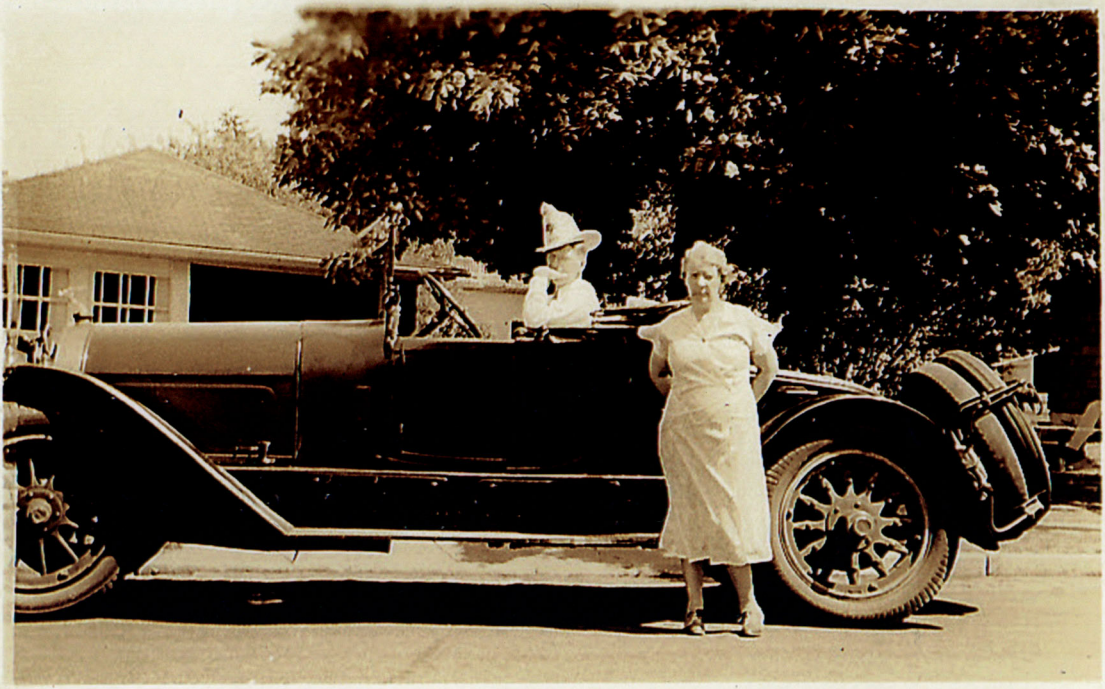
Instruction Book

Locomobile

Pleasure Cars



INSTRUCTION BOOK

FOR

LOCOMOBILE

(Six-Cylinder)

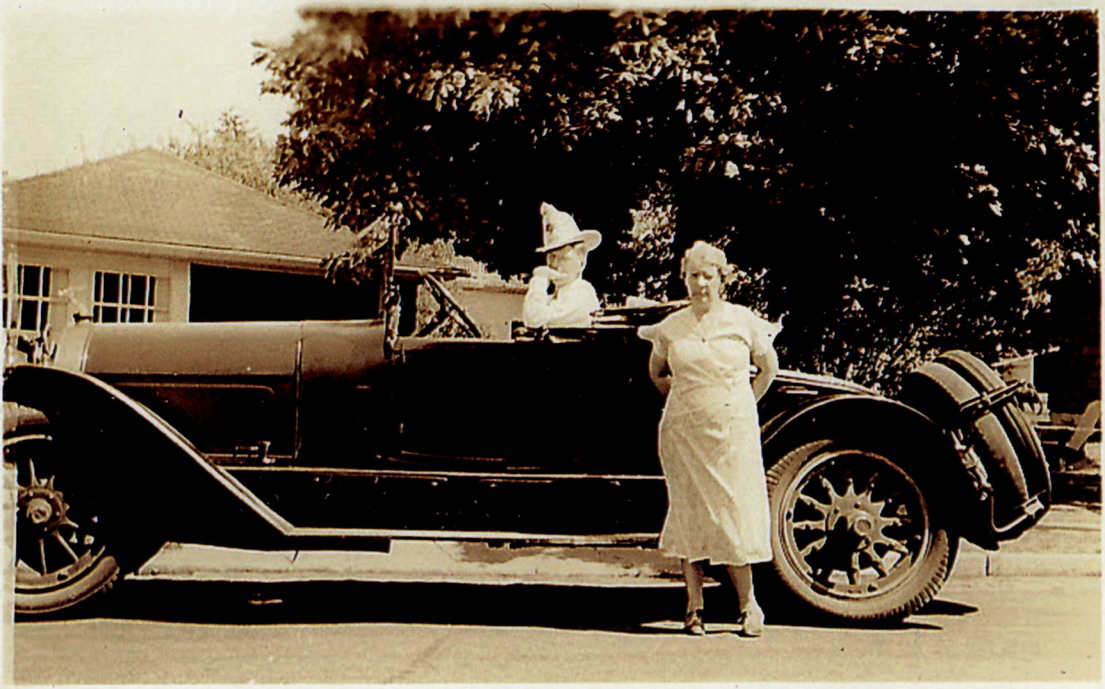
CARS

The 38 Locomobile, Type R 6
The 48 Locomobile, Type M 6

The Locomobile Company
of America

BRIDGEPORT, CONNECTICUT, U.S.A.

Branches:
New York Boston Chicago San Francisco Philadelphia
Washington Baltimore Pittsburgh Minneapolis
St. Louis Atlanta Oakland Los Angeles
Kansas City Seattle



PREPARED BY
ADVERTISING DEPARTMENT
LOCOMOBILE COMPANY OF AMERICA

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Bridgeport, Connecticut

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LOCOMOBILE INSTRUCTION BOOK

SIX-CYLINDER "38" AND "48"

PLEASURE CARS

CHAPTER ONE

LUBRICATION OF MOTOR AND ITS AUXILIARIES

Every Day or Every 250 Miles.

The Oil Level in the engine should be kept at a proper height. Once every day, or when running continuously, every 250 miles, fill the engine through the front breather pipe, pouring the oil in slowly and stopping when the oil begins to flow out of the levelling petcock on the right side of the engine.

When empty it will take 7 quarts to fill the "48" H.P. engine to its proper level, and 6 quarts to fill the "38" H.P. Fill the engine preferably when warm.

The Petcock Handle should be at right angles to the petcock when closed. Be sure the petcock does not become plugged up. It may be cleaned with a piece of wire.

The Water Pump has two grease cups *11*. These should be filled with mutton tallow, beef tallow or a pure heavy mineral grease. Turn down these cups every day.

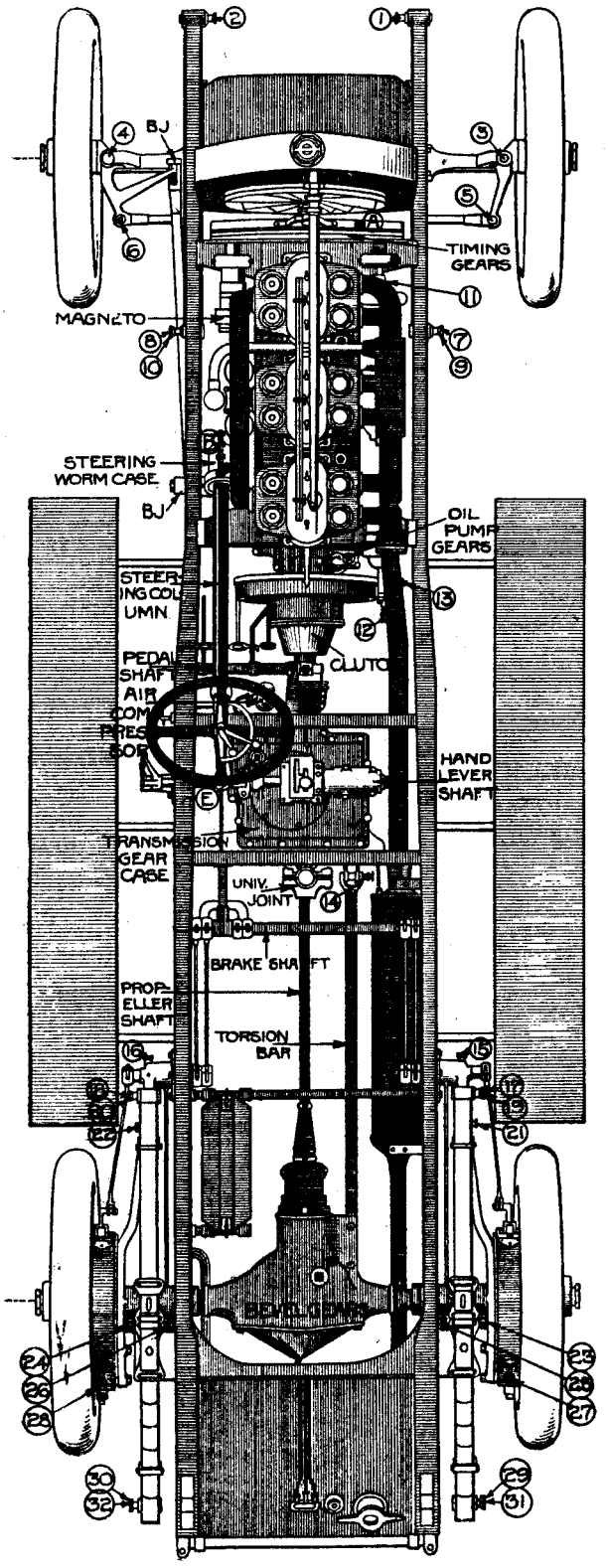


Fig. 1.
Oiling Diagram

The "38" Type R6
The "48" Type M6

See Key on opposite, preceding and the following pages

This diagram, with full oiling instructions, is issued in a larger size, suitable for hanging up on the wall of the garage, where it can be referred to readily.

Every 1,000 Miles.

The Generator has two oil cups. These should receive five or six drops of oil every 1,000 miles.

The Starting Motor has two oil cups which should receive four or five drops of oil every 1,000 miles.

There are two grease cups (*12* and *13*) on the starting motor gear case, one on the splined countershaft, and one on the gear shift fork bracket. Keep these filled with grease and turn down once a week.

Every 2,000 Miles.

Every 2,000 Miles the oil should be drained off and the system cleaned (*see Chapter on Maintenance, page 57*). Refill with fresh oil and put a pint of oil into the timing gear case. An oil plug *A* is provided for this purpose.

The By-Pass Valve should be kept along the pipe (*open*) for all normal running, *except:*

1. After bearings have been taken up, in which case run about 100 miles with the valve across the pipe.

2. If continuous heavy grades are to be encountered, or soft roads where pulling is hard for a long period.

3. If it is desired to clear the piping of some slight obstruction.

The Oil Gauge shows slight pressure at high speed when the by-pass is open. The pressure is considerably increased when the by-pass is closed.

The Magneto has two oil cups which should receive five or six drops of oil every 2,000 miles.

The Air Compressor should be drained of its oil and refilled once every 2,000 miles. A drain plug is located in the bottom of the pump. The oil is poured in through the oil vent in the side of the pump until it overflows.

Once a Season.

The Fan Bearings should be packed with grease at the beginning of each season. This is done by unscrewing the cap on the back of the bearing, filling the cavity with grease and replacing the cap.

The Oil Pump Gear Housing should be packed with grease once a season through plug *C*.

LUBRICATION OF THE TRANSMISSION SYSTEM.

The Clutch is of the dry plate type, and, therefore, requires no lubrication.

Every 2,000 Miles.

The Transmission Case holds 7 quarts of grease. A stand pipe overflow is provided for determining the proper level. About once every 2,000 miles add grease through plug *E* and bring it up to the proper level.

Every 5,000 Miles.

The Rear Axle should be drained every 5,000 miles and refilled with 5 quarts of grease. This takes care of the differential, bevel driving gears and ball bearings.

Twice a Season.

The Wheels should be lubricated about twice a season. This is done by removing the hub-cap, packing it with grease and screwing it down again.

Once a Season.

The Clutch Brake ball bearing should be packed with grease once a season. To do this, the split collar which the clutch fork acts upon should be removed and the bearing packed. Once a season should be sufficient.

The Clutch Universal (*T. U.J.*) which is between the clutch and transmission should be packed with grease once a season. Remove the split housing, pack with grease and replace.

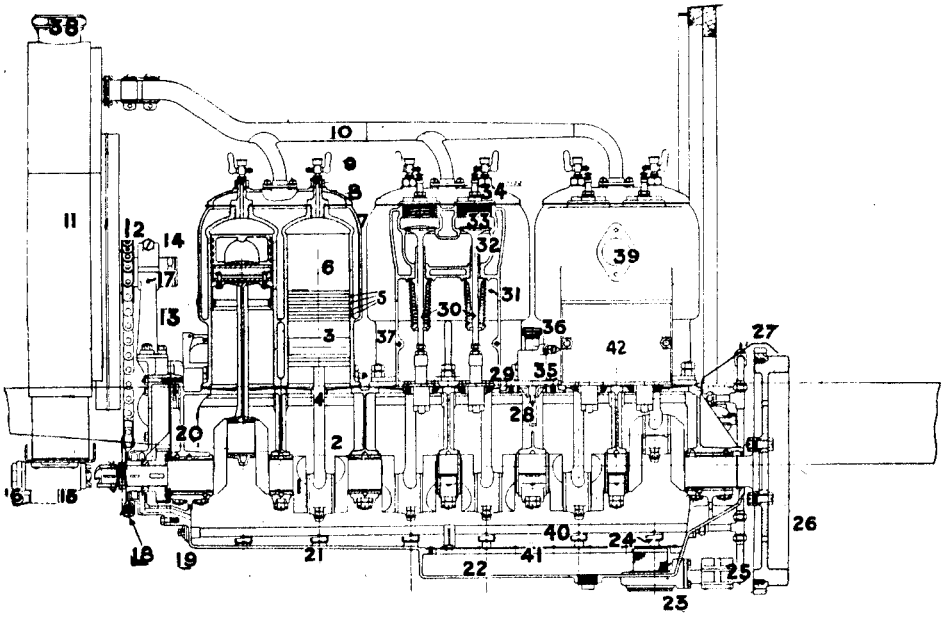


Fig. 2. SIDE ELEVATION OF MOTOR

1. Crank Shaft.
2. Connecting Rod
3. Piston
4. Baffle Plate
5. Piston Rings
6. Cylinder
7. Water Jacket
8. Cover Plate
9. Pet Cock
10. Water Discharge Pipe
11. Radiator
12. Fan
13. Fan Bracket
14. Fan Bracket Adjusting Nut
15. Starting Crank Socket
16. Starting Crank Socket Cover
17. Fan Belt
18. Fan Pulley
19. Drain Oil Trough Supply Pipe
20. Gear Case
21. Engine Oil Pan
22. Sump
23. Strainer Plug
24. Connecting Rod Oil Trough
25. Oil Pump
26. Fly Wheel
27. Oil Bypass Valve
28. Oil Supply Pipe Main Bearing
29. Valve Tappet
30. Valve Spring
31. Valve Stem Guide
32. Valve
33. Valve Cap
34. Spark Plug
35. Air Pressure Pump
36. Check Valve
37. Hot Air Pipe Carburetor
38. Radiator Filler Cap
39. Intake Port
40. Oil Supply Pipe to Troughs
41. Sump Baffle Plate

The Universal Joints (*P. U.J.*) should be packed with grease once a season.

LUBRICATION OF THE CONTROLLING MECHANISM

Every Day.

The Steering Tie Rod and Steering Pivots should receive attention every day. They are lubricated by grease cups *3*, *4*, *5* and *6*, respectively, which should be kept filled and turned down one full turn every day.

Once a Week or Every 500 Miles.

The Brake Shoe Supporting Bracket should be oiled once a week. Oil cups *27* and *28* are for this purpose.

Every 1,000 Miles.

The Spark and Throttle Levers on the steering column should be given a few drops of oil on the fixed ends once every 1,000 miles.

The Steering Column and **Carburetor Air Valve** regulating collar should be oiled freely every 1,000 miles.

The Brake Shaft Equalizers, the brake rod jaws and intermediate brake rod jaws should be oiled freely every 1,000 miles to prevent rust and provide the slight lubrication required.

Every 2,000 Miles.

The Steering Worm Gear Case should be filled with grease every 2,000 miles through plug *B*. About a pint is required to fill the case.

The Ball Socket Universal Joints (*B.J.*) at each end of the steering connecting rod should be repacked with grease once in every 2,000 miles, or in sandy country more frequently, as may be found necessary. It is necessary to remove the leather covers and clean both covers and universal joints when this is done.

The Foot Pedal Shafts are concentric. Oil holes are provided for lubricating, and these should receive a thorough oiling every 2,000 miles.

The Hand Lever Shaft is provided with oil holes for lubricating. These should be oiled freely every 2,000 miles.

The Brake Shafts and intermediate brake shafts operate in anti-friction graphite bushings and require no lubrication.

Once a Season.

The Screw and Nut Device which operates the spark advance and the throttle, and which will be found at the base of the steering column, should be packed with grease once a season. The housing containing this mechanism has a cover which is readily removed to permit this.

LUBRICATING THE CHASSIS

Every Day.

Grease Cups *1*, *2*, *7* to *10*, *17* to *20*, *29* to *32*, should be given a full turn every day and kept filled.

Every Other Day, or Every 500 Miles.

Grease Cups *15*, *16*, *21* to *26* should be given a full turn every other day or about once in 500 miles, and kept filled.

SUMMARY

Every Day.

Grease Cups *1*, *2*, *7* to *10*, *17* to *20*, *29* to *32*, should be given a full turn every day and kept filled.

Every Other Day.

Grease Cups *15, 16, 21* to *26* should be given a full turn every other day, or about once in 500 miles, and kept filled.

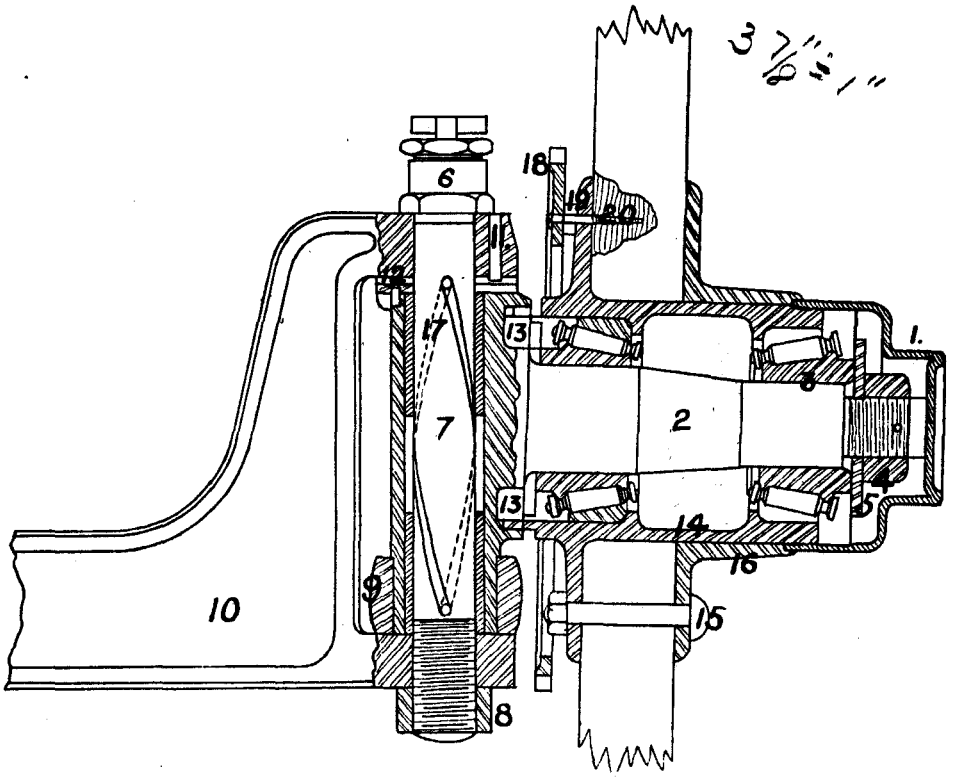


Fig. 3. FRONT HUB

1. Hub Cap
2. Steering Pivot
3. Roller Bearing Cone
4. Retaining Nut
5. Retaining Washer
6. Grease Cup
7. Steering Head Bolt
8. Steering Head Nut
9. Steering Arm
10. Front Axle
11. Front Axle Dowel Pin
12. Front Axle Steering Head Washer
13. Felt Washer
14. Front Hub
15. Spoke Bolt
16. Hub Flange
17. Grease Groove
18. Speedometer Gear
19. Spacing Washer for 18
20. Wood Screw for 18

Steering tie rod and steering pivots should receive attention. Water pump grease cups turned down.

Brake shoe supporting bracket should be oiled.

Twice a Season.

The wheels should be lubricated.

Every 250 Miles.

Fill oil reservoir in engine.

Every 1,000 Miles.

The Generator should be oiled.

The Starting Motor should be oiled.

Grease cups on starting motor gear case should be turned down.

Spark and Throttle levers should be oiled.

Steering Column and Carburetor air valve regulating collar oiled.

Brake Shaft equalizers should be oiled freely.

Every 2,000 Miles.

Oil should be drained off and system cleaned.

Magneto should receive 5 or 6 drops of oil.

Air Compressor should be drained of oil and refilled.

Add grease to transmission.

Steering Worm Gear Case should be packed with grease.

Ball and Socket universal joints at each end of steering connecting rod repacked.

Foot Pedal shafts thoroughly oiled.

Hand Lever shafts thoroughly oiled.

Every 5,000 Miles.

The Rear Axle should be drained and refilled through plug *F*.

Once a Season.

The fan bearings should be packed with grease.

Oil Pump Gear housing should be packed with grease.

Clutch brake ball bearing should be packed with grease.

Clutch universal between clutch and transmission should be packed with grease.

Universal joints packed with grease.

Screw and Nut at base of steering column should be packed with grease.

LUBRICANTS, GENERAL REMARKS

Oils.

Our Engineering Department is continuously experimenting with oils and greases, endeavoring to enlarge the list of approved lubricants for our customers. We also keep a check on those already approved to insure the maintenance of proper standard of quality.

The qualities requisite for a satisfactory gas engine oil are based on a compromise between its various physical properties.

The viscosity should be sufficient to give good lubrication at the highest probable temperature of the bearings and cylinder walls.

The viscosity should not be too great at ordinary temperatures to obstruct the free flow of oil through the piping system.

The oil should not show too low a flash or fire test, as it will burn off the walls of the cylinders too rapidly and the consumption of oil will be high and lubrication of the pistons and cylinders inadequate. An exceedingly high flash and fire test is undesirable as such an oil accumulates carbon rapidly in the combustion space and shows a tendency to plug up the piping system and strainer.

The oil should be as low as possible in carbon residue when distilled slowly to destruction in a retort. This quality insures its burning away from the cylinders cleanly and leaving no carbon behind.

The chill point should be as low as possible, although we expect our customers to safeguard the car against freezing and excessively low temperatures.

The specific gravity is a check on the density of the oil, and has little or no value as an additional means of identification. The above named properties are independent of it.

In general, avoid the use of heavy oils in Locomobile engines; that is, Baumé 26.5 or below.

We have adopted for our engine oil characteristics the following specifications:

Viscosity at 100°, 175–250 seconds, Saybolt.
Viscosity at 210°, 41–52 seconds, Saybolt.
Flash Point, 325° F. to 425° F.
Fire Test, 375° F. to 540° F.
Carbon residue not over .5% distilling 1½ oz. to destruction in three hours' time.
Chill point, 8° F. or below.
Baumé, between 26.5 and 31.

In such places as magneto bearings, generator and starting motor ball bearings, the oil acts as a rust preventative; not as a lubricant. In such places engine oil may be used or a light spindle oil.

Greases.

Gear greases should be free from acids or soapy matter. They should show as low a chill point as possible and retain their viscosity at working temperatures. Wherever they are used in ball bearings they should be free from any suspended matter such as cork or asbestos. Certain grades of graphite greases are permissible, as recommended hereafter. The grease should show a marked tendency to build up on the gears and not cling to the sides of the case. It should have as high specific heat as possible, and low internal friction. This last is very important as it determines whether the temperatures of the grease in operation will be low or high, and whether the friction losses in the gears will be large or small.

Cup Greases.

These should be free from acids, alkalies and soapy matter. They should be fairly plastic at very low temperatures and should run at the highest temperatures to be encountered under working conditions. They may contain various grades of graphite. Cup greases are used where there is small relative movement and high pressures, or where service is intermittent and continuous lubrication not required.

LIST OF APPROVED LUBRICANTS

Oils for Engines and General Lubrication.

The following Lubricants have been given an exhaustive test at the factory, and are recommended for use on Locomobile Cars:

Russian White Heavy, Geo. A. Haws Co., 142 Front St., New York City.

