.0"	2.25"	9	155	
						40-5560-G	46.0"	2.25"	10	200	
						40-5560-H	46.0"	2.25"	12	240	
						40-5560-I	46.0"	2.25"	11	230	
						40-5560-K	46.0"	2.25"	13	330	
						40-5560-L	46.0"	2.25"	12	250	
Starting 1935.....	78-5310-D	40.3"	2.0"	12	305	78-5560-A	46.5"	2.25"	12	215	
	78-5310-E	40.3"	2.0"	13	325	78-5560-D	46.8"	2.25"	13	330	
						78-5560-E	46.8"	2.25"	13	245	
						78-5560-F	46.8"	2.25"	15	375	
						78-5560-G	46.8"	2.25"	9	155	
Starting 1940.....	01A-5310-D	41.9"	2.0"	11	200	01A-5560-A	46.8"	2.25"	8	140	
	01A-5310-F	41.9"	2.0"	12	240	01A-5560-B	46.8"	2.25"	9	155	
						01A-5560-C	46.8"	2.25"	14	330	
	022A-5310-B	40.3"	2.0"	11	245	01A-5560-E	46.5"	2.25"	12	215	

Truck

1932 to 1934.....	BB-5310-A	38.3"	2.25"	13	550	BB-5560-A	50.4"	2.5"	13	580	
	BB-5310-B	38.2"	2.25"	14	700	BB-5560-B	50.4"	2.5"	12	340	
1935 and 1936.....	79-5310	36.7"	2.25"	14	1000	BB-5560-C	50.4"	2.5"	14	835	
1937 to 1939.....	79-5310	36.7"	2.25"	14	1000	Same as 1932 to 1934.....					
1940-41.....	81T-5310	39.4"	2.25"	14	1000						
	01T-5310	36.0"	2.0"	11	650	001T-5560-A	45.0"	2.5"	10	900	

Helper Springs for Truck and Cab-Over-Engine

1932 to 1939.....						BB-5588-AR	35.5"	2.5"	5	400**	
1940.....						BB-5588-B	35.5"	2.5"	5	930**	
						01T-5588	32.5"	2.5"	7	1850	

Cab-Over-Engine

1938 and 1939.....	81W-5310-A	40.0"	2.25"	13	500	BB-5560-A	50.4"	2.5"	13	580	
						BB-5560-B	50.4"	2.5"	12	340	
1940-41.....	81W-5310-A	38.0"	2.25"	13	600	BB-5560-C	50.3"	2.5"	14	835	
	81W-5310-B	38.0"	2.25"	13	685	001T-5560-A	45.0"	2.5"	10	900	

1 Ton

1938 and 1939.....	78-5310-E	40.3"	2.0"	13	325	82Y-5560-A	45.0"	2.25"	12	465	
						82Y-5560-B	45.0"	2.25"	13	520	
						82Y-5560-C	45.0"	2.25"	14	640	
1940-41.....	01Y-5310	36.0"	1.75"	8	395	82Y-5560-A	45.0"	2.25"	12	465	
						82Y-5560-B	45.0"	2.25"	13	520	
						82Y-5560-C	45.0"	2.25"	14	640	

¾ Ton

1940-41.....	01Y-5310	36.0"	1.75"	8	395	82Y-5560-A	45.0"	2.25"	12	465	
						82Y-5560-B	45.0"	2.25"	13	520	
						82Y-5560-C	45.0"	2.25"	14	640	

Service Handbook

Engine Specifications—General

	Lincoln-Zephyr		Mercury and Ford 95-H.P.	Ford 85-H.P.	Ford 60-H.P.
	1936 to 1939	Starting 1940			
Number of cylinders.....	12	12	8	8	8
Cylinder block—"V" Type....	75°	75°	90°	90°	90°
Crankshaft.....	120°	120°	90°	90°	90°
Bore.....	2.75"	2.875"	3.187"	3.062"	2.6"
Stroke.....	3.75"	3.75"	3.75"	3.75"	3.2"
Displacement (Cu. In.).....	267	292	239	221	136
Taxable H.P. rating.....	36.3	39.6	32.5	30.0	21.6
Firing order.....	1, 4, 9, 8, 5, 2, 11, 10, 3, 6, 7, 12	1, 4, 9, 8, 5, 2, 11, 10, 3, 6, 7, 12	1, 5, 4, 8, 6, 3, 7, 2	1, 5, 4, 8, 6, 3, 7, 2	1, 5, 4, 8, 6, 3, 7, 2
"L"-head type engine.....	Yes	Yes	Yes	Yes	Yes

Lincoln-Zephyr	Compression Ratio	Cylinder Head Material	Maximum Brake Horsepower		Maximum Torque (Pound-Feet)		Compression Pressure	
			HP	RPM	Torque	RPM	Maximum Pressure	At Crank- ing Speed
1936 to 1939.....	6.7	Aluminum	110	3900	186	2000	146	1000 105
1940 and 1941.....	7.2	Aluminum	120	3500	226	1800	154	1000 110

Mercury (95)

1939 & 1940.....	6.5	Aluminum	95	3000	180	1850	160	2000 100
Starting 1941.....	6.15	Cast Iron	95	3600	175	1850	—	— —

Ford Pass. (85)

1932.....	5.5	Cast Iron	65	3400	139	1500	114	1800 95
1933.....	6.3	Aluminum	75	3800	145	1500	135	1800 105
1934 to 1936.....	6.3	Aluminum	85	3800	147	2000	140	2500 105
1937.....	6.50	Aluminum	85	3800	170	2200	160	2375 100
1938.....	6.50	Aluminum	85	3800	170	2200	160	2375 100
Starting 1939.....	6.15	Cast Iron	85	3800	155	2400	147	2300 100

Com'l, ¾ Ton and 1 Ton (85)

1932.....	5.5	Cast Iron	65	3400	139	1500	114	1800 95
1933.....	6.3	Aluminum	75	3800	145	1500	135	1800 105
1934 & 1935.....	6.3	Aluminum	85	3800	147	2000	140	2500 105
1936.....	5.32	Cast Iron	80	3800	138	2000	110	2500 95
1937 & 1938.....	6.12	Cast Iron	85	3800	150	2000	140	2400 100
Starting 1939.....	6.15	Cast Iron	85	3800	155	2400	147	2300 100

Passenger and Commercial (60)

Starting 1937.....	6.6	Aluminum	60	3500	94	2500	158	2800 105
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Truck (85) and C. O. E.

