

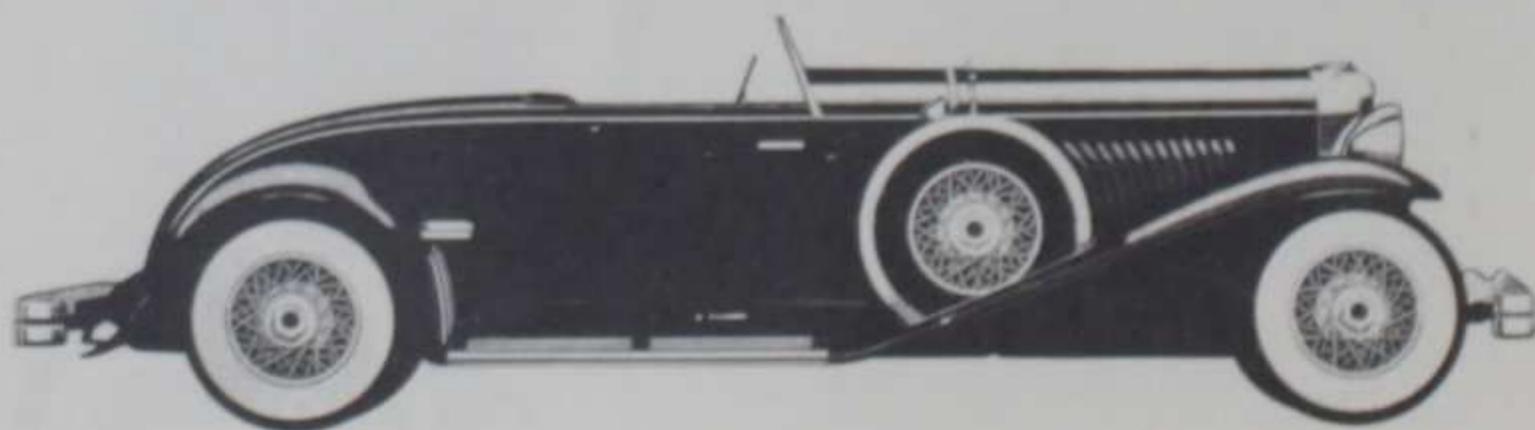
Owner's Instruction Book

Duesenberg

MODEL - J

Announcement

This is a reprint of an original Duesenberg Owner's Instruction Book. Owing to the continued interest in the "Duesie", one of the unique and famous cars in American history, we have made available a few of these reprints for owners, collectors, and motor car enthusiasts.— Clymer



THE DUESENBERG CONVERTIBLE ROADSTER

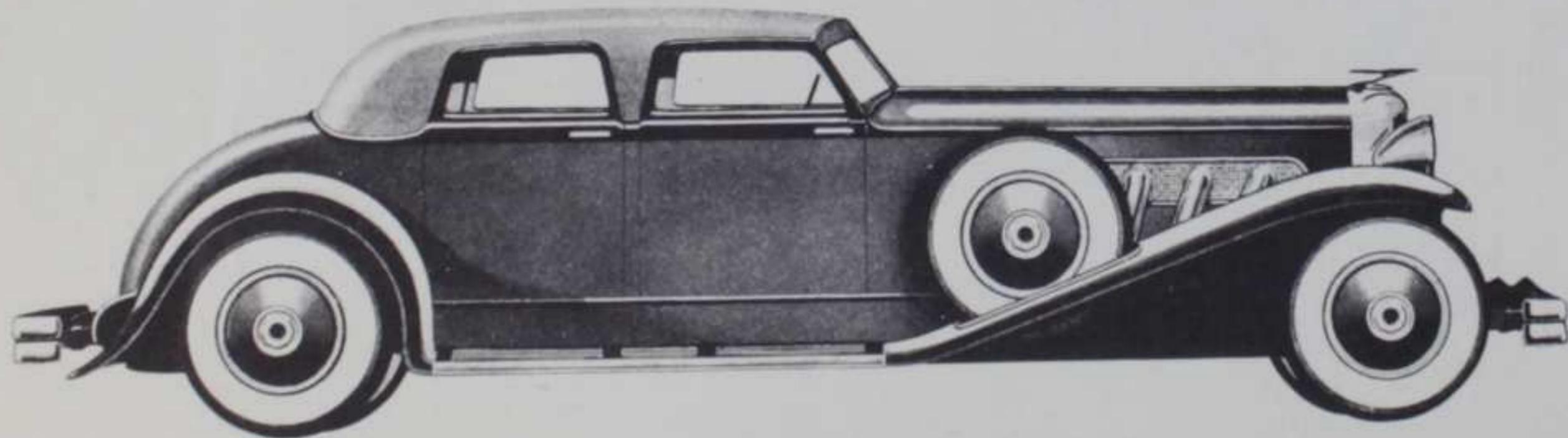
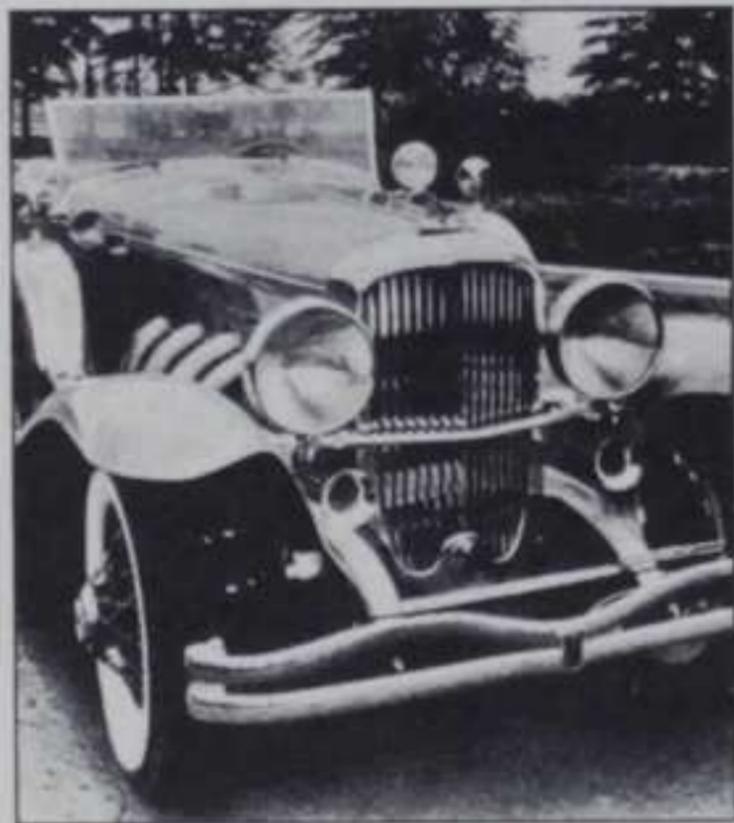
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FLOYD CLYMER

*World's Largest Publisher of Books Relating to
Automobiles, Motorcycles, Motor Racing, and Americana*

1268 South Alvarado Street Los Angeles 6, California

*This stream-lined supercharged
Duesenberg is not freakish in ap-
pearance. There are many designs
and suggestions for you to choose
from.*



320 HORSEPOWER SUPERCHARGED DUESENBERG

License and Insurance Data

Number of cylinders.....	8
Cylinder bore.....	3 $\frac{3}{4}$ in.
Stroke.....	4 $\frac{3}{4}$ in.
Piston displacement.....	420 cu. in.
Horse Power (SAE rating).....	45

The car serial number will be found on front of dash upper left-hand side.

The motor number is stamped on the left rear motor support leg.

The front axle number is stamped on top flange center section of I beam.

The rear axle number is stamped on top of center section of steel housing.

Approximate Shipping Weights for Standard Types

2-4 Pass. Roadster Convertible Coupe.....	142 $\frac{1}{2}$ W. B.	5250 lbs.
4 Pass. Convertible Sedan.....	142 $\frac{1}{2}$ W. B.	5550 lbs.
5 Pass. Standard Sedan.....	142 $\frac{1}{2}$ W. B.	5450 lbs.
4 Pass. Sport Phaeton.....	142 $\frac{1}{2}$ W. B.	5250 lbs.
7 Pass. Standard Sedan.....	153 $\frac{1}{2}$ W. B.	5850 lbs.
Chassis (Only).....	142 $\frac{1}{2}$ W. B.	4450 lbs.
Chassis (Only).....	153 $\frac{1}{2}$ W. B.	4550 lbs.

Illustrations

1. Instruments
2. Lubricating system of motor
3. Cross-sectional view-left side of motor
4. Photograph and cross-sectional view-front of motor
5. Valve and ignition timing diagram
6. Photograph of carburetor and cross-sectional view of fuel pump.
7. Cross-sectional view of clutch, and transmission.
8. Cross-sectional view of rear axle and torque tube.
9. Cross-sectional view of front axle and external view of brake assembly
10. Master cylinder assembly
11. Plan view of chassis
12. Shackle assembly
13. Wiring diagram

INSTRUMENTS AND CONTROLS

(1) IGNITION SWITCH

The ignition switch located on the instrument board when turned to the right snaps out to the "on" position and closes the circuit between the storage battery and the ignition system. Thus, current is supplied for igniting the gasoline in the cylinders, which is the first step in starting the motor. Always stop the motor by turning off the ignition switch and be very careful to see that switch is never turned on when the motor is not running as the battery may be completely discharged.

(2) THROTTLE CONTROL LEVER

The hand throttle is closed when the lever is in its upper-most position and should be opened by moving the lever downward approximately $\frac{1}{2}$ " on quadrant for the second step in starting the motor. The speed of the motor may thus be regulated by the hand lever or foot pedal.

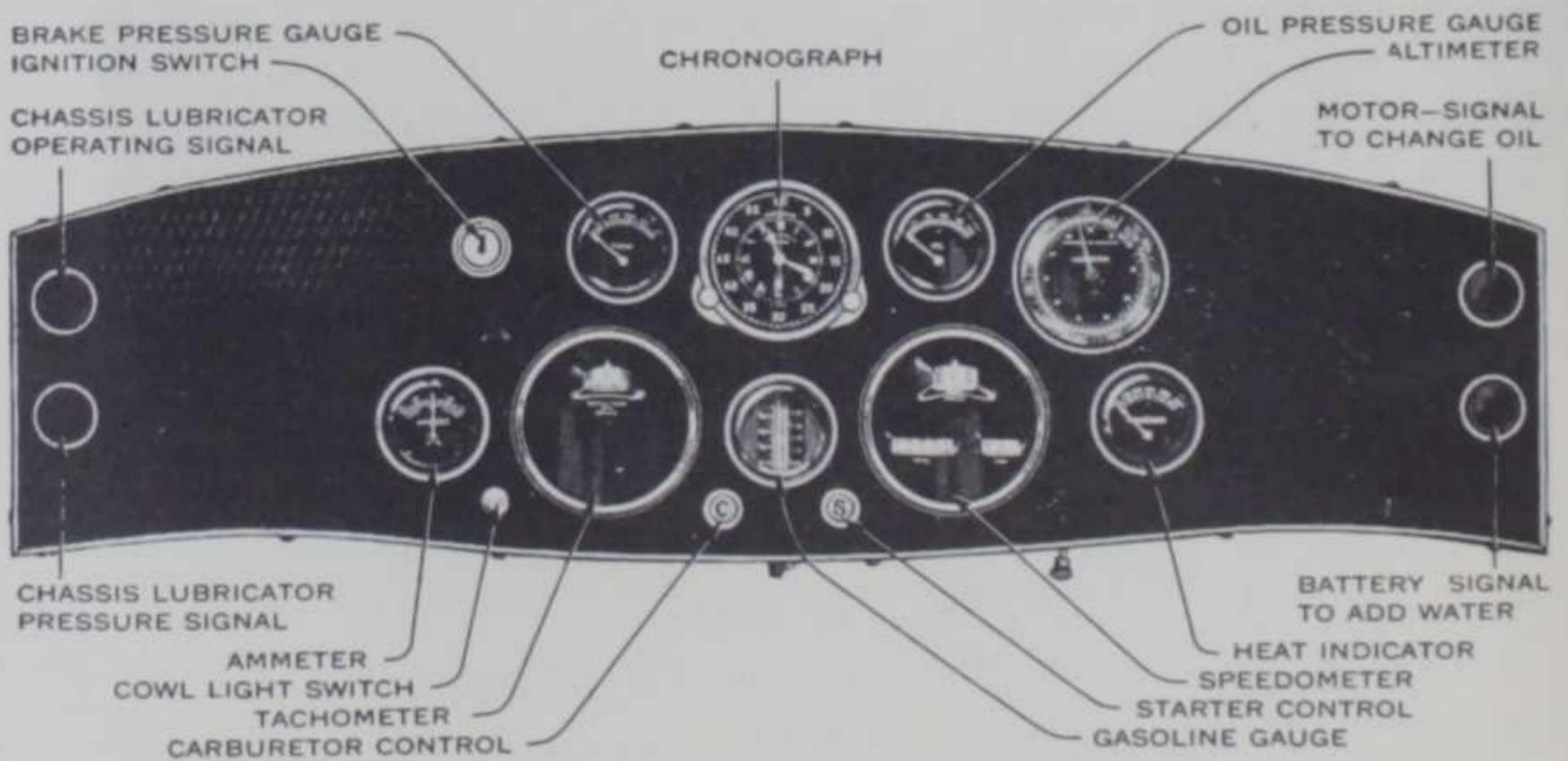


Fig. 1. Instruments

(3) SPARK CONTROL LEVER

The ignition timing is retarded when the lever is in its uppermost position and should be moved to approximately mid position of the quadrant for the third step in starting the motor. As soon as the motor has started the ignition should be advanced by moving lever downward to position where maximum performance of the motor is obtained. Learn to regulate position of spark lever for different motor speeds, keeping it in the advanced positions for higher motor speeds and retarding it as required for maximum power at lower speeds.

(4) ACCELERATOR PEDAL

The accelerator pedal performs the same function as the hand throttle lever and ordinarily is used in preference to the hand lever.

(5) CARBURETOR CONTROL

The carburetor control is to be used for enriching the carburetor mixture as required when the motor is cold. The fourth step in starting the motor is to pull the carburetor control out as far as possible until the motor starts to fire, and immediately return it gradually to its normal position as the motor warms up. Under extremely cold weather conditions it may be necessary to leave the control pulled out approximately $\frac{1}{2}$ " for a few minutes to give the correct carburetion until the water temperature is normal. The control should be pushed all the way in to the instrument board as the warming up process is completed to prevent excessive oil dilution and resultant cylinder wear.

(6) STARTER CONTROL

The engaging of the starting motor is accomplished by pulling the control button located on instrument board out as far as possible and is the fifth and last step in starting the motor. The starter should be engaged at intervals of 10-15 seconds and should not remain engaged for longer periods as this will discharge the battery rapidly. If the motor does not start after two or three attempts, an immediate investigation should be made to determine the trouble by checking the following items.

1. Gasoline supply may be exhausted.
2. Gasoline mixture may be too rich or lean. Carburetor may be choked excessively by leaving dash control out too long.
3. Open throttle approximately half way to start when motor has been choked excessively.
4. Check gasoline supply at carburetor by removing hexagon drain plug in bowl near the front on the outside. It may be necessary to remove and clean strainer bowl assembly Part No. J-1232 Fig. 3 and prime the system by operating gasoline pump by hand.
5. Be sure switch is on and check to see if electrical terminals are tight at the distributor and ignition coils back of the instrument board.
6. In cold weather depress the clutch pedal so as to eliminate the load on the starting motor of turning the transmission.
7. Check starter ground strap from starter to frame and battery terminals to see that they are absolutely tight.
8. Check battery charge.

(7) CLUTCH PEDAL

The clutch pedal controls the operation of the clutch and releases or disengages the motor to permit shifting and engaging the transmission gears. A clearance of 1" to 1½" should be maintained between the return position of the pedal and the floor board at all times to insure proper clutch action. (See clutch). The foot should not be permitted to rest on the clutch pedal while driving as this subjects the clutch parts to unnecessary wear.

(8) BRAKE PEDAL

The foot brake pedal operates the 4 wheel hydraulic brakes commonly known as service brakes. Application and control of brakes is accomplished by depressing the pedal in the conventional manner, the braking effect being directly proportional to amount of pressure exerted on the pedal.

(9) GEAR SHIFT AND LEVER

The transmission is of the conventional three speeds forward with the standard universal gear shift. Due to the special design of the transmission a lightning shift of gears may be made even at high motor speeds.

(10) LIGHT CONTROL LEVER

The lighting switch is located at the base of the steering column and is operated by the third control lever on top of steering column. Extreme position to the left is for cowl and tail lamps, next position to right all lights off and the two positions to the extreme right for headlights and tail light with the headlight beams deflected for one of the positions.

(11) HAND BRAKE LEVER

The hand brake lever operating the emergency brake is to be used for locking car in position when parked. Form the habit of locking the brake when the car is parked.

(12) WINDSHIELD WIPER

The windshield wiper is operated from the vacuum in the manifold and is controlled at the assembly by a thumb screw.

(13) TACHOMETER

The tachometer is a revolution counter attached to the rear of one camshaft giving direct revolutions per minute of motor speed.

(14) SPEEDOMETER

The speedometer instrument gives the direct reading in miles per hour up to 150, together with total and trip mileage.

(15) CHRONOGRAPH (Clock and Split Second Stop Watch)

The clock is an eight day instrument incorporating in its movements a split second watch by the use of which actual developed speed can be figured from the specific time and distance covered.

(16) ALTIMETER

The altimeter records barometric pressure in inches of mercury together with altitude measured in feet. The graduated scale for altitude may be shifted, thus allowing the scale to be set at zero with dial indicator whereby variations in altitude are indicated directly for different localities. By setting the altitude dial to the exact altitude of a given locality according to the corresponding barometer reading, weather conditions or changes may be approximated.

(17) OIL PRESSURE GAUGE

The oil pressure gauge indicates the condition of the oil pressure system for the motor and gives the pressure reading in pounds per square inch. Form the habit of observing the oil gauge to see that it shows correct pressure at all times. If pressure should drop below normal, lack of oil or very thin oil may be the reason.

(18) GASOLINE GAUGE

The gasoline gauge indicates in gallons the amount of gasoline in the tank. This gauge is calibrated or set at the factory and should require no attention thru the lifetime of the car.

(19) BRAKE PRESSURE GAUGE

The brake pressure gauge indicates the hydraulic pressure developed upon application of the brakes or in other words the working condition of the system. The brakes ordinarily require approximately 200 pounds pressure for operation but the system is capable of developing 500 pounds pressure in emergencies; thus a high factor of safety is maintained for breaking effect in controlling the car.

(20) AMMETER

The ammeter indicates the working condition of the electrical system or in other words the rate of charge or discharge of the battery. The ammeter should indicate a charging rate of 10-12 amperes with all lights turned off at a road speed of 20-30 M. P. H.

(21) HEAT INDICATOR

The heat indicator gives the temperature of the water cooling system in degrees of Fahrenheit. The most efficient operating temperature is from 160-200 degrees although in extremely warm or cold climates the temperature may run slightly higher or lower.

(22) INSTRUMENT BOARD SIGNAL LIGHTS

The green signal light at the right side marked "Bat" when burning approximately every 1500 miles reminds you that the battery should be inspected and pure distilled water added to bring the solution to within $\frac{3}{8}$ " of top.

The red signal light at the right side marked "Oil" when burning approximately 750 miles indicates that the motor oil should be changed.

The red signal light at the left side when burning approximately every 60-80 miles indicates that the chassis lubricating mechanism is operating and immediately afterward the green signal light should flash showing that oil is being delivered to the various shackle bearings. Should the second light fail to operate check the oil supply in chassis lubricator supply tank at the right front side of the dash.

(23) HOOD LOCK

To lock the hood properly it is necessary to place the lock control handle upright when dropping hood in position, then turn handle down in right hand direction, pushing cylinder of key lock "in" to lock control lever in down position.

Tool box and battery compartment locks operate in the same manner.

(24) RADIATOR CAP

When removing radiator cap care should be taken to unscrew cap as far as possible before lifting from shell, otherwise cap will not return to its proper locking position when again installed.

Paragraphs 25-29 inclusive discontinued.

OPERATION

In the designing and building of this car every effort has been made, to make it as complete as possible and to eliminate the many annoyances of periodic inspection and lubrication so essential to prolonging the life of the average motor car.

In furthering this motive the manufacturing division has taken all possible precautions in building and testing this car to eliminate various items of checking and preparation usually necessary upon receipt of the car at its destination.

When cars are shipped it will be necessary to check the following items.