Speares Diamond White, Alden Speares Sons Co., 140 Sixth St., Boston.

Sonnenborn's No. 4, No. 5 and Amalie White Russian, L. Sonneborn Sons, Inc., Fulton and Pearl Sts., New York City.

Mobiloil "E", Vacuum Oil Co., 61 Broadway, New York City.

Oil for Magneto, Generator and Starting Motor Bearings.

"Three in One," or some good light spindle oil or engine oil as listed above.

Greases for Rear Axle, Wheels, Transmission, Universal Joints, Steering Mechanism, Etc.

Lubroleine Medium, Fiske Bros. Refining Co., 24 State St., New York City.

Dixon's No. 1 Cup Grease, Jos. Dixon Crucible Co., 68 Reade Street, New York City.

Whitmore No. 1, Whitmore Mfg. Co., Cleveland, O.

Whitmore No. 2, Whitmore Mfg. Co., Cleveland, O.

K-00, N. Y. & N. J. Lubricant Co., 165 Broadway, New York City.

Cup Greases.

For all places where grease cups are provided.

Gredag, International Acheson Graphite Co., Niagara Falls, N. Y.

CHAPTER TWO

MECHANICAL CONSTRUCTION

Generation of the Power.

The power is generated by a six-cylinder engine of the four cycle type (*see Fig. 2, page 15 and Fig. 5, page 28*). The T head type of construction is used with tungsten steel valves on opposite sides of the cylinder. The bore and stroke of the "48" is 4½"x5½". Of the "38," is 4¼"x5".

The maximum horsepower developed is 82.5 for the "48", and 65.5 for the "38". (*See horsepower curves in Chapter 5.*) The engine is of the medium high speed type. By this we emphasize the fact that while Locomobile motors can easily operate at speeds of over 2,000 r.p.m., the construction of the reciprocating parts, crankshaft and bearings have not been lightened to the point where they would fail under any amount of heavy duty work, such as hard pulling at low speed with wide open throttle.

Cylinder

The cylinders are of close grained grey iron, bored and ground to a perfect finish. They are cast in pairs with the valve chambers on opposite sides of the head. The volume of the combustion space in each cylinder is carefully calibrated to insure each cylinder developing the same power. It is 26% of the total volume of the cylinder when the piston is at the bottom of its stroke.

Pistons

The pistons are grey iron castings, ground to proper size and perfect finish. They are fitted with four compression rings at the top, machined from individual castings and ground to a perfect finish. There is an extra ring at the bottom of the piston to prevent excess of oil passing the piston and causing smoking. The wrist pins are of case hardened alloy steel, ground to a finish, and are a drive fit into the piston bosses where they are prevented from turning by two

studs. The wrist pin bears in a bronze bushing in the connecting rod.

Connecting Rods

The connecting rods are drop forgings of chrome nickel steel, heat treated. The crank pin bearings are bronze boxes lined with babbit metal. Heavy steel shims are placed between the upper and lower halves of the boxes to prevent the boxes from turning.

Crankshaft

The crankshaft is a special nickel steel forging, machined and ground to a finish. There are seven bearings. This construction gives great stability, balance and freedom from whipping action. The six-cylinder engine to date is the only multiple cylinder engine commercially successful which has a perfect balance. This is an inherent property of a six-cylinder engine. This balance is ideal and is only attained when the crankshaft, connecting rods and pistons are carefully corrected as to weight and center of gravity. The pistons are all chosen in sets of six, all weighing the same. The connecting rods are balanced in sets of six and the center of mass of each rod in the set must be in the same position as its mates. The crankshaft is given a running balance. The result is a smooth even-running motor, free from vibration.

Balance

Crankcase

The crankcase is a bronze casting of great strength and toughness. The engine support brackets are cast integral with the crankcase. Four point suspension is used, as it gives stability to the entire front end of the chassis.

Bearings

The main bearings are supported from the case by chrome nickel steel studs. These bearings are carefully scraped in by hand. They are bronze boxes, lined with babbit and of sufficient surface to give long life under the severest conditions of load and speed.

Camshaft

The camshafts are chrome nickel steel forgings, the cams being integral with the shafts. The exhaust camshaft is 1⅛″ in diameter; the admission ⅞″. They are supported by five large bronze

bearings. The cams are hardened by a process developed by us which leaves the surface hard and the inner structure tough.

The camshaft gears are of the helical tooth type, made from special material. They are cut with extreme care and the qualities of the material employed are such that they improve with use, the surfaces of the teeth attaining a glass-like hard finish. The camshaft gears are driven by an alloy steel pinion on the crankshaft. The water pump shaft gear and magneto shaft gear are driven by the camshaft gears. They are of chrome nickel steel. The selection of material and type for these gears gives the best results obtainable for quietness and long life, and is the result of long and careful experiment.

Valves

The valves are of tungsten steel, of very large diameter. They are carefully ground to a true seat at the factory. They will not warp or pit under extremely severe usage.

The tappets are of alloy steel and they operate in a bronze guide. The rollers are of case hardened steel, operating on hardened pins. The tappets are adjustable for clearance under the valve stems. This clearance is nominally .008" on the exhaust side and .004" on the admission side.

The valve tappets, valve stems and springs are enclosed in an aluminum housing for protection against dirt, water, etc., and to reduce whatever slight noise there may be to a minimum.

Oil Pan

The lower portion of the crankcase is an aluminum casting which closes in crankshaft and bearings. It is firmly bolted to the upper half of the crankcase. This casting is known as the engine oil pan. It contains the oil pump, oil reservoir or sump and troughs for lubricating the connecting rods.

CONSTRUCTION

Oiling System.

The motor is lubricated by a combined low pressure feed and splash system. The oil sump in the rear of the aluminum engine oil pan, *Fig. 4*, holds about 7 quarts of oil for the

"48" and about 6 quarts for the "38" engine. The oil pump is of the gear type, positive in its action, operates below the surface of the oil in the sump and is, therefore, always primed. The oil intake to the pump is through a removable strainer *2*. The discharge from the pump is carried away through a pipe *5* which branches, one branch *6* passing along the bottom of the engine oil pan and supplying the six troughs for splash lubrication; the other branch *8* passes along the upper half of the crankcase and branch pipes lead from it to each of the main bearings. This same branch also feeds oil direct to the magneto and pump shaft bearings.

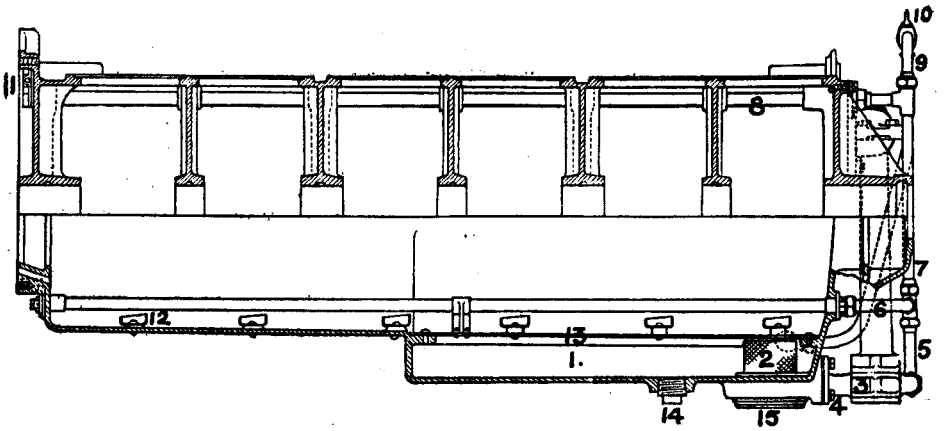


Fig. 4. THE OIL PAN

1. Sump or Reservoir
2. Strainer
3. Pump
4. Pump Supply Pipe
5. Delivery Pipe
6. Supply Pipes to Troughs
7. Supply Pipe to Main Bearings and Overflow
8. Supply Pipe to Main Bearings
9. Oil Bypass
10. Bypass Valve
11. Oil Feed to Magneto and Pump Pinion Bearings
12. Troughs for Connecting Rod
13. Removable Baffle Plate
14. Drain Plug
15. Strainer Plug

The pressure of the oil on the main bearings is controlled within certain limits by the bypass valve *10*. When this is open as in ordinary running, the only pressure on the oil is the gravity head due to the oil bypass pipe. When the valve is closed all the oil delivered by the pump is sent through the pipes to the various troughs and bearings and the pressure varies considerably with the speed.

The surplus oil delivered to the pump and magneto shaft bearings is thrown off by a suitable flange, gathered again and drained back to the oil sump.

The connecting rods have a small scoop which dips a predetermined amount (1/8") into the troughs. The rods are lubricated in this manner. The surplus oil thrown out by the scoops is dissipated all over the inside of the crankcase, lubricating the pistons, wristpin and camshaft bearings, valve tappets and rollers. The surplus drains back to the oil sump.

Baffle plates are placed in the bottom of each cylinder to reduce the opening through which the oil reaches the cylinder walls. This prevents too copious a lubrication of the piston and consequent smoking of the exhaust, high rate of oil consumption and rapid carbonizing of the combustion space.

A large baffle plate covers the oil sump and prevents the flooding of the front end of the motor when going down a steep grade.

THE FUEL SUPPLY SYSTEM

The fuel tank holds 30 gallons of gasoline. It is hung from the rear of the chassis and is readily accessible for refilling. The tank is made of heavily galvanized sheet steel.

Tank

It is fitted with an accurately calibrated guage which tells how much fuel is in the tank. The filler cap is a heavy forging which will stand any amount of hard usage. It contains a leather gasket which makes an air tight joint with the filler spout. There is a fine mesh strainer in the filler spout to prevent impurities and solid matter getting into the tank. There is a blow off plug at the bottom of the tank. This plug is in a settling pocket where water in the fuel will settle and may be drained off.

The piping from the tank to the carburetor and pump is soft, seamless tubing, to which all fittings are brazed.

Piping

The piping is carried forward under the left side member of the frame. It is made up into sections so that it can be readily taken off without disturbing any other part of the car.

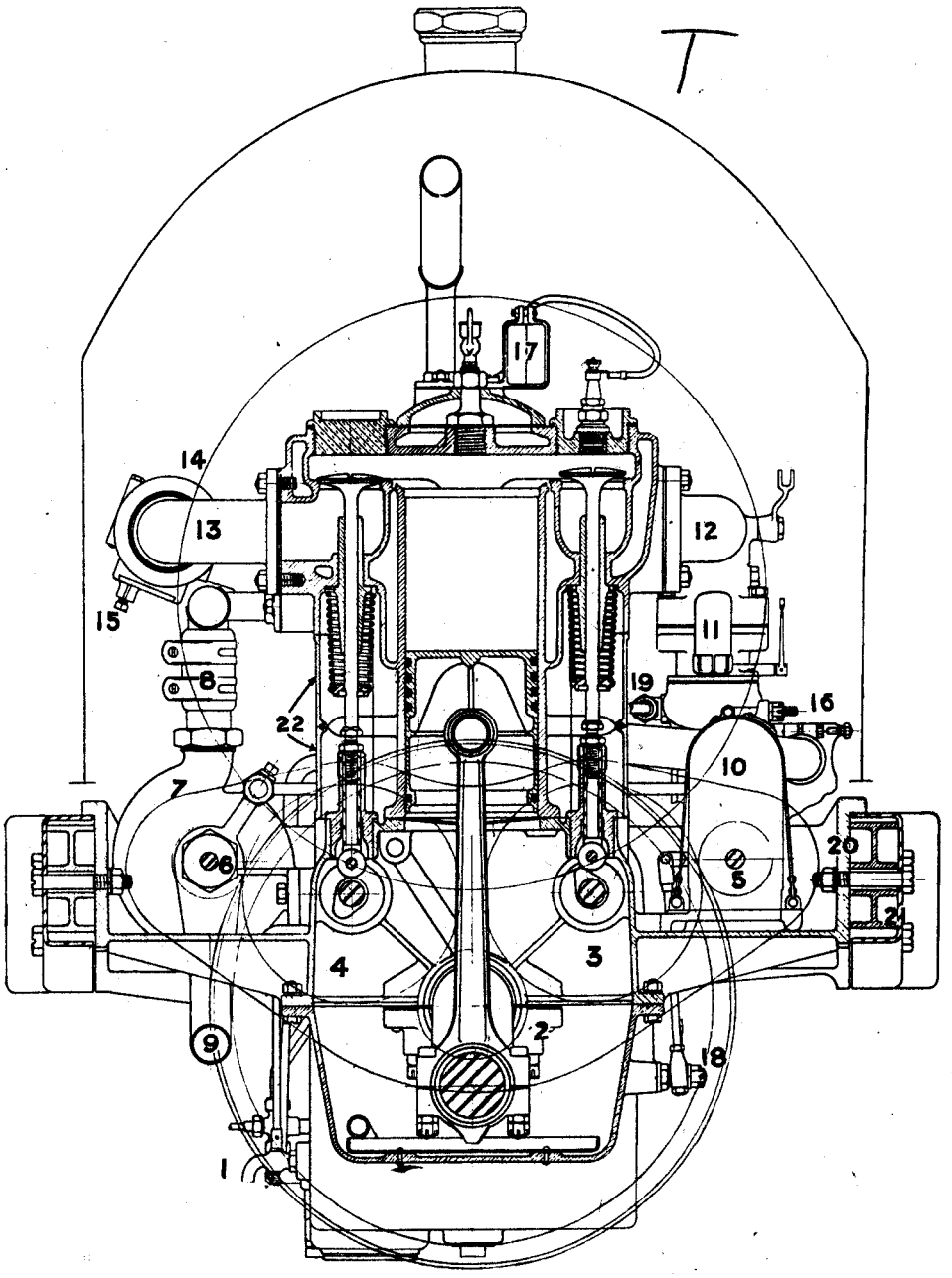


Fig. 5. CROSS SECTION OF MOTOR

1. Oil Level Pet Cock
2. Crankshaft Pinion
3. Intake Camshaft Gear
4. Exhaust Camshaft Gear
5. Magneto Driving Pinion
6. Pump Driving Pinion
7. Water Pump
8. Cylinder Water Supply Pipe
9. Water Pump Supply Pipe
10. Magneto
11. Carburetor
12. Intake Pipe
13. Exhaust Pipe
14. Hot Air Stove for Carburetor
15. Damper
16. Hot Air Regulating Valve
17. Cable Tube
18. Spark Advance Lever
19. Hot Water Supply to Carburetor
20. Engine Supporting Bracket
21. Frame

The fuel air pressure pump is mounted on the engine crankcase and is driven by an eccentric on the camshaft.

Pump

The pump is single acting and is lubricated from the crankcase. It can be entirely dismounted without disturbing any other part of the engine. The check valve on the pump is of the air brake type in which the valve action is made more rapid and positive by means of a piston attached to it and acted upon by the pressure in the pump discharge pipe.

Regulator

An adjustable regulator or relief valve is set in the air pressure line from the pump to the tank, the purpose of which is to limit the pressure on the fuel. This valve is set to hold 2 pounds pressure. An air pressure gauge on the dash shows the pressure in the tank at all times.

Hand Pump

A hand air pressure pump is provided for raising the pressure when starting. The handle of the pump may be locked in the "In" position by giving it a turn when at the bottom of its stroke. The piping system is made so well that it will readily hold its pressure for from 24 to 48 hours at the time when the car leaves the factory.

THE CARBURETOR

Fuel Valve. A globe valve is provided at the carburetor float chamber, to permit shutting off the fuel supply.

Float

The fuel first enters a settling well in the base of the carburetor float chamber. Here any impurities will settle and be filtered out by the strainer *2*, see *Fig. 17*, page 60, which may be removed from time to time for cleaning. The flow of the fuel to the float chamber is controlled by a float *4* and a needle valve *3*. The float is of spun copper, carefully made as to weight and volume. The needle valve is of non-corrodable metal and the valve and seat are designed to prevent surging of the fuel into the float chamber and to obtain a steady flow. The level of the fuel in the float chamber is care-

fully determined and set at the factory. The end of the needle valve is protected by a cap which may be removed when it is desired to try the needle valve. The gasoline passes through the passage *7* to the atomizer nozzle. This nozzle is really of the double jet type. The low speed holes are drilled just at the point where the throat of the carburetor is narrowest. The high speed jet is located in the top of the nozzle. These holes are drilled with extreme care and should never be tampered with. The nozzle is easily removed.

Atomizer Nozzle

The venturi tube or throat is removable. The diameter and shape of this throat have been carefully worked out and should not be altered.

Venturi

The main air supply enters the base of the carburetor and is supplemented by air from a compensating air valve, which is designed to hold a correct mixture over all ranges of speed and load. This valve is controlled by two springs, one of which *14* operates at low speed and the other *16* operates at intermediate and high speed. These springs are made and calibrated with care. They are adjusted before leaving the factory. The mixture may be made richer or leaner to meet changes in atmospheric conditions by means of the lever *18* which controls the tension of both springs. Any further adjustment if required should be made in accordance with the directions given in the chapter on Adjustment and Maintenance.

Air Valve

The carburetor is fitted with a butterfly throttle valve for controlling the engine. This valve can be operated either by a lever on the steering column or by the foot accelerator. A screw is provided on the carburetor for adjusting the idling position of the throttle valve.

The main air supply can be either hot or cold as desired. A stove or heater is placed on the exhaust manifold and the air is led through a brass pipe to the shutter *25* on the carburetor main air intake. The shutter may be manipulated to secure any combination from all cold to all hot air.

Heating Facilities

The atomizer body is water jacketed *12* as an additional means of securing perfect vaporization of the fuel. There are water pipes leading to the engine water jacket and pump to secure proper circulation of jacket water. The amount of water can be controlled by a valve on the water pump.

Water Jacket

Materials

The carburetor body and float chamber are bronze castings, the float is of spun copper and the needle of special alloy which is hard and will not corrode.

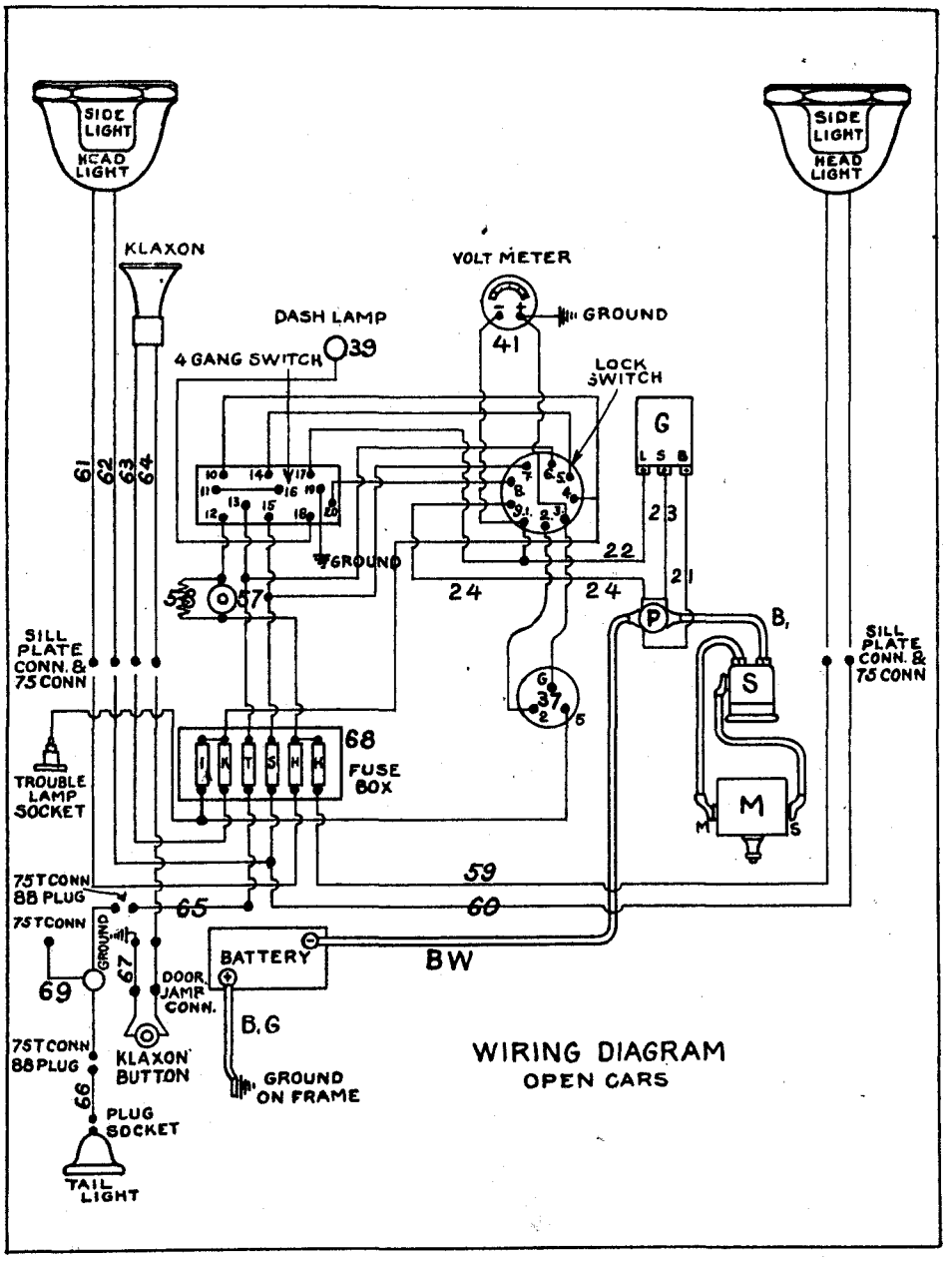
THE COOLING SYSTEM

All Locomobile engines are water cooled, with circulation by positively driven centrifugal pump (*see Fig. 18, page 63*). The water pump has a bronze casing and bronze impeller of ample capacity to insure circulation up to the full capacity of the system. The cylinders are jacketed with large water spaces to insure even temperatures. The radiator is of the honeycomb type. It is made of non-corrodable metal and has sufficient cooling surface to take care of the engine under all conditions on second gear and even on long pulls in low speed. The capacity of the cooling system is 7 gallons approximately for the "48" and 6 gallons for the "38". The radiator is supported in a pressed steel cradle, on rubber pads, at the bottom and held at the top by a tie rod attached to the body.

Pump

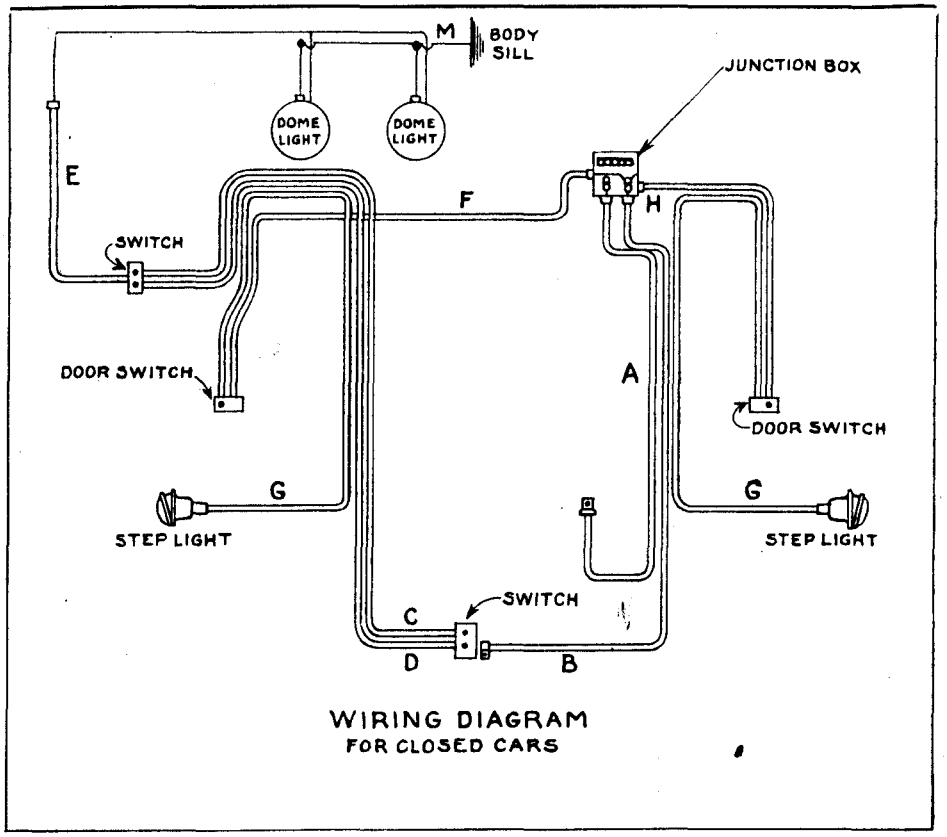
The fan is an aluminum casting. It is very strong and efficient. It is well balanced, a very important point in fan construction as the strains induced from even a slightly unbalanced fan are enormous at high speed. The fan is belt driven from the crankshaft. The tension on the belt is adjustable by means of the eccentric bushing supporting bracket which may be rotated to change the center distance of the fan pulley and main pulley.