1932.....	5.5	Cast Iron	65	3400	139	1500	114	1800 95
1933.....	6.3	Aluminum	75	3800	145	1500	135	1800 105
1934 to 1936.....	5.32	Cast Iron	80	3800	138	2000	110	2500 95
1937 & 1938.....	6.12	Cast Iron	85	3800	150	2000	140	2400 100
Starting 1939.....	6.15	Cast Iron	85	3800	155	2200	147	2300 100

Truck (100)

Starting 1939.....	6.5	Aluminum	100	3540	180	1150-2400	160	2000 100
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Service Handbook

LUBRICATION

	Lincoln-Zephyr	Mercury and Ford 95-H.P.	Ford 85-H.P.	Ford 60-H.P.
Pressure lubrication to all main connecting rod and camshaft bearings.....	Yes	Yes	Yes	Yes
Normal oil pressure at 2000 R.P.M. (lbs. per sq. in.).....	40 to 45	30	30	30
Pump capacity—gallons per minute at 2000 R.P.M.....	2.13	1.57	1.57	.82
Oil reservoir capacity (qts.).....	4	4	4	3½
Oil level gauge.....	Metal float	Measuring rod	Measuring rod	Measuring rod
Oil pump type.....	Gear	Gear	Gear	Gear
Drain plug diameter.....	.75"	1.5"	.75" prior to 1939	1.5"
Crankcase ventilation.....	'36-'38, Breather outlet under car '39-'40, Breather outlet into carburetor air cleaner	Directed flow — outlet under car	'32-'34, From oil filler opening '35-'40, Directed flow — outlet under car	'37-'40, Directed flow — outlet under car

CYLINDER BLOCK

Both banks of block and crankcase cast integral.....	Yes	Yes	Yes	Yes
Material.....	Special cast alloy iron	Ford cast alloy iron	Ford cast alloy iron	Ford cast alloy iron
Cylinder wall finish.....	Polished, honed mirror finish	Polished, honed mirror finish	Polished, honed mirror finish	Polished, honed mirror finish
Water jackets.....	Full length of cylinder	Full length of cylinder	Full length of cylinder	Full length of cylinder
Offset of cylinders.....	0.250"	0.187"	0.187"	0.141"

FLYWHEEL AND STARTER GEAR

Material—flywheel.....	Cast iron	Cast iron	Cast iron	Cast iron
Material—gear.....	Steel	Steel	Steel	Steel
Weight.....	Pass.—34.5 lbs.	Pass.—9" 38.7 lbs.	Pass.—9" 38.7 lbs.	Pass. ('37-'39) —8.5" 31.3 lbs.
		Truck—11" 34.1 lbs.	Truck—11" 34.1 lbs.	Pass. ('40), Comm. ('37-'40)—9" 23.8 lbs.

Service Handbook

Pistons, Rings, Pins and Rod Specifications

PISTONS

	Lincoln-Zephyr	Mercury & Ford 95-H.P.	Ford 85-H.P.	Ford 60-H.P.
Compression rings.....	2	2	2	2
Oil control rings.....	1	1	1	1
Ring groove width—				
Top.....	.0965"	.094"	.094"	.0955"
Center.....	.0960"	.0935"	.0935"	.0950"
Bottom.....	.01885"	.1565"	.1565"	.1580"
Piston and pin assemblies used on 1940 units. *Not including pins.	*(06H-6110)	Cars C99A-6199-A	Cars C81A-6199-A	*All 52-6110-A
Piston and pin assemblies supplied for service for older units. *Not including pins.	*(86H-6110 A to C)	C99A-6199-A to G	*48C-6110-A2 to GR2 *78C-6110-A to GR C81A-6199-A to G	*52-6110-A to FR

Part Number	Material	Dome	Skirt	Weight Grams (Piston Only)	Fit of Piston in Cylinder (Using 0.50" Wide Feeler)	
					Thickness of Blade	Pounds Pull on Feeler Blade
48C-6110-A2 to GR2	Aluminum	Flat	Solid	289	.0015"	7 to 10
52-6110-A to FR	Steel	Spherical	Solid	230	.002"	7 to 12
78C-6110-A to GR	Aluminum	Spherical	Solid	306	.0015"	7 to 10
86H-6110-A to C	Steel	Spherical	Solid	326	.002"	5 to 8
C91A-6199-A to G	Aluminum	Combination	Solid	298	.0015"	7 to 10
C99A-6199-A to G	Aluminum	Combination	Solid	308	.0015"	7 to 10
06H-6110-B to D	Steel	Spherical	Solid	360	.002"	3 to 6

PISTON PINS

	Lincoln-Zephyr	Mercury and Ford 95-H.P.	Ford 85-H.P.	Ford 60-H.P.
Type.....	Floating in rod and piston	Floating in rod and piston	Floating in rod and piston	Floating in rod and piston
Pin retainer 1939-1941.....	Ends of pin	Ends of pin	Ends of pin	Ends of pin
1937 and 1938.....	Ends of pin	Ends of pin	Ends of pin	Ends of pin
1932 to 1936.....	Ends of pin	Ends of pin	Ends of pin	Ends of pin
Pin diameter.....	.7501 to .7504"	.7501 to .7504"	.7501 to .7504"	.6876 to .6879"
Pin length.....				
1939.....	2.482"	2.832"	2.780"	2.368"
1937 and 1938.....	2.482"	2.832"	2.780"	2.368"
1932 to 1936.....	2.482"	2.832"	2.780"	2.368"
1940-1941.....	2.607"	2.832"	2.780" (alum. piston) 2.850" (steel piston)	2.368"
Clearance.....				
In piston.....	+.0005"	+.0000" to +.0003"	+.0000" to +.0003"	.0004"
In rod.....	+.0001"	+.0001"	+.0001"	+.0001"

Service Handbook

PISTON RINGS

Type	Lincoln-Zephyr	Mercury and Ford 95-H.P.	Ford 85-H.P.	Ford 60-H.P.
1939-1941—No. 1.....	Plain.	Plain.	Plain.	Plain.
No. 2.....	Expander.	Expander.	Expander.	Expander.
No. 3.....	Exp. oil control.	Exp. oil control.	Exp. oil control.	Exp. oil control.
1938 and earlier—Nos. 1 and 2	Plain.		Plain.	Plain.
No. 3.....	Plain oil control.		Plain oil control.	Plain oil control.