(30) PREPARING CAR FOR SERVICE

1. Remove spark plugs and insert approximately $\frac{1}{2}$ oz. of cylinder oil into each cylinder.
2. Fill radiator with clean water (capacity 7 gal.) In cold weather an anti-freeze solution should be used. See paragraph 73.
3. Fill gasoline tank (capacity 26 gal.)
4. Be sure oil in crankcase is up to proper level which is indicated by oil level gauge on left side of motor. (capacity 3 gal.)
5. Check air pressure of tires, which should be 40 lbs. for front, 38 lbs. for rear.
6. Test battery with hydrometer and see that all plates are covered with water.
7. Check all lights to see that they burn properly.

(31) RUNNING A NEW MOTOR

The most critical period in the life of the motor is the first 1000 miles of operation. Permanent injury or damage may result through the failure to observe the simple but fundamental laws of "working in" the new motor.

During this initial period of operation, additional cylinder lubrication should be supplied by adding one quart of light crystal engine oil to each ten gallons of gasoline used.

Sustained or continued high motor speeds are extremely detrimental until the motor has passed the initial 1000 miles of operation. Even after this mileage the motor should never be raced, especially when cold.

(32) OPERATING THE CAR

Operating the car, that is, starting the motor, shifting gears, controlling and stopping the car is all accomplished in the conventional manner with which all operators are familiar. It is

therefore needless to narrate this simple procedure, but we will give a list of driving suggestions which we trust will assist in operating the car and adding comfort for its passengers.

1. Use the power of the motor and brakes moderately in controlling the car.
2. Drive with the carburetor control all the way in against the dash at all times except when starting with the motor cold. Rich mixtures cause rapid oil dilution and excessive cylinder wear.
3. Form the habit of glancing at the instrument panel. The instruments indicate the operating condition of the lubricating, electrical and cooling systems. Watch the oil gauge to see that it shows normal pressure at all times.
4. Do not ride with foot on the clutch pedal or disengage clutch when coasting down steep grades as these practices cause early service replacements and expense.
5. Leave ignition "On" when coasting. Failure to do this allows gasoline to wash the cylinder walls and thin lubricating oil, while unburnt gasses passed into the muffler may produce great damage when ignited later as the switch is turned "On".
6. Learn to regulate the spark control in relation to motor speed, driving with it in the advance position for high motor speeds and retarding it for ascending steep grades at low speeds.

(33) INSPECTION AND LUBRICATION

In listing the items which must necessarily be checked at different intervals we have assumed that the owner is thoroughly familiar with the attention necessary to water in the cooling system, water in the battery, gasoline, oil supply in the crankcase, lights, tire pressure and the daily routine essential to successful motor car operation. However, descriptive details for the above mentioned items will be found under their respective explanations in other parts of this book.

It is imperative that the following items be checked very thoroughly at intervals of 2500 and 5000 miles.

INSPECTION AND LUBRICATION SCHEDULE

2500 MILES

CHASSIS LUBRICATION—Replenish oil supply in chassis lubricator supply tank on right front of dash with Bijur special oil which may be obtained at our service stations or at Bijur Lubricating Co., 250 W. 54th St., New York City.

5000 MILES

COMPRESSION—Check cylinder compression by turning motor with hand crank if compression is not uniform check valve clearance.

DISTRIBUTOR—Wipe distributor head clean, inspect and adjust contact points.

TIMING—Check ignition timing.

FAN—Check fan belt adjustment.

SPARK PLUGS—Clean and adjust.

GENERATOR—Inspect coupling, commutator, and brushes, and clean them if necessary. Add 10-15 drops of oil to each bearing.

GASOLINE STRAINER—Remove and clean screens, etc.

WATER PUMP—Inspect water pump packing for leaks. Tighten packing nut if necessary.

WHEELS—Align front wheels and pack front wheel bearings with a good grade of light cup grease similar to alemite.

STEERING GEAR—Inspect for lost motion, pack gear with Whitmore's "65" lubricant, pack pivot pin bearings and tie rod joints with cup grease.

BRAKES—Adjust if necessary. Fill supply tank to within $\frac{1}{2}$ " of top with genuine Lockheed brake fluid.

CLUTCH—Inspect for 1" to $1\frac{1}{2}$ " free travel of clutch pedal and adjust if necessary.

AXLE-REAR—Inspect grease supply and bring to height of level plug with Whitmore's "0" lubricant.

TRANSMISSION—Inspect grease supply and bring to height of level plug with Whitmore's "0" lubricant.

BATTERY—Remove terminals, clean, grease, and tighten.

BODY BOLTS—Tighten.

AXLE SPRING CLIPS—Tighten.

SHOCK ABSORBERS—Inspect and replenish oil supply if necessary.

CHASSIS LUBRICATOR—Remove signal box pump housing cap (J-1159) Fig. 3 to clean felt and screen. Do not remove plugs in lower part of cap housing as a supply of glycerine is retained in well at this point to protect pressure switch.

Whitmore's lubricant for transmission, rear axle and steering gear may be obtained at our service station or Whitmore Manufacturing Co., Cleveland, Ohio.

ENGINE

(34) LUBRICATION SYSTEM

Efficient and adequate lubrication is supplied with positive pressure to all bearings and wearing surfaces of the motor. The diagram explaining the oil circulation system will be given by illustration No. 2. You will note the location of the oil pump at the lowest point in the oil sump where the oil is picked up after being filtered and screened and then discharged to the main pressure line feeding the entire system. From the main pressure line oil is first distributed to the main bearings, connecting rod bearings and piston pins, which in turn lubricate cylinder walls and piston rings. From this point in the main line a supply is also sent directly to all camshaft bearings, accessory drive shafts and idler sprockets for timing chain mechanism. The excess of oil supplied to camshaft bearings is maintained at the specific level in the camshaft housings to provide a bath of oil for all parts of the valve mechanism. Overflow or drain holes in the camshaft housing allow surplus oil to drain back into crank case and is thus kept in circulation. The oil filter located on the right side of the cylinder block is constantly filtering and removing all foreign matter in the oil supply taken from the pressure line after pressure is supplied to all units.

(35) OIL PUMP

The oil pump is of the conventional gear type, having a capacity much greater than is actually necessary to supply an abundance of pressure at all times. The pump is driven by a vertical shaft through the side gears mounted on generator drive shaft. It is mounted to the first cross web of the cylinder block and crank case by two cap screws and is coupled to its vertical drive shaft by means of a square sleeve coupling. The main pressure line from pump to cylinder block may be disassembled after loosening tube packing lock nut. In order to remove oil pump it is first necessary to remove the oil pan and sump and then detach from its mounting.

(36) OIL PRESSURE

The oil pressure adjustment is located on the lower left hand side of the cylinder block just in front of the oil float gauge indicator. By changing this adjustment screw and turning in a clockwise direction the pressure will be increased as indicated on the gauge on the instrument board. Turning in an anti-clockwise direction reduces the pressure accordingly. This adjusting screw is connected by a flexible cable to the relief valve sleeve in the oil pump; consequently when the adjusting screw in the block is changed you are merely increasing or decreasing spring tension on relief valve at the oil pump. The surplus oil by-passed by the relief valve is discharged directly back in the oil supply.

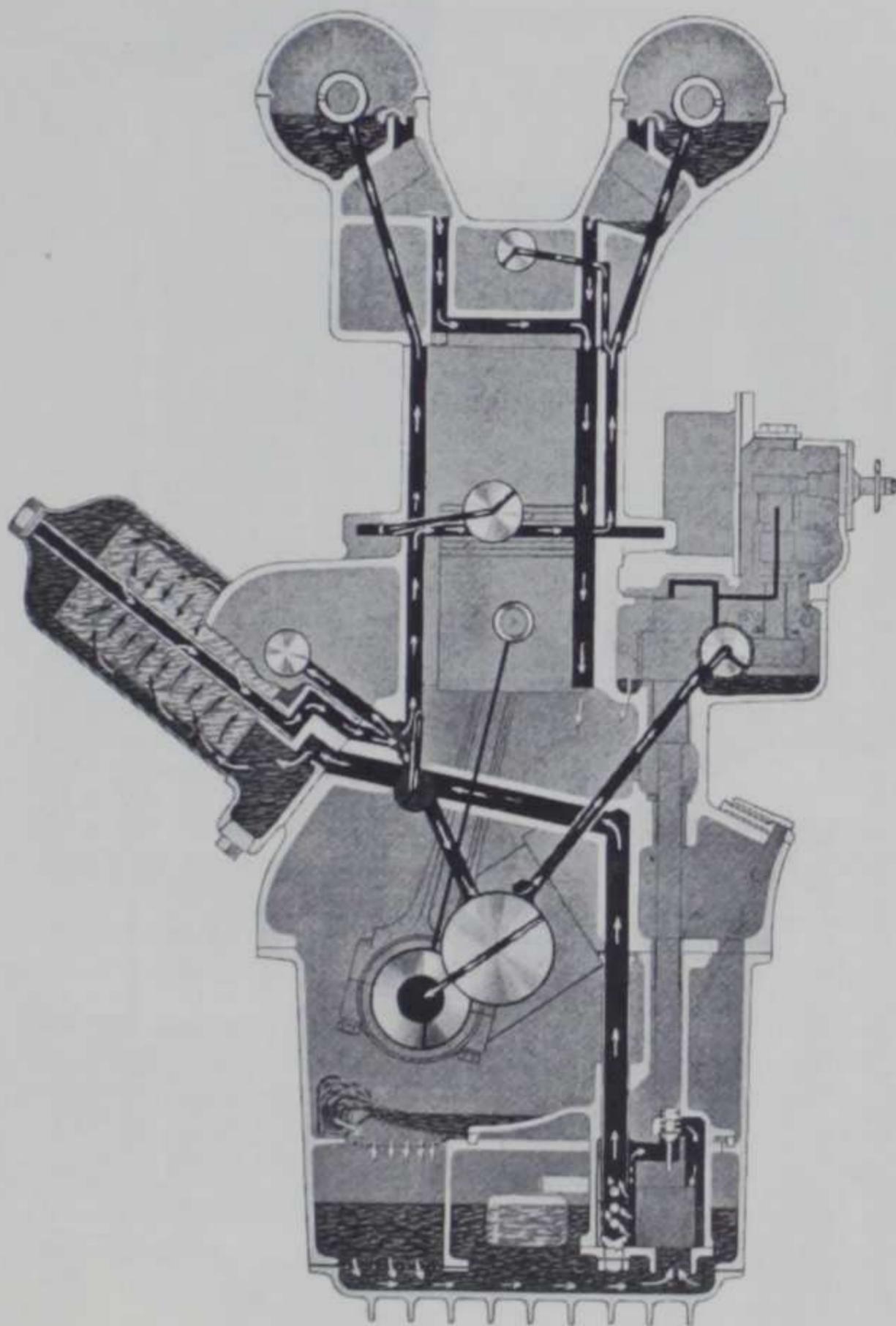
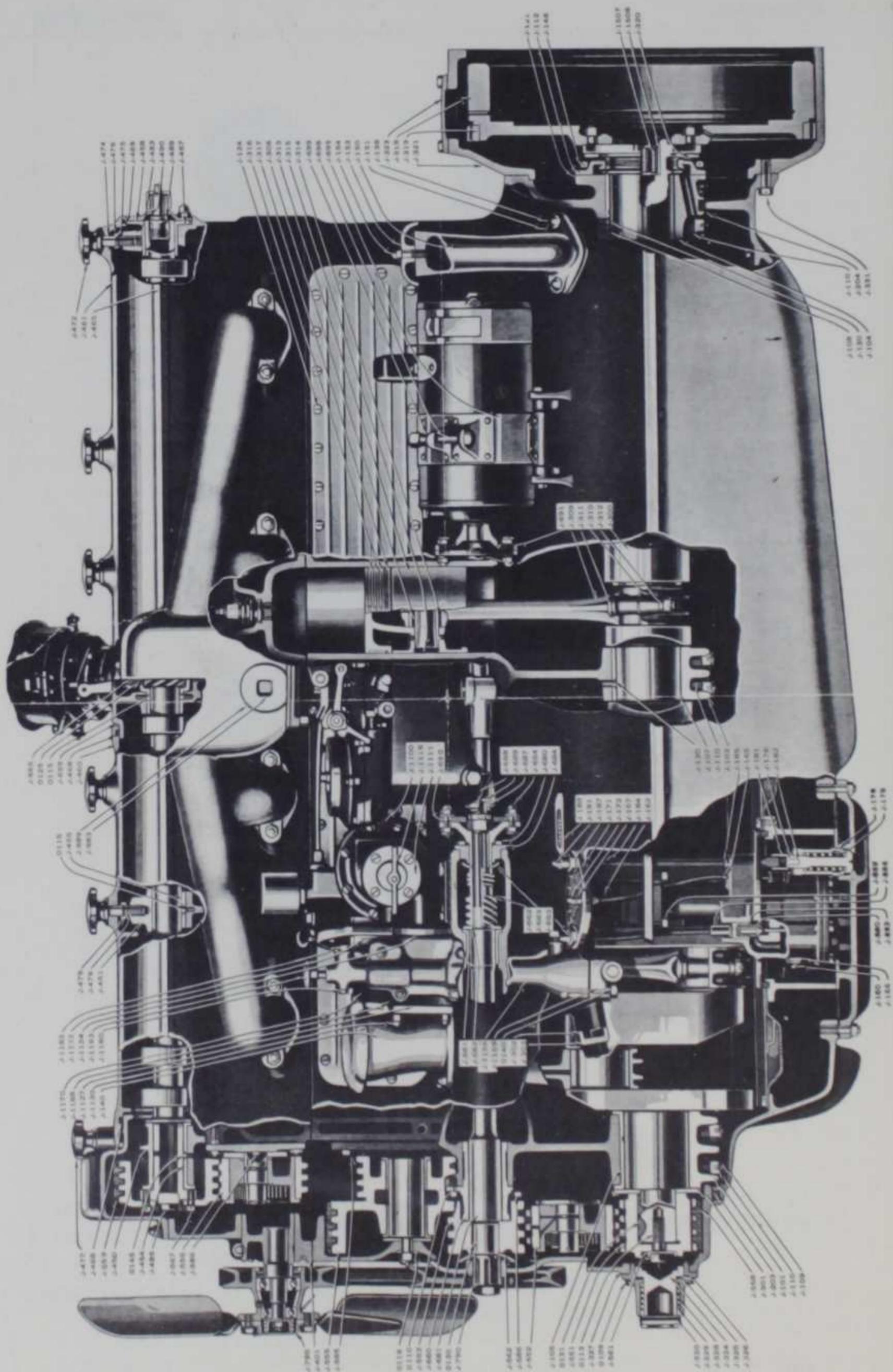


Fig. 2. Lubricating System of Motor

The correct oil pressure to be maintained at all times is approximately 2 to 10 pounds for low idling speeds and approximately one pound for every mile per hour with a maximum of 80 to 100 pounds for high speed operation. It is very essential that this correct pressure is maintained at all times.

(37) OIL SUPPLY AND FLOAT GAUGE

The capacity of the crankcase is 12 quarts and this supply is indicated by a float indicator gauge located at the lower front left hand side of the cylinder block.



Patented in U. S. A.

SIDE VIEW OF MOTOR

Fig. 3. Cross Sectional View Left Side of Motor

Fig. 3. PARTS DESCRIPTION

J- 101	Front main bearing cap	J- 467	Cam cover rear cap gasket
J- 103	Center main bearing cap	J- 468	Cam cover front and center packing
J- 104	Rear main bearing cap	J- 469	Cam cover rear packing
J- 105	Front main bearing bushing	J- 472	Cam cover large hand nut assembly
J- 107	Center main bearing bushing	J- 474	Cam cover large hand nut stud
J- 108	Rear main bearing bushing	J- 475	Cam cover small hand nut retainer Wire
J- 109	Main Bearing Stud	J- 476	Cam cover small hand nut retainer
J- 110	Main bearing stud nut	J- 477	Cam cover small hand nut assembly
J- 112	Rear main bearing oil retainer	J- 484	Camshaft bearing cap dowel
J- 121	Rear main bearing oil retainer Gasket	J- 485	Crankshaft plug
J- 124	Cylinder water plate screw	J- 489	Tachometer drive plug
J- 130	Main bearing bushing retainer screw	J- 490	Tachometer drive cover
J- 138	Chain case cap short screw	J- 551	Crankshaft sprocket
J- 140	Oil filler body	J- 552	Lower adjusting sprocket assembly
J- 146	Rear main bearing oil retainer screw	J- 553	Accessory shaft Sprocket
J- 150	Breather body	J- 555	Transfer sprocket assembly
J- 151	Breather body Gasket	J- 556	Upper adjusting sprocket assembly
J- 153	Breather body cap	J- 558	Lower chain
J- 154	Breather body cap screw	J- 559	Upper chain
J- 160	Oil gauge float bracket screw	J- 561	Crankshaft sprocket lock washer
J- 162	Oil gauge flexible shaft	J- 562	Gen. shaft sprocket oil slinger
J- 165	Oil gauge flexible shaft lower end	J- 567	Camshaft sprocket cap screw
J- 166	Oil gauge float bracket bushing	J- 585	Transfer sprocket assembly stud
J- 167	Oil gauge indicator	J- 586	Adjusting sprocket assembly stud
J- 171	Oil gauge face plate	J- 654	Gen. coupling disc screw
J- 172	Oil gauge indicator nut	J- 659	Distributor base
J- 176	Oil drain valve	J- 660	Generator drive shaft front bearing
J- 178	Oil drain valve body	J- 661	Generator drive shaft rear bearing bushing
J- 179	Oil drain valve spring	J- 665	Distributor control shaft
J- 181	Oil drain valve stem collar	J- 680	Gen. shaft rear housing cap screw
J- 182	Oil drain valve lift pin	J- 681	Gen. drive shaft
J- 184	Oil drain valve flex shaft upper end	J- 682	Gen. drive shaft thrust washer
J- 185	Oil drain valve flex shaft lower end	J- 683	Gen. drive shaft rear oil slinger
J- 187	Oil drain valve flex shaft packing nut	J- 684	Gen. drive shaft rear housing cap
J- 189	Oil drain valve lever	J- 687	Gen. drive coupling shaft
J- 191	Oil drain valve lever screw	J- 688	Gen. drive coupling shaft end
J- 203	Oil pan front packing	J- 689	Gen. drive coupling shaft pilot
J- 204	Oil pan rear packing	J- 691	Generator coupling
J- 300	Crankshaft	J- 695	Generator strap
J- 301	Crankshaft thrust washer	J- 698	Generator strap stud
J- 302	Crankshaft oil hole plug	J- 699	Generator strap nut
J- 303	Crankshaft oil hole plug gasket	J- 785	Fan assembly
J- 306	Connecting rod bushing	J- 790	Fan drive pulley lock washer
J- 309	Connecting rod	J- 859	Oil pump body to cylinder screw
J- 310	Connecting rod cap	J- 880	Relief valve
J- 311	Connecting rod bolt	J- 882	Relief valve spring
J- 312	Connecting rod bolt nut	J- 883	Relief valve flexible shaft assembly
J- 313	Piston	J- 886	Relief valve flexible shaft lower end
J- 314	Piston pin	J- 983	Intake manifold core hole plug
J- 315	Piston pin lock ring	J- 989	Intake manifold core hole plug gasket
J- 316	Piston compression ring	J-1012	Crankcase ventilator flange
J- 317	Piston oil ring	J-1100	Fuel pump assembly
J- 318	Fly-wheel	J-1232	Gasoline filter bowl
J- 319	Fly-wheel ring gear	J-1111	Fuel pump drive housing cover
J- 320	Fly-wheel bolt	J-1118	Fuel pump shaft handle
J- 321	Fly-wheel housing	J-1124	Fuel pump housing cover screw
J- 323	Fly-wheel cover plate	J-1127	Signal box cover gasket
J- 324	Starting jaw	J-1130	Signal box stud nut
J- 325	Starting jaw cap	J-1156	Signal box pump housing
J- 326	Starting jaw packing	J-1159	Signal box pump housing cap
J- 327	Starting jaw cap gasket	J-1170	Signal box cap
J- 328	Starting jaw spring	J-1180	Signal box pump reg. guide screw
J- 329	Starting jaw spring retainer	J-1188	Signal box cap gasket
J- 330	Starting jaw pin	J-1193	Signal box pump reg. spring assembly
J- 331	Fly-wheel housing cap screw	J-1507	Clutch pilot bearing
J- 401	Cylinder head gasket	J-1508	Clutch pilot bearing retainer
J- 450	Camshaft front bearing cap	0113	Hex. head cap screw
J- 451	Camshaft inter bearing cap	0115	Flat head machine screw
J- 453	Exhaust camshaft center bearing cap	0119	Plain cut washer
J- 454	Camshaft front bearing bushing	0125	Tapper pin
J- 455	Camshaft inter bearing bushing	0130	Woodruff key
J- 458	Camshaft rear bearing bushing	0131	Woodruff key
J- 460	Intake cam front cover	0113	Hex head cap screw
J- 461	Intake cam rear cover		
J- 465	Intake cam rear cover gasket		

(38) CHANGING OIL

This quantity of oil should be maintained in the crankcase at all times and drained, to be replaced, after 750 miles as indicated by operation of the signal light on the instrument board marked "Oil". Never flush motor with kerosene or flushing oil as it is impossible to remove a portion of this fluid which will remain in the different reservoirs. Ten drops of light engine oil should be added to generator shaft bearings at the same time motor oil is changed. The oil filter on the right hand side of the cylinder block contains a mesh covered cartridge, which removes and retains all sludge and foreign material found in the oil. This filter should be disassembled and cleaned thoroughly with gasoline at 10,000 miles and after 20,000 miles it is advisable to replace this cartridge. The filter may be completely disassembled after removing large hex nut on top.