Fan



Piping

The main water supply and discharge pipes are so designed that the distribution of water in the three cylinder castings is equal. A valve on the pump permits the draining off of all water in the carburetor without draining the engine cooling system, or disconnecting any pipes.



WIRING DIAGRAM
FOR CLOSED CARS

ELECTRIC LIGHTING AND STARTING SYSTEM

All 1915 Locomobiles are equipped with the Westinghouse Electric Lighting and Starting System, designed especially for the Locomobile (*see Fig. 6, page 34*).

Regulation

The regulation of the generator is automatic, no extra regulating device being required. It is accomplished by a differential winding of the field, and is magnetic, there being no moving parts required. The output curve of the generator is shown in Chapter 5, with and without lamps lit. The generators are made of such material that, as the generator gets warm the output is tapered down so that in summer when the high charging rate is not needed, the output is low, and in winter when it is needed, it is high.

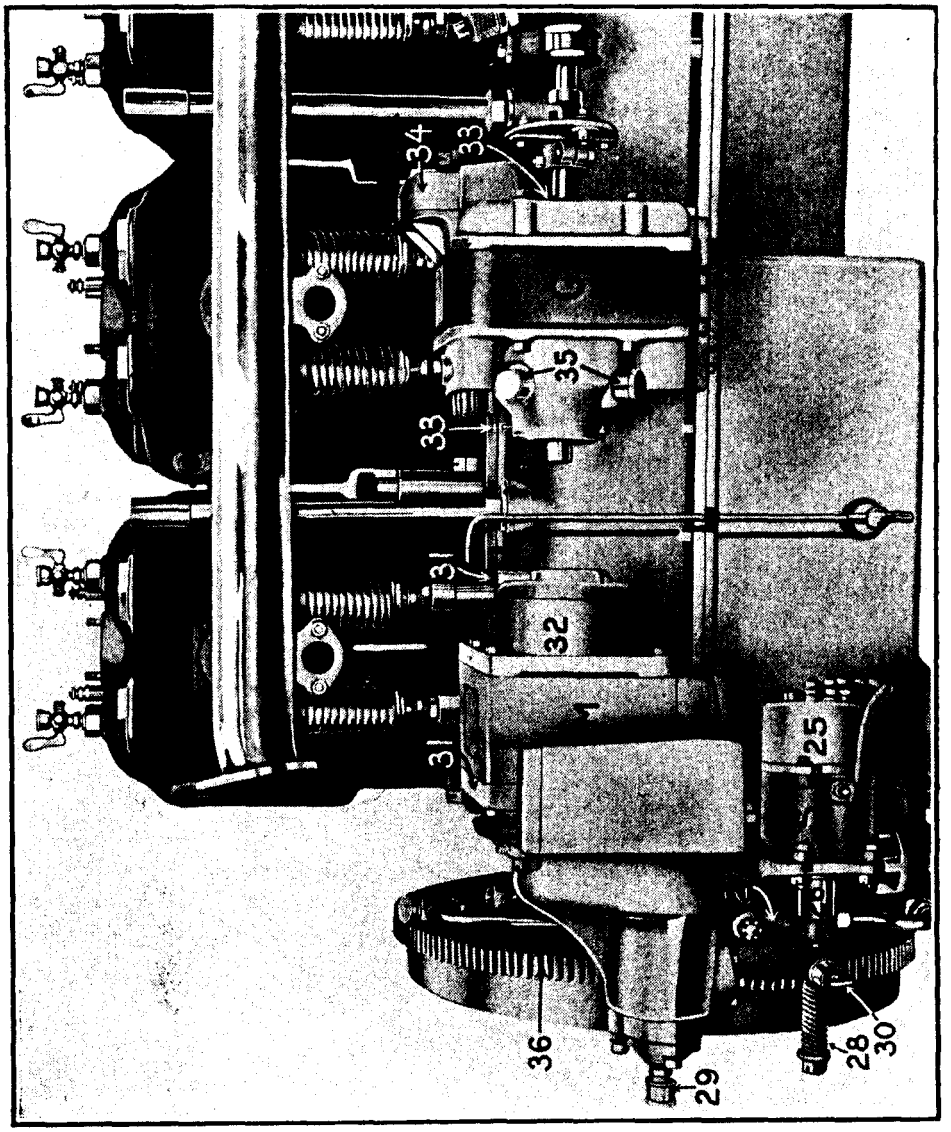


Fig. 6. APPLICATION OF ELECTRIC SYSTEM TO THE ENGINE

25. Switch Base
26. Iron Core
27. Core Shifting Fingers
28. Steel Spring
29. } Grease Cups
30. }
31. Starting Motor Oil Cups
32. Starting Motor Commutator Cover
33. Generator Oil Cups
34. Cutout Switch Cover
35. Generator Commutator Oil Cups
36. Flywheel Gear
M. Motor
G. Generator
S. Shift Switch

Wiring

The wiring is carried out on the single wire system, the wires being carried for the most part in a flexible metal conduit, both for protection and as an additional "ground" for the return current. The connectors are of special design so that the current will not pass through the springs in them or cause them to heat. Condensite insulation is used as it resists heat and will not warp, and for its mechanical strength.

Wiring Diagram. Referring to the wiring diagram and photographs the system will be clearer. The same numbers apply to the same parts in both the diagram and photographs.

Battery Ground Wires

One terminal of the battery, the **positive**, *BG*, is grounded on the frame side member. The negative lead *BW* passes along the right side member of the frame, forward to the primary relay switch *P* located beside the engine on the frame side member. The current for supplying the lighting system is taken through the wire *21* from the switch *P* to the *B-* terminal of the generator *G*, the current passing through the series field of the generator and out through the terminal *L* to the lead *22* and to terminal *1* on the lock switch.

Starting Motor Control

On the generator there is an extra terminal marked *S*, so connected to the cutout switch *34* of the generator that it has voltage only when the engine is running below 300 r.p.m. A wire *23* runs from this terminal to a magnetic coil in the switch *P*, from the coil a wire *24* runs to terminal *9* on the lock switch and out through terminal *8* to terminal *20* on the four gang dash switch and thence to the ground by way of terminal *19*. Now when the starting button is depressed, the current flows along the wires *23* and *24*, through the lock switch, closing switch *P*, which permits the current to flow through *B.* to the magnetic pinion shift switch *S*. In the magnetic pinion shift switch *S* is a powerful electro-magnet having a series or pull-in coil and a shunt or holding coil. The pull-in coil becomes

energized and pulls a soft iron core into the magnet winding; this core shifts the starting gear into mesh with the flywheel, just before the gear meshes; however, a small amount of current is allowed to flow through a resistance in the switch *S* and through the starting motor, which causes it to spin slightly, making the gears mesh more easily. When the gear is fully meshed a final contact is made in the switch *S*, whereby the hold-in coil becomes energized and the full starting current flows through *B* to the starting motor which turns the engine over.

Automatic Release

When the engine commences to fire and speed up, the voltage of the generator builds up and the cut-out switch closes, grounding the positive side of the generator. The instant this occurs, the wires *23* and *24* on the generator being grounded on both ends, cease to carry current to the primary relay switch magnet which allows the switch to open. This demagnetizes the magnetic pinion shift coil and a powerful spring *28* unmeshes the starting gear and opens the circuit in *S*. *A brake brings the starting motor gears to rest quickly.* An over-running clutch is provided which prevents the starting motor from being driven by the flywheel. It is apparent that no harm can result from leaving one's foot on the starting button when the engine speeds up, and no harm can result from depressing the starting button when the engine is running, unless the car should be throttled down below eight miles an hour.

Starting Motor

The starting motor is series wound, weighs 21 pounds and develops about .7 horsepower at 5.25 volts. It turns the "38" over at about 125 revolutions per minute and the "48" about 115 revolutions per minute, which is amply fast enough to start on the magneto.

Returning to the lighting system. The current is led to *1* terminal of the lock switch; when the lock switch is in the "On" position the current passes out through terminals *4* and *5*. From *4* the current goes to the headlight switch terminal *10* on the four gang dash switch and to the Klaxon and ignition fuses. From terminal *5* the current goes to

the side and tail light switch (*terminals 14, 11 and 16*) on the four gang dash switch. The dash lamp circuit *D* is not fuse but is connected to *1* terminal of the lock switch.

Lock Switch

Referring to the lock switch terminals, *1* is battery and generator feed wire and is the source of supply to the lighting system. *2* is connected to the terminal *2* on the Bosch coil. *3* is connected to the grounded side of the voltmeter (*positive*). *5* is connected to the side and tail light terminal on the four button lighting switch. *4* is connected to the headlight terminal on the four-button switch and to the Klaxon trouble plug and ignition fuse bus. *6* is connected to the tail lamp wire on the lamp side of the switch. *7* is connected to the side light wires on the lamp side of the switch. *8* is a continuation of *24* to the starting button. *9* is connected to the wire *24* from the primary relay switch magnet coil.

In the "On" position, *1*, *4* and *5* are connected so all the lights, horn and ignition are operative by the buttons of the four-button switch. *2* and *3* are not connected so the magneto is not grounded. *6* and *7* are not connected to the battery. *8* and *9* are connected so the starter can be used. In the "Day" position, *1*, *4* and *5* are disconnected so the horn, lights and ignition are cut out. *2* and *3* are connected, grounding the magneto. *6* and *7* are disconnected from *1* terminal. *8* and *9* are disconnected so starter cannot be used.

In the "Night" position, *1*, *4* and *5* are disconnected, *2* and *3* are connected, grounding the magneto. *6* and *7* are connected to the battery and hence current can flow direct to the side and tail lights, locking them on. They cannot be turned off by buttons *47* and *48* (*page 52*). *8* and *9* are disconnected so starter cannot be used. The Yale key can be withdrawn in all three positions thus locking the switch.

The Bosch switch, *37*, should ordinarily be left on the magneto position and the motor stopped with the lock switch. The engine will start on the magneto if the spark is put about two-thirds up the quadrant on the steering column. The base of the lock switch is standard and inter-

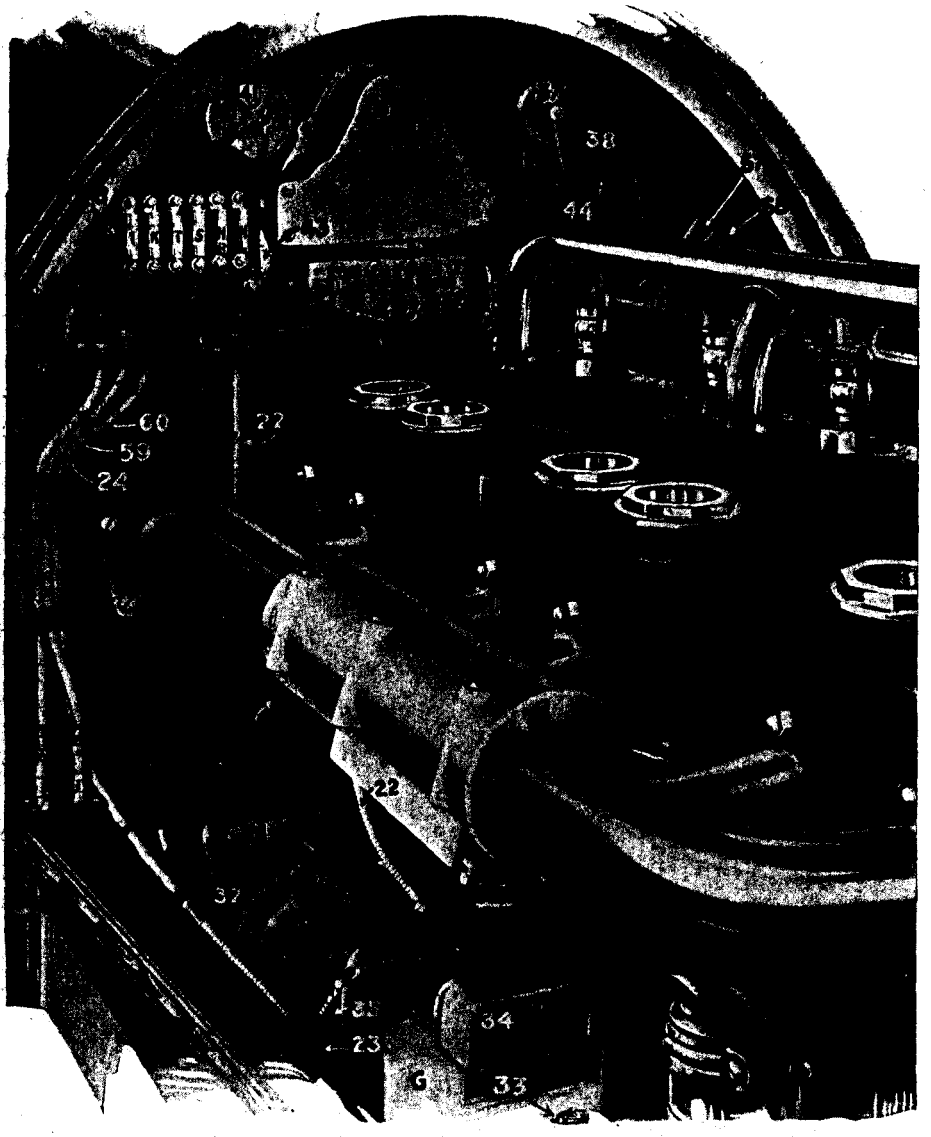


Fig. 7. ELECTRIC SYSTEM AND DASH EQUIPMENT

10. Headlight Switch Terminal
11. Tail Light Switch Bus
13. Tail Light Switch Terminal
14. Side and Tail Light Terminal
15. Side Light Terminal
16. Tail Light Bus
17. Dash Light Terminal
18. Dash Light Terminal
19. Connection to Ground
20. Starting Button Terminal
21. Battery Lead to Generator
22. Main Lead Generator and Battery to Dash
23. Lead Cutout Switch to Magnetic Coil
24. Lead Magnetic Coil to Lock Switch Terminal
32. Starting Motor Commutator Cover
33. Generator Oil Cup
34. Cutout Switch Cover
35. Generator Commutator Oil Cup
37. Bosch Switch
38. Gasoline Pressure Gauge
39. Dash Light
41. Voltmeter
43. Locking Switch
44. Hand Pressure Pump
57. Dimmer Switch
58. Resistance Coil for Dimming Headlights
59. Headlight Lead
60. Primary Relay Lead
68. Fuse Block Base
I. Ignition and Trouble Fuse
K. Klaxon Fuse
T. Tail and Body Lamp Fuse
S. Side Light Fuse
HR. Headlight (Right) Fuse
HL. Headlight (Left) Fuse
M. Starting Motor
G. Generator

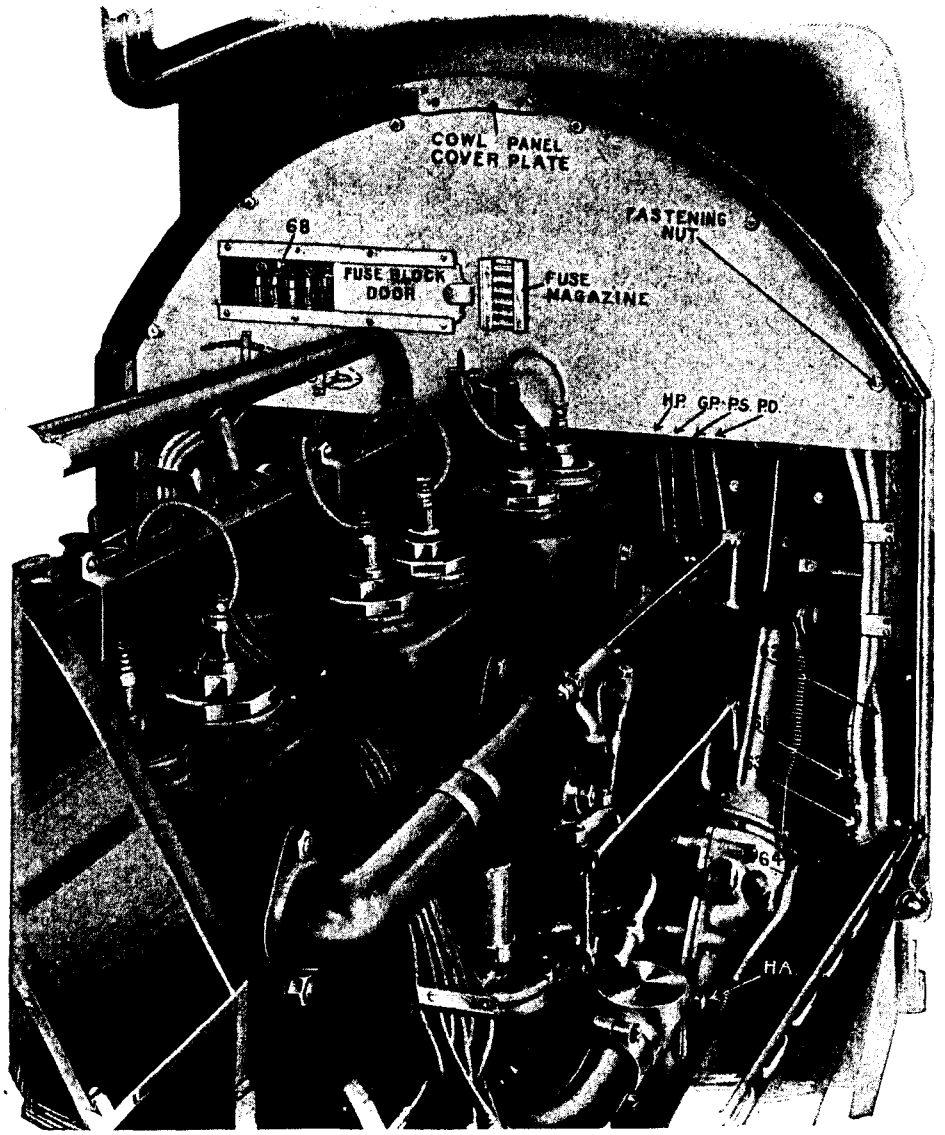


Fig. 8. LEFT SIDE OF MOTOR AND FALSE DASH

61. Head Light Lead
62. Side Light Lead
63. Lead to Klaxon
64. Lead from Klaxon to Button
68. Hot Air Regulator Valve

HP. Hand Pressure Pump Pipe
GP. Gasoline Pressure Gauge Pipe
PS. Primer Supply Pipe
PD. Primer Discharge Pipe

changeable on all cars. Each lock plate, however, is made for a special key. Fig. 7 shows the fuse block. The fuses are from left to right: *1* ignition and trouble, *2* Klaxon, *3* tail and body, *4* side lights, *5* left headlight, *6* right headlight, *57* is the dimmer switch which is in series with the switch operated by button *47* for the headlight, *58* is a re-

sistance coil of .5 ohms for dimming the headlights, this is in parallel with the switch *57*. Fuses for the fuse box can be obtained anywhere in the country where standard electrical supplies are available. Ask for National Standard Glass Midget or S. A. E. Standard Indicating Fuses, 10 amperes.

Automatic Generator Switch

Referring to Fig. 7. The wire *21* is the battery lead to the generator. *23* is the extra wire from the generator to the switch *P* (*Diagram, page 32*). *22* is the main lead from the generator and battery to the dash. *34* is a cover over the automatic cutout switch. When the generator is not running, it must be disconnected from the storage battery, otherwise it would short circuit. When it is in operation it must be connected to the battery or it will burn out its field. The automatic switch under the cover *34*, performs this function. *It should not be tampered with.*

Nos. *59*, *60* and *24* are leads from the headlights primary relay switch and sidelight. These leads are carried in flexible brass conduit, nickel plated. The head, side light and Klaxon leads may be disconnected from the bonnet sill and either the sills or the dash removed as a unit without disturbing the wires. Standard single contact connectors of the bayonet lock type connect the cable groups together in sections of convenient length, so that a section may be removed for repairs or replacement with little trouble.

The battery is provided with a cover which holds it down to the rack as well as protects it from dirt and water.

The tail light cable tube *65* runs along the left side member of the frame. The rear portion of this lead *66* may be disconnected if it be desired to remove it for any reason. The main section of this tube runs into a junction box midway between the engine and rear axle on the left side member of the frame. From this box a lead *67* is taken off with a suitable connector to which the main lead for the tonneau lights and body wiring may be fastened.

Step Light

On the running board shield of all cars there are step lights operated by switches in the rear door hinge pillars. The cable tube connecting these lights to the body are made with fittings so they may be readily disconnected when removing the body.

Body Wiring

All wiring in closed or open bodies is carried out on the single wire conduit system. The current is tapped off the same lead that supplies the tail light and the tail light switch must be thrown to render the system "alive". During the day when the tail light is not required the system is "dead".

On open cars, a junction box is located in the front seat compartment. In closed cars a fused junction box is located in the rear seat compartment. The dome lights may be lit either by the occupant of the car or by the driver.

Telephone System

All closed cars, except coupés, are equipped with a telephone system for talking with the chauffeur. The transmitter is concealed in a pocket from which it may be drawn, the attached wires being unwound from a concealed reel. The system operates from a small dry battery under the rear seat, contained in a waterproof metal case.

Care and Maintenance

For care and maintenance of electric starting and lighting system, see Chapter 3 on "Maintenance and Adjustment."

The Ignition System

The ignition system on all 1916 Locomobiles is the Bosch high tension dual (*see Fig. 9, page 42*).

This consists of a Bosch ZR6 model 4 magneto and a combination coil and dash switch.

The magneto has two separate breakers, one for battery ignition and one for magneto ignition. The same distributor for high tension current to the plugs is used for

both coil and magneto, but the system supplies in reality two distinct sources of ignition.

Magneto

The magneto is set so that with the spark fully advanced, the spark occurs while the piston is still 7/16" from the top of the cylinder on the "48" and 5/16" on the "38". The battery breaker is set to give the spark a little later than the magneto so that when the spark control lever is set to full retard, the battery spark will occur after the piston has started on its downward stroke; this is done to make hand cranking safe in case of a failure of the electric starter.

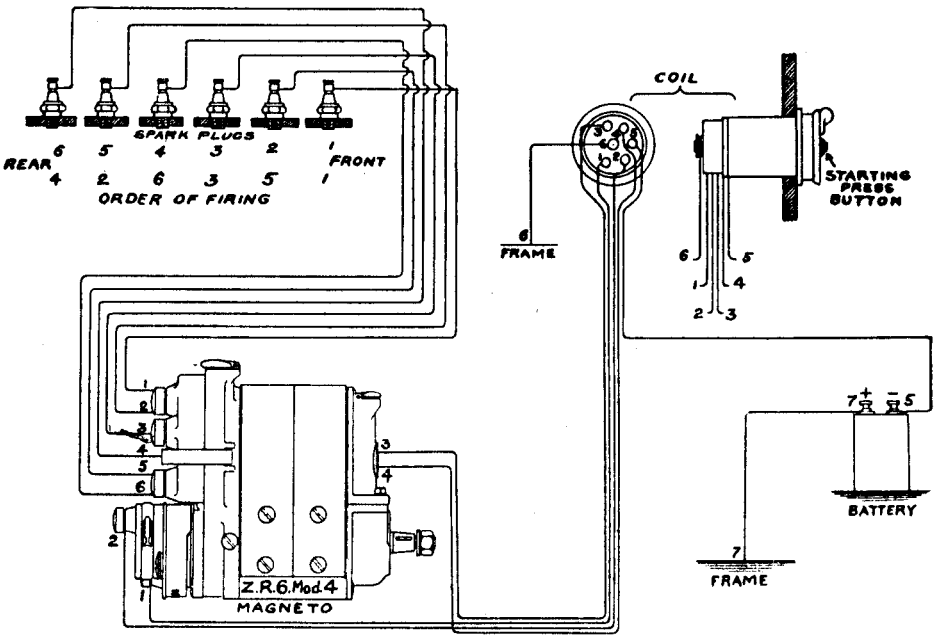


Fig. 9. IGNITION WIRING DIAGRAM

The magneto is so designed that it is entirely water proof, unless it should actually become submerged in water.

The order of firing is 1–5–3–6–2–4 and the order of connecting the wires is:

Magneto, in order of rotation 1–2–3–4–5–6.
Plugs, in order of firing 1–5–3–6–2–4.

Coil

The coil is a high tension transformer for converting battery current into high tension ignition current of proper characteristics. In combination with it is a three position dash switch by means of which the ignition can be changed from battery to magneto, or cut off altogether.

Cables

The high tension cables used in connection with the ignition apparatus are selected with great care and no other cable should be substituted except such as is supplied by us or by Bosch.