Ring width

1939-1941, Compression.....	.0930-.0935"	.091-.092"	.091-.092"	.0920-.0925"
Oil control.....	.1845-.1850"	.154-.155"	.154-.155"	.1535-.1540"
1938 and earlier, Compression.....	.0930-.0935"		.0915-.0920"	.0920-.0925"
Oil control.....	.1860-.1865"		.1545-.1550"	.1545-.1550"

Ring thickness

Expander type (for steel pistons)	1939 1940-41			
No. 1 comp.....	.115-.123"	.125-.130"		.110-.120"
No. 2 comp.....	.094-.098"	.105-.109"		.095-.100"
Oil control.....	.090-.094"	.105-.109"		.095-.100"
Expander type (for alum. pistons) *				
No. 1 comp.....		.135-.145"	.130-.140"	
No. 2 comp.....		.108-.113"	.105-.110"	
Oil control.....		.108-.113"	.105-.110"	
Plain (for steel or alum.)				
No. 1 and 2 comp. and oil control.....	.115-.125"	.135-.145"	.130-.140"	.110-.120"

Ring gap (All types of rings)

No. 1 and 2 comp. and oil control.....	.008-.013"	.009-.014"	.008-.013"	.009-.012"
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*Supplied only through Service.

CONNECTING RODS

Length (center to center).....	7.40"	7.0"	7.0"	6.125"
Crank pin end bore.....	2.298"	2.360"	2.220"	.37-.39, 1.800"
Width.....	.869"	.871"	.871"	.700"
Bushing bore.....	.7506"	.7505"	.7505"	.6879"
Length.....	1.166"	1.311"	1.311"	1.115"
Rod weight (grams).....	638	488	39-40, 476 37-38, 453 1932-6, 471	37-39, 271 40, 295

CONNECTING ROD INSERTS

Type.....	Fixed in rod	Floating	Floating	Floating
Flanges.....	No	No	1939—No	No
Rods carried on each pair of inserts..	One	Two	Earlier—yes	Two
Length—overall				
1939-41.....	.787"	1.747"	1.747"	1.403"
Earlier.....	.787"	—	1.933"	1.535"

Service Handbook

Camshaft, Crankshaft and Valve Specifications CAMSHAFT AND GEAR

	Lincoln-Zephyr	Mercury and Ford 95-H.P.	Ford 85-H.P.	Ford 60-H.P.
Shaft material				
Forged Steel			1932-34	
Special Ford Cast Alloy Steel	1936-41	1939-41	1935-41	1937-40
Gear held to shaft by:				
Bolts	1940-41	1941	1941	
Press fit	1936-39	1939-40	1939-40	1939-40
Gear material				
Bakelized Fabric	1936-40	1939-40	1932-40	1937-40
Aluminum Alloy	1940-41	1941	1941	
Bearings	Steel backed; babbitt lined	Steel backed; babbitt lined	Steel backed; babbitt lined	Steel backed; babbitt lined
Number	4	3	3	3
Bearing journal				
Diameter	1.797"	1.797"	1.797"	1.498"
Length—Front	1.485"	1.660"	1.660"	1.2"
Center	1.720"	1.400"	1.400"	1.2"
Rear	1.111"	1.776"	1.776"	1.0"

CRANKSHAFT

Type	Counter-balanced; 120°	Counter-balanced; 90°	Counter-balanced; 90°	Counter-balanced; 90°
Material				
Forged Steel			1932-34	
Special Ford Cast Alloy Steel	1936-41	1939-41	1935-41	1937-40
Length—overall	32.25"	26.03"	24.47"	26.03"
Crank pin journal				
Diameter	2.126"	2.139"	1.999"	1.999"
Length	1.75"	1.75"	1.937"	1.75"
Main bearing journals				
Diameter	2.401"	2.499"	*2.399"	2.499"
Length—Front	1.841"	1.721"	1.841"	1.721"
Center	1.378"	1.676"	1.736"	1.648"
Rear	2.255"	2.255"	2.255"	2.255"

*Lincoln-Zephyr has two center bearings.
†1.999", 1932 to 1936.

Service Handbook

CRANKSHAFT (Cont'd)

	Lincoln-Zephyr	Mercury and Ford 95-H.P.	Ford 85-H.P.	Ford 60-H.P.
Weight, pounds	1936-38 73.5 1939-40 80.0	1939-40 69.0	1932-34 65.6 1935-36 60.0 1937-38 63.8 1939-40 66.0	1937-39 44.9 1940 40.5
End play	.002"-.006"	.002"-.006"	.002"-.006"	.002"-.005"

Main Bearing Inserts*

Length—overall	Lincoln-Zephyr	Mercury and Ford 95-H.P.	Ford 85-H.P.	Ford 60-H.P.
Front	1.625"	1.506"	1.506"	1.510"
Center	1.248"	1.506"	1.506"	1.510"
Rear	2.248"	2.251"	2.251"	1.999"
Wall thickness	.1005"	.0855"	.0855"	.0855"
Type of cap	Piloted	Piloted	Piloted	Piloted
Shims	None	None	None	None