(39) OIL SPECIFICATIONS

It is not possible to use the same grade of engine oil for all seasons of the year except in extremely mild climates.

An "extra heavy" grade of oil should be used for the warm seasons with specifications as follows:

Viscosity at 100° F	1421 Saybolt
Viscosity at 210° F	105 Saybolt
Flash	455° F
Cold Test	16° F

This grade of oil may be obtained in many nationally advertised brands and is classified in most cases as "extra heavy" or S. A. E. specification No. 60. Use only the very best oil obtainable.

For the winter months the next lightest grade should be used which is S. A. E. No. 50 or where the cold weather is extremely severe S. A. E. No. 40 oil may be desirable.

(40) CRANKSHAFT

The crankshaft is one of the vital factors contributing to the smooth and uniform flow of power at all speeds. The shaft, machined on all surfaces, is balanced statically to within one-onehundredth of an ounce and then given a dynamic balance with the same limits for all motor speeds. Further than this, cartridges or tubes partially filled with mercury are attached to the cheek of the shaft; the shifting of the mercury in the tubes thus eliminating even the slightest variation in power impulses.

The shaft of chrome-nickel-manganese steel has eight connecting rod throws and five main journals of ample size with extremely large connecting cheeks giving a positive alignment and rigidity under all loads. The center four connecting rod bearings are in one plan, at right angles "90 degrees" to the two end pairs. Oil supplied at the main bearing journals is transmitted to the connecting rod bearings through holes drilled in the cheeks of the shaft, where an enlarged chamber pockets any sludge that may be present in the oil and thus gives absolutely clean oil to the bearings.

(41) MAIN BEARINGS

Five main bearings with a large diameter of $2\frac{3}{4}$ " lined with "Mogul Genuine" bearing metal support the crankshaft. Main bearings are fitted with .0015" clearance to allow a full cushion of oil for supporting the shaft. End thrust is taken at the front main bearing and held to .0015" limit. No shims are provided for tightening bearings as this operation should not be necessary in the life of the motor. However bearings may be tightened by removing each lower half using very fine emery cloth on a surface plate to remove desired amount of metal from the top faces of cap. Be sure to tighten bearing cap nuts securely.

(42) CONNECTING RODS

The connecting rods made of duralumin using a steel cap, provide a very light and strong unit, adding greatly to the efficiency of the engine. Rod bearings with a large diameter of $2\frac{7}{16}$ " are lined with "Mogul Genuine" bearing metal and fitted with .0015"—.002" clearance. One web of the I-beam section of the rod is gun-drilled to provide oil pressure to piston pin bushings. No shims are provided for tightening bearings as the shims will not allow correct alignment of lower half with upper half of rod. Also it ordinarily is unnecessary to tighten bearings in the life of the motor but may be accomplished in the same manner as explained in the previous paragraph for the main bearing. Be sure cap nuts are anchored securely.

(43) PISTON, PINS, RINGS

The pistons used are made of extremely light aluminum alloy, the design of which allows and maintains uniform expansion of the skirt with the cylinder walls for all motor temperatures. The skirt of the piston is separated from the head on the circumference, thus causing heat to be dissipated from the head of the piston into the pin bosses and connecting rods before the skirt has received only $\frac{1}{3}$ the amount of heat normally transmitted by other conventional designs. Pistons are fitted with .0025"—.003" clearance and maintain this clearance through many thousand miles of operation. Four piston rings are used; three compression $\frac{1}{8}$ " wide, one double duty oil regulating ring $\frac{3}{16}$ " wide. Rings are fitted with .014" to .016" end clearance.

A hollow piston pin $1\frac{1}{16}$ " in diameter floats in the piston pin or connecting rod bushing and is locked in the piston by means of two steel snap rings at each end. The pin is given a just free fit in the bushing and a slight driving fit in the piston.

(44) CYLINDER BLOCK—CRANKCASE

The eight cylinders are cast en bloc with the upper half of the crankcase using a detachable cylinder head. The material of block

is chrome-nickel casting, giving long wearing life to cylinder bores. All cylinder barrels are water-jacketed for the full circumference and the entire length. Aluminum cover plates enclose the water jackets on both sides of the block to provide a protection to casting in case of freezing.

Connecting rod and piston assemblies may be removed from the bottom of the block by rotating crankshaft during the operation

(45) OIL BASE—LOWER HALF OF CRANKCASE

The oil base is an aluminum casting with long deep cooling fins on the underneath side. Two breathers mounted on the left side of the cylinder block provide additional ventilation for cooling the oil supply in the crankcase. A baffle pan and fine mesh screen at a height of $2\frac{1}{2}$ " covers the entire inside area of the oil base giving a large surface for removing foreign material in oil supply before entering the pump. It is not necessary to remove screen for cleaning when changing oil, but should be done if oil base is removed at any time. To remove crankcase it is necessary to remove, screws anchoring mud pans on top flange, $3\frac{1}{8}$ " cap screws underneath anchoring top flange to cylinder block, $5\frac{3}{8}$ " cap screws underneath bolting rear flange to flywheel housing.

A large circular plate is located in the bottom which may be removed for inspection of the oil pump, oil drain valve and oil float gauge.

(46) FLYWHEEL

The flywheel is a steel forging $14\frac{15}{16}$ " in diameter completely machined on all surfaces. A hardened steel ring gear with 119 teeth is shrunk on the flywheel to engage with the starting motor. Twelve $\frac{7}{16}$ " bolts and nuts unevenly spaced anchor flywheel to crankshaft flange so that it is impossible to assemble the flywheel to the shaft in the wrong position. Markings on the flywheel indicate top centers for both No. 1 and No. 8 in this manner: 1 and 8, TOP. Marks appear before and after center to give reference for ignition and valve timing which is given in inches and degrees before or after center.

(47) CYLINDER HEAD

The cylinder head is a chrome nickel casting carrying the valve mechanism and overhead camshafts directly above the valves. The head is removable and may be detached from the cylinder block by removing upper chain cover, chain driving camshafts, cylinder head stud nuts accessories etc., as explained under "Carbon and Valves". Water passages encircle valves and spark plug chambers on all sides, giving positive and abundant cooling for all parts even for the most severe conditions. Two intake and two exhaust valves are used to give increased power by permitting a full charge

of fresh gas to enter the combustion chamber and then expelling it through the large area thus eliminating the necessity of excessive heat being passed over single valves, as takes place in conventional cylinder combustion design.

(48) VALVE MECHANISM

The valves are mounted at 35 degree angles to vertical center line of cylinder head with camshaft mounted directly above and operating valves through sleeve tappet between shaft and valve. Excess oil supplied to camshaft bearings under pressure is trapped in the camshaft housing and maintained at a level above tappets to provide an oil bath for valve tappets, guides and contact of tappet against cam. An oil vapor thus passes through tappet assembly to lubricate valve stem and guide beneath. Consequently a very quiet and trouble-free valve operation is maintained at all times.

(49) VALVES

Intake valves are made of chrome-nickel steel, with $1\frac{1}{2}$ " diameter head, $11/32$ " diameter stem and 30 degree seat.

Exhaust valves are made of silichrome steel with $1-7/16$ " diameter head, $11/32$ " diameter stem and 30 degree seat.

(50) VALVE TAPPETS AND TAPPET GUIDES

Valve tappet guides are a just free fit into cylinder head and anchored in pairs by means of two clamps each. A clearance fit of .0015 inches between tappet and guide is maintained at all times using a special steel for both units.

(51) VALVE ADJUSTMENT

Adjustment of valves is provided by adjusting nut (J-420, Fig. 3 and adjusting sleeve J-421, Fig. 3). This adjusting nut assembly makes contact between end of valve stem and underneath surface of tappet. Shims of the desired thickness are assembled between adjusting nut and sleeve to give the required clearance of .022" between the tappet and camshaft. An ordinary thickness or feeler gauge may be used for checking clearance between tappet and heel of cam, while 1-inch micrometers will be needed for checking thickness of adjusting nut to give correct clearance by addition or removal of shims in nut. In order to perform the operation of adjusting valves, it is first necessary to remove camshaft covers, upper chain cover, upper chain, distributor, camshafts, tappets, etc., to give access to adjusting nuts directly on top of valves. Be sure to check tappet clearance with feeler gauge for each valve before removing camshaft and make pencil notes of all settings in order to be able to change adjusting nut thickness to the desired dimension and thus obtain correct clearance.

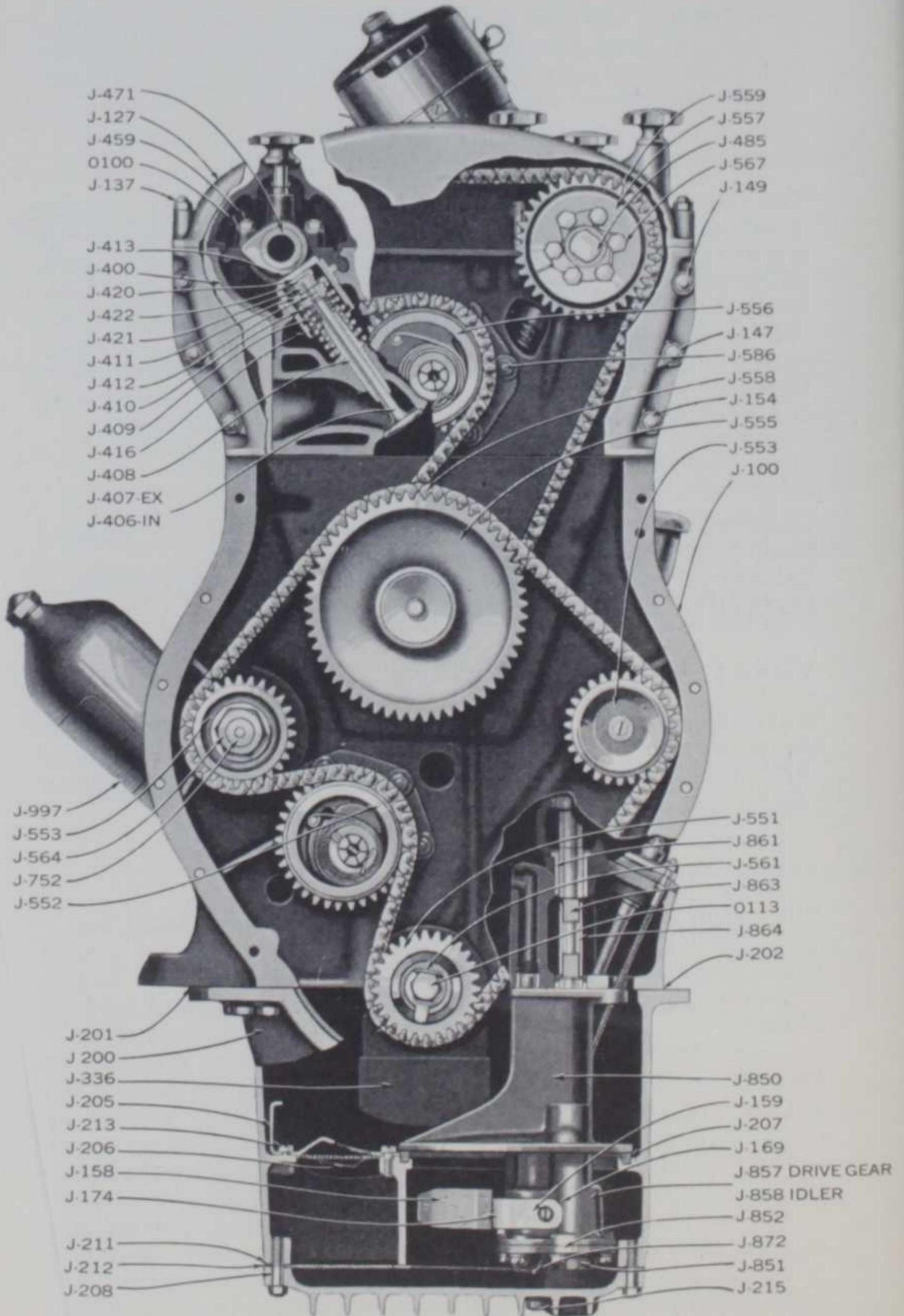


Fig. 4. Cross Sectional View Front of Motor

Fig. 4. PARTS DESCRIPTION

J- 100	Cylinder block	J- 420	Valve tappet adjusting nut
J- 127	Chain case cap	J- 421	Valve tappet adjusting sleeve
J- 137	Chain case cap long screw	J- 422	Valve tappet adjusting shim
J- 147	Chain case upper cover dowel screw	J- 459	Camshaft bearing stud
J- 149	Chain case upper cover long screw	J- 471	Exhaust camshaft
J- 154	Breather body cap screw	J- 483	Camshaft plug
J- 158	Oil gauge float	J- 551	Crankshaft sprocket
J- 159	Oil gauge float bracket	J- 552	Lower adjusting sprocket assembly
J- 169	Oil gauge bevel gear	J- 553	Accessory shaft sprocket
J- 174	Oil gauge float assembly	J- 555	Transfer sprocket assembly
J- 200	Oil pan	J- 556	Upper adjusting sprocket assembly
J- 201	Oil pan R. H. gasket	J- 557	Camshaft sprocket
J- 202	Oil pan L. H. gasket	J- 558	Lower chain
J- 205	Oil pan baffle plate	J- 559	Upper chain
J- 206	Oil pan screen	J- 561	Crankshaft sprocket lock washer
J- 207	Oil pan to oil pump packing	J- 564	Water pump shaft sprocket lock nut
J- 208	Oil pan strainer body	J- 567	Camshaft sprocket cap screw
J- 211	Oil pan strainer body gasket	J- 586	Adjusting sprocket assembly stud
J- 212	Oil pan strainer screen assembly	J- 752	Water pump drive shaft
J- 213	Oil pan baffle plate screw	J- 850	Oil pump body
J- 215	Oil pan strainer body long stud	J- 851	Oil pump cover
J- 336	Crankshaft small counterweight	J- 852	Oil pump cover gasket
J- 400	Cylinder head	J- 857	Oil pump gear
J- 406	Intake valve	J- 858	Oil pump idler gear
J- 407	Exhaust valve	J- 861	Oil pump drive shaft lower bushing
J- 408	Valve guide	J- 863	Oil pump drive shaft
J- 409	Inner Valve spring	J- 864	Oil pump drive shaft coupling
J- 410	Outer valve spring	J- 865	Oil pump shaft
J- 411	Valve spring retainer	J- 867	Oil pump shaft lower bushing
J- 412	Valve spring retainer wedge	J- 872	Oil pump pressure tube nut
J- 413	Valve tappet	J- 873	Oil pump pressure tube lower gasket
J- 416	Valve tappet guide	J- 874	Oil pump pressure tube lower washer
J- 418	Valve tappet guide clamp stud	J- 997	Oil filter assembly
		0100	Plain hex nut 5/16" - 24
		0113	Hex head cap screw 1/2" - 20 - 1 1/4"

(52) VALVE GUIDES

The valve guides are special steel with press fit in cylinder head and a ream clearance fit of .001" for valve stem.

(53) VALVE SPRINGS AND RETAINERS

The valve springs are made of the best grade electric furnace steel available; two springs being used for each valve and assembled in the conventional manner using aeroplane type retaining washer locks to anchor retaining washer to valve stem. The retaining washer lock is in two halves with outside tapered diameter resting in retainer washer and clamping valve stem at the three ring groove.

(54) CAMSHAFT AND BEARINGS

The camshafts are made of special steel and supported by five bearings each 1 1/4" in diameter. The bearings are lined with "Mogul Genuine" bearing metal and given a clearance fit of .0015" for camshaft journals. End thrust is taken at front bearing maintained at .002" to .003". Valve lift for intake shaft is .350" and .360" for exhaust.

(55) TIMING CHAIN

Two endless silent timing chains with automatic adjustment are used to drive camshafts and accessory shafts. The lower chain part number J-558, Fig. 3, 2 inches wide and approximately 47

inches in length with $\frac{3}{8}$ " pitch drives the generator shaft, water pump shaft, and transfer sprocket for upper chain. The automatic idler sprocket part number J-552, Fig. 3, retains the correct amount of tension on the chain at all times by means of its spring loaded hub and automatically adjusts the chain for wear. The chain may be removed after first removing chain cover and then disassembling automatic idler as explained under "Valve Timing" for the upper chain. The lower chain may be assembled in mesh for any position on all sprockets.

The upper chain, J-559, Fig. 3, $1\frac{11}{16}$ inches wide and approximately 52 inches in length with a $\frac{3}{8}$ " pitch drives the two camshafts from driven transfer sprocket of lower chain. An automatic idler J-556, Fig. 3, maintains the correct tension which automatically compensates for wear. Oil pressure supplied to idler sprockets provide an oil bath for the complete chain mechanism. To remove upper chain first disassemble adjusting idler sprocket. Remove cotter pin and plain washer then with screw driver or thin tool pry forward the sprocket bushing and spring assembly J-574 until spring is almost ready to slip out of the notch in mounting shaft. With special tool part No. J-7016, release tension of spring from notch and pull forward, then allowing the spring to unwind. The idler sprocket may then be removed and the chain lifted off camshaft sprockets. The lower chain may be removed in the same manner after removing covers, etc. In assembling upper chain to sprockets as when setting the valve timing be sure to keep chain taut in the pull direction at all times. Assemble idler sprocket and bushing using special tool to center spring and bushing assembly setting spring with twelve notches or two complete turns. Turn motor with starter to allow chain to assume normal position and reset the tension on spring to 9 notches or $1\frac{1}{2}$ turns.

(56) VALVE TIMING

The valve timing may be checked or reset as outlined in Fig. 5. In order to check timing first remove inspection plate on top of flywheel, exhaust cam cover and front intake cam cover. Rotate crankshaft with pry-bar through inspection plate hole against teeth of flywheel ring gear until crankshaft is on top center for Number 1 and 8 cylinders determined by markings on flywheel as follows No. 1 and 8 Top. Remove distributor head and with spark control advanced note if the main rotor arm is in correct position to fire No. 8 cylinder as explained in Fig. 5. If its position is incorrect rotate crankshaft one complete revolution to bring distributor in firing position for number 8 cylinder when No. 1 intake and exhaust cams are downward as illustrated.

With pry-bar through inspection hole in flywheel housing rotate crankshaft backwards approximately 6 inches on the flywheel and rotate forward until intake valve No. 1 is starting to open. The No. 1 and 8 center line on the flywheel should be just $\frac{3}{8}$ " ahead of center line on flywheel housing.

A straddle clamp should be used to clamp and twist tappet J-413 as the crankshaft is rotated to determine the exact time when the camshaft contacts to open valve. Turn flywheel ahead and with clamp on exhaust valve tappet J-413 the valve should close, or the tappet release, when No. 1 and 8 center line is $1\frac{1}{4}$ " past center line of flywheel housing. The valve clearance should be .023" to .025" to give this timing.

To change or set timing it is necessary to remove upper timing chain cover, radiator, fan, and disassemble chain mechanism as explained under "Timing Chain".

In reassembling chain and sprockets to give the correct timing it will be necessary to remove the six $\frac{5}{16}$ " capscrews and shift timing chain sprockets on each camshaft in order to obtain the correct timing with respect to crankshaft. A block of wood should be wedged between chain on transfer sprocket and case to prevent chain dropping down at this lowest point. The flywheel should be set within $\frac{1}{4}$ " of the respective points for setting camshaft to allow for the slack in the chain. The chain should be kept taut at all times in assembling.

When valve timing is changed it is obvious that the ignition timing should be checked and set as explained under "Ignition Timing".

(57) VALVE GRINDING

Procedure for grinding valves.