Fig. 9 shows the general wiring scheme. Fig. 19, page

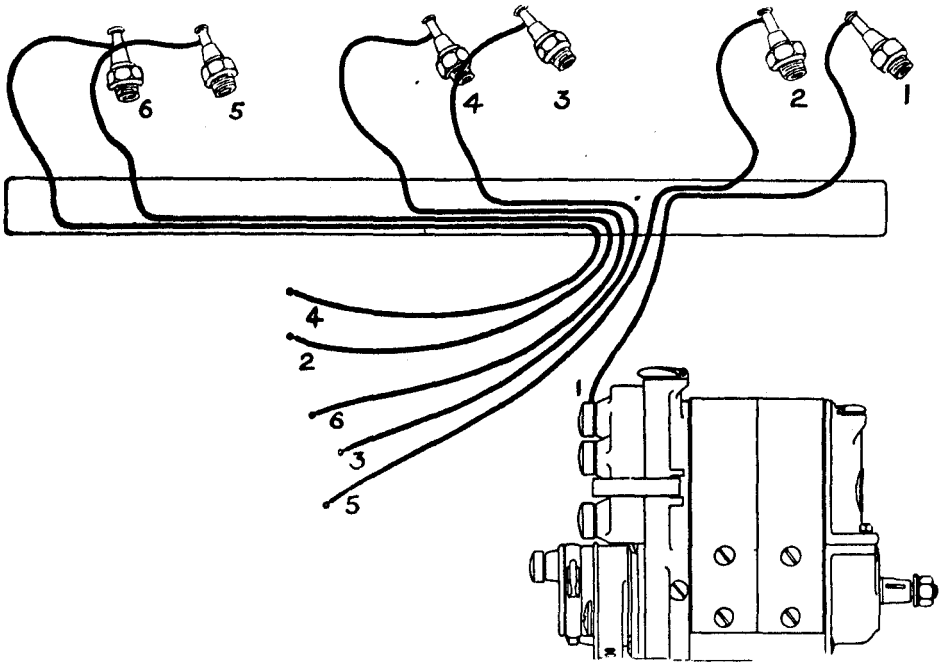


Fig. 10. SPARK PLUGS AND HIGH TENSION CABLES

The firing orders of the "48" and "38" is 153624. The cables are connected in order of rotation beginning with 123 up to 6. The other ends of wires go to plugs in order of firing.

65, shows the position the armature should be in when No. 1 piston is at top center, if the magneto is timed correctly.

The same battery which is used for the lighting and starting system is used to supply current for ignition when using the coil.

Plugs

Locomobiles are equipped with either Bosch or Sootless spark plugs. The plugs are set to approximately .028″ gap at the points.

Transmission of the Power.

Clutch

The clutch used on the 1916 Locomobile is of the dry plate type. Referring to *Fig. 11* the cast steel clutch housing *2* is bolted to the flywheel and driven by it. The housing contains six hard steel keys *3* riveted to it equally spaced around its periphery. Thin saw steel discs 1/16" thick are driven by means

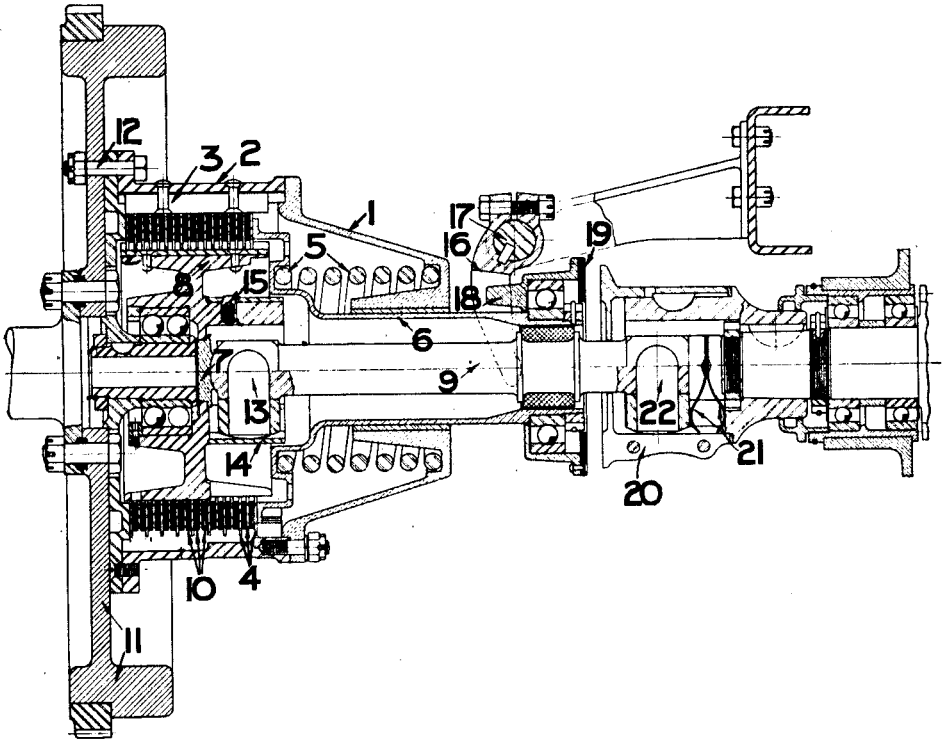


Fig. 11. CLUTCH

1. Clutch Spring Housing
2. Clutch Housing
3. Clutch Disc Key
4. Metal Discs
5. Clutch Spring
6. Disengaging Sleeve
7. Clutch Shaft and Thrust Washer
8. Clutch Disc Retainer Group
9. Shaft
10. Fabric Discs
11. Fly Wheel
12. Clutch Bolt
13. Shaft Driving Block
14. Clutch Universal Sleeve
15. Locking Stud for No. 14
16. Clutch Fork
17. Clutch Fork Shaft
18. Rocker Bearing Retaining Group
19. Clutch Brake Lining
20. Universal Housing
21. Spring
22. Shaft Driving Block

of these keys which mesh with slots in the discs. The clutch disc retainer *8* also has steel slots and has eight saw steel discs which mesh with it. These slots permit lateral movement of the discs along the axis of the clutch. The driving discs and driven discs are spaced alternately and

in between each pair of metal discs *4, 4*, both driver and driven, is a heavy woven fabric disc *10* of material much resembling brake lining, selected with great care after long experimentation. These fabric discs are "floating," that is, they are not driven by either the clutch housing or clutch disc retainer, but act as a medium for transmitting the driving torque from the driving discs to the driven discs, the

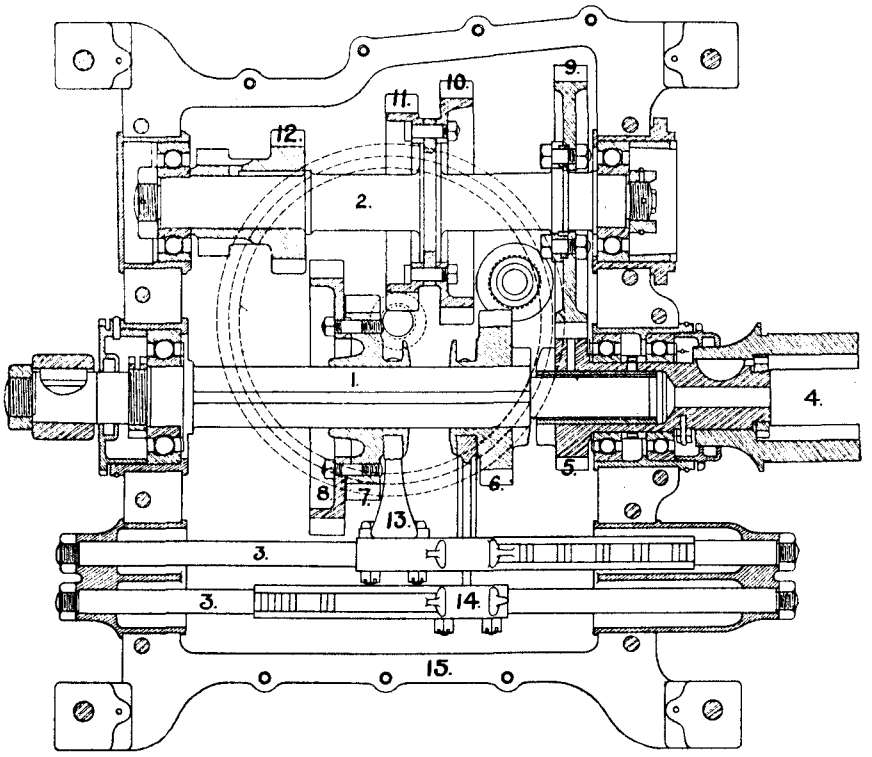


Fig. 12. TRANSMISSION AND GEAR SHIFTING

1. Driving Shaft
2. Countershaft
3. Change Gear Fork Shafts
4. Clutch Pinion Driving Sleeve (Transmission)
5. Clutch Pinion
6. Sliding Gear (Third and Fourth)
7. } Sliding Gears Rev. 1st and 2d speeds
8. }
9. Countershaft Driving Gear
10. Countershaft Gear (third)
11. Countershaft Gear (second)
12. Countershaft Gear, (1st and reverse
13. Gear Shift Fork (reverse 1st and 2d)
14. Gear Shift Fork (third and fourth)
15. Transmission Case

amount of slip depending on the pressure between the discs. This is controlled by the operator who may vary the pressure on the discs by the clutch pedal which acts through the fork *16* upon the rocker bearing retainer group *18* and the disengaging sleeve *6*. With the maximum pressure of the spring *5* acting on the discs, there can be no slip, since

the motor can be stalled with the clutch, with the brake locked.

Smooth Action. With this construction the engagement of the clutch is remarkably smooth and even. The car may be started in traffic on high gear without the slightest jerk or danger of stalling. The power is transmitted from the clutch to the transmission through a shaft *9* having universals at both ends.

TRANSMISSION (*Fig. 12*)

The Locomobile transmission gives four forward speeds and a reverse. The ratios of speed between the engine and rear wheels with 3.538 to 1 rear axle gearing, are as follows:

1st speed	14.152=1.
2nd speed	6.793=1.
3rd speed	4.950=1.
4th speed (*direct*)	3.538=1.
Reverse	20.000=1.

In Chapter 5, page 87, is shown a curve sheet from which the car speed in miles per hour on any gear and at any engine speed may be read off. This varies slightly with various tire sizes, and also with tires that are slightly deflated.

The lower half of the transmission with its four supporting brackets is a manganese bronze casting of great strength and toughness. The upper half or cover is an aluminum casting. The gears are of chrome nickel steel, heat treated, as are also the main shaft and countershaft. The shafts are supported in the finest imported ball bearings.

The shifting members of the gearset are actuated by forks of drop forged alloy steel having guiding sleeves operating on the guide rods *3*, *3*. These sleeves are slotted to correspond with various positions of the sliding gears. Suitable hard steel wedges drop into these slots and hold the gears in mesh as they are selected by the operator.

The entire transmission case is oil tight. A removable cover is provided for inserting grease and for inspection of the interior. There is also a drain plug at the bottom.

PROPELLER SHAFT

The power is transmitted from the transmission to the rear axle by means of a chrome nickel steel propeller shaft, having a full universal at the transmission end and a block and pin type of universal at the rear axle end. This shaft is designed to withstand many times the torque imposed on it, and to resist any whipping action due to rough roads. The universal of the transmission end contains four ball bearings packed in grease, one ball bearing being on each of the four pins of the universal. This construction is practically proof against wear. The universal at the rear axle end, is of the block and pin type (*See Fig. 13*). This type of universal permits lateral motion as well as full universal action and protects the propeller shaft from any tensile or compressive strains due to movements of the rear axle. The universal is contained in a dust proof housing, filled with grease.

Universal

REAR AXLE (*Fig. 13*)

The Locomobile cars are equipped with our own rear axle, which is of the full floating type. The rear axle housing *23* is a steel casting, into which seamless steel tubes are forced under heavy pressure, and riveted. A truss rod passes under the housing and is anchored at the outer end, tending to hold the housing and tubes together as well as stiffen the whole axle. The live axles *7*, *8*, pass through these tubes with felt washers, *26*, which prevent the passage of grease from the housing to the wheel hubs. The splined ends of these live axles *7*, *8*, fit into the differential housing *3*, *4*, which is splined to take them. The shafts are of special chrome nickel steel, heat treated.

Live Axles

The differential housing is made of two steel forgings, bolted together and rotating in two imported annular ball bearings, *10*, *11*. The side thrust of the bevel gear is taken up by a thrust ball bearing, *9*. The bevel pinion shaft *12*, also rotates in two large imported ball bearings and the thrust of the bevel pinion is taken up by a ball thrust bearing *13*.

Ball Bearing

The sleeves on which the bevels are mounted are adjustable to secure proper alignment between the gears.

Gears

The gears are of the spiral bevel type, 4 pitch, made of chrome nickel steel, heat treated to secure a hard surface and tough inner structure. The spiral bevel type of tooth is unquestionably the quietest, smoothest running type of gear yet developed.

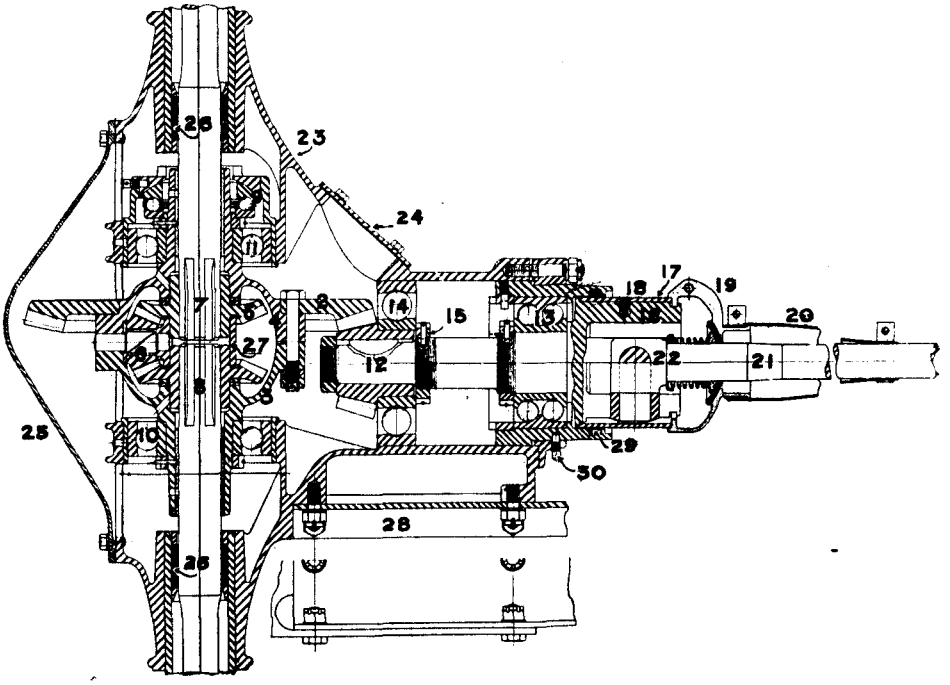


Fig. 13. REAR AXLE

1. Bevel Pinion
2. Bevel Gear
3. Differential Housing R.H.
4. Differential Housing L.H.
5. Compensating Bevel Gear
6. Compensating Bevel Pinion
7. Live Rear Axle L.H.
8. Live Rear Axle R.H.
9. Thrust Bearing
10. Ball Bearings Differential Housing (right)
11. Ball Bearings Differential Housing (left)
12. Bevel Pinion Shaft
13. Bevel Pinion Thrust Bearing
14. Ball Bearing
15. Ball Bearing Retainer
16. Bevel Pinion Shaft
17. Sleeve
18. Locking Pin for No. 17
19. Split Collar
20. Leather Boot
21. Propeller Shaft
22. Sliding Joint Block
23. Rear Axle Housing
24. Stand Pipe for Grease
25. Cover
26. Felt Washers
27. Compensating Pinion Spider
28. Torque Rod
29. Packing-Prop. Shaft Univ. Housing
30. Stud for Locking Bevel Pinion Adjustment

Demountable Features

The full floating rear axle construction permits of the entire dismounting of the bevel gear differential and live axles, without even jacking up the car. The differential may be withdrawn by removing the live axles *7*, *8*, and removing the ball bearing retainer straps. The entire

mechanism operates in grease, The axle is grease tight and dust-proof. A standpipe *24* is provided for grease, and a drain plug.

Torque Rod

The torque rod *28* is anchored to the rear axle housing and fastened between springs to a shackle on the rear transmission cross member. This rod takes all the torque reaction due to the driving effort of the bevel pinion on the large bevel gear. The spring suspension of the torque rod in front protects it against sudden strains and makes the driving effort more smooth. The shackle protects it from tensile and compressive strains due to the rear axle movement. The torque rod is of pressed steel. It does **not** take the braking stresses.

Rear Wheels

The rear wheels are carried on the rear axle tubes by two ball bearings in each hub. The wheels are held on by large nuts and lock nuts. The wheel hub is slotted to receive the teeth on the axle ends and thus the driving effort is transmitted to the wheels.

THE CHASSIS

Front Springs

The front springs are semi-elliptic 38″x2″. The spring eyes are bushed with bronze, the shackles are steel forgings and the shackle bolts are hardened and ground, and fitted with grease cups on one end. The springs are held to the front axle chairs by means of alloy steel clips.

Rear

The rear springs are three-quarter elliptic, 50″x2¼″. The spring eyes are bushed in bronze, the shackles are drop forgings and the shackle bolts are of steel, hardened and ground, each is provided with a grease cup at the end. The springs are fastened to heavy steel spring chairs with alloy steel clips. The spring chairs are bushed with bronze and are free to rotate on the rear axle tubes. They are provided with grease cups. This construction prevents any driving or braking stresses being communicated to the springs.

Frame

The frame is made up of pressed steel channels, the size of the side members being 6″x1¾x5-32″. Chrome nickel steel is used. The members are hot riveted together and all holes are drilled and reamed. This material is exceedingly tough and strong.

The driving thrust of the rear axle is transmitted to the frame through forged steel distance rods *10 Fig. 14*, which in

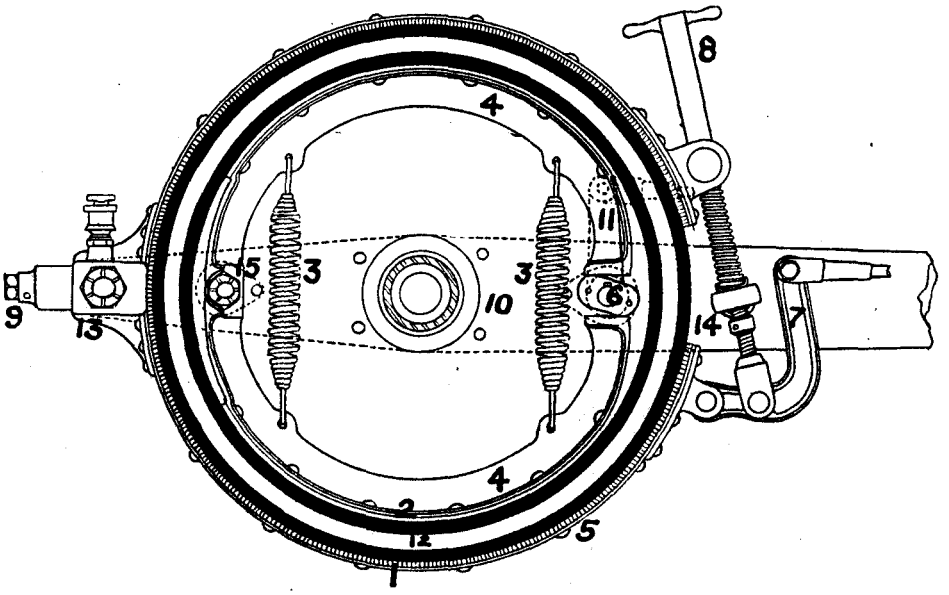


Fig. 14. BRAKE DRUM AND MECHANISM

1. Running Brake Drum
2. Emergency Brake Drum
3. Emergency Brake Shoe Springs
4. Emergency Brake Shoe
5. Running Brake Band
6. Emergency Actuating Cam
7. Running Brake Bell Lever
8. Adjusting Wrench for Brake Band
9. Adjusting Bolt fore and aft
10. Distance Rod
11. Emergency Brake Lever
12. Air Space for Cooling
13. Running Brake Bracket (rear)
14. Running Brake Bracket (front)
15. Emergency Brake Shoe Bracket

Distance Rods

turn transmit it to the frame of the chassis. These distance rods are free to turn on the rear axle tubes. They are bushed with bronze, and grease cup lubrication is provided. Adjustment is provided to alter the length of the distance rod. The front end of the distance rod is fitted with a bushed eye through which passes a large steel bolt. This bolt fits through a steel casting bolted to the frame.

The running and emergency brakes (*Fig. 14*) are carried on the distance rods and all torque due to braking is trans-

mitted to the distance rods and taken up by them. The running brake *5* is a contracting band operating on the outer drum *1*. The emergency brake *4*, *4*, is expanding, and operates on the inner drum *2*. Air space between the drums keeps them comparatively cool and permits the use of one brake without excessive heating of the other drum.

Brakes

PASSENGER ACCOMMODATIONS AND APPOINTMENTS

Locomobile bodies are made of sheet aluminum, beaten into proper shape and fastened to a strong wooden frame work. The instrument panel is located in the hood. The same panel is used on all 1916 models. It is held to the front cowl frame by two bolts at each side. When the body is off the chassis, or when the steering column is out of the car, the instrument panel may be removed by disconnecting the pipes leading to the oil and gasoline pressure gauges, and the pipes leading to the hand pressure pump and primer. Unions are fitted to these pipes to facilitate this. All wires leading to the dash are fitted with plugs and sockets to facilitate disconnecting or connecting without cutting wires.

Cowl Instrument Panel

The body itself straddles the chassis and is supported on three bronze brackets on each side and also by a leaf of the top rear spring which is extended out beyond the spring chair to permit of the fastening of the body to it. These steel brackets are riveted to the side members of the frame.

Body Fastening

The front doors on touring and torpedo cars open forward so that they may be partially opened in summer for additional ventilation. The Locomobile windshield is divided into two horizontal units of heavy plate glass, swung on trunnions from two steel forged uprights. The trunnions are provided with powerful friction locks so that the upper half or lower half of the windshield may be swung into any desired position, each independent of the other. Ventilation of the front seat compartment may be obtained by swinging the windshield divisons backwards.

Ventilation

Windshield

The upper glass overlaps the lower so no rain will spatter in on the occupant, and at the same time the upper glass is protected so that it cannot strike the lower one and break off. This is a distinct advantage and does not interfere with the operation of the windshield.

The top division of the windshield may be swung down out of the way parallel to and in front of the lower division.

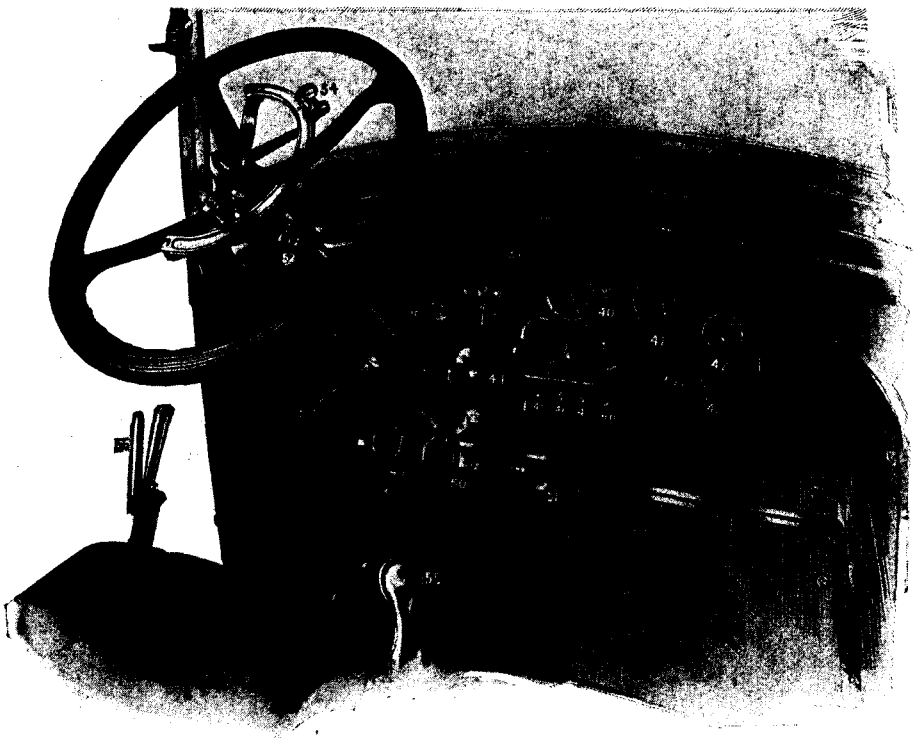


Fig. 15. DASH AND CONTROL UNITS

37. Bosch Switch
38. Gasoline Pressure Gauge
39. Dash Light
40. Speedometer and Clock Group
41. Voltmeter
42. Oil Gauge
43. Locking Switch
44. Hand Pressure Pump
45. Starting Button
46. Panel Light Button
47. Side and Tail Light Button
48. Head and Tail Light Button
49. Clutch Pedal
50. Brake Pedal
51. Accelerator Pedal
52. Carburetor Air Adjustment
53. Throttle Lever
54. Spark Advance Lever
55. Gear Shift Lever
56. Emergency Brake Lever
57. Dimming Button

The windshield is rain tight when both sections are closed.