VALVES

Mushroom end valve stem	Yes	Yes	Yes	Yes
Lifter:				
Non-adjustable; hollow cast	1936-37	1939-41	1932-41	1937-40
Hydraulic, self-adjusting	1938-41			
Valve, guides and spring removable as an assembly	1936-41	1939-41	1934-41	1937-40
Valve seat inserts (high tungsten chrome alloy steel):				
For exhaust valves only	1936-41		1933-38	1937-40
For all valves		1939-41	1939-41	
Valves chrome nickel alloy steel	Yes	Yes	Yes	Yes
Diameter of:				
Valve head	1.537"	1.537"	1.537"	1.281"
Valve stem	0.3115"	0.3115"	0.3115"	0.2795"
Stem end	0.550"	0.550"	0.550"	0.460"
Angle of seat	45°	45°	45°	45°
Diameter of lifter	0.9995"	0.9995"	0.9995"	0.8295"
Lift of cam	0.292"	0.292"	0.292"	0.251"
Spring length (valve closed)	2.13"	2.13"	2.13"	2.05"
Spring pressure: Valve closed	51-57 lbs.	37-40 lbs.	37-40 lbs.	26-30 lbs.
Valve open	111-121 lbs.	76-80 lbs.	76-80 lbs.	48-52 lbs.
Stem to guide clearance	.0015"-.0035"	.0015"-.0035"	.0015"-.0035"	.0015"-.0035"
Valve timing	1936-37 1938-41		1932-36 1938-41	
Intake opens B.T.C.	19.5°	10.42°	9.5°	9.5°
Intake closes A.B.C.	54.5°	35.58°	44.0°	54.5°
Exhaust opens B.B.C.	57.5°	50.92°	48.0°	57.5°
Exhaust closes A.T.C.	16.3°	8.08°	6.0°	6.5°
Valve clearance	.0125" to .0135"	Zero	.011" to .012"	.011" to .012"

*1936 and later only.
†Lincoln-Zephyr has two center bearings.

Transmission, Clutch and Universal Joint Specifications

[illegible]

CLUTCH+

[illegible]

*One only for 101" W.B. Cab-Over-Engine units.
†All clutches are dry single plate.
‡For bus services clutch is same as truck for 1937.
§Three for 1940 units.
¶Universal joints for all trucks, Cab-over-Engine and Tonpara are of precentered type. Universal joints for other units are self-centering (floating) type.

Service Handbook

Cooling System Specifications*

Thermostatic Control of Circulation	Location of Thermostat	Location of Water Pumps	Location of Fan	BELT DRIVES		
				Fan	Generator	Water Pumps

Lincoln-Zephyr

1936 to 1941...	Yes	Upper Hoses	Block	Crankshaft	No	Yes	Yes
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Mercury

1939 and 1941	Yes	Heads	Block	Crankshaft	No	Yes	Yes
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Ford Passenger and Commercial

1932 and 1933...	No	None	Heads	Generator Shaft	Yes	Yes	Yes
1934 to 1936...	Yes	Upper Hoses	Heads	Generator Shaft	Yes	Yes	Yes
1937 to 1939...	Yes	Heads	Block	Generator Shaft	Yes	Yes	Yes
1940-41.....	Yes	Heads	Block	Crankshaft	No	Yes	Yes

Truck

1932 and 1933...	No	None	Heads	Generator Shaft	Yes	Yes	Yes
1934 to 1936...	Yes	Upper Hoses	Heads	Generator Shaft	Yes	Yes	Yes
1937 to 1939...	Yes	Heads	Block	Generator Shaft	Yes	Yes	Yes
1940-41.....	Yes	Heads	Block	Crankshaft	No	Yes	Yes

Cab-Over-Engine

1938 and 1939...	Yes	Heads	Block	Generator Shaft	Yes	Yes	Yes
1940-41.....	Yes	Heads	Block	Generator Shaft	Yes	Yes	Yes

1 Ton

1938 and 1939...	Yes	Heads	Block	Generator Shaft	Yes	Yes	Yes
1940-41.....	Yes	Heads	Block	Crankshaft	No	Yes	Yes

¾ Ton

Starting 1940...	Yes	Heads	Block	Crankshaft	No	Yes	Yes
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*All radiators are fin and tube type, rubber cushion mounted. Two centrifugal type water pumps, one for each bank of cylinder block.
†Two belts optional at extra cost 1935 and 1936; regular equipment 1937 to 1939 and 1940 Cab-Over-Engine.
‡Deluxe 1939 has fan mounted on front end of crankshaft.

Service Handbook

Capacity of Cooling System Quarts	Pump Capacity Gal. per Min. at 3000 RPM	No. of Fan Blades	Fan Diameter	Effective Core Frontal Area Sq. In.	Hose Inside Diameter	BELT*	
						Approx. Inside Length	Part Number

Lincoln-Zephyr

1936.....	22½	30½	6	17"	391	1.75"	54.4"	H-8620
1937.....	22½	30½	6	3 blades 17"	391	1.75"	54.4"	H-8620
1938 and 1939	25	30½	6	3 blades 17.5"	420	1.75"	54.4"	H-8620
1940-41...	22½	41	6	3 blades 16"	464	1.75"	53.4"	96H-8620

Mercury

1939 and 1940-41.	18	37½	6	3 blades 16.75"	384	1.75"	51.3"	78C-8620-B
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Ford Passenger

1932.....	18	20½	4	15.5"	374	1.75"	51.2"	78-8620-A
1933 & 1934	18	20½	4	15.5"	386	1.75"	54.06"	40-8620-A
1935.....	16½	20½	4	15.5"	382.5	1.75"	54.06"	40-8620-A
1936.....	18	20½	4	15.5"	391	1.75"	54.06"	40-8620-A
1937 & 1938	18	37½	4	15.75"	362	1.75"	51.3"	78-8620A
85 HP..	12½	16½	4	15.75"	341	1.5"	43.9"	52-8620C
60 HP..	17½	37½	6	3 blades 16.75"	384	1.75"	50.1"	78-8620B
1939	18	37½	4	15.75"	362	1.75"	51.3"	78-8620A
DeL. 85HP	12½	16½	4	15.75"	341	1.5"	43.9"	52-8620C
85 HP..	18	37½	6	3 blades 16.75"	384	1.75"	51.3"	78-8620A
60 HP..	12½	16½	2	14.8"	384	1.5"	43.9"	52-8620C