1. Remove hood.
2. Remove radiator. (Remove brace rods, radiator hose connections, hold down nuts, and lift radiator directly upwards).
3. Remove fan. (Remove eccentric locking bolt in cover and pull fan forward from its mounting.)
4. Remove camshaft covers upper chain cover, distributor and control, spark plugs and wires, tachometer cable at rear of intake camshaft, heat indicator line and bulb in water manifold, water manifold, exhaust manifold, intake manifold, carburetor, exhaust heat connection across cylinder block, etc.
5. Disassemble upper chain as explained under "Timing Chain".
6. Remove cylinder head stud "acorn" nuts.
7. Assemble special eye bolts and hooks to spark plug holes to provide anchors for hoist in lifting cylinder head.
8. After head is removed and placed on bench, camshaft, valve tappets, springs and valves may be removed. A special tool part No. J-7017 should be used in depressing valve springs for removing valves.
9. An improvised rack should be made for carrying tappets, adjusting nuts, and valves and so marked in order to reassemble these parts in their original location. Failure to

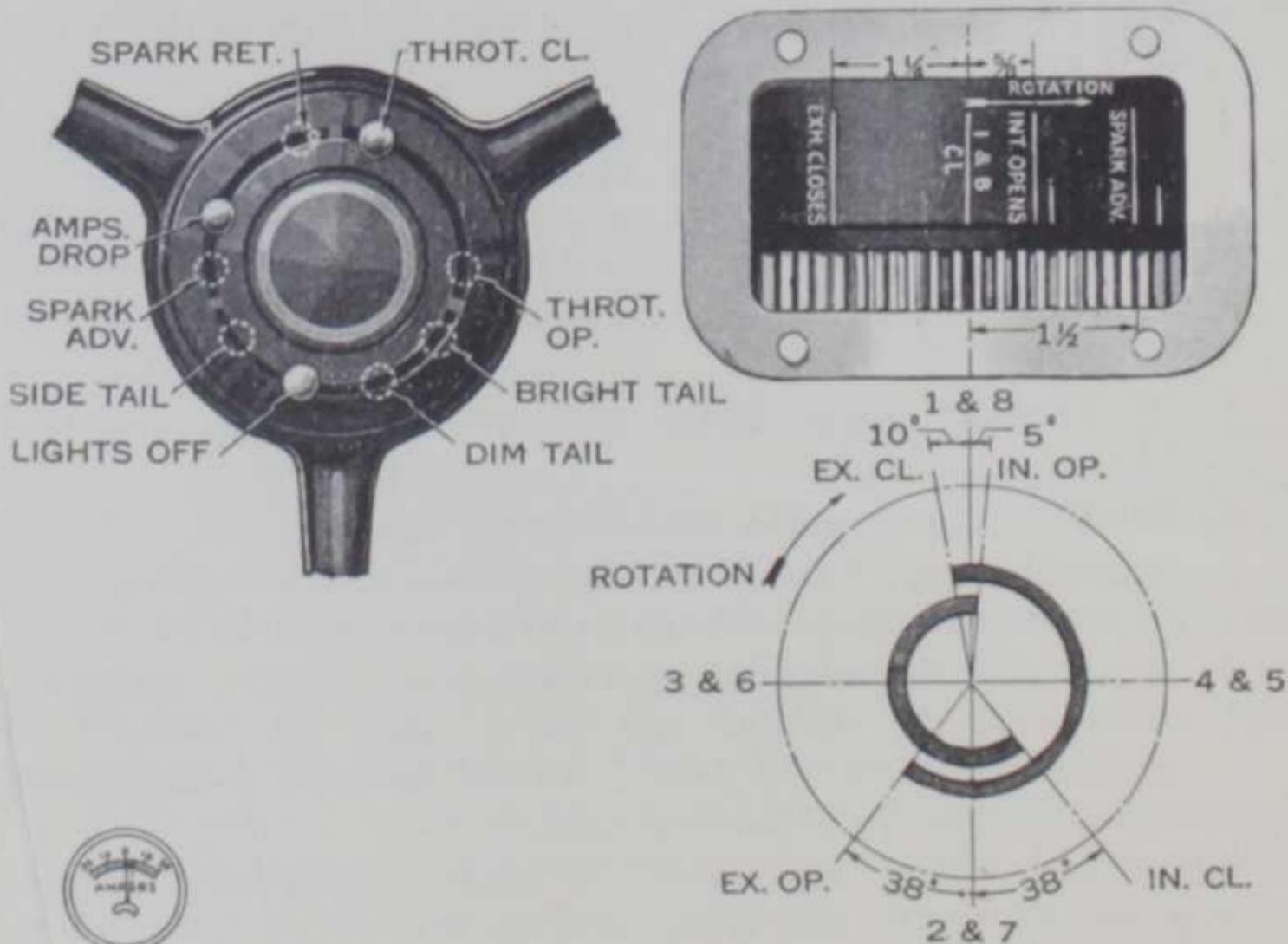
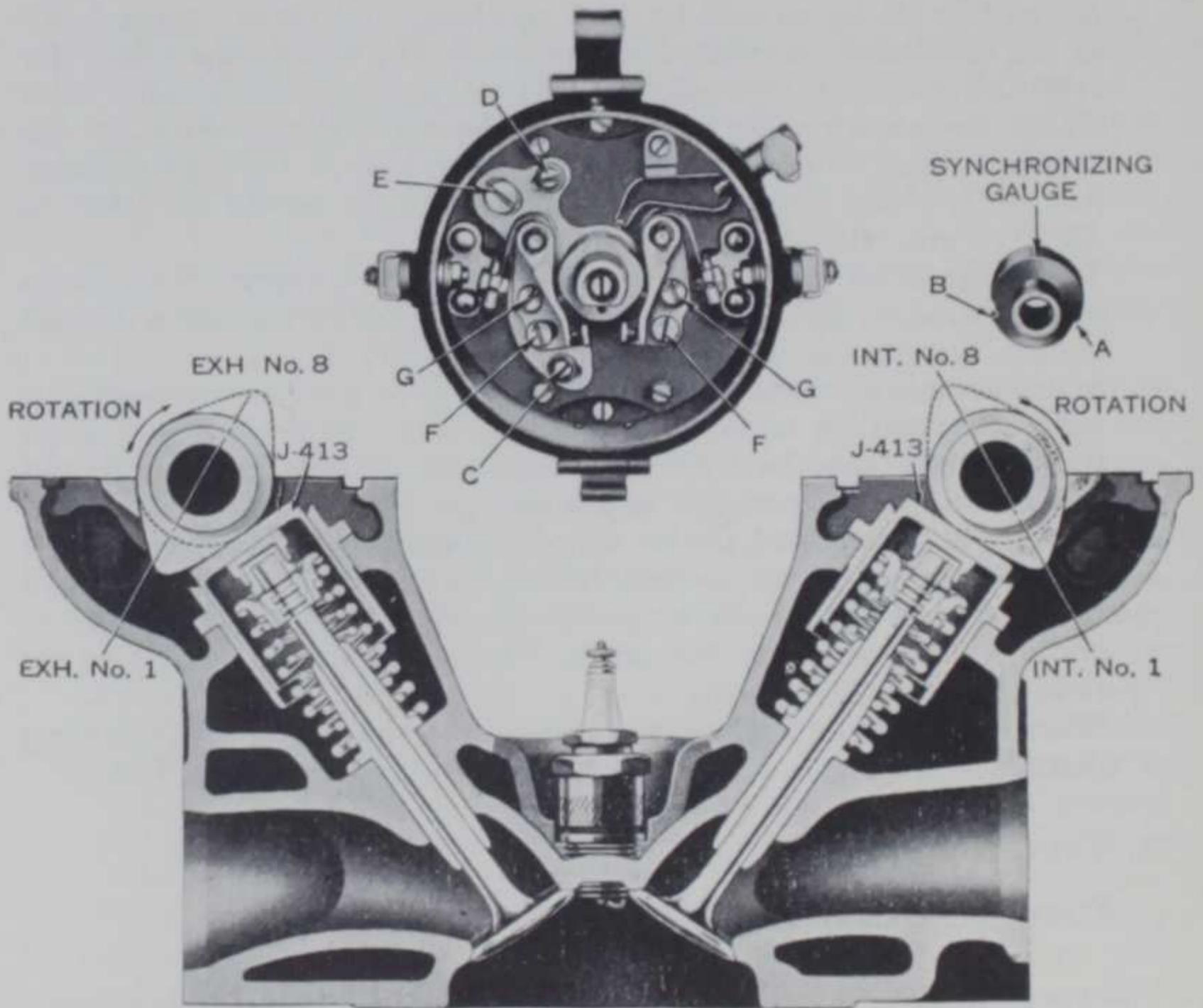


Fig. 5. Valve and Ignition Timing Diagram

do this will cause a great amount of additional work in setting valve clearances.

10. In grinding valves, seats should not be given a greater width than $3/32''$. In case it is necessary to grind seats, to a greater width in order to obtain a full bearing for the complete circumference a valve seat sweeping tool should be used to narrow the seats.
11. Reassemble valves, springs, keepers, tappet valves, adjusting nuts and camshafts. Be sure tappet guide clamps and all camshaft bearing caps are tight. Rotate camshafts and with feeler gauge blades obtain actual clearance between cams and tappets. Remove camshafts, tappets and tappet adjusting nuts and with shims of varying thickness change length of adjusting nut to the required dimension to give $.023''$ to $.025''$ clearance. One inch micrometers must necessarily be used to check length of adjusting nut before and after removing shims.
12. Assemble cylinder head and units to motor being sure to set valve and ignition timing as illustrated in Fig. 5 and described under their respective headings.

(58) CARBON DEPOSIT

Ordinarily it is not necessary to clean out carbon and grind valves under 15,000 to 25,000 miles, provided a clean burning high compression gas is used at all times. Oil changes must be made as recommended to eliminate crankcase dilution and carbon deposits.

Carbon can only be removed by scraping after cylinder head is removed as described under "Grinding Valves".

FUEL SYSTEM

Gasoline is supplied to the carburetor from the 26 gallon tank at the rear by means of a mechanically operated bellows pump in conjunction with an electric booster pump. A gasoline chamois strainer bowl is placed just ahead of the pump to trap dirt and sediment which has accumulated in the gas tank. A positive supply of clean gas is thus maintained at the carburetor under all operating conditions.

(59) CARBURETOR

The special Schebler carburetor is a duplex air metering type supplying the two separate manifold chambers from one fuel chamber and bowl. The carburetor has two $1\frac{1}{4}''$ throat openings with adjustments for each one similar to two carburetors and thus metering the gas mixture separately to Nos. 3, 4, 5, 6 and 1, 2, 7, 8 cylinders as is readily determined by observing the intake manifold.

CONTROL HOOK-UP

The control tubing is fastened securely in the clamp and screw

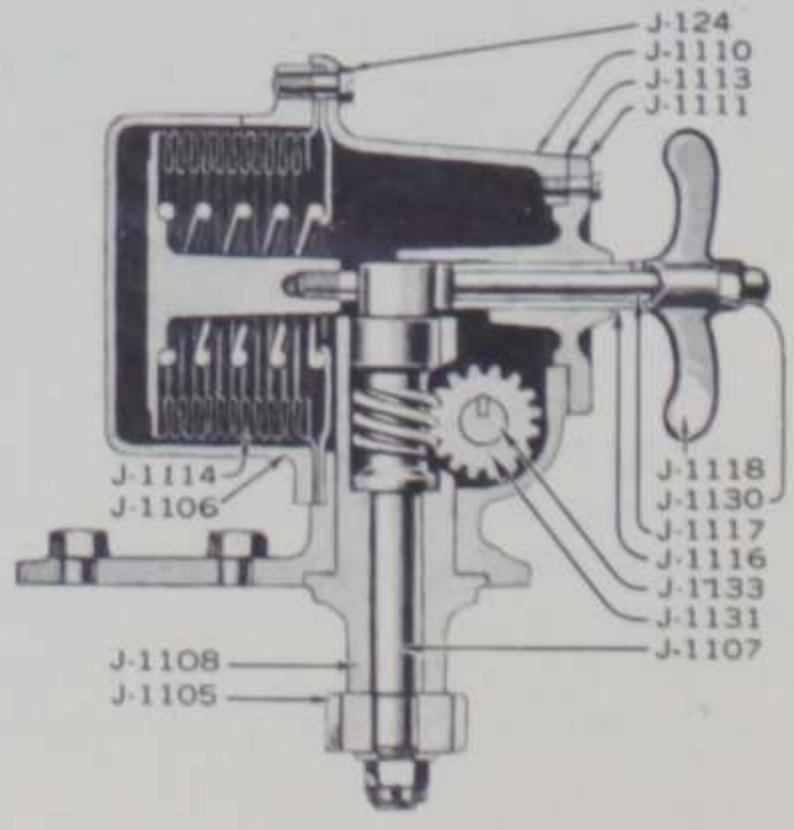
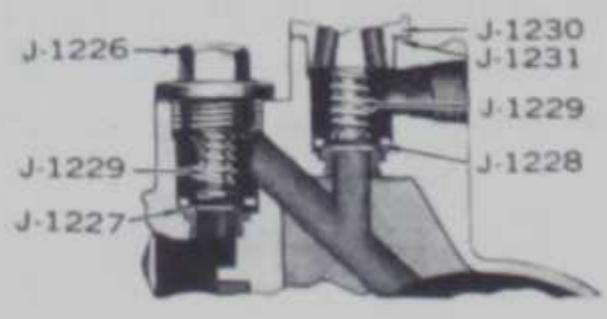
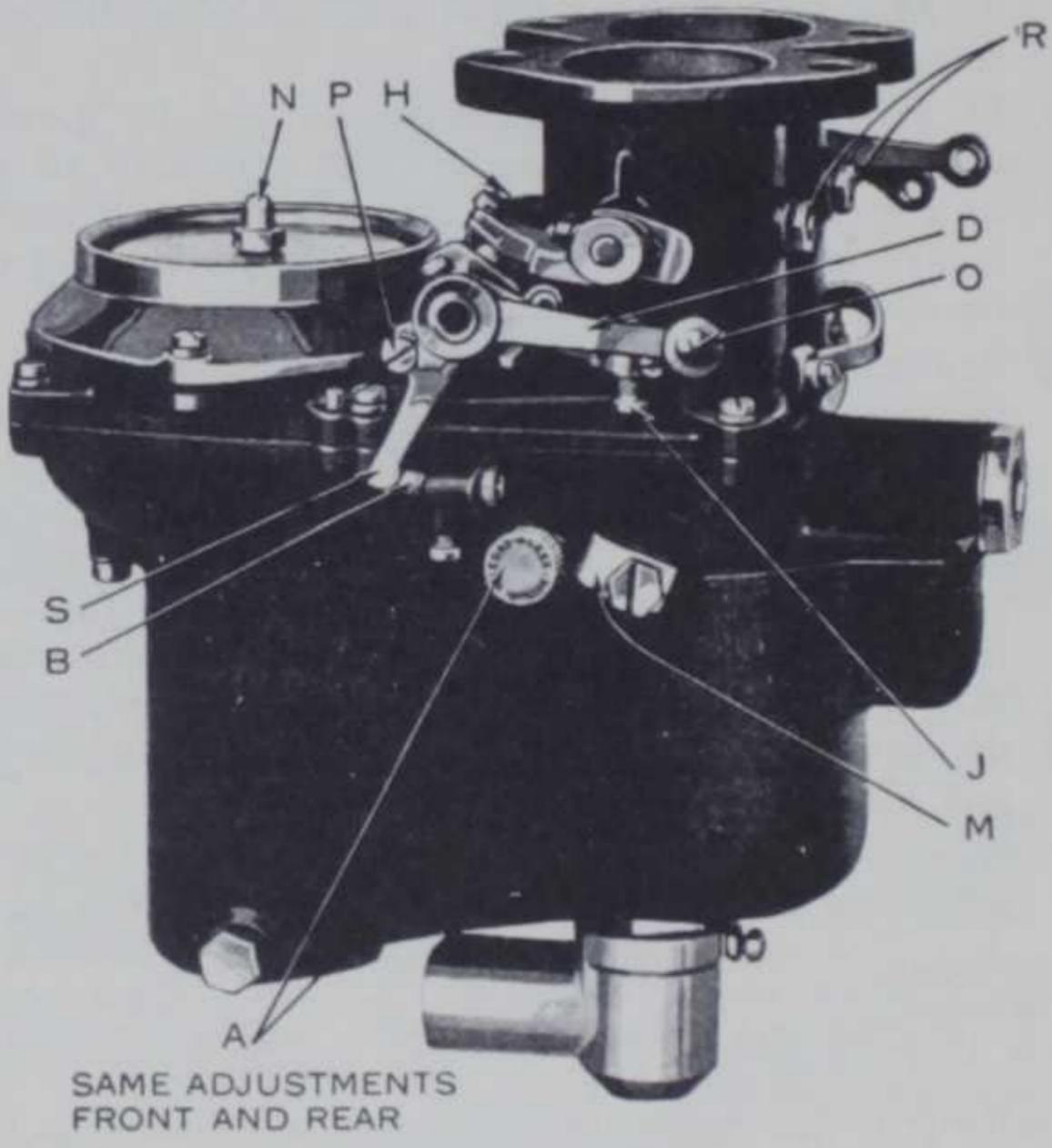


Fig. 6. Carburetor and Cross Sectional View of Fuel Pump

Fig. 6. PARTS DESCRIPTION

J- 124	Fuel pump drive housing screw	J-1117	Fuel pump shaft rod
J-1105	Fuel pump driven gear	J-1118	Fuel pump shaft handle
J-1106	Fuel pump bellows housing	J-1130	Fuel pump shaft bottom nut
J-1107	Fuel pump drive shaft	J-1131	Signal box driven gear
J-1108	Fuel pump drive shaft bearing	J-1133	Signal box drive shaft
J-1110	Fuel pump drive housing	J-1226	Fuel pump intake plug
J-1111	Fuel pump drive housing cover	J-1227	Fuel pump intake valve
J-1113	Fuel pump drive housing cover gasket	J-1228	Fuel pump outlet valve
J-1114	Fuel pump bellows assembly	J-1229	Fuel pump valve spring
J-1116	Fuel pump operating shaft	J-1230	Fuel pump pressure dome
		J-1231	Fuel pump valve plug gasket

assembly "M" with tubing projecting about 1/16" beyond the clamp and the control wire in binding post "O" so there is about 1/16" play between the loose lever "D" and screw "P." When the throttle is closed after tightening binding post "O" straighten out the control wire so that the loose lever "D" does not bind the dash control lever "S" and cause it to stick open when moved. Use this control only in starting and warming up motor as explained in Part I of this book under "Instruments and Controls". If trouble is had in starting a warm motor open the throttle half way.

IDLING ADJUSTMENT—There are two idle adjustments as marked "A" one on the front side and one at the rear. The motor should be thoroughly warmed up before making the idle adjustments. Both spark and throttle should be fully retarded.

Before making idle adjustments "A" in front disconnect spark plug wires to Nos. 3, 4, 5, and 6 cylinders and allow the engine to run as a four cylinder motor.

Turning "A" in front, to the right (clockwise) makes the mixture leaner for cylinders 1, 2, 7, and 8; to the left makes the mixture richer.

Disconnect spark plug wires to 1, 2, 7 and 8 cylinders before changing idle adjustment "A" in rear.

Turning "A" in rear as if it were connecting to the same shaft as "A" in front, leans or richens the mixture for cylinders No. 3, 4, 5 and 6. The motor should idle down to approximately 200 r p m on the tachometer when running as a four cylinder motor or approximately 350 r p m when running as an eight cylinder motor.

To change the idle speed, adjust the idle screw "H". After making above adjustments and engine is running as an eight cylinder motor it may be necessary to change both adjustments the same number of clicks to make the total mixture lean or rich.

RANGE ADJUSTMENT—This adjustment is only effective in the driving range at speeds from 20 to 70 miles per hour and does not effect acceleration or hill climbing with wide open throttle. The adjustment is made by turning the range adjusting screw "B" to the left for a lean mixture and to the right for a rich mixture. This adjustment as shipped from the factory is usually found to be best.

To obtain the original factory setting, screw the range adjusting screw "B" in or out so the head is flush with the edge bushing enclosing it. Whenever the range adjustment is changed it is necessary to readjust the idle mixture.

SECOND METHOD OF ADJUSTMENT—In case the carburetor cannot be adjusted in the above manner to give the desired results the following procedure may be used.

Set range screw "B" to original factory setting as explained in the previous paragraph.

With spark and throttle fully retarded idle the motor on each set of four cylinders and lean the respective idle adjustment on each set until motor stops, then back up or enrichen 8-14 notches until motor runs smoothly. This adjustment must be made separately for each set of four cylinders. Any variation in r p m for the two sets may be altered by turning screw "R" in to speed up, or out to slow down its group of cylinders. The total idling speed of the motor operating on eight cylinders may be set by turning screw "H".