Gear Shift The gear shift lever is located in the center line of the car, just forward of the front seat, convenient to the driver's hand and out of the way when entering or leaving the car.

Emergency Lever. This is convenient to the driver's left hand (*Fig. 15*). Its location places it out of the way when entering or leaving the car. The pedals for clutch, accelerator and running brakes are convenient to the driver's feet, as are the switches for the electric lighting and starting systems.

Klaxon Button The Klaxon button is located in the left front door (*on all but Berlins*), the current being carried through contactors in the door jamb to horn in wires within a flexible metal conduit.

Tonneau Light A tonneau light on the back of the front seat is provided. There is an adjustable shade. A switch immediately to the right of this light operates it.

Robe Rail There is a robe rail fastened to the back of the front seat. This is made of brass heavily nickeled, and is swung on hinges so as to adjust itself to the number of robes.

Step Lights On the running board dust shields, just below the tonneau doors are located two step lights (*one on each side of the car*) which at night are automatically lighted when the tonneau door is opened.

The switches for operating these lights are in the door hinge pillars. The body wires are all enclosed in a metal conduit, and a junction box is provided under the front seat. The current is taken from the tail lamp circuit, so that in the day time the system will be inoperative.

The connection for supplying current to the system is under the tonneau floor boards, just behind the front seat.

Electric Connection The connections from the body to the step lights will be found in the tool compartments, at the right and left side, close to the lights themselves. These connections are all readily broken by removing the plugs on the ends of the cable tubes from their respective sockets.

Space for Luggage, Parcels, etc. There are capacious pockets in each of the four doors, two large cases in the back of the front front seat which contain the side curtains and a compartment under the front seat. On the right and left side of the tonneau just forward of the rear seats are two small pockets for knick-knacks,

which may be reached without getting up. Under the tonneau seat is a shallow compartment for the cape top slip cover. Under the front seat is a spacious storage compartment.

Tool Compartment

The tool compartments are in the running board dust shield. There are two on each side. They are fitted with Yale locks, operated by the same key which unlocks the bonnet, tires and electric lock switch.

Tire Air Pump

It will be noted that in the left front tool compartment there is a hose already attached to an air compressor mounted on the transmission. A handle in this same compartment connects or disconnects the pump from the transmission countershaft. This pump can blow up a 37"x5½" tire to 90 pounds in about 4½ minutes with the engine running at about 1,200 r.p.m.

Provision For Tires

A set of tire irons and a tire pan are fastened to the back of the chassis, with capacity for two spare rims and shoes, or two spare wire wheels, out of the way, and at such a point that their weight adds materially to the good riding qualities of the car. The tires are held in place by straps and an adjustable steel tie-rod which has a Yale lock operated by the same key as bonnet, lock switch, etc.

Bonnet

The bonnet is made of steel and aluminum. It is entirely unique in that either half may be removed separately by withdrawing the plungers which hold it in place and act as hinges. The bonnet locks and has spring latches for holding it tight.

Cape Top

The Locomobile Cape Top is of the one-man type. A handle is conveniently fastened to one of the bows and the top can be raised by one person with one hand after a little practice. The top is held in front by two windshield standards. Cam locks fastened to the top engage these standards. The back part is permanently fastened to the body, making a finished piece of work.

CHAPTER THREE

MAINTENANCE AND ADJUSTMENT

Connecting Rod and Main Bearings

The bearings will not require adjustment more than once a season as a general rule. The connecting rod bearings and the main bearings are provided with means for taking up the wear. This is a task which we would prefer to have done at our branches, dealers, or a first class repair shop, as it is work requiring special experience and judgment.

Wrist Pin Bearings

These bearings very seldom require adjustment. When they do, it is necessary to rebush the connecting rod at the wrist pin end.

The operation of removing the valves from the Locomobile motor is very simple. First unscrew the bronze cap from the cylinder. Then remove the valve stem cover plates. A valve spring tool is furnished with the kit. To use this, turn over the engine till the valve is fully open; insert the tool under the valve spring washer. Then turn the engine till the valve drops away from the spring. This will enable you to lift the valve out through the top opening by removing the key washer on the valve stem. Our engines are equipped with tungsten steel valves. These valves do not warp or pit under extremely hard usage. They require little or no attention, and should not require grinding during the entire season.

Removing Valves

Clean the valve and valve seat very carefully with gasoline, seating the valve and turning a few times to clean the valve seat. Then wipe the valve and seat clean. Block up the opening leading to the cylinder very carefully with a clean cloth so as to keep out every particle of grit and grinding compound. We use at the factory a preparation

Grinding Valves

known as Eureka Valve Grinding Compound. Place a small amount of valve grinding compound on the seat of the valve, giving it a few turns to spread the compound evenly on the seat of the valve. Then with a large screw-driver inserted in the slot of the valve turn it in a semi-circle back and forth, pressing lightly so as not to push out the paste between the valve and the seat. Unless this is done it will take more time than is necessary to grind the valve properly. While grinding raise it occasionally from the seat a little and turn slightly to insure an even surface. After grinding the valve for a few minutes, remove it and examine it. If it is ground properly a light, silvery line will show all around the valve. If it is not ground sufficiently, repeat the operation. When finished, clean the valve and cylinder very carefully with gasoline, squirting plenty of the gasoline into the opening through which the valve stem passes. Use great care to clean out all particles of grit. When everything is properly cleaned, remove the cloth and seat the valve with a few drops of oil under the valve and valve stem. Place the spring in position with large end up and spring cap underneath. Press spring slightly until the key can be slipped in place under the valve stem. In replacing the valve cap, see that it and gasket in cylinder are clean. Then screw down tightly to make a tight joint.

Carbon Deposit. The cleaning out of carbon is a necessary part of the maintenance of a car that gets considerable hard usage. The Locomobile should run 5,000 miles before accumulating enough carbon to interfere with the operation of the motor. If kerosene is injected regularly an owner could probably run through a season without accumulating sufficient carbon to affect the operation of the car. To clean out carbon: Remove the valve covers. Turn motor by hand until pistons 1 and 6 are on top center. Scrape off the carbon from the piston heads and other places where it has accumulated and blow the loosened particles over to the exhaust side of the motor. Then clean piston heads for 2 and 5 cylinders; and finally for 3 and 4 cylinders. The valve caps should not be replaced in a promiscuous manner. Note that each valve

Removing Carbon From Cylinder

cap is numbered and each opening on the cylinder is numbered to correspond.

The oyxgen method is much more rapid and thorough when done properly, and is preferable to the above where the apparatus is available, but when it is used, the spark plugs should be removed.

Adjusting The Valve Tappet

Should the valves be ground in or a new valve inserted, or if for any reason the clearance between the valve lifter and valve stem needs readjustment, remove the cover plates over the valve stems and loosen up the jamb nuts. See that the particular valve lifter being adjusted is on the back of the cam (*piston near top of compression stroke for that cylinder*). Then adjust the clearance between the lifter and valve stem to .004″ on the inlet side, and .008″ on the exhaust side.

Valve Timing

All valve timing on the camshaft (*i.e.* where *the camshaft is for some reason reset in relation to the crankshaft*) should be done at one of our branches. For information of our patrons we give the following table of our valve timing expressed in inches of piston travel from top or bottom center:

"48"	**Exhaust Opens** ¾″ before bottom center	**Exhaust Closes** ⅛″ past top center
	Inlet Opens Top center	**Inlet Closes** ¾″ past bottom center
"38"	**Exhaust Opens** ¾″ before bottom center	**Exhaust Closes** ⅛″ past top center
	Inlet Opens Top center	**Inlet Closes** ⅝″ past bottom center

Lubrication. Lubricate the engine and parts as directed in the first Chapter. The lubricating system of the engine requires no special care except once in every 2,000 miles it would be well to drain off all the oil, rinse out the oil pan with kerosene, and clean the strainer in the bottom of the pan, refilling with fresh oil. Leave the oil bypass valve open except as instructed on page 13 of this book.

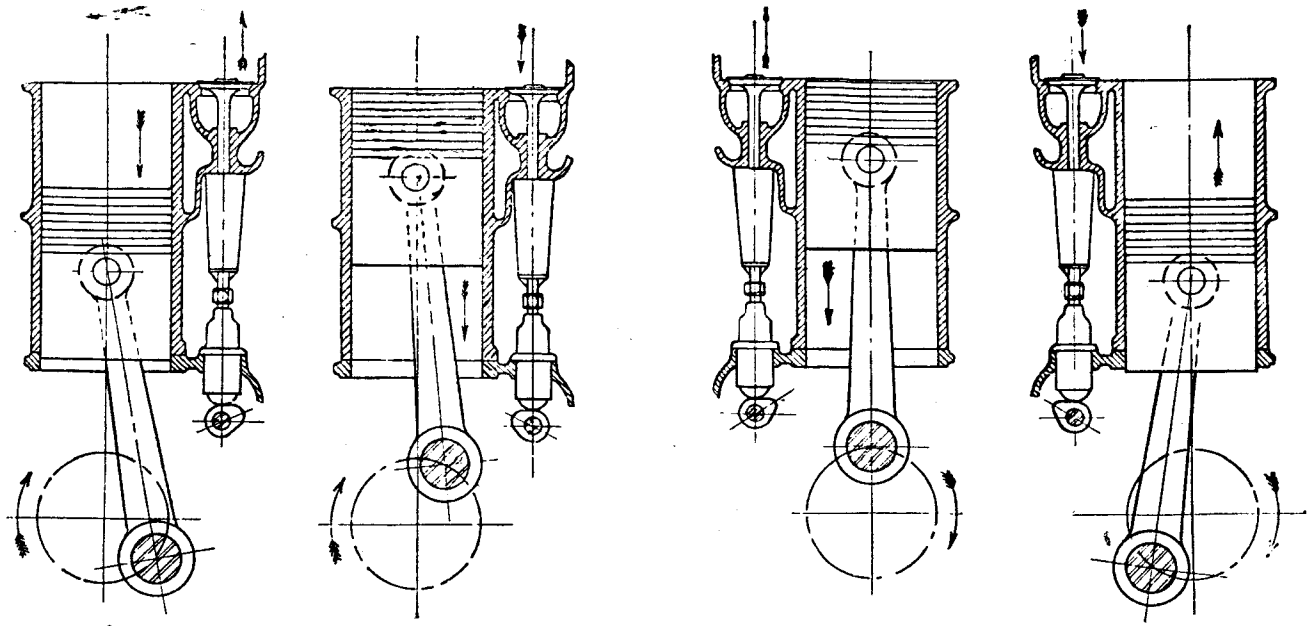


Fig. 16. VALVE TIMING "R6" AND "M6" ENGINES

1. Exhaust Opens	2. Exhaust Closes	3. Admission Opens	4. Admission Closes
"38" ¾" Before Bottom Center	⅛" Past Top Center	Top Center	⅝" Past Bottom Center
"48" ¾" Before Bottom Center	⅛" Past Top Center	Top Center	¾" Past Bottom Center

The Fuel Supply System. There is a drain plug at the bottom of the tank, which should occasionally be removed, depending on how frequently the tank is refilled, and a slight amount of gasoline drained off. This is to remove any water or sediment, which may accumulate in the tank and get into the piping. When replacing the cap on the filler spout of the tank be sure that it is turned down tight, as any leakage of air will affect the fuel supply.

Tank

If at any time it becomes necessary to clean the pipes leading from the tank to carburetor and pressure pump, the pipes can be dropped down by uncoupling the unions just behind the battery, and also on the front end of the pipes where they are attached to the carburetor, air pressure regulator, and air pressure gauge, then remove the lips holding the pipes.

Piping

Air Pressure Regulator. This is set for 2 pounds pressure, and should not be tampered with.

To operate the pump, turn the handle till the piston can be withdrawn, and the pump operated. When the desired pressure is reached (*1½ to 2 lbs.*), push the handle all the way in and turn it till it is locked; otherwise the air pressure may force it out again if there is a slight leak.

Hand Pressure Pump

The carburetor has been designed and built by the Locomobile Company of America for service on the Locomobile cars. There are only three adjustments possible after it leaves the factory. We guarantee this carburetor to give most efficient service with these three adjustments only. We warn you against taking the carburetor apart and trying to fix imaginary troubles.

Carburetor

The operation of the carburetor is explained in Chapter on Construction, pages 29 and 30, for your information, but it is not expected that any adjustments will be made other than the three advised and explained as follows:

ONLY THREE ADJUSTMENTS OF THE CARBURETOR POSSIBLE

Adjustment No. 1. Auxiliary Air Valve.

When the air adjusting collar on the steering column is turned clock-wise as far as it will go (*be sure first to loosen the milled thumb nut*) the lift of the air valve from its seat will be less than $\frac{3}{16}$".

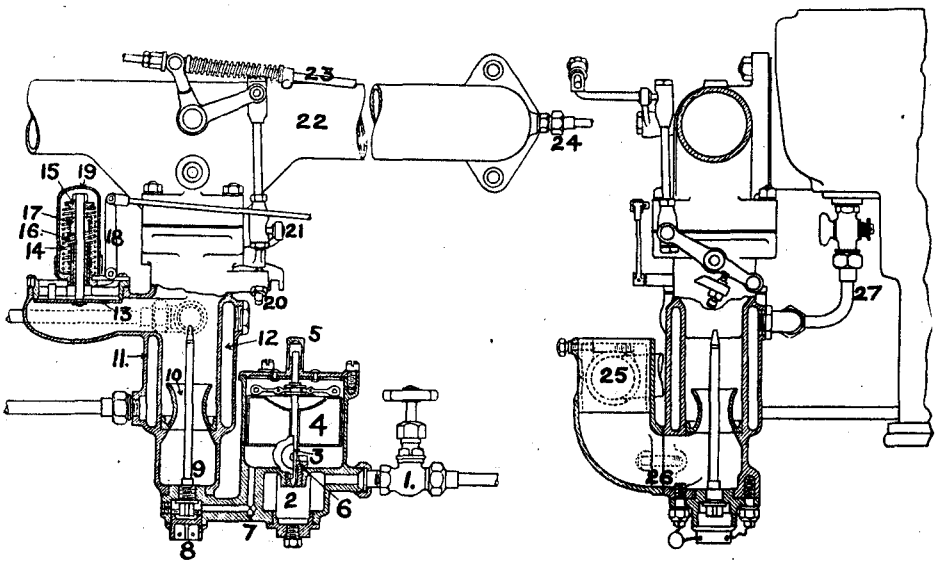


Fig. 17. CARBURETOR

1. Fuel Valve
2. Strainer
3. Float Chamber
4. Float
5. Needle Cap
6. Needle Valve Seat
8. Fuel Passage to Atomizer Chamber
8. Plug Atomizer Chamber
9. Stand Pipe
10. Venturi (removable)
11. Atomizer Body
12. Hot Water Jacket
13. Automatic Air Valve
14. Low Speed Valve Spring
15. Adjustment for No. 14
16. High Speed Spring
17. Adjustment for No. 16
18. Air Valve Adjusting Lever
19. Cap for Air Valve Springs
20. Throttle Stop
21. Throttle Lever
22. Manifold
23. Throttle Valve Rod
24. Primer Discharge Pipe
25. Hot Air Valve
26. Main Air Supply
27. Hot Water Supply

Set the adjusting nut *17* so it will allow the air valve to open $\frac{1}{16}$". After this is done, see that the high speed spring *16* is the right length (1½"); the space between the adjusting nut *17* and the top of the spring *16* will be 3-32". Now get the engine started and run the car at fairly high speed (45 m.p.h.) and **find the best position** for the air valve adjusting collar, gradually turning it back and forth.

Then stop the car, but not the engine. The low speed spring is then adjusted by the nut *14* until the mixture is right for idling. The milled thumb nut may then be moved around and turned down to mark this position of the collar.

The carburetor once properly set, it is not necessary to manipulate the air control except from day to day as weather conditions require.

Adjustment No. 2. To Set for Idling.

The mixture must be right before this is done. Give screw *20* a turn or two to the left. This will close valve *21*, tending to close the passage through which the gas enters the intake manifold and the engine will slow down. To increase the supply of gas, reverse the action.

Before adjusting throttle, see that all connections between hand lever, foot accelerator and carburetor are unimpeded. Use this adjustment for obtaining final idling position of throttle.

Adjustment No. 3. Hot and Cold Weather.

The temperature of the air entering the carburetor through *26* should be lower in summer than in winter. Since warm air enters the carburetor from a sleeve around the exhaust manifold, it will be necessary in unusually hot weather to reduce the temperature of this air, although the air entering the inlet manifold should always be warm. A shutter *25* is inserted in the air pipe leading from the manifold. By opening this shutter cooler air will be taken into the carburetor. But always keep manifold **warm to the touch.**

The carburetor is water jacketed and connected to the engine cooling system. It is thus heated to the temperature of the water in the radiator, which should be between 150° and 170°. In warm weather less heat is required, and if gasoline vaporizes too quickly, the circulation of warm water in the carburetor jacket may be cut off by a hot water valve provided for this purpose.

How to Tell When Mixture is Too Rich. Black smoke will come from the exhaust. The motor will be sluggish and slow to accelerate if more than the proper amount of gasoline is used.

If Gasoline Overflows from Carburetor. This may be because the float is not functioning properly in the float chamber. It may be that by merely tapping on the sides of the carburetor the difficulty may be overcome. Too much hot air and hot water may also cause an overflow with very volatile gasoline. Or some grit or sediment may have gotten under the seat of the needle valve. In which case shut off the fuel supply valve next to the float chamber and drain the carburetor; remove the cover of the float chamber and flush the needle valve seat with gasoline.

Draining the Float Chamber. Occasionally remove the drain and strainer plug from the carburetor float chamber and allow the gasoline to flush the settling chamber controlling the flow with the fuel valve next to the float chamber.

THE COOLING SYSTEM

Radiator

The important part of the maintenance of the cooling system is to keep the radiator filled with clean water. If you cannot get good, clear water, then you will find it desirable to clean the system more frequently than would otherwise be necessary. To do this proceed as follows: Disconnect the short piece of hose between the radiator and the cylinders; connect hose with the radiator; obtain a piece of hose five or six feet long and connect it with the brass pipe of the cylinders, leading the other end of it away from the car; then start the motor and the water will be pumped through the entire system.

In the rare event of a leak in the radiator, take it to some repair shop where radiator repairs are understood and frequently handled. In the event of a serious leak, the matter had better be referred to the nearest Branch Office, or the Factory. The radiator rests in a flange cradle to which it is securely bolted, and these bolts should be examined once in a while to see if they are tight. To remove the radiator,

first drain off all the water, then unscrew the nuts, disconnect all piping, and the center bonnet rib, and lift it off. Handle with great care. If the radiator becomes badly clogged with mud it must be cleaned. Much of the dried mud may be removed from the front of the radiator by brushing carefully with a whisk broom. Do not under any circumstances attempt to clean out the radiator holes by poking a wire through. The proper way to clean out the radiator is by a slow stream from a hose, soaking the

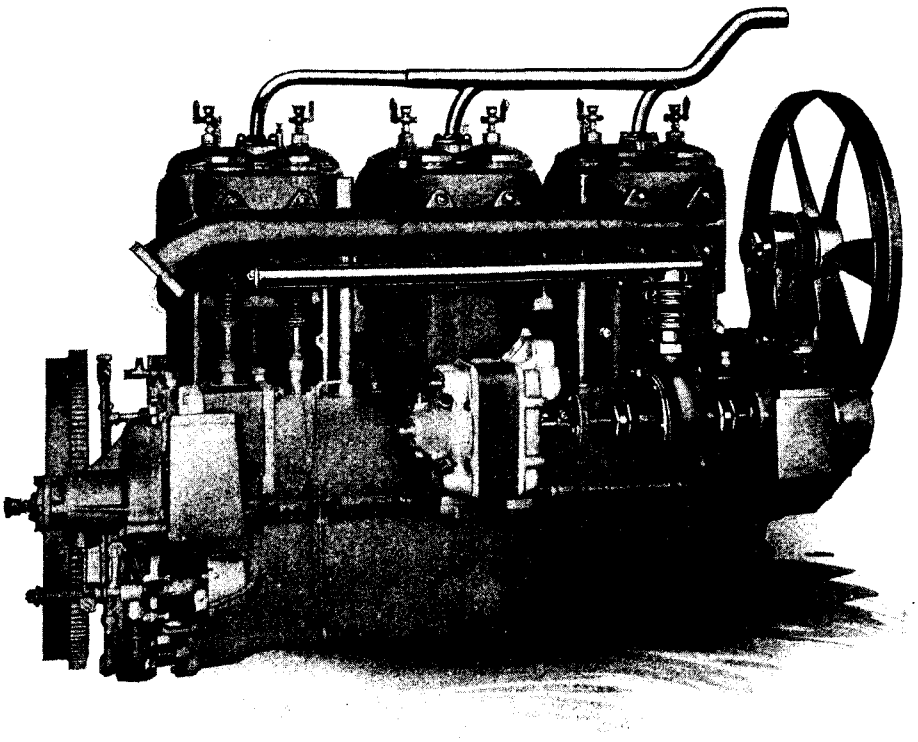


Fig. 18. ENGINE SHOWING COOLING SYSTEM

mud, and washing it from the back of the radiator out through the front. In doing this do not splash water over the magneto. If very dirty, internally, run through a hot soda solution.

Winter Use. Some cars are used so little during the winter that it is not advisable to use any anti-freezing mixture, but simply drain after each period of use. To do this open the pet cock under the radiator and run the motor for a minute or two (*no longer*) so as to prevent the formation of any water pockets. After the car has stood for a time

in a cold place, with cooling system drained, fill the radiator with hot water before turning the motor over. The best anti-freezing solution is denatured alcohol, the strength of the solution depending entirely on the climate in which the car is operated. In some parts of the country where the weather is often below zero it may be necessary to use as much as 40% denatured alcohol. In ordinary weather, such as may be expected in the vicinity of New York, where zero weather is rare, a 30% solution is satisfactory. In Chapter 5 are given curves showing the proportions of the various solutions used for the prevention of freezing.

When the car is to be laid up for the winter and the water has been drained off, the pipes leading from the cylinder to the carburetor, and from the carburetor to the radiator, should be disconnected and drained.

Fan

From time to time inspect the fan belt to see if it is slipping, especially if the motor appears to be overheating. Do not tighten up the fan belt too hard as it throws an overload on the belt. Once a season it is well to soak the belt over night in cold-pressed castor oil, as this keeps it pliable and in thoroughly good condition. After adjusting the belt tension be sure to lock the eccentric as otherwise the belt will quickly work slack again.

Water Pump

Should the water pump glands develop a slight leak, this can be overcome readily by tightening up on the stuffing boxes; however, this should be done with care as too tight a stuffing box will cause overheating or seizing. Keep the pump lubricated as directed in Chapter 1. Should it be necessary to repack the glands use for each one 15″ of 5/16″ Graphon Spiral Self-Lubricating Packing, made by the New York Belting & Packing Company.

The hot water supply pipe from the pump to the carburetor is provided at the pump with a valve. When running the car ordinarily, the hexagonal head on the end of this valve should be backed out as far as it will go. If you desire to drain the carburetor and for some reason must remove the pipe from the pump, screw the hex head in as far as it will go, as this prevents the cooling water from draining off.

IGNITION SYSTEM

Spark Plugs

The only elements of the ignition system which require attention from time to time are the spark plugs. If the proper lubricating oils are used in the engine and the carburetor air valve control is properly adjusted to keep the mixture right, plugs will stand up for thousands of miles without attention. The plugs recommended by us and furnished with the car should be used, and no others. The spark gap should be set at .028″ to 030″ for best results.

The condition of the porcelain on the portion of the plug exposed to the explosive mixture is a fair indication whether the mixture is too rich.

If it is all sooty, the mixture is rich; but if the sooty deposit is greasy, it shows that the engine is getting excessive lubrication.

If the engine misses when running slow and accelerating the points of the plug may be too far apart; while if the engine develops a tendency to miss fire at high speed, the points may be too close.