Commercial

1932.....	18	20½	4	15.5"	386	1.75"	51.2"	78-8620-A
1933 & 1934	18	20½	4	15.5"	386	1.75"	54.06"	40-8620-A
1935.....	16½	20½	4	15.5"	444	1.75"	54.06"	40-8620-A
1936.....	18	20½	4	15.5"	444	1.75"	54.06"	67-8620-R
1937 85 HP	18	37½	4	17"	444	1.75"	51.3"	78-8620A
60 HP..	12½	16½	4	15.75"	444	1.5"	43.9"	52-8620C
1938 and 1939 85 HP	18	37½	4	15.75"	444	1.75"	52.1"	51-8620
60 HP..	13	16½	4	15.75"	444	1.5"	43.9"	52-8620C
1940-41	16½	37½	6	3 blades 16.75"	384	1.75"	51.3"	78-8620A
1940 60 HP	12½	16½	2	14.75"	384	1.5"	43.9"	52-8620C

Truck

1932 to 1934	18	33	4	15.5"	386	1.75"	51.2"	78-8620-B
1935.....	20½	33	6	15.5"	444	1.75"	54.06"	40-8620A
1936.....	20½	33	4	19.0"	444	1.75"	52.1"	51-8620
1937 85 HP	20½	37½	4	18.0"	444	1.75"	52.1"	51-8620
60 HP..	20	16½	6	15.5"	444	1.5"	43.9"	52-8620C
1938 and 1939	20	37½	4	18.0"	444	1.75"	52.1"	51-8620
1940-41.....	18	37½	4	19.0"	450	1.75"	51.3"	78-8620A

Cab-Over-Engine

1938 to 1941	20	37½	4	18.0"	444	1.75"	52.1"	51-8620
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1 Ton

1938 and 1939 85 HP	18	37½	4	15.75"	444	1.75"	51.3"	78-8620A
60 HP..	13	16½	6	15.5"	444	1.5"	43.9"	52-8620C
1940-41	18	37½	4	19.0"	450	1.75"	51.3"	78-8620A
1940 60 HP	13	16½	6	16.75"	450	1.5"	43.9"	52-8620C

¾ Ton

1940-41	18	37½	4	19.0"	450	1.75"	51.3"	78-8620A
85 HP...	13	16½	6	16.75"	450	1.5"	43.9"	52-8620C

*All belts are .63" wide max. Pulley groove angle is 28°.

FUEL SYSTEM SPECIFICATIONS

	Type Fuel Pump	Fuel Tank Cap.	Type Fuel Gauge	Type Carburetor	Venturi Diameter	Normal Altitudes	Main Jet Sizes			Average	Limits
							5000 to 10,000 Feet	10,000 Feet	Over 15,000 Feet		
Lincoln-Zephyr											
1936 to 1939.....	Mechanical Diaphragm	15½	Electric	Dual down draft	.97" .94"	.046" .051"	.044" .049"	.042" .047"	.040" .045"	1½" 11"	± ⅛" ± ⅜"
1940-41.....	Mechanical Diaphragm	16	Electric	Dual down draft	1.0"	.053"	.051"	.045"	.043"	11"	± ⅛"

Mercury

1939	Mechanical Diaphragm	14	Electric	Dual down draft	.97 ^a .94 ^a	.045 ^a .050 ^a	.043 ^a .048 ^a	.041 ^a .046 ^a	.039 ^a .044 ^a	1/2 ^a 1 1/8 ^a	± 1/8 ^a ± 1/8 ^a
1940-41	Mechanical Diaphragm	14	Electric	Dual down draft	.94 ^a	.050 ^a	.048 ^a	.046 ^a	.044 ^a	1 1/8 ^a	± 1/8 ^a

Ford Passenger and Commercial

1932 to 1933...	Mechanical Diaphragm	11½	Hydrostatic	Single throat down draft						1¼"	± 11"
1934 and 1935	Mechanical Diaphragm	11½	Hydrostatic	Dual down draft	1.03"	.048"	.046"	.044"	.042"	½"	± 11"
1936	Mechanical Diaphragm	11½	Electric	Dual down draft	1.03"	.048"	.046"	.044"	.042"	½"	± 11"
1937 and 1938 85 HP..	Mechanical Diaphragm	11½	Electric	Dual down draft	.97" .94"	.045" .050"	.043" .048"	.041" .046"	.039" .044"	½" 11"	± 11" ± 11"
60 HP..	Mechanical Diaphragm	11½	Electric	Dual down draft	.81"	.035"	.033"	.032"		½"	± 11"
1939—85 HP..	Mechanical Diaphragm	12½	Electric	Dual down draft	.97" .94"	.045" .050"	.043" .048"	.041" .046"	.039" .044"	½" 11"	± 11" ± 11"
60 HP..	Mechanical Diaphragm	12½	Electric	Dual down draft	.81"	.035"	.033"	.032"		½"	± 11"
1940 85 HP..	Mechanical Diaphragm	12½	Electric	Dual down draft	.94"	.050"	.048"	.046"	.044"	11"	± 11"
60 HP..	Mechanical Diaphragm	12½	Electric	Dual down draft	.81"	.043"	.041"	.039"	.037"	11"	± 11"
1941	Mechanical Diaphragm	11½	Electric	Dual down draft	.81"	.043"	.041"	.039"	.037"	11"	± 11"

Ford Truck

1932 to 1936: Same as Ford Passenger and Commercial, year for year except: Fuel tank capacity 14 gallons; hydrostatic fuel gauge used in 1936.

1937 to 1941: Same as Ford Passenger and Commercial, year for year except: Fuel tank capacity 14½ gallons.

Cab-Over-Engine

1938 to 1941: Same as 85 HP Ford Passenger and Commercial, year for year except; Fuel tank capacity 18 gallons. 1940-41 20 gallons

1 Ton

1938 to 1941: Same as Ford Passenger and Commercial, year for year with same engine except: Fuel tank capacity 14½ gallons.

3/4 Ton

Starting 1940: Same as Ford Passenger and Commercial, year for year with same engine except: Fuel tank capacity 14½ gallons.

*Carburetor with .97" venturi has mechanically operated power jet.

Carburetor with .94" venturi has vacuum operated power jet.

†Has vacuum operated power jet.