WIDE OPEN THROTTLE ADJUSTMENT—The extreme high speed adjustment may necessarily need to be changed in some localities but this should only be done by an authorized Schebler service station. This adjustment is made at the contact cam screw "J" operating against throttle cam.

(60) CARBURETOR HEAT CONTROL

Exhaust heat is passed from the exhaust manifold across the cylinder block to the chamber around the intake manifold and then discharged through auxiliary pipe and muffler mounted along the left side of the frame. The amount of heat by-passed is regulated by means of a thermostatically controlled valve at the exhaust manifold. This valve automatically opens when motor temperatures are low and closes as the motor maintains the correct running temperature. The temperature at the top of the intake manifold is maintained at 125°F and 150°F to give uniform carburetion. Should the manifold receive too much heat the connecting link between the thermostat and valve at the exhaust manifold should be lengthened. A butterfly valve operated by the throttle rod further controls this heat as it leaves the intake manifold into the pipe and auxiliary muffler. This valve operates to compensate for variation of pressure in the exhaust system by closing when the pressure in the exhaust manifold is greatest and opening when pressure is low.

(61) FUEL PUMP

A spring loaded diaphragm or bellows, operated by means of a cam, driven from a side gear on the generator shaft constitutes the fuel pump. As the cam compresses the bellows, the inlet check valve under the large hexagon nut just at the rear of the gas filter opens and allows gas to pass into pump. Immediately as the cam action releases and allows the bellows to expand with the spring tension, the outlet valve opens under the dome expansion chamber and gas passes to the carburetor. The dome expansion chamber filled with air equalizes the pressure of the pump for the carburetor.

Should the pump fail to deliver gas to the carburetor, remove and clean, check valves under the hexagon nut at the rear of the filter and under dome expansion chamber.

The entire mechanism runs in a bath of oil eliminating any necessity for attention and adjustment. A handle at the side of the pump is attached to the diaphragm shaft and when operated by hand for a few strokes will prime the entire system. The strainer bowl should be removed and cleaned or slushed every 5,000 miles.

(62) ELECTRIC BOOSTER PUMP

An electric booster fuel pump is mounted in the left frame side member underneath the front seat. This pump further insures a uniform pressure in the gasoline line at all speeds and requires no attention. The ignition switch controls the operation of this unit.

(63) GASOLINE GAUGE

The gasoline gauge on the instrument board indicates at all times the amount of fuel in the rear tank. It is operated by the weight of gasoline pressing on a column of air which in turn causes the red liquid in the gauge head to rise or fall. Should the car be left standing for a week or longer the gauge may show less than the tank contains but driving the car for several blocks will cause the reading to be corrected.

If any difficulty is encountered with the gauge proceed as follows. Disconnect the air line at the gauge head. The liquid must come to rest exactly at zero. If necessary adjust the height of the column or add to or remove a few driops of liquid at the top of the brass tube. To remove liquid absord some on a toothpick or match.

Caution. Use only the special telegage liquid obtainable from the factory or the King-Seeley Corporation, Ann Arbor, Mich. Remove gas tank filler cap and blow air line dry with 50 full vigorous strokes of a hand tire pump. Do not use compressed air. Connect air line at gauge head and see that line is air tight at tank unit. The gauge will read zero until the car is driven a few blocks, whereupon the correct reading will be maintained.

IGNITION SYSTEM

The ignition system may be classified as two distinct units with one set of breaker points and coil firing the center four cylinders (3, 4, 5, 6) and the other set of points and coil firing the two end pairs (1, 2, 7, 8). This type ignition permits low speed breaker point contacting thus giving positive firing of spark plugs under all speeds. The spark plugs are located directly over each piston and at the center of gas turbulence in the combustion chamber.

(64) DISTRIBUTOR

The distributor is mounted in casting above center of intake camshaft and locked in position by retaining plate and four "acorn" headed studs. By removing studs and plate with spark control lever the distributor may be removed. The head and rotor are of the single jump spark type using side outlet cap. A four lobe cam and double breaker arms in parallel circuit with the coils fire the cylinders in the following order. 1-6-2-5-8-3-7-4.

(65) SPARK ADVANCE

The distributor is a semi-automatic advance with the rotation in a clockwise direction viewing from the top. A manual advance of 20 degrees is obtained by shifting the distributor in its mounting. An automatic advance of 40 degrees is obtained through spring controlled governor weights of the marine type located beneath the breaker plate in the distributor cup and require no attention. As the speed of the motor and distributor shaft increases, when accelerating, the weights are gradually thrown outward and advance the cam in the direction of rotation.

(66) CONTACT POINTS

The contact points should be inspected every 5,000 to 10,000 miles and set at .018"—.024" clearance when fully opened by cam. To adjust points for this dimension loosen screws "F" and turn screws "G". Fig. 5. Points should present a "frosted" appearance and if black should be cleaned with fine emery cloth on a flat tool surface. Do not attempt to synchronize points by setting with different clearances but shift points on anchor plate as described under "Ignition Timing".

(67) IGNITION TIMING

Turn motor until intake and exhaust cams are in the same position as shown in Fig. 5, which is the firing center for No. 8 cylinder and four lobe cam should be in position as shown.

In timing the ignition it is quite necessary to set both sets of points so that they are absolutely synchronized and fire all cylinders at same time with relation to their respective center lines on the flywheel. The points may be synchronized in the following manner

by use of special synchronizing tool J-6965 as illustrated in Fig. 5. Considerable time can be saved in retiming the engine by marking position of rotor and four lobe cam before removing so that it may be put back in the same position.

Loosen the screw in center of cam mounting the second time and remove cam, but do not tighten screw as synchronizing gauge should be free to turn when placed on this shaft. Rotate the gauge until the breaker arm rubbing blocks drop into the notches on its surface. Then holding the shoulder of the one notch firmly against the side of the block at "A" loosen the screws "C" and "D" and turn eccentric "E" until the side of the other block is in contact with the shoulder of the notch at "B". With the arms in this position tighten screws "C" and "D". The adjustment can be checked by holding the gauge solidly against the rubbing blocks and lifting each breaker arm in turn. If they are properly set a slight friction will be felt as the arms are raised from the gauge. Remove synchronizing tool and place four lobe cam on mounting post and lock in position so that No. 8 cylinder will fire at $1\frac{1}{2}$ " before top center with spark control fully advanced. No. 3 cylinder should fire just 90 degrees later on the flywheel at $1\frac{1}{2}$ " before its top center. These firing points may be determined by turning flywheel, using prybar with ignition switch "On" and noting when ammeter drops to zero.

(68) DISTRIBUTOR HEAD

The distributor has one high tension lead for each coil and eight spark plug leads with terminals marked in the same manner as the wires are attached to the plugs. The firing order 1-6-2-5-8-3-7-4 is thus obtained by each end of the dual arm rotor firing the respective cylinders in this order.

(69) CARE OF DISTRIBUTOR

Eight to ten drops of light engine oil should be placed in side oiler every 5,000 to 10,000 miles. Also when points are adjusted a very thin film of vaseline should be placed on cam to lubricate fibre rubbing block contact. The center plunger and the brass track inside the head should always make contact with rotor at center and carbon rubbing brush. The carbon brush may be broken quite easily in case head is not removed properly.

(70) CONDENSERS

Two condensers are mounted inside the distributor housing beneath breaker plate assembly and connected in parallel with the respective set of points.

(71) SPARK PLUGS

The spark plugs used are built specially for this motor using a standard 18 mm. thread. Points should be set at .022—.028 inches.

In no case should different plugs be used and when replacement is necessary be sure to obtain plugs with the exact specifications on the porcelain as given on the original ones.

(72) COILS

Two coils mounted on rear of instrument board are connected in parallel circuits to the respective set of coil points. A single ignition switch controls the complete circuit.

COOLING SYSTEM

(73) COOLING SYSTEM

Ample cooling is supplied by means of a large capacity radiator with positive circulation direct from centrifugal water pump located pump located at right front side of motor.

The capacity of the entire system is 7 gallon with a drain valve located at the bottom of the radiator on the left hand side to be used for flushing. A drain cock is also provided at the right rear side of the cylinder block to drain portion of water remaining around cylinder chambers.

A non-freezing solution of water and alcohol (only) is recommended for use during the winter months. Many other non-freeze solutions are recommended individually by their respective manufacturers as nothing has been found more satisfactory in every manner than alcohol.

A table is given below for your convenience in preparing the correct mixture proportions for desired temperatures.

Atmospheric Tem.	Alcohol	Water
10° F. above Zero	6 qts.	22 qts.
0° F. Zero	8 qts.	20 qts.
10° F. below Zero	9½ qts.	18½ qts.
20° F. below Zero	11½ qts.	16½ qts.
30° F. below Zero	13½ qts.	14½ qts.

Should alcohol be spilled on the lacquer wash immediately with water to avoid dissolution.

(74) HOSE CONNECTIONS

The two radiator hose connections should be inspected every few months and clamps tightened to prevent any leaks occurring at these points. Hose connections should be replaced at the end of the winter months as the anti-freeze solution may deteriorate the inside and thus restrict water passages and circulation.

(75) WATER PUMP AND FAN

The water pump located on the right front side of the cylinder block is driven by means of a safety coupling from accessory shaft

and lower chain. A stainless steel shaft with brass rotor impellor and aluminum housing forms a non-corrosive unit to provide efficient operation throughout the life of the car. A long non-gran bronze bushing and steel thrust button eliminate the necessity of adjustments or replacements and the only attention necessary is the occasional tightening of the packing nut. New packing may be installed without removing water pump.

The fan is supported on plain annular ball bearings and should be packed with alemite grease every 10,000 miles. To adjust fan belt, loosen eccentric locking bolt at top of mounting and turn top of eccentric with spanner wrench to left side of car to remove slack in belt. It is not necessary to have belt absolutely taut.

CLUTCH

The clutch is a dual-plate, dry disc type, designed especially for ruggedness, ease and smoothness of operation.

It is composed of two major units; the cover and pressure plate assemblies, the driven member using a special dampening element for absorbing and storing the power impulses of the motor into an uninterrupted torque at all speeds.

(76) CONSTRUCTION

The driven member or dual plate assembly consists of a hardened splined hub, two driven discs to which the friction facings are attached and the center driving plate.

Twelve coil springs are located between the splined hub flange recesses and the driving blocks that are riveted to the discs. This feature allows a determined amount of lateral movement between the discs and the hub to compensate for lapse of power between power impulses of the motor.

The cover plate assembly consists of the outer driving plate and the stamped cover plate in which are mounted the twelve pressure springs and six release levers. These springs produce a pressure against the outer and inner pressure plates and flywheel face to engage the friction faces of the lining for the drive discs. The pressure exerted by these springs is far in excess for the actual requirement to compensate for wear on the facings and thus eliminate any necessity for future adjustments to units within the assembly. The only adjustment necessary is at the clutch pedal and this should be maintained so as to produce 1" to 1½" free movement of the pedal from the floor board. The clutch release bearing being completely enclosed and lubricated automatically by the chassis lubricating system relieves any necessary attention for lubrication.

(77) DISASSEMBLING AND ASSEMBLING

To disassemble the clutch it is first necessary to remove the transmission. In moving the transmission from its mounting be sure not

not allow the weight of the unit to rest on the clutch shaft when partially removed from clutch assembly. Remove the six $\frac{3}{8}$ " cap screws at the outer edge in the cover plate assembly. The complete unit may then be removed from the flywheel.

Mounted in the cover plate there are three center plate adjustment screws. When installing the assembly on the flywheel the three center driving plate and adjustment screws should be backed out until their ends are flush with the face of the pressure plate.

In placing the complete clutch on the flywheel a splined dummy shaft should be used to align the splined hub with the forward pilot bearing while the six cap screws in the cover plate are being tightened down. After the above operation the three center plate adjusting screws should be screwed forward as far as possible and then backed off four notches.

It is then only necessary to adjust the pedal position as described in previous paragraph. Should a splined dummy shaft not be available for aligning splined hub in the assembly the transmission may be placed in position and then the six cap screws tightened thru

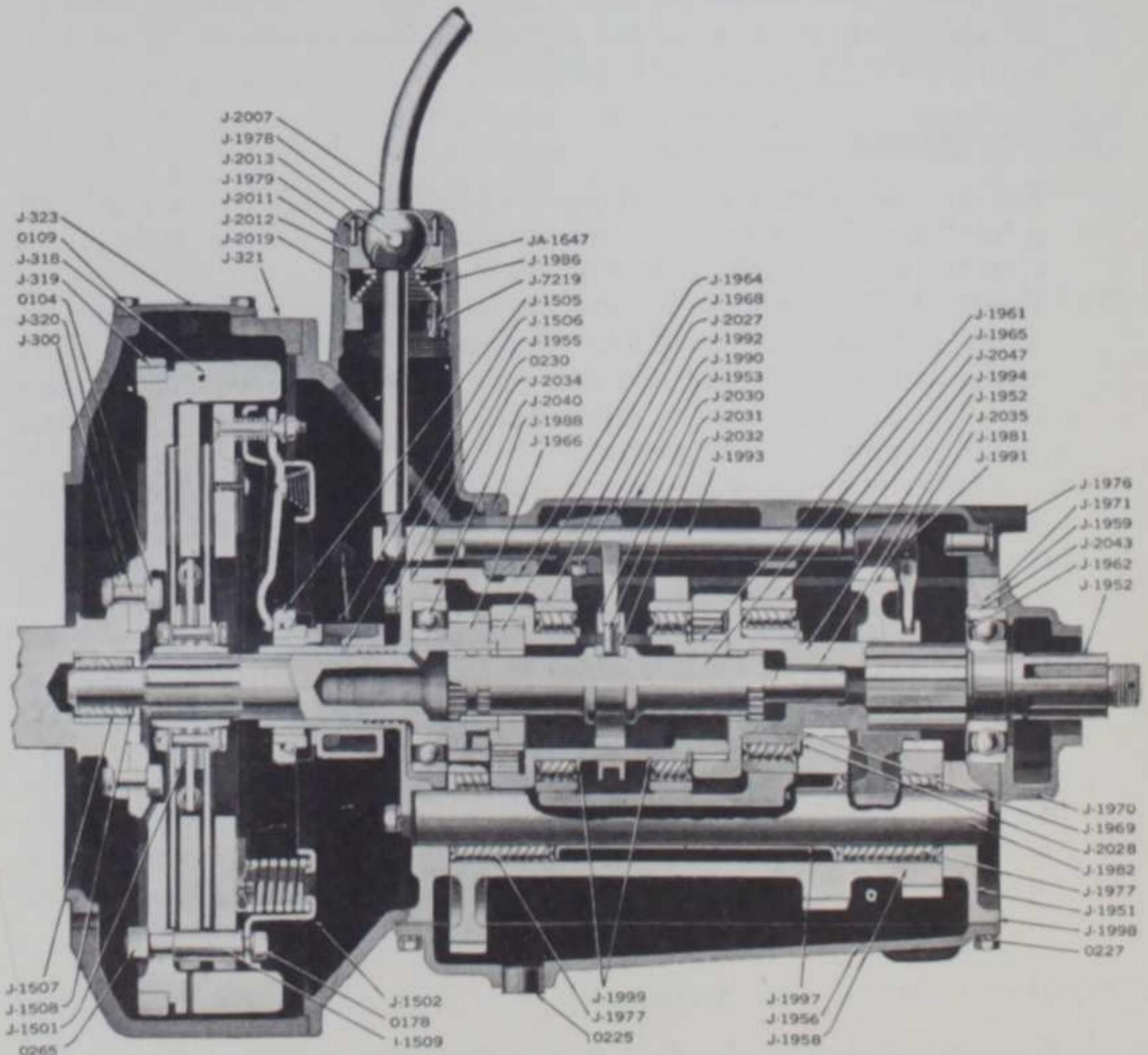


Fig. 7. Cross Sectional View of Clutch and Transmission

Fig. 7. PARTS DESCRIPTION

J- 300	Crankshaft	J-1986	Gear shift lever support
J- 318	Flywheel	J-1988	Gear shift bracket dust felt
J- 319	Flywheel ring gear	J-1990	Shifter high & intermediate fork
J- 320	Flywheel bolt	J-1991	Shifter low and reverse fork
J- 321	Flywheel housing	J-1992	Shifter fork screw
J- 323	Flywheel housing cover plate	J-1993	Shifter high and second rail
J-1501	Clutch driven member assembly	J-1994	Shifter low and reverse rail
J-1502	Clutch cover plate assembly	J-1997	Countershaft gear bearing spacer
J-1505	Clutch release bearing	J-1998	Transmission case pan.
J-1506	Clutch release sleeve	J-1999	Eccentric gear snap ring
J-1507	Clutch pilot bearing	J-2007	Transmission case pan gasket
J-1508	Clutch pilot bearing retainer	J-2011	Gear shift bracket
J-1509	Clutch driving stud	J-2012	Gear shift lever socket
JA-1647	Gear shift lever spring washer	J-2013	Gear shift lever fulcrum pin
J-1951	Transmission case	J-2019	Gear shift lever socket nut
J-1952	Main shaft	J-2027	Eccentric gear (NC-212) bearing
J-1953	Shaft frame	J-2028	Main shaft bearing washer
J-1955	Main drive gear bearing retainer	J-2030	Clutch gear shift collar
J-1956	Transmission case pan	J-2031	Clutch gear shift collar pin
J-1958	Countershaft gears	J-2032	Clutch gear shift collar ring
J-1959	Main shaft rear bearing adapter	J-2034	Main drive gear bearing retainer gasket
J-1961	Eccentric gear	J-2035	Main shaft pilot bushing
J-1962	Main shaft oil retainer rear washer	J-2040	Main drive gear bearing (No. 1211)
J-1964	Shift frame gasket	J-2043	Main shaft rear bearing (No. 1308)
J-1965	Direct and second speed clutch gear	J-2047	Main shaft front bearing (No. 211)
J-1966	Main drive gear	J-7219	Gear shift lever socket nut screw
J-1958	Second speed drive gear	0104	7/16 - 20 plain hex nut
J-1969	Main shaft snap ring	0109	5/16 - 24 - 5/8" hex head cap screw
J-1970	Main shaft rear bearing retainer	0178	3/8" - 25 - 7/8" hex head cap screw
J-1971	Main shaft rear bearing retainer gasket	0225	3/4" Briggs std. allen pipe plug
J-1976	Back up switch plunger	0227	5/16" - 18 - 3/4" hex head cap screw
J-1977	Countershaft gear bearing	0230	3/8" - 16 - 7/8" hex head cap screw
J-1978	Gear shift lever (lower end of lever)ball	0265	9/16" - 18 plain hex nut
J-1979	Gear shift lever socket pin		
J-1981	Main shaft low and reverse gear		
J-1982	Countershaft		

opening in the transmission housing with gear shift assembly and plate removed. The three screws may then be adjusted.

(78) CLUTCH SERVICE POLICY

To save the individual dealer the expense of procuring assembly fixtures and tools for the replacement of clutch parts the following service method has been adopted:

For a nominal charge the cover plate assembly and the driven member assembly may be returned to the factory to be reconditioned. This work will be done with all worn parts replaced and the units will be the same as when new.

TRANSMISSION

(79) TRANSMISSION

The transmission is supplied with three speeds forward and one reverse but is a "four speed forward type" of design. An internal over-running gear gives a direct drive in both second speed and high gear allowing an absolutely quiet second gear. This design also permits an exceedingly quick shift between high and second speeds.

A conventional countershaft with quill gear drives the low and reverse sliding gear, on the main shaft at the rear of the transmission giving the low and reverse gear.

Roller bearings are used throughout the entire unit except for the main shaft bearings at the front and rear to give a positive alignment and add further to quietness.

The standard universal gear shift positions are used.

The transmission should be drained every 10,000 miles and a fresh supply of Whitmore's "0" lubricant added. Approximately 5 pints is required to bring oil to level of filler plug.

In order to disassemble transmission from car it is first necessary to remove universal joints and shaft as explained under "Universal Joints".

Remove clutch and brake pedals, shift lever and pedestal hand brake lever and controls backing light connection front muffler cover and nuts bolting transmission to flywheel housing, etc. The transmission may then be removed by pulling to the rear and lifting left side slightly to allow clutch release shaft to pass master cylinder.

Do not allow the weight of the transmission to hang on clutch shaft as the alignment of the complete assembly will be disturbed. If the clutch is removed be sure to use centering tool for locating driven disc in correct position as explained under "Clutch".

(80) SPEEDOMETER GEARS

Gears at the rear of the transmission drive the speedometer. The Speedometer drive and driven gear are enclosed in the small housing at the rear of the transmission and can only be removed after universals and shaft is removed. Any change in rear axle ratio will necessitate a change in speedometer gears.