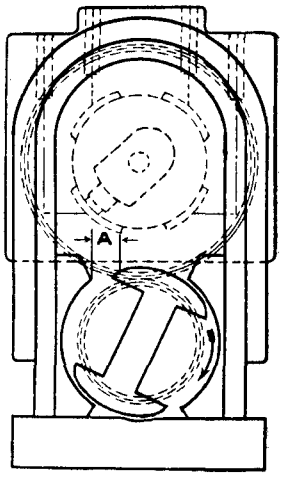


Figure 19.
ARMATURE SETTING

Magneto

The only attention the magneto will require during a season's run is to oil as directed in Chapter 1, and occasionally to remove the cover of the distributor and wipe off the surface of the commutator with a clean rag. Do not attempt to change the timing of the magneto, the setting of which is shown in *Fig. 19*.

The armature shaft of the magneto is set so that the "H" piece is a specific distance from the pole piece. This distance is "*A*" in *Fig. 19*, and is 21 millimeters or .827″ for the "38," and 25 millimeters or .985″ for the "48." All motors are set this way at the factory before shipment, and

the adjustment should not be altered. If a new magneto be installed, or other changes make a new setting necessary, turn flywheel so that piston is at top center on compression stroke; twist armature shaft coupling clock-wise until the "H" piece is the proper distance from the pole piece, and then splice the coupling. It is assumed in such a case that the motor is correctly timed otherwise.

High Tension Magneto Setting

The makers of the magneto supply wrenches for adjusting the magneto. On one of these wrenches is a flat piece of steel .35 millimeters in thickness. Once a year the breaker points of the magneto breaker should be cleaned and readjusted so that when the points are fully separated they are just .35 mm. apart; at the time this adjustment is made clean the breaker points. The battery breaker points should be adjusted to open .4 mm.

More detailed information is found in the instruction book on ignition, furnished with each car.

Do not tamper with the magneto, but go to the nearest Bosch branch (*see Chapter 5, page 109, for list of stations*) and have the magneto gone over thoroughly once a season.

Ninety per cent. of the ignition difficulties are caused by wiring troubles, or plug troubles; so always see that there are no punctured high tension cables; especially give attention to the two high tension cables which lead to the coil. In our system of wiring the Bosch coil is supplied with battery current through the locking switch, so in case of failure of the battery ignition test the lead to five terminals of the coil and see if it is "alive."

Wiring

There is a grounding wire running from the No. 2 coil terminal to the No. 2 lock switch terminal, and if this becomes grounded, the magneto side will not operate.

The Bosch coil *37* should ordinarily be left in the "on" position, and the engine stopped with the lock switch.

THE ELECTRIC LIGHTING AND STARTING SYSTEM

The Starting Motor. Lubricate as directed in Chapter 1, both the gears and the starting motor. There are no adjustments on the motor or starting gears.

There is a small name plate *25* on this switch which covers an inspection hole. If any difficulty occurs in the starting gears meshing, or if the motor operates feebly and the battery is up to full charge, remove the mud pan and the name plate on this switch and see first that the copper contactor of the switch touches the two copper fingers of the resistance in passing them, in fact this contact should exist at the very start of the travel of the contactor and end slightly before the gears mesh. Also see if the faces of the contacts in the ends of the switch housing and of the contactor itself are in good condition, free from dirt and signs of burning.

Magneto Shift Switch

When this switch operates a sharp click is audible if the ear is placed near it. There are no adjustments. Should the switch fail to operate when the starting button is depressed, examine the wires *23* and *24* to see if they are "alive" when the starting button is used. If not, the trouble is in the circuit formed by wires *23* and *24*. If it sticks, a sharp blow from a hammer on the side of this switch will nearly always cause it to operate.

Primary Relay

GENERAL DIRECTIONS AND INFORMATION

The battery should receive attention once a week. Take the Chargometer and read the gravity. If the battery is fully charged it should show about 1.300 on the scale. If the electrolyte is low, add enough water to cover the tops of the plates about ⅛". Do not attempt to read gravity after adding water, as this reading would not be correct. (*Note instructions in book supplied by the Battery makers, Willard Storage Battery Co.*)

When driving, the voltmeter *41* (*Fig. 5*) should show about 7 to 7.5 volts. If it is higher than this, say 8 volts or

more, look at the battery. The electrolyte may be low, in which case add water as directed, or the battery may be overcharged, in which case run the starter for five minutes or turn all the lights on for an hour. When the engine is not running the voltmeter should show 6.3 to 6.5 volts.

At night if the lights appear very bright when driving and get dim when the car is stopped, the battery lead to the generator is poorly connected or the battery is getting dry. If when driving the lights flare up and go out, the battery lead has become broken and the generator has burned out the lights. **Note.—The generator should not be run disconnected from the battery.**

1. Motor fails to operate when starting button is touched.

First place the ear near the switch *P* and hear if it clicks when the starting button is touched. If it does, the trouble is further along the line; if it doesn't, the switch is sticking. Remove and inspect plunger; clean out and replace; test out for ground or open circuit.

2. Relay Switch P works, but starter fails to work.

Caused by: (1) Either the gear shift switch sticking, or (2) by an open circuit in either the gear shift switch or the starting motor. To see if the motor is all right, take a long wire about No. 10 and run it from the battery negative to the terminal marked *M* on the motor. If the motor spins, the trouble is in the gear shift switch; if it does not, the trouble is in the motor. In either case remove and inspect the part which appears to be defective,

3. Difficulty in making the starting gears mesh.

This is caused by the motor not getting its initial spin when meshing the gears. Remove the switch cover (*Fig. 6, 25*) and see if the two copper fingers, which make the first contact through the resistance, are properly bent so that they touch the copper mushroom in its travel. If this does not remedy the trouble, remove switch and send it to us.

4. Voltmeter indicates very low voltage with the engine not running.

Caused by cut-out switch sticking closed. Remove cover *34* and inspect switch. If the switch is sticking, pull out the cotter pin, remove the armature (*moving part of the switch*) from the pin which carries it; clean the pin with the spring or blade of the switch. Should further trouble be experienced, notify our nearest branch or Westinghouse Automobile Service Department.

5. Engine does not stop when locking switch is turned to "Day" or "Night."

Probably the fingers inside the lock switch base connecting terminals *2* and *3* are spread too far apart. Press them together, but leave a little space between for the switch blade. Do not press the fingers so close that they touch when the switch blade is not between them, as then the magneto will be grounded.

6. Side and tail lights fail to light when lock switch is in "Night" position.

Fuses may be blown. Look for a ground.

Fingers in lock switch connecting *6* and *7* may be spread so they do not touch switch blade. Close up fingers.

7. One or more lights go out.

Fuse may be blown. Look for a ground.

Open circuit.

If the fuse is blown, do not replace immediately or until a reason has been found for the fuse blowing. If this rule is not observed you will merely use up fuses without learning the source of the trouble.

If the circuit is open, disconnect the particular line giving trouble from the battery and locate the trouble with a test lamp.

8. Lamps get black quickly.

Caused by too high a voltage at lamps.

(*a*) May be 6-volt lamps instead of 7. Always use

7-volt lamps except in the reading and dome lights of closed cars. These should be 6 volts.

(*b*) Battery may be sulphated or electrolyte low. Add distilled water, or send battery to Willard Service Station.

(*c*) Broken or loose connection from generator to the battery. Look for trouble in wire *21* and *B.W.* If the starter works all right, trouble is in wire *21.*

Lock Switch

If at any time it becomes necessary to operate the car without the Lock Switch, owing to difficulty with same, run a wire from terminal *1* to terminal *4* and *5* on the back of the Lock Switch. Connect *8* and *9* with wire. Remove wire from terminal *2* and tape it up. The car can then be operated independent of the Lock Switch.

Oiling of Locks. Caution. Be sure never to use any oil on the locking switch, or any other lock on the car. A little powdered graphite dropped on the key will often relieve the stiffness. Oil will gum up the lock and ruin it.

Trouble Lamp. A trouble lamp socket is located under the cowl panel instrument board, on the right side. In putting in the trouble lamp plug, be careful not to make a short circuit, as there is no fuse in this line.

Klaxon

The two contact points in the left front door post are for the Klaxon connections. The points and plates should be kept clean. If the horn fails to blow, try putting a screw driver across the two points and if the horn blows the trouble will be found in the wiring in the door. If it does not, the trouble is in the horn or the wiring between the horn and door connector. If the fuse is blown, test out the circuit for a ground. Should the Klaxon blow without pressing the button or continue to blow, this indicates a ground in the lead from horn to door button.

Wiring

When trouble is experienced which appears to be in the wiring, disconnect the battery and work from the battery out to the rest of the system, trying each group of wires with a test lamp. By doing this the source of the trouble can be quickly run to earth and much time saved.

Very little trouble will be experienced with the wiring switches, etc. If it is necessary to get at the connections behind the dash or to remove the lock switch, four-button or dimming switch, lift the bonnet and remove the six thumb-nuts holding the coverplate on, then remove the plate exposing the dash wiring.

It is unreasonable to suppose that the troubles here discussed are likely to occur, and it is difficult to discuss all possible troubles which might arise. The cases discussed are merely those which would be difficult to locate for one not specially posted on our lighting and starting system.

All bulbs used in our system are National Standard Bulbs, 7-volt, Style No. 1100 base, except the tonneau light bulb which is a T5, 4 c.p., 7-volt tungsten, with special terminals. Do not use 6-volt lamps except in the dome lights in closed cars.

Closed Cars

The wiring for closed cars is shown on page 33. This is a straight system of grounded conduit wiring. The connectors and lamp sockets are for single contact lamps (*No. 1100 base*). The junction box for the wires is under the rear seat, so that in case of trouble the circuits can be separately tested without tearing up the trimming.

The shades used in the dome lamps are replaceable if they should be broken.

Cowl Panel Board

The clock *40* is wound by turning to the right and withdrawing from its receptacle. This exposes the winding key. To set the hands pull the key till it clicks, then turn to set hands. Push key back to place for winding. Knurled head *20* is for setting the mileage on trip recorder. Knurled head *20'* is for setting the mileage to correct trip.

When running on battery ignition put Bosch coil vibrator screw to the left, as shown by dotted lines (*Fig. 15, page 52*). For starting, put it to the right.

The battery requires only such attention as is given in this chapter. It **must receive** this attention, however, as it

is the heart of the electrical system. For further information, a complete book of instructions is furnished by the makers, and a paster of directions is on the under side of the cover. Always see that the cover is screwed down tight. Make sure that when the leads to the battery are removed and replaced that the contact surfaces are good. Screw connections down tight.

Battery

After connections are made smear a little vaseline on them to seal the joints and prevent corrosion from acid fumes.

If it becomes necessary at any time to remove the battery, the ground connection should be taken off. Likewise disconnect the negative side of the battery. To do this, it will be necessary to remove the cover which is done by unloosening the two wing nuts which hold down the cover plate and swing the screws out to the right and left of the battery cover. The battery may then be lifted out through the floor of the tonneau.

The solution should have a specific gravity of between 1.285 and 1.300, if the battery is fully charged, and should be kept within these limits.

If the solution does not come up level with the hole in the bottom of the inside cover, fill to this point with pure distilled water, if the specific gravity is above 1.3.

Every six months have the battery inspected, cleaned and recharged by a competent electrician, to prevent sulphating. We provide a battery hydrometer with each car.

The following is a list of the lamp specifications used on the new Locomobile. The bulbs used are Bryan-Marsh, Mazda, 7-volt bulbs, style 1100 base; but either General Electric, Westinghouse or Sunshine bulbs can be used.

Lamps

Lamp Specifications, 1916.

All bulbs to have tungsten filaments, style No. 1100, G. E. base (*Edi-swan socket, single wire system*) except the tonneau lamp.

Open Cars.

Headlight. G–16½ bulb. 21 candle power, 7 volts.

Signal Lights. G–10 bulb, 6 candle power, 7 volts.

Tail Light. G–10 bulb, 3 candle power, 7 volts.

Cowl Light. G–6, 3 candle power, 7 volts.

Trouble Light. G–8 bulb, 6 candle power, 7 volts.

Tonneau Light. T–5 bulb, 6 candle power, 7 volt. With special double cap base.

Step Light. G–6 bulb, 3 candle power, 7 volt.

Closed Cars.

Headlights. G–16½ bulb, 21 candle power, 7 volts.

Signal Lights. G–10 bulb, 6 candle power, 7 volts.

Tail Light. G–10 bulb, 3 candle power, 7 volts.

Dome Light. G–6, 3 candle power, 6 volts.

Cowl Light. G–6, 3 candle power, 7 volts.

Trouble Light. G–8 bulb, 6 candle power, 7 volts.

Tonneau Light. T–5 bulb, 6 candle power, 7 volts. With special double cap base.

Step Light. G–6 bulb, 3 candle power, 7 volts.

When ordering lamps, specify any of the following makes: Bryan-Marsh, General Electric or Westinghouse.

In cleaning the headlights it should be noted that the reflectors are of polished silver and their surface is very sensitive to any gritty matter. Under no circumstances should these reflectors be cleaned with any scouring medium. Polish the headlights gently with a chamois cloth. If they are spotted, clean with a mixture of pure lamp black and kerosene, being careful *not* to rub the reflector in circles, only in and out from the center.

The headlights can be easily focused by a milled head outside of and at the rear of the lamp.

Dome Lights. The interior of the dome light may be reached by turning the catch at the edge of the lamp and then swinging the globe down on its hinges.

Before talking through the telephone press the button on the transmitter several times, as the click in the receiver attracts the attention of the driver. Hold the transmitter vertically close to the mouth, speak in an ordinary conversational tone and enunciate clearly. In pulling the telephone from the pocket or replacing it, run the cord as nearly straight out from the mouth of the hidden reel as possible.

Telephone Closed Cars

The telephone is operated from a set of dry cells in a metal box under the rear seat. If the batteries run down, they should be replaced with one American Ever Ready dry battery No. 710.

Merely turn the cover of the battery box, lift it off, pull out the old battery and put in the new one, taking care to have the bare spot on the side of the battery in the right position to ground on the contact spring in the box. Replace the cover and lock it by turning in the reverse direction.

TRANSMISSION SYSTEM

Clutch. This is a dry plate construction, requiring **no lubrication** or adjustment.

In case trouble should be experienced with the clutch, get in touch with the nearest branch or dealer.

Transmission. This requires no attention except to lubricate as directed.

Rear Axle. Adjustments of the gears, distance rods, etc., are unnecessary, and should not be attempted. Lubricate as directed. The rear axle driving shafts are removable by taking off the hub caps and pulling them out.

The method of adjustment of these brakes is almost self-evident. There is a socket wrench fastened permanently to the front of each brake. To tighten, turn the screw one-half turn, one turn, or whatever may be necessary. Jack up the wheels and get someone to press down the running brake pedal until you can just turn the wheel over by a strong effort. If the brakes are equalized

External Running Brakes

properly, both wheels should turn with about the same effort. If they do not, tighten or loosen until both pull alike. Turn the adjusting wrench to the **right, clock-wise,** to tighten. Make the adjustment on each brake the same. If the brakes seem to be too tight after the car has just been washed it is due to the fact that the combination wire and asbestos brake lining has swelled slightly from the water. In a very short time this condition will disappear.

Internal Expanding Brakes

To adjust the brakes jack up the rear wheels so as to be able to turn them. Open the door in the housing that encloses the front end of the rear spring, on each side of the car. The method of adjustment on each side is the same. Loosen the check nut at the front end of the brake rod and turn the latter so as to shorten it, thus taking up the play. After varying the length of the brake rod set up the check nut tightly. When both brakes are fully released there should not be the slightest friction observable when you turn the rear wheels by hand. Adjust each brake separately.

The equalizing device will take care of any small variation that may exist, so that when the brake is applied the action on both wheels will be the same.

Relining Brakes

The brakes may require relining, and if it is necessary to do this, where it is not expedient to have our branch or dealer do the work, it can easily be done by a competent mechanic. For the outside brake shoes (*running brake*) use 44 copper rivets, No. 12, ½" long, two strips of 3/16"x3" Multibestos or similar **woven** brake lining 48 5/8" long.

For the emergency brake shoes use 48 No. 12 copper rivets, ½" long and four strips of Multibestos brake lining 3/16"x2½"x14½" long.

Always use **woven** not stitched brake lining material.

When the brakes have been relined, it is necessary to adjust the nut *9*, (*Fig. 14, page 50*) until the brake lining just about clears the surface of the drum when the brake is fully released. Keep the brakes always in proper adjustment; it is a matter of personal safety, and when neglected results in decreased braking power.

Tires. To obtain the best service from tires keep them inflated as given below:

Table of Inflation Pressures (*Approximate*).

"38" Locomobile, front tires, 36"x4½"	80 lbs.
"38" Locomobile, rear tires, 37"x5"	90 lbs.
"48" Locomobile, front tires, 37"x5"	90 lbs.
"48" Locomobile, rear tires, 37"x5"	90 lbs.

Air Compressor. In the left front tool compartment is an air hose for connecting the air compressor to the tires. Connect it to the capped fitting in the frame and to the tire. Start the engine (*gears neutral*) and pull the handle in the compartment out and turn it to the right; this couples up the compressor which starts pumping. It takes about 4½ minutes to pump up a flat 37"x5½" tire to 90 lbs. with the engine turning over 1,200 revolutions per minute. (*Do not throw gears into mesh while engine is running at high speed*). When the gauge registers 10 to 15 pounds higher than the amount required, disconnect the hose at tire, and attach to next tire requiring inflation. It is not necessary to stop the compressor, as the hose can be connected or disconnected while the engine is running. It is always advisable to pump 10 to 15 pounds higher than the pressure required, except in very warm weather, because the tire valves have about 10 to 15 pounds resistance. **Always turn the handle to the left when you have finished using the compressor.**

To Regulate Pop (*or safety*) **Valve.** To prevent over-inflation of tires, a safety valve is provided at top of pump. To adjust this, unscrew hexagon lock nut in center of top of pump. Then, while the engine is running, turn the adjusting screw (*the small screw at top of pump*) until the gauge registers the desired pressure, then tighten lock nut again. It should be set about 10 to 15 pounds higher than the amount required in the tire. The pressure is relieved through a hole in the side of the valve. This valve is adjusted at the factory and should require no further adjustment.

What to do in case of failure to get the desired pressure. Examine all hose joints and the hose. (*Use water test for locating leaks*). If everything is found to be tight, remove the ball and spring in the pop valve and clean the valve seat. It is seldom necessary to remove the check valves or the pump cylinders for cleaning, and these should never be disturbed until everything else has been tried.

Cape Top

Care should be used in lowering the cape top that it will fold properly, close and flat. The bow holders at the rear should be made ready first to receive the bows, and the slip cover attached at the rear. Unlock the front of the top from the windshield and push the top straight back before breaking the bows. Do not fold the top when it is wet, unless unavoidable, if done raise it as soon as possible and let it dry off.

Washing the Car

The owner who desires to preserve the good appearance and finish of his car should pay careful attention to the important operation of washing the car. Thoroughly rinse with water until all particles of grit and dirt have been removed. Use for this purpose a stream from a hose, being careful that the pressure of the stream is only great enough to carry the water six or eight inches beyond the end of the hose. Never use a fast running stream as it will drive grit and dust into the varnish.

Be careful to select a proper soap. Avoid laundry or toilet soaps. We recommend Imported Castile, as it does not contain the alkali or acid found in so many other soaps, which if applied to varnish ruins its lustre and finally destroys it.

Never rub the soap direct on the car, or rub the soap on a wet sponge and then apply it. Dissolve the soap in a pail of water, so as to make a good suds, which should be sopped on with a sponge. Apply liberally where the parts are very dirty.

Rinse off immediately with clean water, flowing the water with a hose, using a fresh sponge and flowing the water below it to insure that any grit or dirt that may be left on

the surface is washed away, so that the sponge will not pick it up and scratch the varnish. After the final sponging, the car should be dried with a clean chamois. All sponges should be of the best quality, and should be kept clean. Never use the same sponge for both body and chassis.

Never use hot or even warm water. The proper temperature is 60° to 70°.

Tools and Equipment.

The Locomobile cars are all fully equipped with a list of tools when they are delivered and a few spare parts as extra equipment.

The tool bag contains the following list of tools, and is sealed when put into the car:

Tool Kit Complete (*Includes Tool Bag, Tools and Spare Parts*): as follows:

1 engineer's wrench, 5-16".
1 engineer's wrench, 25-64"x29-64".
1 engineer's wrench, 33-64"x41-64".
1 engineer's wrench, 49-64"x37-64".
1 engineer's wrench, 1 1-64"x1 33-64".
1 engineer's wrench, 1 17-64".
1 socket wrench, 33-64".
1 socket wrench, 44-64".
1 socket wrench, 49-64".
1 bicycle wrench, 4".
1 monkey wrench, 10".
1 combination pliers, 6".
1 screw driver.
1 oil can, (*long spout*).
1 ball pein hammer, 10 oz.
1 jack.
1 cold chisel, 3-4".
1 tire repair kit.
1 hook spanner wrench.
1 valve cap and hub cap wrench.
1 rear axle sleeve nut wrench.
1 Bosch magneto adjusting wrench.

1 spark plug socket wrench.
1 hook spanner wrench.
2 Bosch switch keys.
1 offset socket wrench.
1 chargometer.
1 starting crank.
1 tire brace.
1 tool for removing valves.

Spare Parts.

1 admission and exhaust valve in tool bag.
1 spark plug, in tool bag.
1 fan belt hook, in tool bag.
2 wheel rims, (*Firestone*) on tire irons.
6 National Standard Midget fuses, 15 amperes, on Cowl Panel Cover Plate.
1 bulb case, with bulbs, in left front tool compartment.

The distribution of the spare parts, equipment, etc., is as follows:

GENERAL EQUIPMENT
And Where it May be Found.

Left Front Compartment.

1 box containing 1 each of Electric Light Bulbs used.
1 Starting Crank.
1 Tire Inflating Hose Complete.

Left Rear Compartment.

No. 1 set of Trunk Straps (6 *pieces*).
No. 2 Trunk Guides.
1 Oiling Chart.
1 Instruction Book (*Locomobile*).
1 Instruction Book (*Westinghouse*).
1 Instruction Book (*Bosch*).
1 Instruction Book (*Willard Battery*).
1 Instruction Book (*Klaxon Horn*).

Right Front Compartment.

1 Tool Bag Complete (*Sealed*).

1 Adm. or Exh. Valve (*in Tool Bag*).
1 Spark Plug (*in Tool Bag*).
1 Fan Belt Hook (*in Tool Bag*).
2 Bosch Switch Keys (*in Tool Bag*).
1 Spark Plug Socket Wrench.
1 Chargometer.
1 Trouble Lamp and Cable.
1 Tire Repair Kit.

Right Rear Compartment.

1 Jack and Handle.
1 Tire Wrench.

Equipment Not Found in Running Board Compartments or Under Auxiliary Seat.

1 Oil Can, under hood.
1 Cape Top Slip Cover, under back seat.
1 Radiator Apron, under rear seat.
1 Bosch Switch Key, in coil on dash.
1 Spare Rim, on tire carriers.
6 Spare Fuses, 10 amperes, National Standard Midget on Cowl Panel cover plate under bonnet.
Fuse pliers on Cowl Panel cover plate.

Delivered Special.

3 Keys for Locomobile Locking System.

CHAPTER FOUR

GENERAL OPERATION

The center lever (*Fig. 20*) at the right of the driver is the gear shifting lever. By consulting the diagram, *Fig. 21*, at the right it will be noticed that the quadrant is provided with two slots: one long and one short; *1* and *2* mark the positions of the gear lever in the larger slot to engage the first and second speeds respectively; "Neutral" position of the gear lever in either slot means that none of the four speeds

Gear Lever

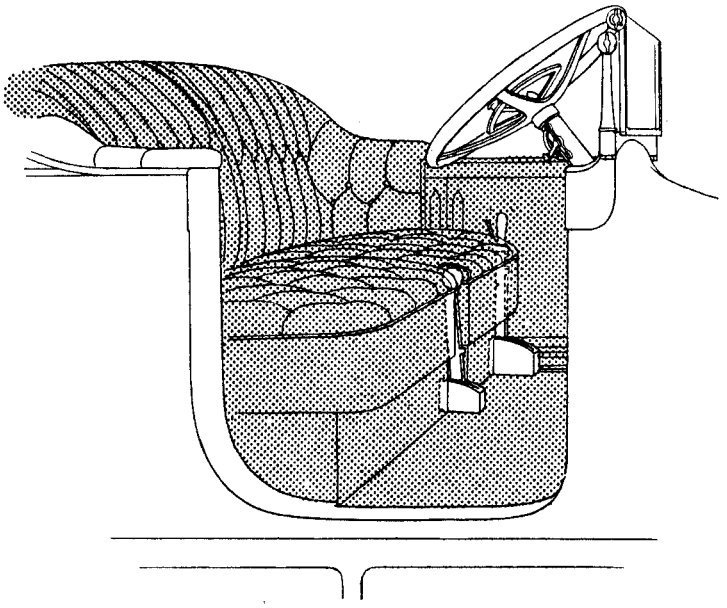


Fig. 20. OPERATING LEVERS

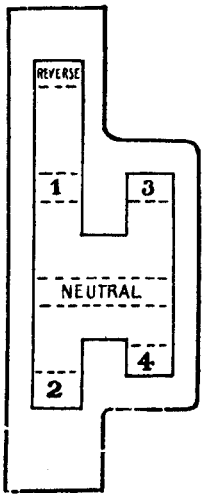


Fig. 21. QUADRANT

or reverse are engaged. In order to obtain "reverse" position in the larger slot it is necessary to press a button on top of the lever when shifting it. The button is not used at any other time. When the car is left standing the gear lever should always be left in neutral position.