Generator Specifications

GENERATOR PART NUMBER	CHARACTERISTICS										FIELD			ARMATURE			CONTROL	GENERATOR SERVICES BY PART NUMBER		
	TYPE	FELLY PART NUMBER	SHAFT PART NUMBER	WINDING PART NUMBER	MAXIMUM SPEED (RPM)	MAXIMUM TORQUE (LBS-FT)	MAXIMUM POWER (HP)	MAXIMUM EFFICIENCY (%)	MOUNTING DIMENSIONS (IN)	MOUNTING DIMENSIONS (IN)	PART NUMBER	RESISTANCE (OHMS)	INDUCTIVE REACTANCE (OHMS)	PART NUMBER	RESISTANCE (OHMS)	INDUCTIVE REACTANCE (OHMS)				
640	44-1018-A	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-B	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-C	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-D	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-E	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-F	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-G	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-H	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-I	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-J	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-K	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-L	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-M	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-N	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-O	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-P	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-Q	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-R	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-S	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-T	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-U	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-V	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-W	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-X	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-Y	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-Z	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-AA	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-AB	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-AC	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-AD	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-AE	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-AF	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-AG	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-AH	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-AI	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-AJ	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-AK	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-AL	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-AM	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-AN	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-AO	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-AP	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-AQ	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-AR	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-AS	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-AT	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-AU	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-AV	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-AW	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-AX	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-AY	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-AZ	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-BA	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-BB	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-BC	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-BD	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-BE	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-BF	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-BG	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-BH	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-BI	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-BJ	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-BK	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-BL	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-BM	5	6	119	600	17	1800	11	10	11	24	3.40-10175	1.0	1.22	44-10005	29	36	44-10005	Stator	640
640	44-1018-BN																			

BATTERY

Year	Aluminum Supply?	Mercury	Feed Delivery	Feed Plans	Feed Commercial	Feed Tablets	Feed Tonnage	Feed M. Tonnage	Feed C.O.E.
1982			CS-10655-A	CS-10655-A	CS-10655-A	CS-10655-A			
1983			CS-10655-C	CS-10655-C	CS-10655-C	CS-10655-C			
1984			COIAF-10655-A	COIAF-10655-A	COIAF-10655-A	COIAF-10655-A			
1985			COIAF-10655-A	COIAF-10655-A	COIAF-10655-A	COIAF-10655-A			
1986	COIAF-10655-A		COIAF-10655-A	COIAF-10655-A	COIAF-10655-A	COIAF-10655-A			
1987	COIAF-10655-A		COIAF-10655-A	COIAF-10655-A	COIAF-10655-A	COIAF-10655-A			
1988	COIAF-10655-A		COIAF-10655-A	COIAF-10655-A	COIAF-10655-A	COIAF-10655-A			COIAF-10655-A
1989	COIAF-10655-A	COIAF-10655-A	COIAF-10655-A	COIAF-10655-A	COIAF-10655-A	COIAF-10655-A			COIAF-10655-A
1990	06H-10655-A	01A-10655-A	01A-10655-A	01A-10655-A	01A-10655-A	01A-10655-A			01A-10655-A

Part Number	Volts	Located Under	Plate Feet Cuts	Height	Width	Length	Capacity (any 9 cells)			Total Plate Area (sq. in.)	Type Filter	Beach Charging Rate Amperes		Replaced for Service by
							Amperes (Hour Rate)	Amperes (Hour Rate)	Minimum at 9° P. with 500 Amp. Discharge			Start	Finish	
B-10655-B	6	Floor	15	7.8"	7.1"	9.15"	95	120	3.00	2406	Plain	6	4	Same
18-10655	6	Floor	13	7.8"	7.1"	9.15"	82	103	2.20	2163	Plain	6	4	CS-10655-A
40-10655-C	6	Floor	17	7.1"	7.2"	10.5"	100	126	3.30	2359	Plain	8	5	COIAF-10655-A
40-10655-D	6	Floor	15	7.1"	7.2"	10.5"	90	110	2.35	2258	Plain	6	4	CS-10655-C
78-10655-A	6	Hood	17	7.1"	7.2"	10.5"	100	126	3.30	2359	Vent. Hood	8	5	COIAF-10655-A
78-10655-B	6	Hood	15	7.1"	7.2"	10.5"	90	110	2.35	2258	Vent. Hood	6	4	CS-10655-C
81A-10655-A	6	Hood	17	7.1"	7.2"	10.5"	100	126	3.30	2359	Bel lows	8	5	COIAF-10655-A
81A-10655-B	6	Either	15	7.1"	7.2"	10.5"	90	110	2.35	2258	Bel lows	6	4	CS-10655-C
81A-10655	6	Hood	19	8.9"	7.2"	10.5"	135	170	4.45	3505	Plain	10	8	Same
81B-10655	12	Floor	13	10.0"	11.0"	21.2"	133	140	3.7	3702	Plain	8	5	No Service
86H-10655	6	Either	17	7.1"	7.2"	10.5"	100	126	3.30	2359	Bel lows	8	5	COIAF-10655-A
91AS-10655-B	6	Either	11	7.9"	7.2"	10.5"	65	63	2.0	1656	Plain	6	4	Not Serviced
01A-10655-A	6	Hood	17	9.2"	7.3"	10.6"	120	150	4.0	3043	Bel lows	10	8	Same
06H-10655-A	6	Hood	17	9.2"	7.3"	10.6"	120	150	4.0	3043	Bel lows	10	8	Same
09B-10655	12	Floor	17	9.8"	10.9"	20.5"	158	215	5.1	8172	Plain	15	10	Same
9DT-10655	12	Floor	25	10.0"	11.0"	21.2"	180	215	2.2	4128	Plain	15	10	Same
9E1-10655	12	Floor	15	9.8"	9.8"	20.5"	137	150	2.8	5040	Plain	15	10	Same

NOTE: "81A" Batteries can be placed in cars where battery is under floor seat or hood.

“40” Batteries can only be used in cars where battery is under floor or seat.

“78” Batteries can only be used under hood as the vent hose type filler plugs require extra head clearance.