(81) HAND BRAKE

The hand brake mounted at the rear of the transmission proves a very simple and efficient mechanism. To adjust brake shoes loosen screw in equalizer sleeve at the center of the shaft, Fig. 11, which expands and contracts the shoes. Tighten adjusting nut on end of shaft to the position where hand brake lever will lock brake when in the fifth notch on its ratchet. When lever has locked brake in this position tighten screw in equalizer sleeve.

(82) UNIVERSAL JOINTS

Two universal joints are used, one cushion ball joint and one mechanical joint. The cushion ball joint contains eight rubber balls to cushion and insulate drive line from power plant. The mechanical joint is lubricated automatically from the propeller shaft bearing at the torque yoke. To disassemble universal joints remove the eight bolts thru flange for rear universal and the four large bolts thru front universal. Disassemble hand brake shoes from mounting and the complete shaft unit may be removed. If rubber joint is completely disassembled a clamping ring will be necessary to hold balls with drive cross and blocks to proper position for engaging in steel casing. The mechanical joint may be completely disassembled and parts replaced without special tools.

REAR AXLE

The rear axle exemplifies simplicity and rigidity in its general construction and employs the very latest in hypoid gearing for the final drive. The gears or bearings should not require any attention or adjustment throughout the life of the car provided the unit receives adequate lubrication.

(83) LUBRICATION

It is very essential that Whitmore's gear lubricant No. "0" be used in the rear axle as this is the only grease that is particularly suited for the hypoid gearing. This grease may be purchased at Duesenberg service stations or may be obtained direct from the Whitmore Manufacturing Co., of Cleveland, Ohio, and their representatives. The rear wheel bearings are lubricated from the supply in center of the axle and a composition washer located inside the brake drum assembly against the bearing retainer seals the lubricant at this point, thus preventing it from passing into the brake assembly. However do not fail to drain lubricant and flush ever 10,000 miles and refill with a fresh supply. The reason for this is that metal dust and sludge forming with the old oil will be extremely detrimental to all parts if allowed to remain in use.

(84) PINION AND RING GEAR

The hypoid gear construction provides for the pinion being off center (2 inches) which permits torque drive to be exceptionally low, allowing the chassis gravity center to be low and adding to the safety in operating the car. The assembly is mounted on ball bearings throughout with a sleeve adjustment for maintaining the correct position of the ring gear.

Fig. 8. PARTS DESCRIPTION

JX-1901	Rear axle wheel pinion bearing	J-3031	Differential carrier right side cap
JX-1908	Rear axle wheel bearing nut lock washer	J-3032	Rear axle hypoid 14-53 pinion
JX-2017	Differential spider arm	J-3033	Rear axle hypoid 14-53 gear
JX-2042	Differential L. H. bearing	J-3034	Differential right side ball bearing
JX-2045	Differential bearing lock screw	J-3035	Differential gear cover
JX-2064	Drive pinion front bearing (double row)	J-3036	Differential ring gear bolt
JX-2069	Pinion bearing retainer nut	J-3037	Rear axle wheel bearing R. H. lock nut
JX-2081	Bevel pinion nut	J-3038	Rear axle wheel bearing L. H. lock nut
JX-2087	Bevel drive pinion washer	J-3039	Drive pinion bearing retainer
J-2526	Brake drum	J-3040	Drive pinion bearing retainer shim
J-2527	Brake drum screw	J-3041	Bevel drive pinion bearing spacer
J-3001	Rear axle housing assembly	J-3042	Rear spring R. H. seat
J-3002	Differential bevel pinion	J-3043	Rear spring L. H. seat
J-3003	Differential side gear	J-3044	Differential bearing retainer lock
J-3007	Bevel pinion nut lock washer	J-3045	Differential gear cover stud
J-3008	Differential bearing nut lock washer	J-3047-A	Shock absorber saddle
J-3009	Differential carrier R. H. stud nut	J-3048	Differential carrier right side stud
J-3010	Rear axle housing	J-3049	Differential carrier left side stud
J-3011	Rear axle housing end	J-3052	Differential bearing nut
J-3012	Differential carrier stud	J-3055	Rear brake drum pilot
J-3013	Rear brake upper-half cover	J-3056	Rear brake cover bolt
J-3014	Rear brake lower-half cover	J-3452	Torque tube assembly
J-3015	Rear axle wheel bearing R. H. nut	J-3455	Propeller shaft assembly
J-3016	Rear axle wheel bearing L. H. nut	J-3474	Torque yoke bearing cap
J-3017	Rear axle wheel bearing retainer	J-3475	Torque yoke bearing spacer ring
J-3019	Rear axle packing	J-3477	Torque yoke bearing retainer
J-3020	Rear axle packing retainer	J-3478	Torque yoke bearing retainer shim
J-3021	Rear axle R. H. shaft	J-3480	Torque tube yoke
J-3022	Rear axle L. H. shaft	J-3481	Torque tube yoke cap
J-3023	Wire wheel R. H. rear hub	J-3506	Universal joint rear flange
J-3024	Wire wheel L. H. rear hub	J-3' 20	Radius rod assembly
J-3025	Wheel bearing retainer bolt	J-3524	Radius rod eye bolt
J-3026	Differential carrier	J-3531	Universal joint cotter
J-3027	Differential carrier gasket	J-3535	Universal joint shaft nut
J-3028	Differential right case	0103	3/8" - 24 plain hex nut
J-3029	Differential left case	0142	3/8" - 24 jam nut
J-3030	Differential carrier left side cap	0147	3/8" - 24 Castle nut

nuts. The unit may then be removed. This practice of disassembling is to be discouraged however, because in reassembling it is impossible to observe the tooth contact or bearings in setting the gears. Therefore in all cases it is the best policy to completely remove the rear axle assembly from under the car when major repairs or disassembling is necessary to obtain proper tooth contact.

(85) AXLE SHAFTS AND BEARINGS

The axle shafts are hollow and extremely large to provide a great factor of safety in carrying the load and at the same time eliminating excess weight. The shafts are supported at the outer end on large annular ball bearings which require no attention or adjustment throughout the lifetime of the car. The axle shaft, brake drum and bearing assemblies may be disassembled from the axle as a complete unit by first removing the 8-3/8" cap screws J-3025 and then tapping lightly outward against the inner edge of the drum.

(86) TORQUE TUBE—Propellor Shaft

The torque tube encloses the propellor shaft and maintains a positive alignment for complete line of drive. The tube is anchored to the frame crossmember thru a yoke and rubber insulators allowing a cushioned drive direct to rear axle independent of springs and shackles. The propellor shaft is supported at the front by means of an annular ball bearing automatically lubricated and is connected to the pinion shaft at the rear thru a splined slip joint.

The torque tube may be disassembled after removing complete unit with rear axle or after removing universal joints. To dismantle complete unit remove spring clips lower half torque yoke insulator brackets, rear universal flange bolts, brake line flexible connection, chassis lubricator connection to propellor shaft bearing, etc. The propellor shaft can then be pulled forward out of tube after removing the front bearing retainer screws.

FRONT AXLE

(87) FRONT AXLE

The front axle is a chrome molybdenum forging of I beam section with reinforced flanges of ample strength to carry all radial and vertical stresses. The pivot pins are anchored in the axle forging with the steering knuckle and brake mechanism revolving about a double row radial bearing at the top and at ball thrust bearing at the bottom. An adjustment for end thrust is provided at the lower bearing by means of shims, J-2532 and adjusting nut, J-2531, Fig. 9. To make this adjustment remove locking bar J-2548 and back off adjusting nut J-2531. Remove one thin shim J-2532 and tighten nut securely. Remove sufficient shims until there is no perceptible up and down movement of steering knuckle or until a slight drag is noticed on revolving knuckle about pivot pin.

Pivot pin bearings should be packed with alemite cup grease every 10,000 miles using Zerk Gun and fitting in axle forging.

(88) TIE ROD

The tie rod or steering cross rod has an automatic adjusting ball joint at each end. These joints should be packed with alemite cup grease every 10,000 miles and otherwise no attention or adjustment is necessary. A right hand and a left hand thread is provided at the respective ends of the rod to screw into ball joints.

The ball joints at each end of the drag link or rod from the steering drop arm to the left steering arm should be adjusted so that the rod may be twisted when gripped firmly by the hand. To obtain this adjustment, tighten ball ends as far as possible and then back off until cotter pin can be inserted.

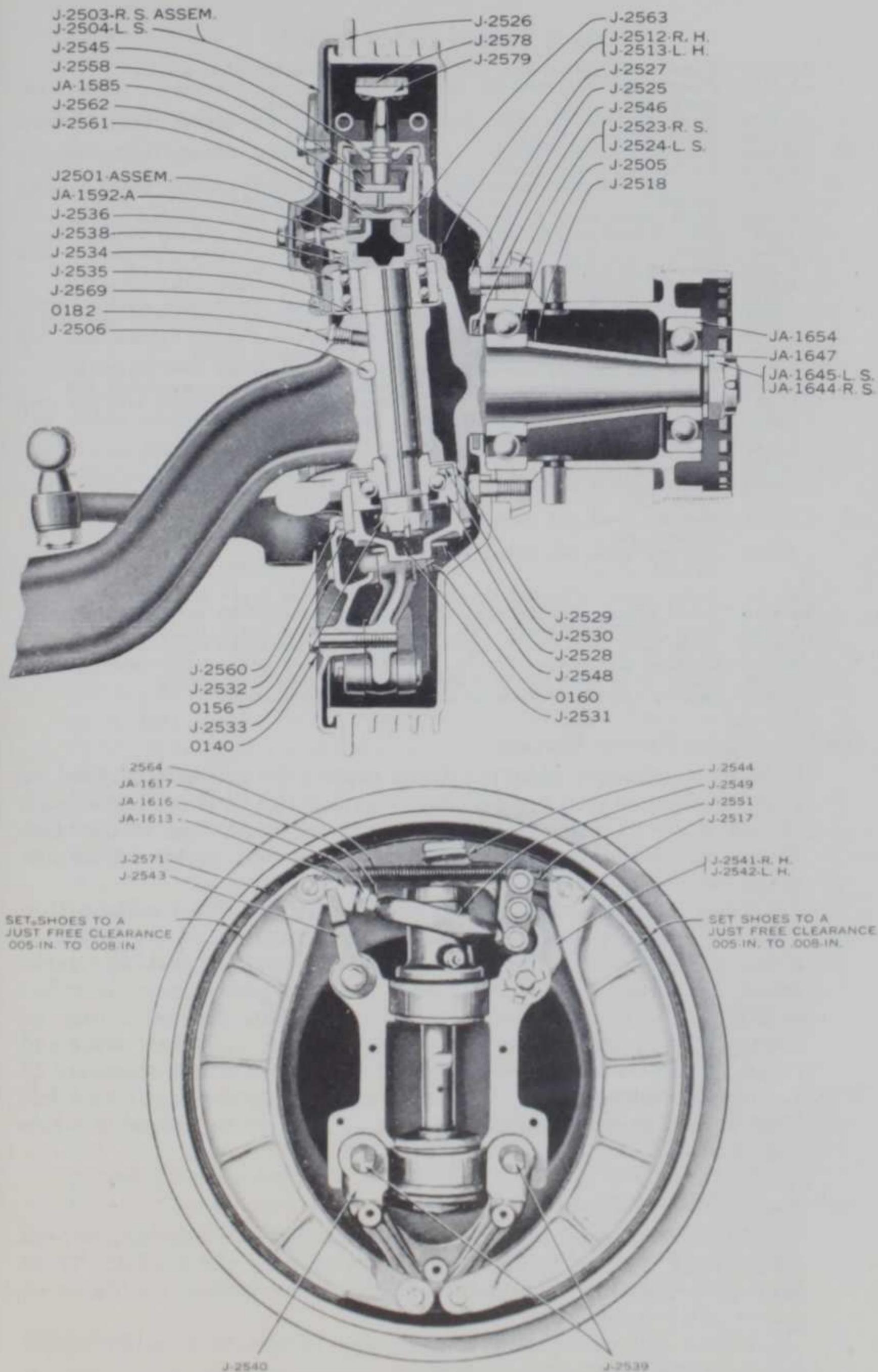


Fig. 9. Cross Sectional View of Front Axle and Wheel Brake Assembly

Fig. 9. PARTS DESCRIPTION

JA-1585	Front brake piston disc	J-2533	Steering pivot pin nut
JA-1592A	Front brake hydraulic air bleeder screw	J-2534	Steering knuckle radial ball bearing
JA-1644	Front wheel R. H. nut	J-2535	Steering knuckle radial bearing cover
JA-1645	Front wheel L. H. nut	J-2536	Steering knuckle radial bearing felt
JA-1647	Front wheel nut washer	J-2538	Steering knuckle radial bearing felt retainer
JA-1654	Front wheel outer bearing	J-2545	Front brake cylinder block
J-2501	Steering knuckles pivot pin assembly	J-2546	Front hub bearing retainer felt
J-2503	Front brake cover R. H. assembly	J-2548	Thrust bearing retainer nut lock
J-2504	Front brake cover L. H. assembly	J-2558	Front brake hydraulic piston
J-2505	Front wheel inner bearing	J-2560	Front brake lower cover felt
J-2506	Steering knuckle pivot pin lock	J-2561	Brake piston cup washer insert
J-2512	Steering R. H. knuckle	J-2562	Brake cylinder piston seal cup
J-2513	Steering L. H. knuckle	J-2563	Brake cylinder piston seal cup spreader spring
J-2518	Front wheel hub bearing spacer	J-2569	Front brake cover upper felt
J-2523	Front wire wheel R. H. hub	J-2578	Front brake toggle arm pad
J-2524	Front wire wheel L. H. hub	J-2579	Front brake toggle arm pad rivet
J-2525	Front hub bearing retainer	0140	Hex head cap screw 5/16" - 24 - 1-1/2"
J-2526	Front brake drum	0156	Hex head cap screw 5/16" - 24 - 1-1/4"
J-2527	Front brake drum screw	0160	Hex head cap screw 5/16" - 24 - 1/2"
J-2528	Steering pivot pin thrust ball bearing	0182	Zerk lubricator fitting (straight) 1/8" pipe thread
J-2529	Steering pivot pin thrust ball bearing cover		
J-2530	Steering pivot pin thrust bearing cover felt		
J-2531	Steering pivot pin thrust bearing retainer nut		
J-2532	Steering pivot pin thrust bearing retainer shim		
JA-1613	Brake toggle adjusting block	J-2542	Front brake toggle L. H. support
JA-1616	Brake toggle adjusting nut	J-2543	Front brake adjusting link guide
JA-1617	Brake toggle adjusting lock nut	J-2544	Front brake toggle arm
J-2517	Brake shoe	J-2549	Front brake toggle adjusting link
J-2539	Steering arm rod	J-2551	Front brake toggle link
J-2540	Front brake shoe (lower support)	J-2564	Brake shoe spring
J-2541	Front brake toggle R. H. support	J-2571	Brake lining

(89) ALIGNING FRONT WHEELS

It is very necessary that the front wheels be properly aligned to give satisfactory steering and long wearing life to tires. The wheels should stand $\frac{1}{8}$ " to $\frac{1}{4}$ " closer together in front than in the rear. This dimension should be taken at one to two inches below the center of the wheel.

To check "Toe in" do not jack up front of car. First make a thin mark or line at the center of each tire in front and set device or gauge to this dimension. Roll the car backwards until the marks are at the correct height in the rear and with gauge note the difference from the original dimension in front. This dimension may be changed by loosening the two clamp bolts at each ball joint and twisting the tie rod in the proper direction. It is not necessary to disassemble tie rod for changing "toe in" as the right and left hand thread at each end changes the length of the assembly when rod is turned.

(90) FRONT WHEEL BEARINGS

The front wheels are carried on two annular ball bearings, which are given a tapping fit into the hub and onto the spindle. These bearings require no adjustment but should be packed with alemite grease every 5,000 miles.

To remove hub assembly it is necessary to obtain a puller which can be supplied on special order.

BRAKES

The hydraulic braking system embodies all the latest development in hydraulics, giving the utmost in efficiency and simplicity of construction. The system consists of four completely sealed, internal expanding brakes operated directly from hydraulic pressure developed at the master cylinder assembly upon depressing foot pedal. The brake pedal, when depressed, moves the piston within the master cylinder, thus displacing the brake fluid out thru the lead lines to the four wheel cylinders. The brake fluid enters into each of the wheel cylinders causing the piston to move upward, thus operating a reducing lever to expand the shoes against the brake drums. As pressure on the pedal is increased greater pressure is developed in the system and consequently greater braking effect is obtained. Equal and undiminished hydraulic pressure is transmitted to each brake assembly and therefore inherent equalization of braking is obtained at all times.

(91) MASTER CYLINDER

The master cylinder is contained within the supply tank, being operated thru a connecting linkage attached to the brake pedal. The supply tank carries the reserve supply of fluid and protects the master cylinder submerged in the fluid from taking in air, dirt or water. In the head of the master cylinder, held in place by a return spring, is a combination inlet and outlet check valve. When the foot pedal is depressed and the master cylinder is pushed outward, the fluid opens the outlet check valve as it is being forced into the system. When the foot pedal is released, the master piston return spring forces the piston to its "off" position against its stop. At the same time the wheel cylinder pistons are being returned by the brake shoe return springs forcing the fluid back thru the inlet check valve until the fluid pressure balances the weight of the master piston return spring at which point the inlet valve closes. As the master cylinder returns to the "off" position, liquid is allowed to enter or be expelled, thus maintaining a constant volume of fluid in the system at all times, compensating for expansion or contraction and replenishing any loss resulting from leaks. It is imperative that the master piston be in its "off" position or fully returned when the brake pedal is resting against the toe board, else this compensating feature will be lost and the proper pressure and braking will not be maintained. To check for this setting remove the clevis pins at pedal linkage and note that the piston is fully returned. To change the position of the piston with relation to the foot pedal it will be necessary to shift bell crank J-4803 on its shaft in the desired direction of rotation.

(92) BRAKE SUPPLY TANK

The supply tank described under the heading of "Master cylinder" is a simple reservoir and carries the surplus supply of brake fluid.

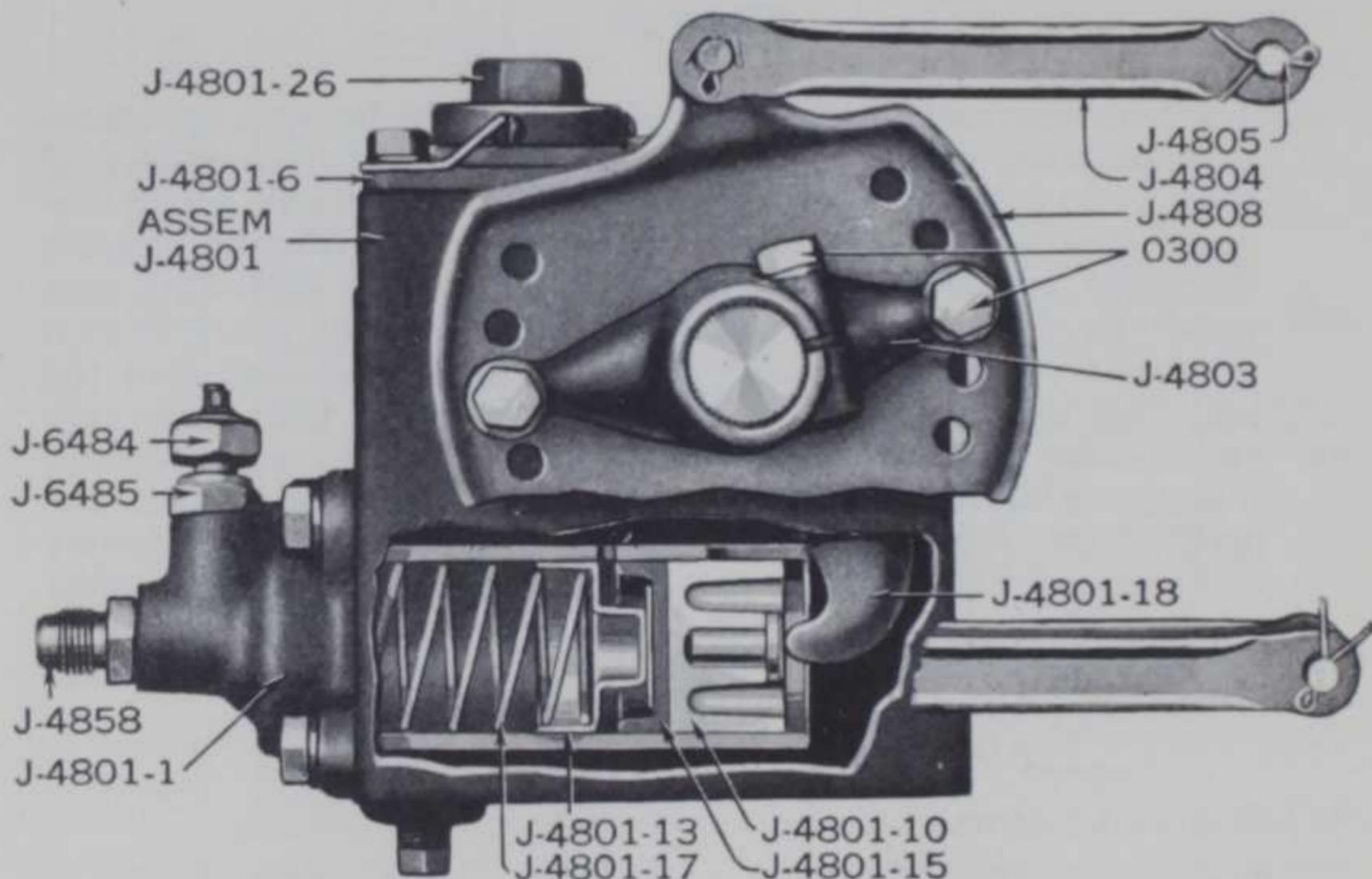


Fig. 10. Master Cylinder Assembly

0300	Master cylinder lever cap screw	J-4801-26	Master cylinder filler plug assembly
J-4801	Master cylinder assembly		
J-4801-1	Master cylinder supply tank	J-4803	Master cylinder lever
J-4801-6	Master cylinder supply tank cover	J-4804	Master cylinder lever link
J-4801-10	Master cylinder piston assembly	J-4805	Master cylinder lever link pin
J-4801-13	Master cylinder piston return spring retainer	J-4808	Master cylinder lever adjusting Plate
J-4801-15	Master cylinder piston cup	J-4858	Master cylinder to brake line union connection
J-4801-17	Master cylinder piston return spring	J-6484	Master cylinder light switch adapter
J-4801-18	Master cylinder brake shaft lever	J-6485	

The filler plug (J-4801-26) in the tank is fitted with a breather valve sealing the tank and thus preventing evaporation of fluid and dirt entering. The supply of fluid should be maintained to within $\frac{1}{2}$ " of the top of the tank. Use only "Lockheed" brake fluid.