Emergency Brakes

The brakes are operated by the outer hand lever (*56 Fig. 15, page 52*) at the left of the car and provided with a spring latch. To apply the brakes simply pull the lever back. This operation by means of suitable rods, and cams, expands the two brake shoes against the inner dircumference of the brake drum. The spring latch is for the purpose of holding the brakes after they have been set—a convenievce when the car is left standing.

Running Brake

The running brake pedal (*50 Fig. 15 page 52*) is operated by the right foot. The brake is applied by pushing the pedal, forward at the same time pushing the left foot pedal (*49*) to release the clutch.

Clutch Pedal

The clutch pedal is operated by the left foot (*49 Fig. 15*). Press forward to release the clutch. The clutch pedal must always be operated with care. When starting the car, the pressure on the pedal should be released very gradually. "Slipping the clutch" slows down the speed of the car temporarily. This is done by pressing on the pedal so that the clutch is partially disengaged and rotates at a lower speed than the fly-wheel.

It is better when driving in traffic to throttle down or go into a lower gear rather than depend on slipping the clutch for holding down speed.

Spark Lever

The hand lever *54* on the outer circumference of the quadrant on the steering wheel is the spark lever. When pulled as far backward as it will go the spark is fully retarded. When it is pushed forward the spark is advanced. The proper amount of advance depends on the conditions of operation. As a rule for all driving between 15 and 45 miles an hour carry the spark ¾ advanced, below that speed retard to ½ advance, and above that speed carry full advance.

The spark lever must always be fully retarded before cranking the motor by hand. This is very important. With the electric starter the spark may be advanced ½. When driving the spark may be pretty well advanced— about ¾ full for normal driving, and full advance for high speeds.

Hand Throttle

The inner lever *53 Fig. 15* on the steering wheel pushes forward to open the throttle. The usual method of operation is to set the lever only part way forward on the quadrant—at such a point as will cause the car to run about 10 miles per hour or so on level roads. Then greater speed or more power for hills or heavy roads is obtained by pressing on the foot throttle or accelerator. When the hill is climbed or the road improves the pressure on the foot pedal is released and the car speed is reduced to 10 miles an hour.

Ignition Switch

The rear end of the horizontal spark coil is in the form of a three-way switch flush with the dashboard. The switch lever may be moved to three positions: "*O*" for off, "*M*" for magneto, and "*B*" for battery. A key is provided enabling the operator to lock the lever in the center position "*O*". See Ignition Wiring Diagram, page 42. Ordinarily leave the coil permanently on "*M*" as engine will start on magneto and stop with the lock switch.

Priming Button

The priming button (*57 Fig. 15*) is placed conveniently to the left of the steering column. When pressed, a needle valve allows gasoline from the tank to flow directly into the engine admission pipe. It must be noted that if there is no pressure in the tank, the pressure should be raised to about 2 pounds by means of the hand pump set into the dash.

Starting Button

This is the button *45* of the four on the dash and is marked "starter". This should be pressed and held down till the engine starts. If the gears fail to mesh the first time, touch the button quickly once and then the gears will mesh.

Air-Regulating Device

This device, which is located on the steering column, consists of a collar *52*, which by varying the strength of the inner spring on the automatic air valve, regulates the amount of air admitted to the carburetor. To decrease the air, turn clockwise: to increase, reverse this direction. An adjustable stop is provided.

A Muffler Cut-out

For trying out the motor a cut-out is placed on the exhaust pipe. The handle is on the right side of the car under the running board. We do not recommend its use except for adjusting carbureter, etc.

Hand Pressure Pump. Unlock the handle of the hand pump *L* by turning it until it can be withdrawn.

STARTING THE MOTOR

All new model Locomobiles are equipped with the Westinghouse starting and lighting system, especially designed for Locomobile cars.

The Following Rules Should Always Be Followed Carefully

1. Put the gear shift lever *55 Fig. 15* in neutral. 2. Switch the Bosch coil to the Magneto position, marked "*M*."

To Start

Spark lever should be ½ advanced. If the engine fails to start, try "*B*" position on coil, and turn the coil button to the arrow points to the right. (Be sure the lock switch *43* is in the "ON" position.) 3. Turn the air valve collar on the steering column to the right to get a rich mixture. 4. Pump up about 2 lbs. pressure in the gasoline tank by the hand pressure pump. 5. Now touch the starting button *45* on the dash board. The motor will be turned over and commence running. When this occurs, the starter gear is automatically pulled out of mesh, whether the starter button is depressed or not. When the engine is warm, the carbureter air valve collar is gradually turned till the normal position is found. This is best learned by experience (*see paragraph on adjustment, page 83.*) If it is desired to run on the battery ignition, the coil should be put in the "*B*" position and the button turned with the arrow to the left.

Changing Gears

Press the left foot hard against clutch pedal and maintain this pressure. Shift the gear lever to first speed. Release the hand brake lever. Speed up the motor by opening the throttle a little wider and advancing the spark a little. Now release the pressure on the clutch pedal very slowly and evenly

so that the clutch will engage with the fly-wheel gradually and start the car without a jerk.

When the car is under way and has gone twenty feet or more and attained good momentum, release the clutch, remove the foot from accelerator and allow the motor to reduce its speed. Shift the gear lever promptly to second speed and let in the clutch again, accelerating the motor moderately. The change from first to second speed is accomplished most quietly when made very soon after actually starting the car from a state of rest on first speed. Next shift to the third position and finally to fourth position. The car should be run on the fourth speed most of the time. In engaging reverse, always wait until the car is at an absolute standstill. Press down the button on the top of the gear lever and move it to extreme forward position in the outer slot. If it will not go all the way, let up on the pressure on the clutch pedal a very little and the lever will pass into reverse position.

Hill Climbing

In order to climb a hill, speed up the motor as you approach it so as to increase the power of the motor and the momentum of the car. Most hills can be climbed thus without shifting gears. When the motor begins to labor retard the spark.

If you come to a hill that is evidently a steep one, too steep for sensible driving on the fourth speed, shift promptly to the third speed and you will then be able to climb it more quickly and with less shock to the motor and transmission than on the fourth speed. Do not wait until the car has lost momentum. This is very important, shift *before* it is necessary.

If you should find it necessary to stop going up hill, apply the brakes promptly. In starting again, first engage the 1st speed, maintaining pressure on brake pedal, then release the emergency brakes. Then immediately afterward release pressure on the brake pedal and the car will start up the hill. Be sure to have the motor turning over fairly fast, or it will "stall" on the engagement of the clutch. This is best learned by practice.

CHAPTER FIVE

USEFUL INFORMATION

Figuring Speeds

In order to find the speed of any automobile, it is necessary to know three things, namely, the speed of the engine in revolutions per minute, the gear ratio or gear reduction, and the size of the rear wheels. To make this figuring unnecessary for our patrons, the chart above has been produced, from which the result can be taken without any actual figuring.

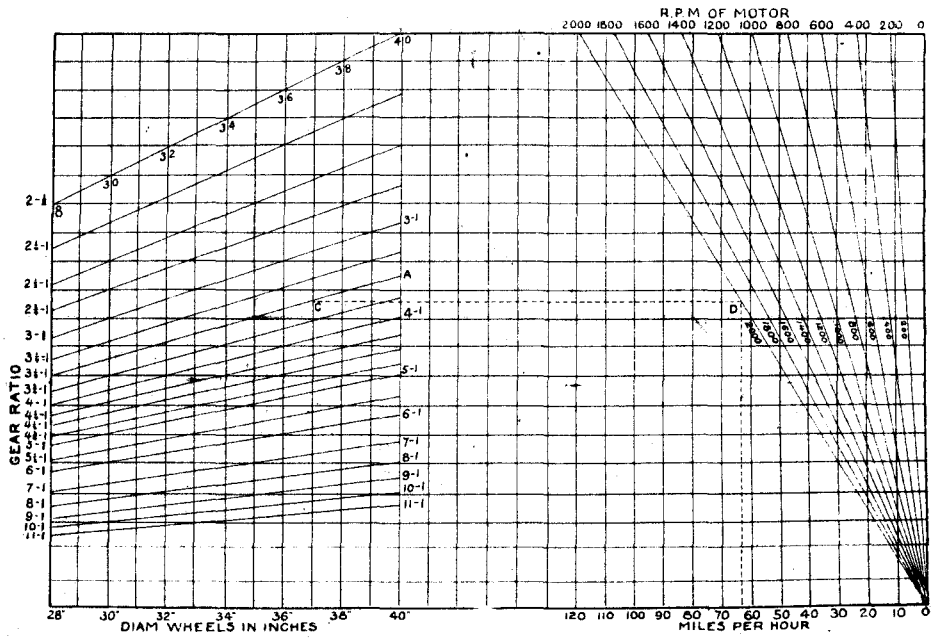


Diagram Showing Car Speed and Its Relation to Wheel Diameter, Engine Speed and Gear Ratio

Thus beginning at the bottom on the left hand side, the diameter of the wheels is 37″; follow vertically up the 37″ line, that is the one midway between 36″ and 38″, until it intersects the gear ratio diagonal. In this case the gear

reduction is 3½ to 1. The 37″ line intersects this, marked *A* at the right hand end, at the point *C*.

Then follow horizontally across to the right hand end, where such a horizontal line would intersect the diagonals representing the speed of the engine. In this instance, the engine speed is taken at 2,000 r.p.m., and the line intersects it at the point *D*. From this point drop a vertical to the base, which will be intersected at a point representing the car speed, in this case 64 m.p.h.

The table can be used also to find the engine speed in revolutions per minute, knowing the car speed in miles an hour (*which can be read on the speedometer*), the size of tires and the gear reduction. In such a case proceed as before, obtaining the horizontal line *C—D* extending across the diagram. Then starting on the right hand base line, at a point indicating the speed, as at 64 m.p.h., draw a line vertically upward until it intersects this *C—D* line. This point of intersection *D* will come on a curve, giving the speed of the motor. In this case it comes on the 2,000 r.p.m. curve exactly, but if the speed were followed upward from 60 m.p.h. for instance another point would be obtained not on any of the curves drawn. However, it would be midway between 2,000 and 1,800, so the average of these or 1,900 would be taken as the motor speed. Similarly with other car and motor speeds, the gear reduction and tire size remaining constant at all times.

HORSE POWER FORMULAS

Four-Cycle Engines

Authority	*Formula*
S. A. E Royal Auto Club	$\frac{D^2N}{2.5}=\text{H.P.}$
Brit. Inst. of Auto Engrs.	$0.45\ (D+L)\ (D-1.18)=\text{H.P.}$
E. P. Roberts	$\frac{D^2LRN}{18{,}000}=\text{H.P.}$

D = Diam. of cylinder in inches R = Rev. p. m. crank shaft
L = Length of stroke in inches N = Number of cylinders

Derivation of the S.A.E. Horse Power Formula

The indicated horsepower of a single-cylinder, four-cycle engine is equal to one-quarter times the mean effective pressure P, acting throughout the working stroke, times the area of the piston A, in square inches, times the piston speed S divided by 33,000, thus:

$$\text{I. H. P.} = \frac{1}{4} \times \frac{P\,A\,S}{33{,}000}$$

Multiplying this by the number of cylinders N gives the I. H. P. for an engine of the given number of cylinders, and further multiplying by the mechanical efficiency of the engine E gives the brake horse power. Therefore the complete equation for B. H. P. reads:

$$\text{B. H. P.} = \frac{PASNE}{33{,}000 \times 4}$$

The S. A. E. assumed that all motor car engines would deliver or should deliver their rated power at a piston speed of 1,000 feet per minute, that the mean effective pressure in such engine cylinders would average 90 pounds per square inch, and that the mechanical efficiency would average 75 per cent.

Substituting these values in the above B. H. P. equation, and substituting for A its equivalent, .7854 D^2, the equation reads:

$$\text{B. H. P.} = \frac{90 \times .7854\ D^2 \times 1{,}000 \times N \times .75}{33{,}000 \times 4}$$

and combining the numerical values it reduces to:

$$\text{B. H. P.} = \frac{D^2N}{2.489}$$

or, in round numbers, with a denominator 2.5.

The formula can be simplified however, for ordinary use by considering the number of cylinders, thus for the usual 4-, 6-, and 8-cylinder engines it becomes:

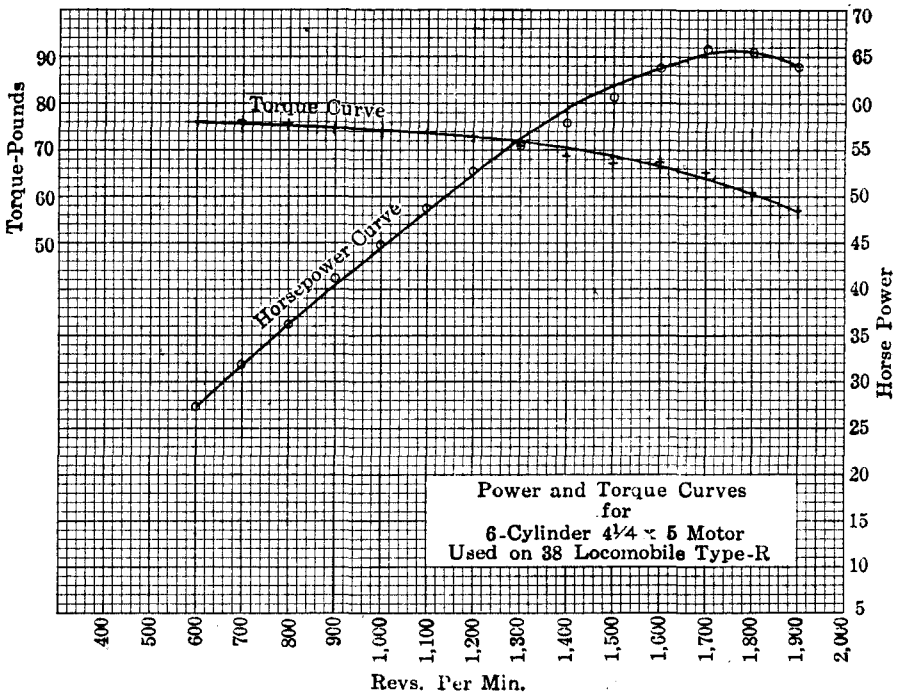
1.6 D^2 = H. P. for all 4-cylinder motors
2.4 D^2 = H. P. for all 6-cylinder motors
3.2 D^2 = H. P. for all 8-cylinder motors

HORSE POWER RATINGS

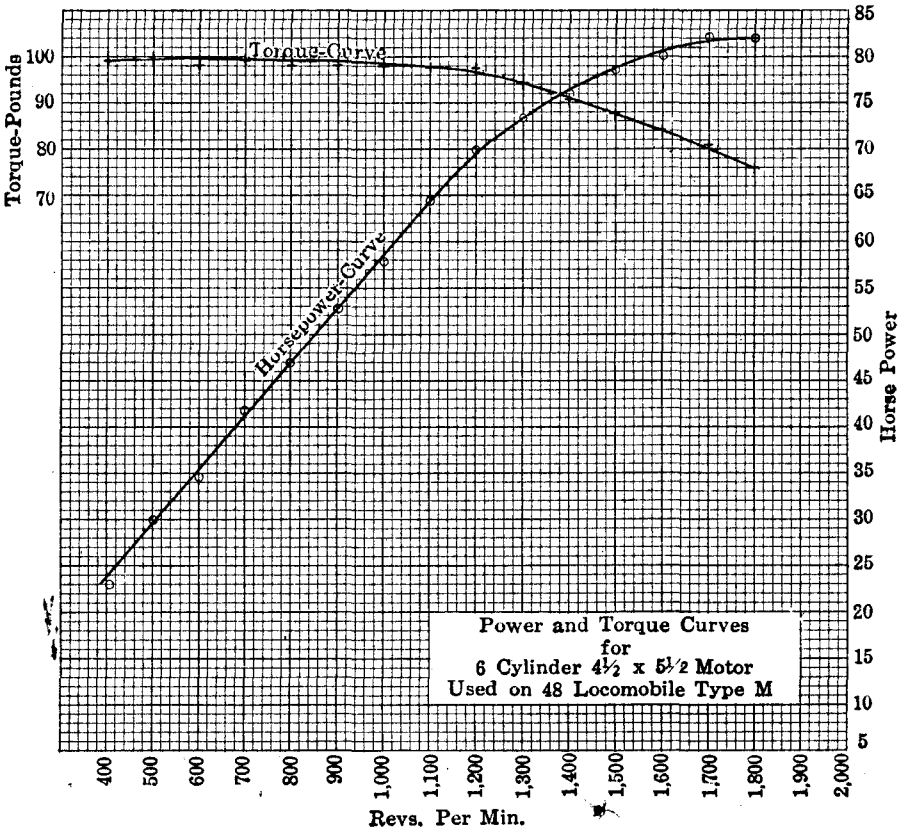
For the convenience of Locomobile patrons, the ratings of all ordinary motors have been figured out and are given in the following table. In this, the standard formula, given and explained on the preceding page has been used, except that for simplification the horse power figures are approximate, being carried out but one decimal place.

Table No. 1 Horse Power Ratings

BORE		HORSE POWER			
Inches	Mm.	2 Cyl.	4 Cyl.	6 Cyl.	8 Cyl.
2 1/2	64	5.	10.	15.	20.
2 5/8	68	5.5	11.	16.5	22.
2 3/4	70	6.1	12.1	18.2	24.2
2 7/8	73	6.6	13.2	19.8	26.4
3	76	7.2	14.4	21.6	28.8
3 1/8	79	7.8	15.6	23.4	31.2
3 1/4	83	8.4	16.9	25.3	33.8
3 3/8	85	9.1	18.2	27.4	36.5
3 1/2	89	9.8	19.6	29.4	39.2
3 5/8	92	10.5	21.1	31.6	42.2
3 3/4	95	11.3	22.5	33.8	45.
3 7/8	99	12.	24.	36.	48.
4	102	12.8	25.6	38.4	51.2
4 1/8	105	13.6	27.2	40.8	54.5
4 1/4	108	14.5	28.9	43.4	57.9
4 3/8	111	15.3	30.6	45.9	61.3
4 1/2	114	16.2	32.4	48.6	64.8
4 5/8	118	17.1	34.2	51.3	68.5
4 3/4	121	18.	36.1	54.1	72.1
4 7/8	124	19.	38.	57.	76.
5	127	20.	40.	60.	80.
5 1/8	130	21.	42.	63.	84.
5 1/4	133	22.	44.1	66.2	88.3
5 3/8	137	23.	46.	69.1	92.1
5 1/2	140	24.2	48.4	72.6	96.8

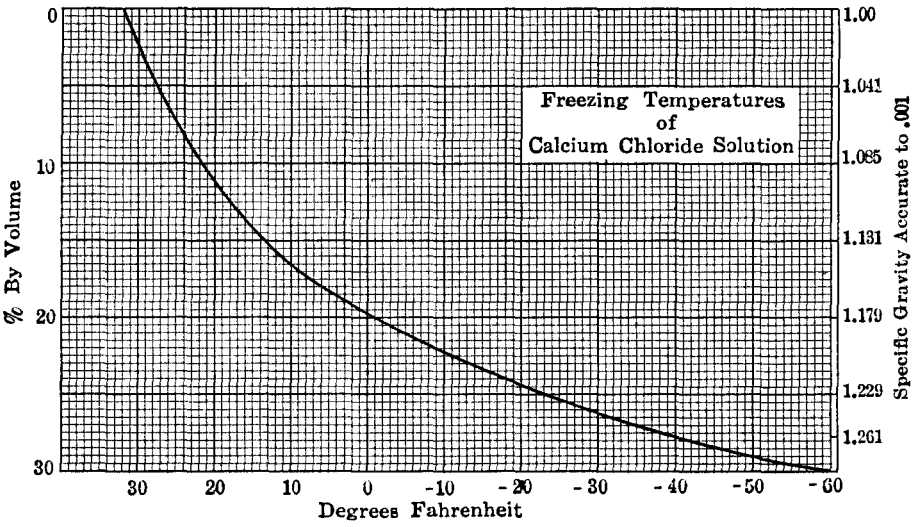


The Curves show the actual performance of Loco Motors.

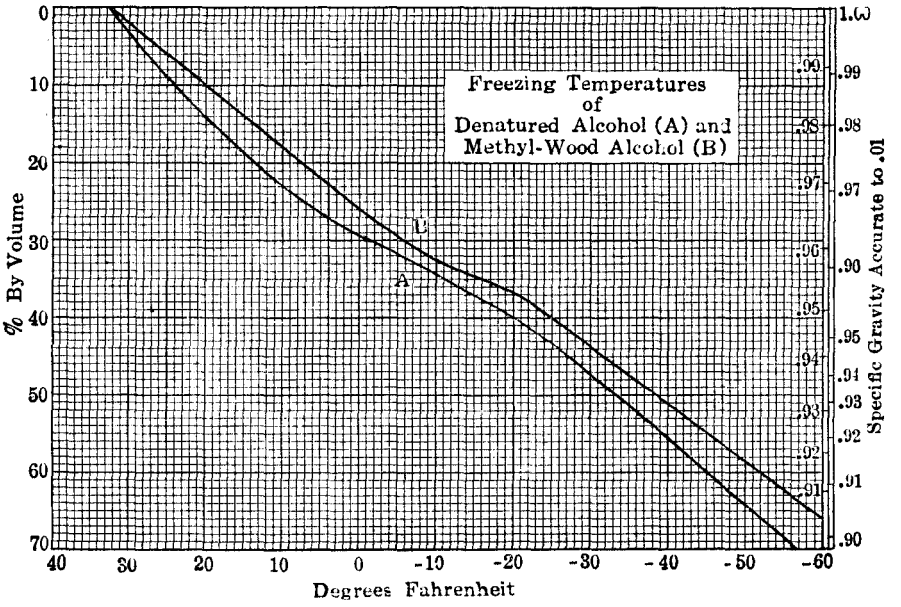


Explanation of Solution Curves

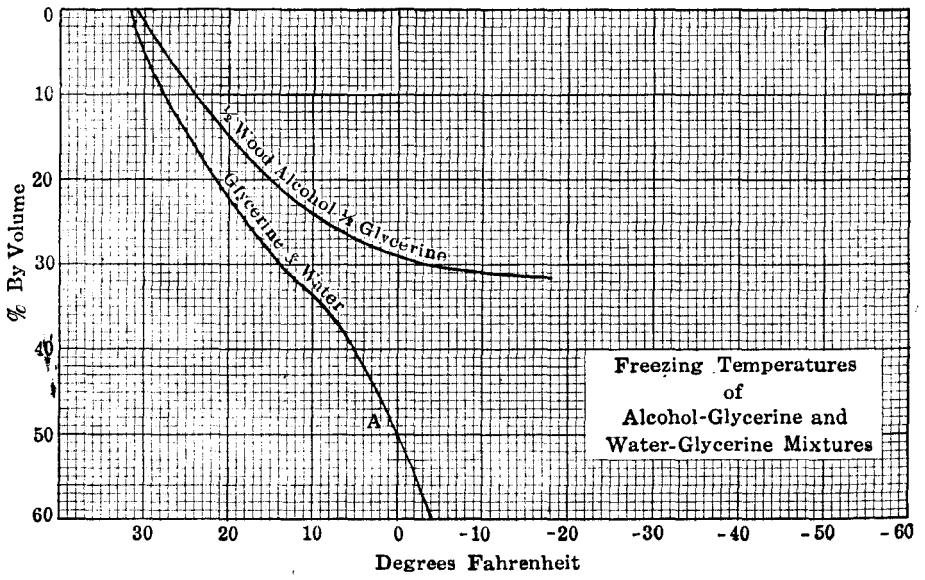
On this and the two following pages are given curves showing the temperatures at which various well-known anti-freezing solutions will freeze, in various proportions of mixture with water, one another and other liquids. These are both interesting and necessary as different latitudes and altitudes require different solutions and each person should be able to select that solution and in that right proportion to avoid having any trouble in the coldest possible weather likely to be experienced in his home location. Tables would show this, but in a less interesting manner.