Starter and Ignition Specifications

STARTER MOTOR

Normal Engine Cranking Speed	Maximum Torque		Teeth in Pinion	Teeth in Ring Gear	Gear Ratio
	Pound-Feet	Ampere Draw			

Lincoln-Zephyr

1936 to 1941.....	100	14	500	10	112	11.2
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Mercury

1939 and 1941	100	14	500	10	112	11.2
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Ford Passenger and Commercial

1932 to 1936.....	100	14	500	10	112	11.2
1937 to 1941						
85 HP and 95 HP..	100	14	500	10	112	11.2
1937-40 60 HP.....	100	14	500	9	122	13.6

Ford Truck

1932 to 1941.....	Same as Pass. and Comm. for respective years.
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Cab-Over-Engine, and 1 Ton

1938 to 1941.....	100	14	500	10	112	11.2
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3/4 Ton

Starting 1940.....	100	14	500	10	112	11.2
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DISTRIBUTOR

Single unit with ignition coil in single waterproof housing; driven direct from front end of camshaft; spark advance fully automatic with vacuum controlled centrifugal governor; two sets of breaker points.

Adjustments: Initial spark advance; vacuum brake control; breaker point gap; synchronization of breaker points with each other for Lincoln-Zephyr only.

Service Handbook

Initial Spark Advance (Deg. on Crankshaft)	Automatic Advance over Initial (Deg. on Crankshaft)	Automatic Advance		Resistance of Primary Ignition Circuit (Ohms)	Number of Ignition Coils	Number of Pairs of Firing Points	Breaker Spring Tension (Ozs.)	Breaker Point Gap
		Begins (RPM)	Ends (RPM)					

Lincoln-Zephyr

1936 to 1941	4	16	400	3000	1.0-1.33	2	2	20-24	.014"-.016"
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Mercury

1939-1941	4	20	400	3000	1.0-1.33	1	1	20-24	.014"-.016"
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Ford Passenger, Commercial and Truck

1932	4	16	400	3000	1.0-1.33	1	1	19-22*	.012"-.014"
1933	4	22	400	3000	1.0-1.33	1	1	19-22*	.012"-.014"
1934 to 1936	4	16	400	3000	1.0-1.33	1	1	22-27	.012"-.014"
1937 to 1941	4	16	400	3000	1.0-1.33	1	1	20-24	.014"-.016"

Cab-Over-Engine and 1 Ton

1938 to 1941	Same as Ford Pass. and Comm. for 1938 and 1939.								
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¾ Ton

Starting 1940	Same as Ford Passenger and Commercial.								
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*Tension should be 22-27 ounces when the larger diameter breaker points (same as 1934 to 1936 cars) are used.

SPARK PLUGS

Lincoln-Zephyr

	Thread	Make	Type	Gap
1936	14 M.M.	Champion	J-9	.025"
1937	14 M.M.	Champion	J-9	.028"-.030"
1938 to 1941	14 M.M.	Champion	H-10	.028"-.030"

Mercury

1939-1941	14 M.M.	Champion	H-10	.025"
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Ford Passenger, Commercial and Truck

1932	7/8"	Champion		.025"
1933	18 M.M.	Champion	C-7	.025"
1934 Standard	18 M.M.	Champion	7	.025"
Optional (Cold plug)	18 M.M.	Champion	6 Com.	.020"
1935 to 1937—85 HP.	18 M.M.	Champion	18	.025"
1937—60 HP.	14 M.M.	Champion	H-10	.025"
1938 to 1941, all engines*	14 M.M.	Champion	H-10	.025"
*1941 Trucks only	14 M.M.	Champion	H-9	.032"

Cab-Over-Engine and 1 Ton

1938 to 1941	14 M.M.	Champion	H-10	.025"
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¾ Ton

Starting 1940	14 M.M.	Champion	H-10	.025"
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Service Handbook

Light and Horn Specifications LIGHTS

Year and Model	HEADLIGHTS										Parking Bulbs C.P.	Tail Light Bulbs C.P.	Stop Light Bulbs C.P.	Inside Body L. Bulbs C.P.	Instr. Panel Bulbs C.P.
	Bulb Type	Watts Each	Beam	Inches Lens	Inches from Center of Car	Switch Location	Separate Beam Control Located	Beam Indicator Bulb	Low Beam Amps	Circuit Breaker					

1932

Ford Car	32-32	27	38	14	Steering Wheel	—	No	20	No	3	3	21	3	3	
Ford Truck	32-32	27	37	14	Steering Wheel	—	No	20	No	3	3	21	—	3	

1933

Ford Car 5-Pass.	32-32	27	29 1/4	16 1/2	Steering Wheel	—	No	20	No	3	3	21	3	3	
Ford 3-Pass.	32-32	27	32 1/4	16 1/2	Steering Wheel	—	No	20	No	3	3	21	3	3	
Ford Truck	32-32	27	32 1/4	—	Steering Wheel	—	No	20	No	3	3	21	—	3	

1934

Ford Car 5-Pass.	32-32	27	29 1/4	16 1/2	Steering Wheel	—	No	20	No	3	3	21	3	3	
Ford 3-Pass.	32-32	27	32 1/4	16 1/2	Steering Wheel	—	No	20	No	3	3	21	3	3	
Ford Truck	32-32	27	—	15 1/2	Steering Wheel	—	No	20	No	3	3	21	—	3	

1935

Ford Car 5-Pass.	32-32	27	31 1/4	17 1/2	Steering Wheel	—	No	20	No	3	3	21	3	3	
Ford 3-Pass.	32-32	27	33 1/4	17 1/2	Steering Wheel	—	No	20	No	3	3	21	3	3	
Ford Truck	32-32	27	42 1/2	19 1/2	Steering Wheel	—	No	20	No	3	3	21	—	3	

1936

Lincoln-Zephyr	32-32	27	33	25 1/2	Steering Wheel	—	No	No	Vibrator	3	3	21	6	6	
Ford Car 5-Pass.	32-32	27	31 1/4	16 1/2	Steering Wheel	—	No	No	3	3	21	3	3		
Ford 3-Pass.	32-32	27	33 1/4	16 1/2	Steering Wheel	—	No	No	3	3	21	3	3		
Ford Truck	32-32	27	42 1/2	19 1/2	Steering Wheel	—	No	No	3	3	21	—	3		