(93) WHEEL BRAKE ASSEMBLIES

The four wheel brake assemblies are identical in construction. Adjustment is only necessary to compensate for wear of the lining and the frequency of this operation depends entirely upon the service they are subjected to. Any unequal braking that may occur will undoubtedly be due to some foreign substance such as paint, grease, oil coming in contact with the lining. This condition may be remedied by thoroughly cleaning the lining with gasoline and roughening the surface with a file. In event the lining becomes thoroughly saturated with oil or grease it will be necessary to reline the shoes.

(94) ADJUSTMENTS

Adjustments of the brakes will not be necessary until such time when the foot pedal goes to the floor board and satisfactory application of the brakes is not obtained. The necessary adjustments can readily be made by moving or expanding the shoes as outlined below.

1. Jack up each individual wheel preferably all at the same time.
2. Remove plates at front assemblies on inside dust cover marked "adjust brake here." Disassemble upper section of rear inside dust cover by removing two (5/16") caps screw and two (5/16") nuts for each section.
3. The adjusting nut (JA-1616) and locking nut (JA-1617) Fig. 9 are identical for all assemblies and provide the only and complete adjustment for the correct position of the shoes. The lock nut contains a left hand thread while the adjusting nut contains both a right and left hand thread for elongating and shortening the link connecting the shoes.
4. Loosen lock nut and turn adjusting nut in the opposite direction, expanding the shoe until the brake drags slightly against the drum (noted by rotating the wheel by hand.) Let the adjustment remain at this point for the time being. Perform this same operation for the 4 assemblies and when a slight drag has been produced on all of them, depress the foot pedal to the floor board. Depressing the pedal and applying pressure to the system allows the two shoes of each assembly to centralize or equalize their position as a unit. Upon rotation of the wheels it will be found that the brakes are again free.
5. Repeat the above operation of adjusting the shoes out against the drum and depressing the foot pedal until the brakes do not free up after depressing foot pedal. When the above adjustment is performed the last time and there remains a slight drag on each wheel, it will be necessary to back off or reverse the adjusting nut (JA-1616) 3 hexagons or one half turn and again depress the foot pedal. The brakes will then be free and all shoes will have the same correct clearance at the drums. The brakes will then be restored to their original setting and effectiveness.

(95) RELINING SHOES

To remove shoes and reline it is necessary to first remove all brake drums. The rear ones are removed as a unit with the axle shaft as described under "Rear Axle Shafts and Bearings". To remove front drums, first remove, spindle lock nut and then tap lightly against inner edge of drum with lead or brass hammer until as-

sembly may be dismantled from spindle. Remove inside dust covers. Remove toggle pins anchoring each shoe at the upper and lower ends. The shoes may then be removed.

(96) WHEEL CYLINDER AND PISTON

To remove pistons at wheel cylinder it is first necessary to remove brake drums as described above. Then by lifting toggle arm (J-2544) up and to the rear, using a lever of sufficient strength the brake assembly will be shifted slightly to the rear and the piston may then be lifted out of the cylinder.

The piston may be removed more easily if the bleeder screw is opened. Use only alcohol to clean piston and cup washer.

(97) BLEEDING SYSTEM

When any of the pressure units or connections are disassembled or disconnected for any reason it will be necessary to "bleed" the system in order to expel the air. Before attempting to "bleed" the system fill the supply tank with genuine Lockheed Brake Fluid and keep the tank at least half full all the time. Unscrew bleeder screw (JA-1592A) $\frac{1}{2}$ turn at one wheel; on front assemblies it will be necessary to remove plate marked "bleed here" and attach rubber hose to protruding shank of screw allowing tube to hang into container such as bottle. Depress foot pedal slowly by hand and return to normal position. Approximately ten complete strokes of pedal will be necessary to bleed each cylinder. Depressing the pedal forces fluid through lines and out at wheel cylinders expelling any air which may be in the system. When no air bubbles are heard or appear at the end of the hose tighten bleeder screw. A bleeder screw in brake line connection at front of dash and should be bled last to expel air trapped at this point. Fluid withdrawn in bleeding operation may be used again in the supply tank provided no dirt is allowed to enter the liquid.

STEERING GEAR

(98) STEERING GEAR

The steering gear is of a special design cam-lever type with constant pitch cam. This design gives what is known as an irreversible steering, preventing road shock being transmitted to the hand wheel and at the same time permitting very easy steering due to the small number of friction surfaces.

Lubrication is the most important factor in maintaining a steering gear at its highest efficiency. It prevents wear and rattle. Remove pipe plug and fill housing completely with *Whitmore's "65" Gear Lubricant* every 5,000 miles.

Only two adjustments are necessary to eliminate all lash in the system. All adjustments should be made with the front wheels jacked up and with the steering drop arm removed. With the front wheels set straight ahead, turn the steering wheel hand to mid-position. This is the position at which the steering drop arm should be assembled and locked securely on the trunion shaft after proper adjustments have been made.

To eliminate up and down movement of the steering wheel or end play in the column, remove locking stud with washer and back off large hexagon nut at the top of the steering gear housing. Remove one of thin shims between large nut and housing and tighten nut securely. Shims of the desired thickness should be removed until a slight drag is produced on moving the steering wheel.

To eliminate lash of lever arm in cam, adjust trunion shaft stop screw located in side gear cover plate at back of housing. Loosen hexagon lock nut and turn screw to right or clockwise until a slight drag is produced on moving the steering wheel. Tighten locking nut securely. Be sure to anchor steering drop arm with trunion arm in midposition of cam as explained above.

The steering column or wheel position may be shifted up or down after loosening the four bolts anchoring steering gear housing to frame and toe board bracket screws. Loosen screws on gate clamp at instrument board bracket and raise or lower wheel to the desired position.

CHASSIS

The chassis unit being built exceptionally low and sturdy permits a driving ease and feeling of safety even at excessive high speeds. The absolute insulation of the power plant and torque drive from the frame by means of rubberized supports eliminates any foreign noises from these units being transmitted to the frame and allows the units to maintain a true alignment with relation to one another. The line or drive is virtually in the same plane as the power plant unit, the angle of deflection being so slight as to eliminate angular stress on the universal joints. The unique design and uniform distribution of weight, produce an equilibrium throughout the chassis giving approximately the same load at each wheel.

(99) FRAME

The frame being of $7/32''$ stock, $8\frac{1}{2}''$ depth, crossed braced by four tubular, and two square shelled cross members gives a rigidity which absolutely prevents even the slightest frame flexure. The cross member at the front of the motor is braced longitudinally from each side of the motor to frame just above the front spring rear shackle. This one feature alone increases the rigidity to an equivalent of a frame twice the thickness as used. The four shell cross members riveted and gusseted at the center section of the frame insures rigidity in a like manner.

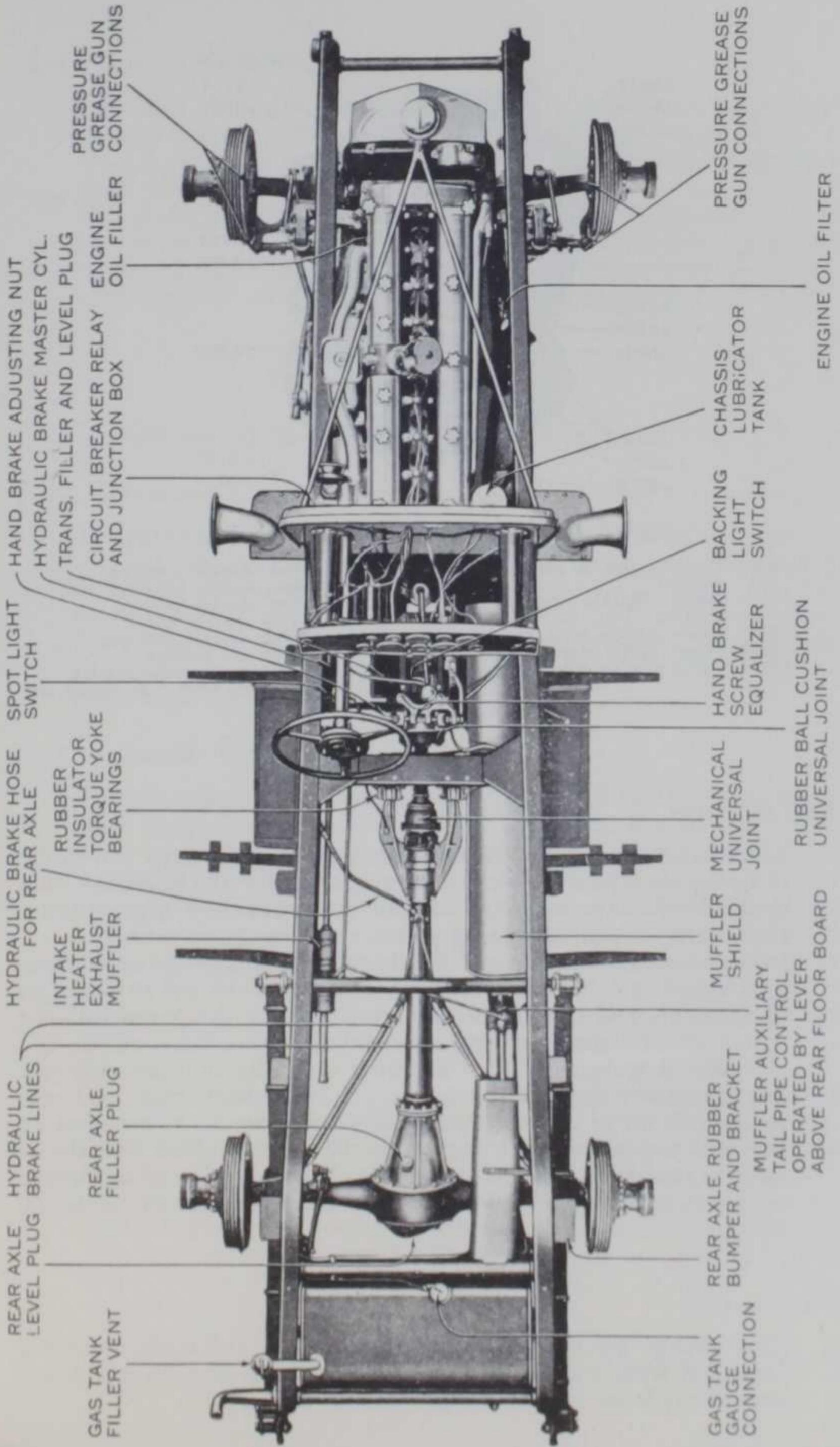
(100) CHASSIS LUBRICATING SYSTEM

All points of the chassis requiring regular and systematic lubrication, are automatically lubricated by a special pressure pump at the motor, supplying pressure through the oil supply tank at the dash to shackles, universal joints, propellor shaft bearing, steering drag link, shock absorber arms, etc. The pressure pump at the motor is a unit of the signal box assembly mounted just ahead of the fuel pump.

The pressure pump normally operates once every 60 to 80 miles, to supply oil under pressure to the chassis bearings. The correct supply of oil to each bearing or unit is controlled thru metering valves located at these points. It is quite necessary that the oil supply be maintained in the reservoir located on the front of the dash, else air and water, causing corrosion at the various units may impair the entire system, or lack of oil may damage pump. The two signal lights at the extreme left of the instrument board indicate the operating of the system explained under "Instrument Controls".

Should the lights burn continuously or not at all the electrical contacts may be at fault.

Other units of the chassis to be lubricated less frequently and not lubricated automatically are listed under "Operation of Cars".



REAR AXLE LEVEL PLUG
 GAS TANK FILLER VENT
 HYDRAULIC BRAKE HOSE FOR REAR AXLE
 INTAKE HEATER EXHAUST MUFFLER
 RUBBER INSULATOR TORQUE YOKE BEARINGS
 SPOT LIGHT SWITCH
 HAND BRAKE ADJUSTING NUT
 HYDRAULIC BRAKE MASTER CYL.
 TRANS. FILLER AND LEVEL PLUG
 CIRCUIT BREAKER RELAY AND JUNCTION BOX
 ENGINE OIL FILLER
 PRESSURE GREASE GUN CONNECTIONS

REAR AXLE RUBBER BUMPER AND BRACKET
 MUFFLER SHIELD
 MECHANICAL UNIVERSAL JOINT
 HAND BRAKE SCREW EQUALIZER
 BACKING LIGHT SWITCH
 CHASSIS LUBRICATOR TANK
 PRESSURE GREASE GUN CONNECTIONS

MUFFLER AUXILIARY TAIL PIPE CONTROL OPERATED BY LEVER ABOVE REAR FLOOR BOARD
 RUBBER BALL CUSHION UNIVERSAL JOINT
 ENGINE OIL FILTER

Fig. 11. Plan View of Chassis Assembly

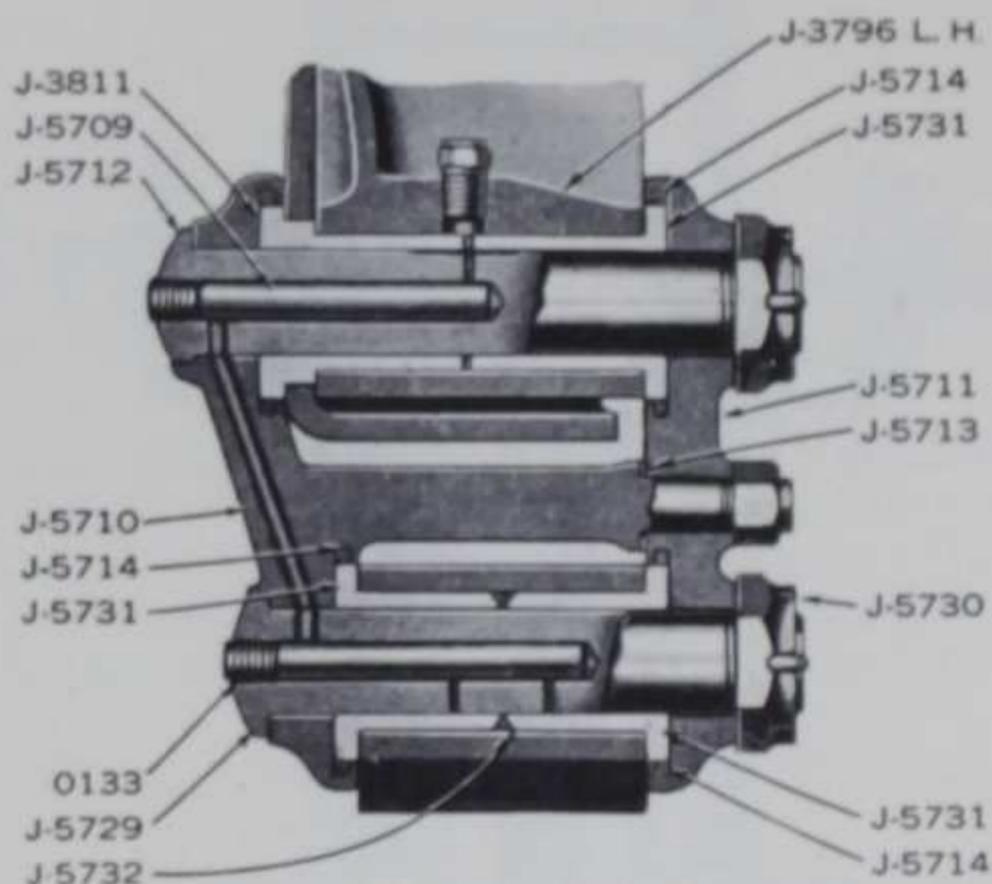


Fig. 12. Front Spring Rear Shackle Assembly

J-3796	Front engine & spring rear L. H. support	J-5712	Offset shackle pivot pin
J-3811	Offset shackle front pin outer Bushing	J-5713	Offset shackle adjusting shim
J-5709	Offset shackle pivot pin filler plug	J-5714	Offset shackle packing
J-5710	Offset spring shackle	J-5729	Spring shackle bolt
J-5711	Offset shackle side arm	J-5730	Spring shackle bolt nut
		J-5731	Spring eye bushing
		J-5732	Spring eye bushing packing
		0133	Pipe plug allen 1/8" briggs std.

(101) SHACKLES

The shackles are of conventional design, using the very best grade of non-gran bronze obtainable as a bearing for the hardened steel shackle bolts. The bushings and bolts are extremely large, thereby eliminating excessive bearing pressure and resultant wear.

Incorporated in the design of the shackle is a special feature, whereby a supply of oil is maintained even against the end thrust faces of the bolts and bushing, eliminating wear at this point and the frequency of tightening and adjusting shackles. The correct end clearance is maintained by tightening the bolts and nuts to a just free clearance, and for the rear shackles of both front and rear springs, shims of a corresponding thickness should be removed on the bolt connecting each leg of the shackle to allow end thrust faces to remain parallel to each other. This operation of tightening or adjusting shackles will only be necessary every 10,000 to 20,000 miles.

(102) SPRINGS

The springs are semi-elliptic in design and are made unusually long and wide with thin leaves to give the greatest strength and desired resilience for the weight of the car.

(103) SHOCK ABSORBERS

The shock absorbers, control or check the spring action for extreme movement both in the upward and downward directions.

Thus it will be found that under all road conditions exceptionally good riding qualities will be maintained.

The shock absorbers require no adjustment throughout the life time of the car. It will of course be necessary to maintain the proper supply of liquid in each unit, using only Delco-Remy shock absorber liquid obtainable at any of their branches.

ELECTRICAL SYSTEM

The ignition system is described under paragraph 64.

(104) GENERATOR

The generator is driven at crankshaft speed from accessory shaft on the left side of motor, thru short shaft using two flexible disc couplings. The armature rotates clockwise on two annular ball bearings which should receive 10 drops of light engine oil every 750 miles at the same time oil is changed in the motor. The generator is a two pole shunt unit using third brush regulation with cut out relay mounted directly on housing.

(105) CHARGING RATE

The charging rate is determined by means of the position of the third brush. To change the position of the brush loosen the round head locking screw located at one side of the bearing cover on the commutator end frame. Remove the cover band and shift the third brush in the direction of armature rotation to increase the output and in the opposite direction to decrease the output. When the adjustment is completed tighten the round head screw securely to prevent brush changing position. The charging rate should not be higher than 12 amperes when generator is hot and lesser charging rates are recommended when lights and starting motor are not used excessively.