1937

Lincoln-Zephyr	32-32	27	33	25 1/2	Dash	Floor	—	No	Vibrator	1.5	3	21	6	1.5	
Ford Car	32-32	27	30 1/4	16 1/2	Steering Wheel	—	No	20	No	1.5	3	21	3	3	
Ford Truck	32-32	27	41	19 1/2	Steering Wheel	—	No	20	No	3	3	21	—	3	

1938

Lincoln-Zephyr	32-32	27	30 3/4	26 1/2	Dash	Floor	—	No	Vibrator	1.5	3	21	6	1.5	
Ford Car	32-32	27	30 1/4	16 1/2	Steering Wheel	—	No	20	No	1.5	3	21	3	3	
Ford Truck	32-32	27	42	19 1/2	Steering Wheel	—	No	20	No	3.0	3	21	—	3	
Cab-over-Eng.	32-32	27	42	27 1/2	Steering Wheel	—	No	20	No	3	3	21	—	3	

1939

Lincoln-Zephyr	32-32	27	30 3/4	26 1/2	Dash	Floor	1.0	No	Vibrator	1.5	3	21	6	1.5	
Mercury	32-32	27	30 1/4	24	Steering Wheel	Floor	1.0	No	Vibrator	1.5	3	21	3	1	
Ford Car	32-32	27	30 1/4	24	Steering Wheel	Floor	1.0	No	Vibrator	1.5*	3	21	3	3	
Ford Tonner	32-32	27	42	19 1/2	Steering Wheel	Floor	1.0	No	Vibrator	3.0	3	21	—	3	
Ford Truck	32-32	27	42	19 1/2	Steering Wheel	Floor	1.0	No	Vibrator	3.0	3	21	—	3	
Cab-over-Eng.	32-32	27	42	27 1/2	Steering Wheel	Floor	1.0	No	Vibrator	3.0	3	21	—	3	

1940-41

Lincoln-Zephyr	Sealed	40-30	30	26 1/2	Dash	Floor	1.0	No	Yes	1.5	3	21	6	1.5	
Mercury	Sealed	40-30	30 1/4	24	Dash	Floor	1.0	No	Yes	1.5	3	21	3	1.0	
Ford Car	Sealed	45-35	30 1/4	24	Dash	Floor	1.0	No	Yes	1.5*	3	21	3	1.0	
Ford Tonner	Sealed	45-35	42	19 1/2	Dash	Floor	1.0	No	Yes	3.0	3	21	—	3	
Ford Truck	Sealed	45-35	42	19 1/2	Dash	Floor	1.0	No	Yes	3.0	3	21	—	3	
Cab-over-Eng.	Sealed	45-35	42	27 1/2	Dash	Floor	1.0	No	Yes	3.0	3	21	—	3	

Service Handbook

HORNS

Year and Model	No. of Horns	Type	Amperes Total
1932			
Ford Deluxe Cars	1	Vibrator	6 to 8
All other types	1	Vibrator	6 to 8
1933			
Ford Deluxe Cars	2	Vibrator	12 to 16
All other types	1	Vibrator	6 to 8
1934			
Ford Deluxe Cars	2	Vibrator	12 to 16
All other types	1	Vibrator	6 to 8
1935			
Ford Deluxe Cars	2	Vibrator	12 to 16
Commercial Cars	1	Vibrator	6 to 8
All other types	1	Vibrator	6 to 8
1936			
Lincoln-Zephyr	2	Air Electric	24 to 28
Ford Deluxe Cars	2	Vibrator	12 to 16
Commercial Cars	1	Vibrator	6 to 8
All other Ford types	1	Vibrator	6 to 8
1937			
Lincoln-Zephyr	2	Air Electric	24 to 28
Ford Deluxe Cars	2	Vibrator	12 to 16
All other Ford types	1	Vibrator	6 to 8
1938			
Lincoln-Zephyr	2	Air Electric	24 to 28
Ford Deluxe Cars	2	Air Electric	24 to 28
All other Ford types	1	Vibrator	6 to 8
1939			
Lincoln-Zephyr	2	Air Electric	24 to 28
Mercury	2	Air Electric	24 to 28
Ford Passenger Cars	2	Air Electric	24 to 28
Trucks and Commercial Cars	1	Vibrator	6 to 8
1940-41			
Lincoln-Zephyr	2	Air Electric	24 to 28
Mercury	2	Air Electric	24 to 28
Ford Passenger Cars	2	Air Electric	24 to 28
Trucks and Commercial Cars	1	Vibrator	6 to 8

Service Handbook

A FRATERNITY WITHOUT A NAME

There is in this world a fraternity without a name. It has no constitution nor bylaws, no membership roll, and its members do not know the names of one another. But they recognize each other when they meet, they work together for a common cause, and they are one of the greatest forces for the welfare of the people of the world. If they had a name it would be the Fraternity of Skilled Drivers.

A skilled driver knows how to handle a car, and he handles it without danger to anyone else or to himself. He knows he and the other drivers must share the roads together. He knows that even the most skilled can be endangered by the lack of skill of others. The motto on his shield is, "Help the other fellow." You've seen him. If you wanted to park, you've seen him hold the line behind till you got it. If you wanted to pass him on the open road, you've seen him slow his speed till you were by. If the hole into which you were trying to get while passing was too small, you've seen him move to the right to let you through. If you had trouble stopping, you've seen him wait and let you roll to safety. Where the right of way was doubtful, you've seen him give it to you. When pedestrians hesitated at a crossing, you've seen him wait and wave them on.

HELP ONE ANOTHER is his creed, for he knows that an emergency can come to any man, and he hopes that if one some day comes to him, some other driver will pay him back.

For the reckless driver he has contempt, just as the skilled workman has contempt for the careless one who would damage the tools that both must use. He has tolerance for the new driver who is doing his best to become skilled. He is a gentleman of the road.

To this good fellowship, he welcomes any who can earn a place. Its nameless membership is as exclusive as a craft of old; yet any driver can get in. No one will propose you for membership and you'll get no formal notice, but some day that other driver will lift his hand from his wheel in a thank you gesture that will say:

"You're okay, brother."
And you'll know you're in.

("From 'How To Become A Skilled Driver' by
Ray W. Sherman for Ford Good Drivers League".)