The third brush control is supplemented by a thermostat which is an automatic switch operated by the heat inside the generator. When the battery is fully charged or the internal temperature of the generator reaches 165 degrees F. the contact points open and a resistance is placed in series with the generator field with the result that the generator output is reduced approximately 40 per cent. This type of control permits a higher charging rate on short drives longer period in the winter time which helps to restore the battery charge.

The brushes should be examined occasionally to see that they are not worn excessively and if necessary clean armature with No. 00 sandpaper.

(106) CUT-OUT RELAY

The cut-out relay mounted on the generator frame serves to automatically connect the generator to the battery circuit when the voltage of the generator is equal to the voltage of the battery and to disconnect the circuit when the generator stops or the voltage drops.

(107) STARTING MOTOR

The starting motor is a six volt, six brush, six pole series wound unit equipped with a bendix drive to engage ring gear on flywheel. The bendix drive automatically engages when starter control is pulled out at dash. The armature is carried in graphite bronze bushings which do not require lubrication. Do not lubricate spiral shaft of bendix drive as it is only necessary that it be thoroughly clean. The cover band should be removed occasionally to inspect brushes to see that they are not worn and commutator cleaned with No. 00 sandpaper.

(108) CIRCUIT BREAKER

The circuit breaker mounted in front of dash on left hand side is a protective device to disconnect any circuit where there is an abnormal discharge or a short circuit. This unit serves the purpose of fuses and gives a buzzing signal to warn operator of the condition of system.

(109) LIGHTING SWITCH

The lighting switch is located at the bottom of the steering column and is controlled by the third lever at the steering quadrant. No attention should be necessary other than to keep the connections tight.

(110) AMMETER

The ammeter on the instrument panel indicates charging and discharging rates of the battery or the correct operating condition of the entire system.

(111) HORN

The horn is a six volt motor driven type and should receive a few drops of light engine oil periodically.

(112) STORAGE BATTERY

The 6 volt 160 ampere hour storage battery is carried in the compartment of the splash shield on the right side of the frame. The negative terminal is grounded as the entire system is of the single wire grounded type. The battery terminals should be cleaned periodically

and given a thin coat of vaseline. Water should be added to the battery to keep liquid $\frac{1}{2}$ " above top of plates. The right hand upper signal light on the instrument board reminds you to inspect battery liquid every 1,500 miles.

(113) LIGHTS

Standard light equipment is:

Headlight—High Beam 32CP, 6-8 Volts, S. C. base

Headlight—Low Beam 21CP, 6-8 Volts, S. C. base

Cowl Lights 3CP, 6-8 Volts, S. C. base

Instrument Light 3CP, 6-8 Volts, S. C. base

Tail Light 3CP, 6-8 Volts, S. C. base

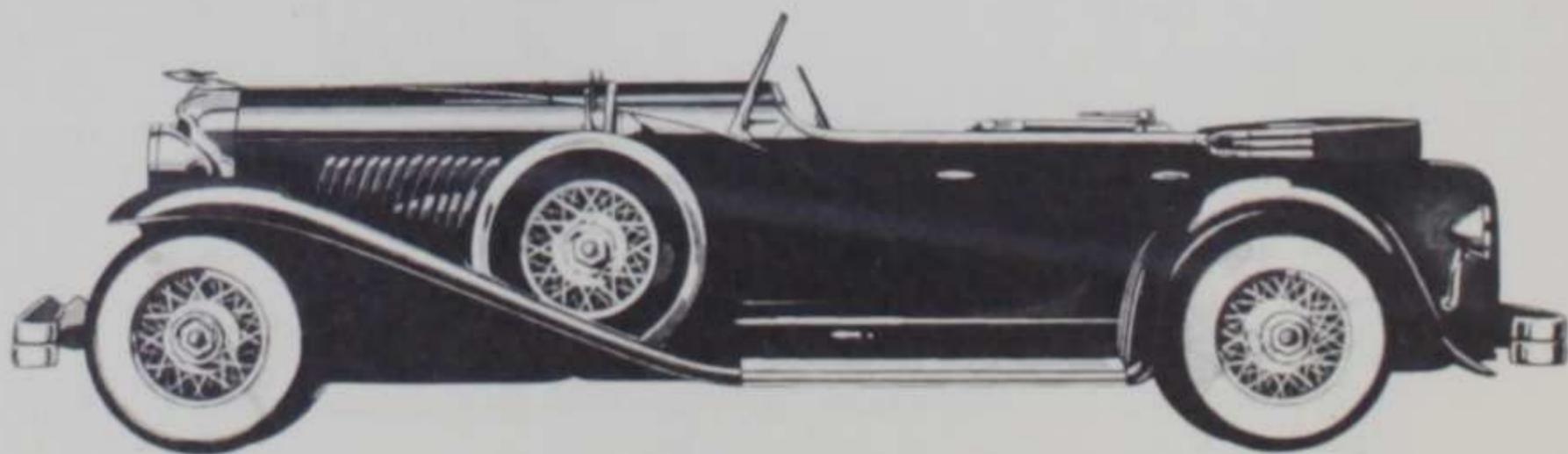
Backing and Stop Light 21CP, 6-8 Volts, S. C. base

All connections should be inspected periodically to prevent open circuits and burning out bulbs.

BODY

(114) BODY

Since practically all bodies supplied on the present chassis are custom built, it is impossible to include maintenance instructions and replacement details for all makes and types. However information may be obtained upon application from this factory or the respective body builders supplying the equipment. In all correspondence be sure to state, body manufacturer, body style and type seating capacity serial numbers and as many details as are available. In all cases give car number with above information.

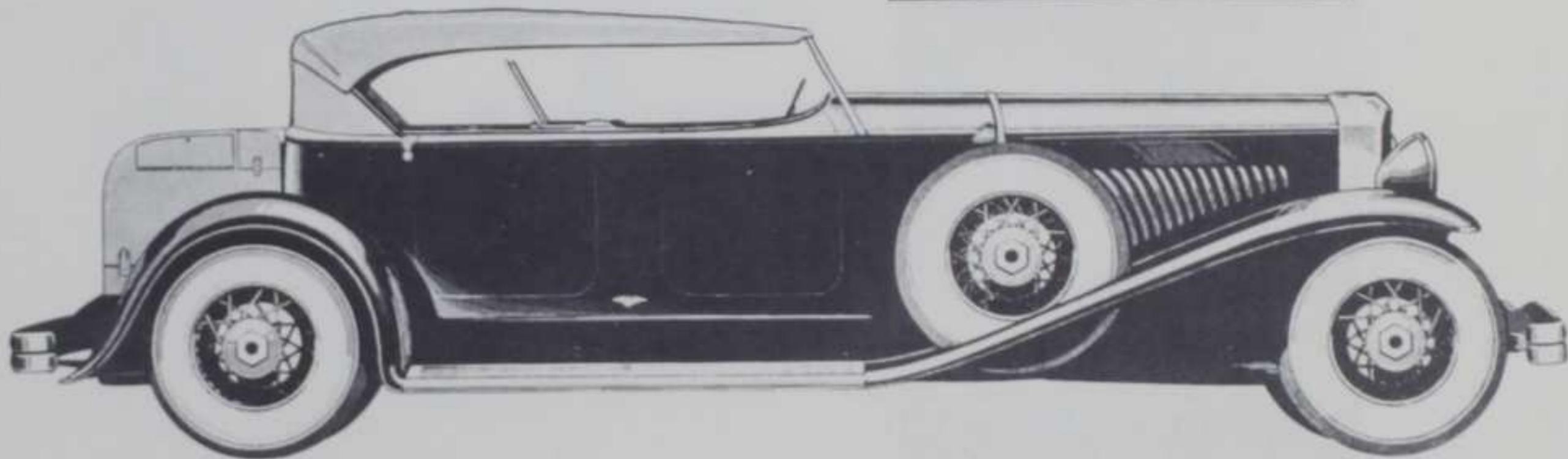


THE DUESENBERG PHAETON

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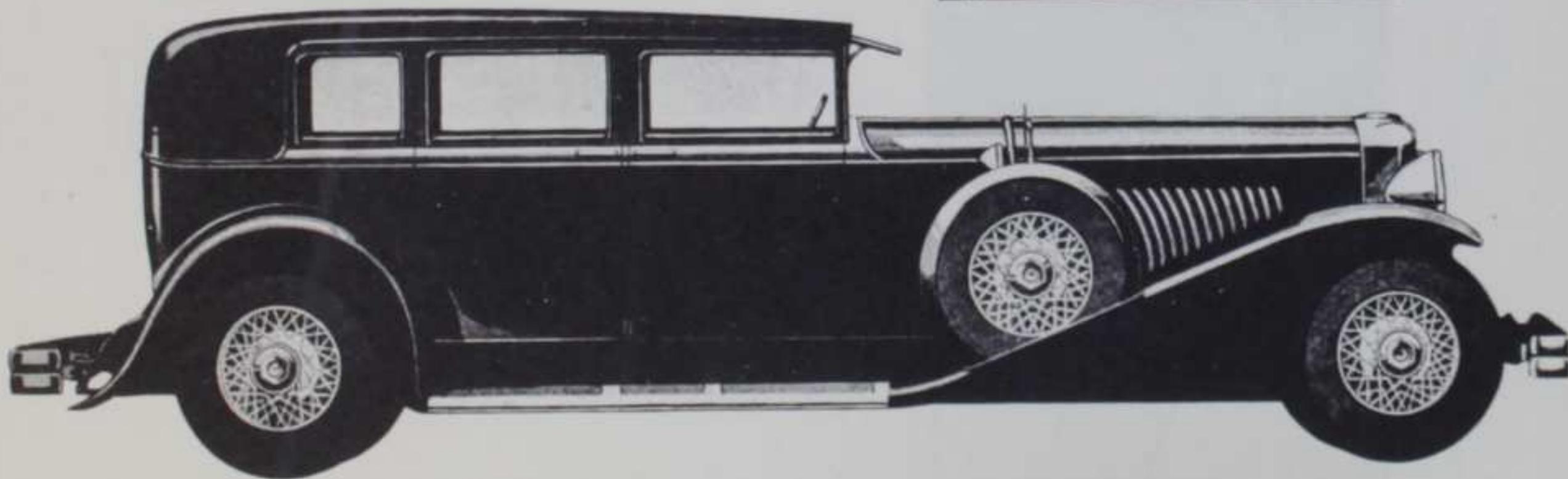
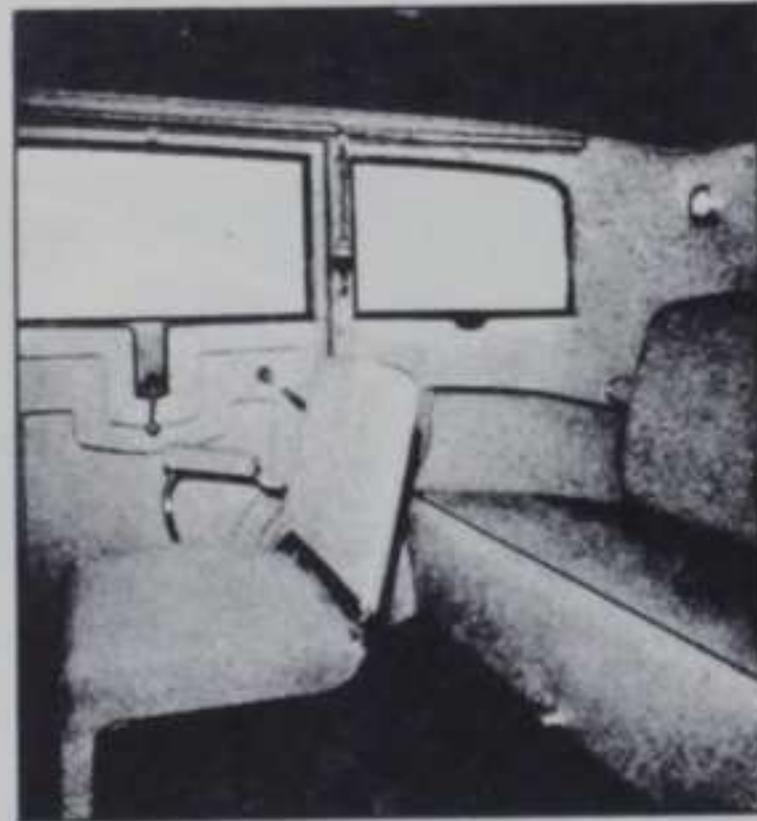
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Specially designed for the long chassis. Tonneau windshield turns down into front seat cowl. Unusual chrome panels add to the attractiveness of the doors. The rubber tile floors are extremely practical.



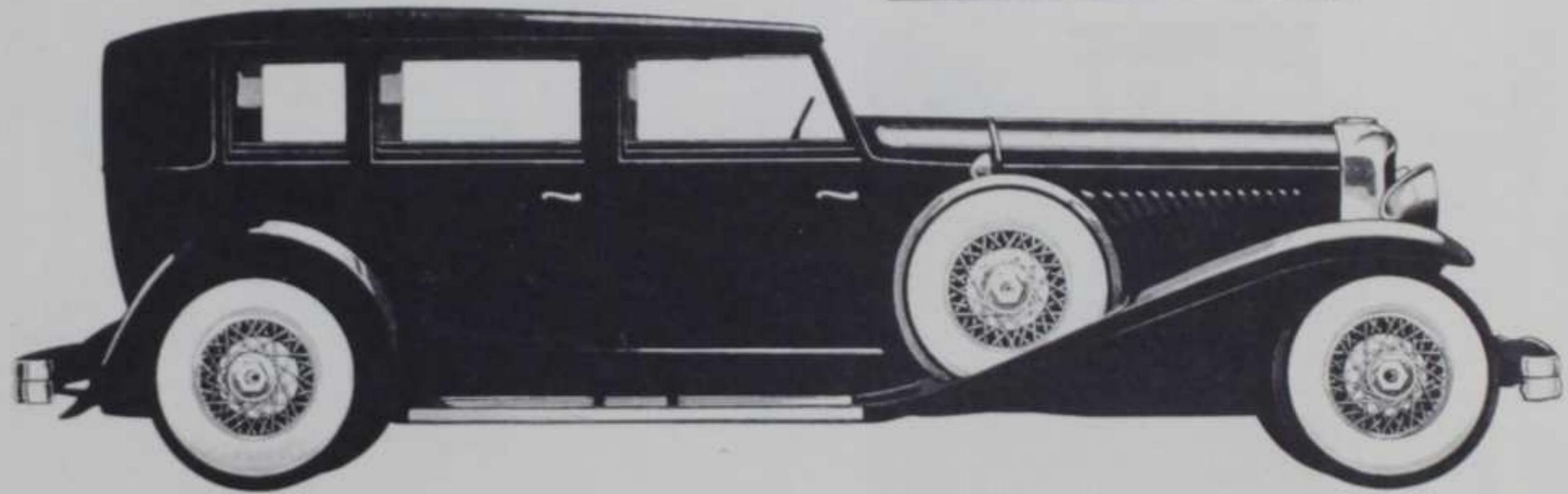
THE DUESENBERG TOURSTER

Unusual body width has been the aim in this design. Six persons ride comfortably in the rear compartment. The large upholstered auxiliary chairs fold completely out of sight. The rear seat is adjustable.



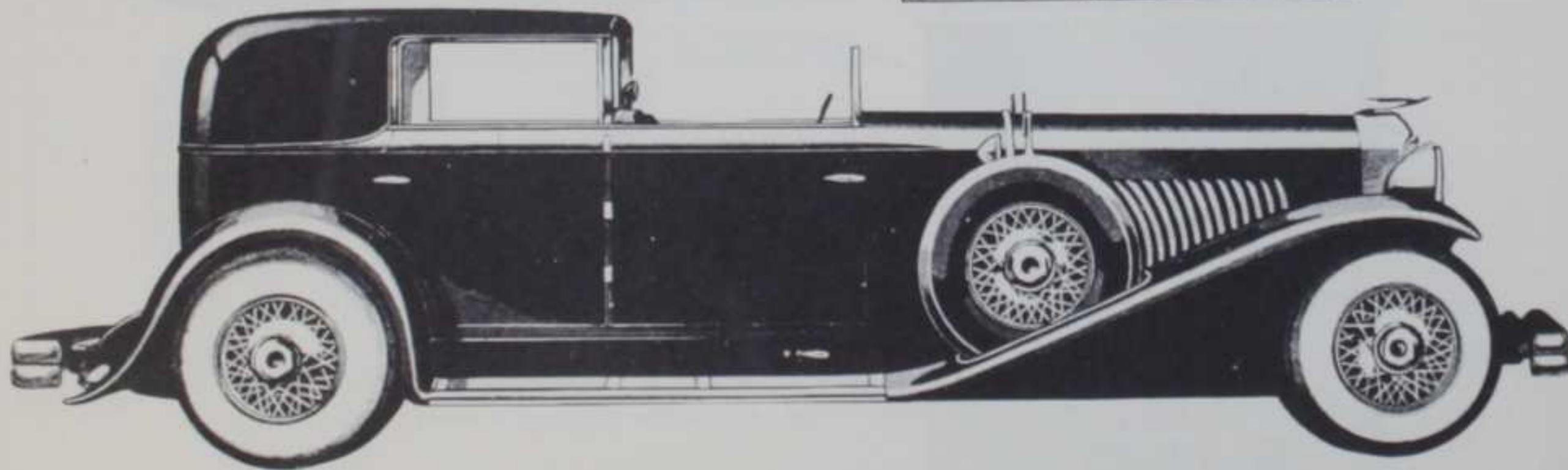
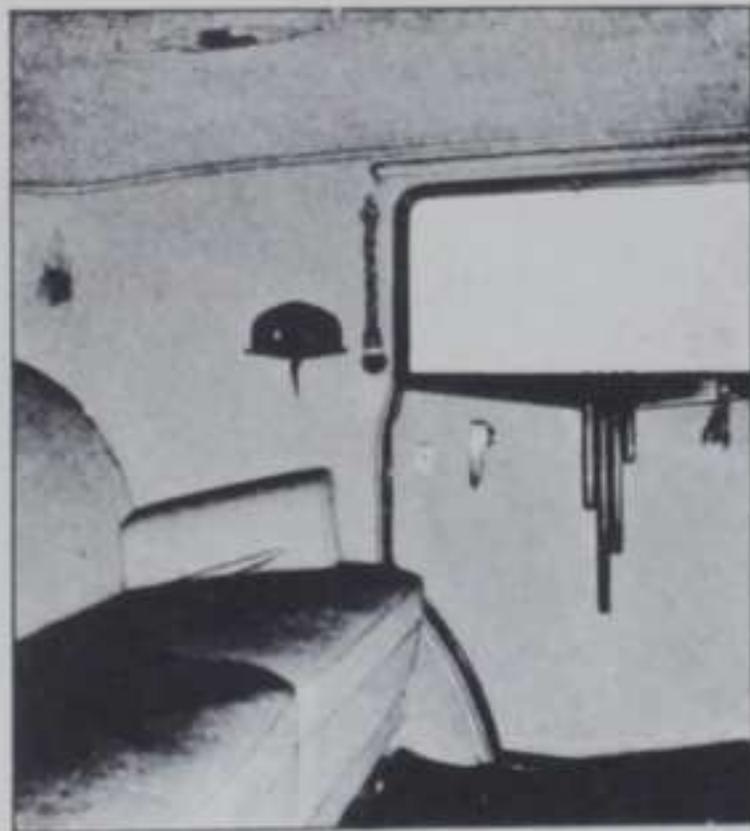
THE DUESENBERG LIMOUSINE

This model is designed especially for those desiring maximum comfort and exceptional headroom. It has high windows affording excellent vision. Large, high doors permit comfortable entrance. Body lines are of the square, formal type.



THE DUESENBERG TOWN LIMOUSINE

Unusual features of this model are long, low, rakish lines; exceptional vision due to thin, duraluminum corner posts; modernistic interior; harmonizing hardware and lights; ebony woodwork; two rear-facing occasional chairs.



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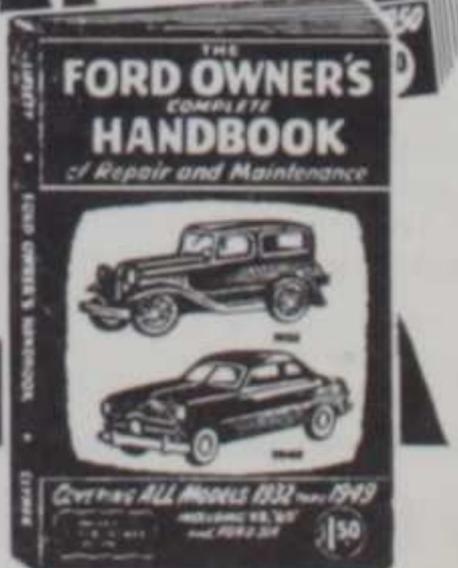
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