Calcium Chloride. The first curve shows the temperatures which can be produced with calcium chloride (*common salt of calcium*). This is obtainable at any drug store and is simply mixed with water in the desired proportion. The best plan is to make a saturate solution of the salt, and then add this liquid to other water in the desired proportion. The scale at the left gives proportions of calcium in the mixture by volume and the base, the temperature resulting, while the right hand scale gives a measure of specific gravities which can be used as a check on the proportions. Note that with 30 per cent. of the mixture calcium chloride a temperature of minus 60 can be obtained.

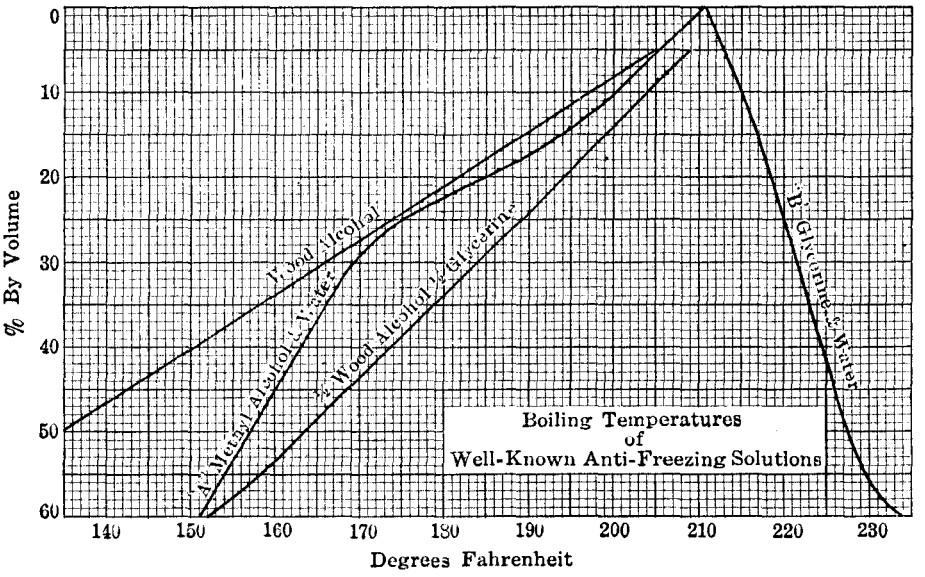


Denatured Alcohol. The next curve is that of denatured alcohol, which is being used more and more for this purpose. In this two curves are given for denatured and methyl or wood alcohol. It will be noted that for equal volumes, the latter gives a slightly lower temperature. Here again the right hand scale gives specific gravities which can be used to check the proportions. Note that with a 70 per cent. solution, a temperature of minus 57 can be obtained, showing less cooling efficiency than calcium.



Glycerine Mixtures. The third curve is that of glycerine, mixed with half wood alcohol, and with water. Neither of these can produce a very low temperature, the former giving minus 18 as its highest and the latter minus 4; this latter also with a 60 per cent. solution.

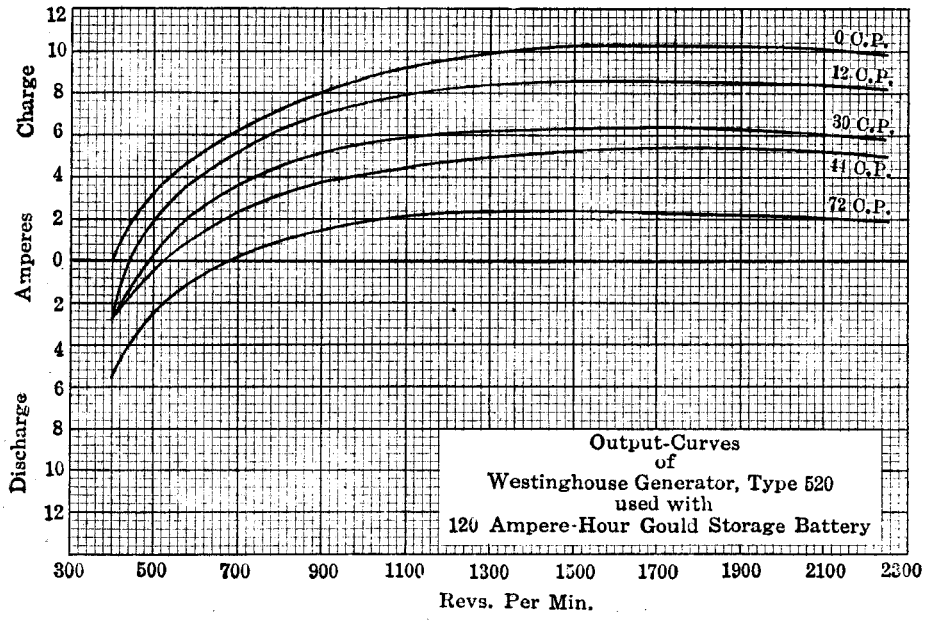
Boiling Temperatures. It is important to know the boiling temperatures of these liquids because frequently we have exceedingly warm days in the middle of winter, or an engine may be allowed to stand, running, for an hour or more, during which it will heat greatly. If not kept below the boiling point, the liquid will boil away and be lost, reduc-



ing the low temperature capacity of the system. Note that the boiling temperatures of all except glycerine increase with weakness of the solution, or conversely, decrease with strength of solution, while that (*glycerine*), increases with strength of solution. It should be noted that wood alcohol boils as low as 140 degrees and lower with solutions of 47 per cent. and greater (*by volume*), while methyl alcohol and water will boil below 170 at all strengths above 30 per cent. These facts make it imperative to use these solutions with great care, as 170 and even 180 are common temperatures.

Output Curves of Electric Generator

The chart below represents the output of the electric generator under various demands and at different speeds. The driver of the car is recommended to study this with care as it indicates to a certain extent the condition of the battery and in this way, the entire electrical system. The notable point about the curves is the abrupt rise at slow speeds and



then the flatness of the remaining part. An ideal output curve would come up at 45 or 60 degrees, then be perfectly horizontal up to maximum speed. On detailed inspection it will be noted how closely these curves approximate this. This result too, is obtained without any special and complicated governing method, but is inherent in the windings of the machine. Another notable point is the increased output of the generator to meet increased lamp load.

AMERICAN TOURING

Interstate Regulations

General lighting requirements are: Two white lights in front and one rear red light showing white on the license tag.

Tags are furnished by the State (or County) *except* as follows: Montana, Nebraska, South Carolina, Tennessee, Texas, Utah and Washington, where they must be furnished by the Owner; and in Oklahoma, where there is no provision.

Licenses are good for 1 year and expire December 31st, necessitating renewal each year before January 1st, *except* in: Minnesota, where the license is good for 3 years, otherwise the same as others; Nebraska and Rhode Island, where the license is good for 1 year from date of issue; Missouri and New York, where the license year begins February 1st; Georgia, where the license year begins March 1st; Mississippi (*law held unconstitutional*) and Washington, where the license year begins June 1st; Kansas, North Carolina and West Virginia, where the license year begins July 1st; Alabama and Florida, where the license year begins October 1st; Tennessee, Utah, Montana, Mississipi, and the District of Columbia where the license is perpetual; and Texas and South Carolina, where there is no provision.

Non-residents are exempt either wholly, on a reciprocity basis or for a limited period varying from 10 days to 6 months *except* in: Oklahoma, South Carolina, Tennessee and Texas, where they are not exempt and must take out a license.

The above information and the following tables are as accurate as can be obtained, but continual changes in the laws are being made. In addition, the laws are still before the Courts in a number of the states.

LICENSE	Position of Tags	SPEED LIMITS
Alabama. Apply Secretary of State, Montgomery. Home license secures same privileges as granted by Home state to non-residents (*reciprocity*).	Rear	30 m.p.h. for ¼ mile considered *prima facie* evidence of excess.
Arizona. Apply Secretary of State, Phoenix. Non-residents exempt for 6 months.	Front and Rear	Closely built up 10 m.p.h., elsewhere in city or town 15 m.p.h. open country 30 m.p.h.
Arkansas. Apply Chairman State Highway Com. Home state license accepted. Non-residents exempt.	Rear	In cities and towns 15 m.p.h. for ⅛ mile, in open country 20 m.p.h. for ¼ mile *prima facie* evidence of excess.
California. Motor Vehicle Division, Sacramento. Home license accepted. Non-residents exempt for 3 months.	Front and Rear	Cities 15 m.p.h., open country 30 m.p.h.
Colorado. Secretary of State Denver. Home license accepted. Non-residents exempt for 90 days.	Rear	No general speed limits.
Connecticut. Secretary of State, Hartford. Home license accepted. Non-residents exempt (*reciprocity*).	Front and Rear	25 m.p.h. for ⅛ mile *prima facie* evidence of excess.
Delaware. Secretary of State Dover. Home license accepted. Non-residents *not* exempt; no fee for license.	Front and Rear	Cities and towns 12 m.p.h., open country 20 m.p.h.
District of Columbia. Automobile Board, Wash. Home license accepted. Non-residents exempt (*reciprocity*) on registering name with Board within 24 hours.	Front and Rear	Maximum 20 m.p.h., between intersecting streets 12 m.p.h., parks 15 m.p.h., across streets 8, around corners 6, in certain specified districts 4 m.p.h.
Florida. Tax Collector of County. Home license accepted. Non-residents exempt for 15 days.	Rear	No general limits. Rule of "reasonable and proper" applied.

LICENSE	Position of Tags	SPEED LIMITS
Georgia. Secretary of State, Atlanta. Home license accepted. Non-residents exempt for 30 days.	Front and Rear	Bridges, curves, intersecting highways, other crossings 6 m.p.h. All other places reasonable and proper.
Idaho. Secretary Highway Commission, Boise. Home license accepted. Non-residents exempt (*reciprocity*).	Front and Rear	30 m.p.h. for ¼ mile *prima facie* evidence excess.
Illinois. Secretary of State, Springfield. Home license accepted. Non-residents exempt for 60 days.	Front and Rear	25 m.p.h. in open country, 20 in cities *prima facie* evidence excess.
Indiana. Secretary of State, Indianapolis. Home license accepted. Non-residents exempt for 60 days.	Front and Rear	Business portion city or town 10 m.p.h., residence 15 or 20, open country 25.
Iowa. Secretary of State, Des Moines. Non-residents exempt (*reciprocity*).	Front and Rear	Over 25 m.p.h. presumptive evidence of excess.
Kansas. County Treasurer. Non-residents exempt for 30 days.	Front and Rear	Cities and towns, 12, country, 25 m.p.h.
Kentucky. Secretary of State, Frankfort. Non-residents exempt (*reciprocity*).	Front and Rear	In cities 10 and 15 m.p.h. for ⅛ mile, in country 20 m.p.h. for ¼ mile *prima facie* evidence excess.
Louisiana. No state law in force. Local restrictions.		
Maine. Secretary of State, Augusta. Non-residents exempt for 30 days. Special restrictions in some towns notably on Mt. Desert Island.	Front and Rear	Cities and towns 10 m.p.h., country 25.
Maryland. Commissioner of Motor Vehicles, Baltimore. Home license of reciprocating states secures license and tags for two periods of 7 days each.	Front and Rear	In cities 18 m.p.h., country 25 m.p.h. *prima facie* evidence excess.

LICENSE	Position of Tags	SPEED LIMITS
Massachusetts. State Highway Comm's, Boston. Non-residents and chauffeurs exempt for 10 consecutive days if home state is reciprocal. License for June, July and August issued at ½ annual fee	Front and Rear	In open country 20 m.p.h. for ¼ mile, in cities and towns 15 for ⅛ mile or more than 8 m.p.h. where view is obscured *prima facie* evidence excess.
Michigan. Secretary of State, Lansing. Non-residents exempt up to 90 days (*reciprocity*).	Front and Rear	Business portions 10 m.p.h., elsewhere cities and towns 15 m.p.h., open country 25.
Minnesota. Secretary of State, St. Paul. Non-residents exempt for 30 days.	Front and Rear	In cities 15 m.p.h. for ⅛ mile, in country 25 for ¼ miles *prima facie* evidence excess.
Mississippi. State Auditor, Jackson. Non-residents exempt for 60 days. Law declared unconstitutional—not replaced.		
Missouri. Secretary of State, Jefferson City. Non-residents exempt for 30 days.	Rear	Over 25 m.p.h. for ½ mile presumptive evidence excess.
Montana. Secretary of State, Helena. Non-residents exempt.	Front Rear	Reasonable and proper.
Nebraska. Secretary of State, Lincoln. Non-residents exempt for 30 days at a time.	Front and Rear	Cities and towns 12 m.p.h., country 25 m.p.h.
Nevada. Secretary of State, Carson City. Non-residents exempt for 30 days.	Rear	Reasonable and proper.
New Hampshire. Secretary of State, Concord. Non residents exempt for 10 days. License for June, July and August issued at ½ annual fee.	Front and Rear	In city or town 15 m.p.h. for ⅛ mile, in open country 25 m.p.h. for ¼ mile conclusive of excess.

LICENSE	Positions of Tags	SPEED LIMITS
New Jersey. Comm's of Motor Vehicles, Trenton. Non-residents exempt 15 days (*reciprocity*).	Front and Rear	Cities 12 m.p.h., open country 25 m.p.h.
New Mexico. Secretary of State, Santa Fe. Non-residents exempt 60 days.	Front and Rear	No general speed limits.
New York. Secretary of State, Albany, New York City and Buffalo. Non-residents exempt (*reciprocity*).	Front and Rear	30 m.p.h. for ¼ mile presumptive evidence of excess.
North Carolina. Secretary of State, Raleigh. Non-residents exempt 15 days (*reciprocity*).	Front and Rear	Business portion city or town 10 m.p.h., residence 15 m.p.h., open country 25 m.p.h.
North Dakota. Secretary of State, Bismark. Home license accepted. Non-residents exempt	Front and Rear	Cities and towns 10 m.p.h. open highway 30 m.p.h.
Ohio. Secretary of State, Columbus. Non-residents exempt. Law declared unconstitutional—not replaced.	Front and Rear	Closely built up sections 8 m.p.h., cities 15 m.p.h., open country 20 m.p.h.
Oklahoma. Highway Commissioner, Oklahoma City. Non-residents not exempt, must take out license, fee $1.00.	No Provision	No speed limits.
Oregon. Secretary of State, Salem. Non-residents exempt 30 days.	Front and Rear	25 m.p.h.
Pennsylvania. State Highway Department, Harrisburg. Non-residents exempt (*reciprocity*).	Front and Rear	Closely built up sections 12 m.p.h. elsewhere 24 m.p.h.
Rhode Island. State Board Public Roads, Providence. Non-residents exempt (*reciprocity*) not over 10 days at a time.	Front and Rear	Closely built up sections of cities and towns 15 m.p.h., open country 25 m.p.h.

LICENSE	Position of Tags	SPEED LIMITS
South Carolina. Clerk of County Court. Non-residents not exempt must take out license fee $1.00.	Rear	15 m.p.h., at street crossings 6 m.p.h.
South Dakota. County Treasurer. Non-residents exempt (*reciprocity*).	Rear	25 m.p.h. presumptive evidence of excess.
Tennessee. Secretary of State, Nashville. Non-residents not exempt, must take out license, fee $2.00.	Rear	20 m.p.h. Local restrictions in cities, towns and villages.
Texas. County Clerk. Non-residents not exempt, must take out license, fee $.50.	Rear	City or town 8 m.p.h., open country 18 m.p.h.
Utah. Secretary of State, Salt Lake City. Non-residents are exempt.	Rear	Closely built up sections 10 m.p.h., elsewhere in city or town 15 m.p.h., open country 20 m.p.h.
Vermont. Secretary of State Montpelier. Non-residents exempt (*reciprocity*). Fee for 3 months, ¼ annual amount.	Front and Rear	In city or town over 10 m.p.h., in open country over 25 m.p.h. presumptive evidence of excess.
Virginia. Secretary of Commonwealth, Richmond. Non-residents exempt for two periods of 7 days each.	Rear	Closely built up sections of cities 8 m.p.h., other sections 12 m.p.h., open country 20 m.p.h.
Washington. Secretary of State, Olympia. Non-residents exempt.	Rear	Business portion of city or town 12 m.p.h., open country 24 m.p.h.
West Virginia. State Auditor, Charleston. Non-residents exempt (*reciprocity*).	Front and Rear	Cities 15 m.p.h., open country 20 m.p.h.
Wisconsin. Secretary of State, Madison. Non-residents exempt.	Front and Rear	Cities and towns 15 m.p.h., open country 25 m.p.h.
Wyoming. Secretary of State, Cheyenne. Non-residents exempt.	Front and Rear	Reasonable.

CANADIAN REGULATIONS

Upon entering the Dominion, the owner or operator must give a bond (see note on page 104) for the re-exportation of the car. In the majority of provinces a Dominion license and tags are necessary.

LICENSE	Position of Tags	SPEED LIMITS
Alberta. Non-residents must take out license, fee $3.00.	Rear	Within city or town limits 10 m.p.h., open highway 20 m.p.h.
British Columbia. Non-residents must take out license, fee $2.00.	Rear	Within city or town limits 10 m.p.h., open highway 15 m.p.h.
Manitoba. Non-residents exempt 30 days, home license accepted.	Front and Rear Both *rigid*	Bridge dam culvert, etc. 6 m.p.h., closely built up sections cities and towns 10 m.p.h., residence sections 15 m.p.h., elsewhere 20.
New Brunswick. Non-residents exempt, home license accepted.	Rear	Closely built up sections 12 m.p.h., other sections 15 m.p.h. open highway 20 m.p.h.
Nova Scotia. Non-residents exempt, home license accepted.	Rear	Closely built up sections 7½ m.p.h., others 12 m.p.h., open highways 15 m.p.h.
Ontario. Provincial Secretary, Toronto. Non-residents not exempt, must take out license fee $4.00.	Front Rear Ont. tags *only*	Within city or town limits 15 m.p.h., elsewhere 20 m.p.h.
Quebec. Provincial Secretary, Sherbrooke. Non-residents exempt (*reciprocity*).	Front and Rear	Reasonable and proper. In built up sections 12 m.p.h., elsewhere 15 m.p.h.
Saskatchewan. Non-residents not exempt, must take out license, fee $10.00.	Rear	Cities, towns and villages 10 m.p.h., open highway 20 m.p.h.

If the tourist is not known personally to the officer at the border, he must take out the license and give the bond as mentioned above. But if known, he may be allowed to enter free of both duty and tax for seven days.

The bond given must be for twice the amount of duty, if the stay is to be for less than 6 months. This is furnished by bonding companies in the principal cities of the United States and Canada, and usually at the border line, the fee being $5.00. The following will furnish such a bond: Guarantee Co. of North America, 111 Broadway, New York City; J. A. Newport & Co., Niagara Falls, Ontario; Niagara Falls Auto Transit Co., Niagara Falls, N.Y.; J. M. Duck, Windsor, Ontario; A. J. Chester, Sarnia, Ontario; F. W. Myers & Co., Rouses Point, N. Y. and Alburg, Vermont. Messrs. Newport and Duck will also procure the license and permit in advance, if requested, the charge being $4.30 ($4.00 fee and 30 cents postage).

The motorist must remember that there are local restrictions everywhere, which could not be given in a limited table like the above, even if all of them were available. For instance, New York, Detroit, Chicago, State of Pennsylvania, Province of Ontario, etc., require either a full stop or slowing to 4 or 5 m.p.h. at a street car stopping to let off or take on passengers. These and local traffic police restrictions can be found out locally, or avoided entirely by driving slowly and carefully at all times, and in a manner consistent with the rights of others, particularly of pedestrians.

In case of accident, the motorist should always stop, obtain the names of witnesses, and give his own name and other information freely, as well as evidence a willingness to assist, whether in the wrong or not.

Touring Helps—Route Books

The whole of the United States and the tourable parts of Canada are covered by the Automobile Blue Books. Of these there are seven volumes, as follows: Vol. 1, New York State and Lower Canada; Vol. 2, New England and the Maritime Provinces of Canada; Vol. 3, New Jersey, Pennsylvania, Delaware, Maryland and Southeastern States.

Vol. 4, the Middle West to the Mississippi River; and Vol. 5, the Far West from the Mississippi to the Pacific Coast, Vol. 6, Cal., Ore., Wash., Brit. Columbia, Vol. 7, the Metropolitan Guide. They are published by the Automobile Blue Book Publshing Co., 2160 Broadway, New York, and 910 S. Mich. Ave., Chicago, at $2.50 a volume.

The Automobile Club of America publishes a tour book which is free to members of the Bureau of Tours, and sold to the public at $3.00. The Blue Book Company also publishes the Pilot maps, covering the New England States and Hudson River district, these consisting of maps only with no text or directions. C. S. Mendenhall, Race Street, Cincinnati, Ohio, publishes automobile maps of some 20 or more states, while similar maps of the Western states are gotten out by the Clason Map Co., Denver, Col.

A number of the Middle-western states are covered by a series of large scale maps published by the Iowa Publishing Co., Des Moines, Iowa. Colorado maps and route books are given away by the Colorado Springs and Denver Chambers of Commerce. An excellent map and guide to the state of Maine is given away by the Maine State A. A., 12 Monument Square, Portland, Maine. Others given away free are: Motor Tours in Nova Scotia, by the *Halifax Morning Chronicle*, Halifax, N. S.; the Goodrich Company, Akron, Ohio, maps of the various sections of the country; and others produced by various other firms, newspapers and civic bodies.

For its members, the American Automobile Association maintains a route bureau and sells a number of excellent maps. In addition, this Association recommends the Blue Book and its members get it at a reduced rate.

For those who can use them, the topographical maps of the United States Geological Survey are most accurate and very interesting, giving more detailed information than any of the others, particularly with regard to difference of elevation. Information relative to them, prices, etc., may be obtained from the Director of the Survey, Washington.

SERVICE STATIONS.

For the information and convenience of **Locomobile** owners, we print below a list of the Service Stations of The Locomobile Company of America, of the Westinghouse Electric & Mfg. Co., of the Bosch Magneto Co., and of the Willard Storage Battery Co., where expert advice and service may be had:

THE LOCOMOBILE COMPANY OF AMERICA.

Factory Branches.

New York City	61st Street, next to Broadway.
Boston, Mass.	700 Commonwealth Avenue.
Chicago, IIll	2000 Michigan Avenue.
San Francisco, Cal	230 Fulton Street.
Philadelphia, Pa	Twenty-Third and Market Street.
Los Angeles, Cal.	Pico and Figueroa Streets.
Seattle, Wash	600 East Pike Street.
Oakland, Cal	12th and Harrison Streets.
Atlanta, Ga	469 Peachtree Street.
Baltimore, Md	107 West Mt. Royal Avenue.
Washington, D. C	1124 Connecticut Avenue.
Pittsburgh, Pa	Euclid Avenue and Baum Street.
Kansas City, Mo	1833 McGee Street.
St. Louis, Mo	3033 Locust Street.
Minneapolis, Minn	832 Hennepin Avenue.
Bridgeport, Conn	Seaside Park.

WESTINGHOUSE ELECTRIC & MFG. CO.

Service Centers.

New York City	528 West 25th Street.
Boston, Mass	37 Wormwood Street.
Philadelphia, Pa	214-220 West North 22d Street.
Chicago, Ill	32 South Peoria Street.
Buffalo, N. Y	768 Elliott Square.
Pittsburgh, Pa	Anderson Avenue, P.R.R.
San Francisco, Cal	1400 Fourth Street.
Los Angeles, Cal	2026 Bay Street.
Seattle, Wash	26 West Conn. Street.
Atlanta, Ga	1333 Candler Building.
Dallas, Texas	Cotton Exchange Building.
Baltimore, Md	121 East Baltimore Street.
Cleveland, Ohio	1104 Swetland Building.
Denver, Col	Gas and Electric Building.
St. Louis, Mo	419 Bank of Commerce Building.
Detroit, Mich	1212 Savings Bank Building.
Kansas City, Mo	1012 Baltimore Avenue.
Salt Lake City, Utah.	Walker Bank Building.
Indianapolis, Ind	Traction Terminal Building.
Cincinnati, Ohio	1107 Traction Building.

BOSCH MAGNETO COMPANY.

Bosch Branches.

New York City	Bosch Magneto Company.
Chicago	Bosch Magneto Company.
Detroit, Mich.	Bosch Magneto Co.
San Francisco, Cal.	Bosch Magneto Company.
Toronto, Can.	Bosch Magneto Company.

Bosch Distributors.

Atlanta, Ga.	Ozburn Auto Supply Co., Inc.
Baltimore, Md.	C. Spoerer's Sons Co.
Binghamton, N.Y.,	R. W. Whipple.
Boston, Mass.	Motor Parts Co.
Buffalo, N. Y.	Motor Parts Co.
Cincinnati, O.	Oskamp Auto Supply Co.
Cleveland, Ohio	Pennsylvania Rubber & Supply Company
Denver Col.	Quinn & McGill Motor Supply Co.
Des Moines, Iowa	Herring Motor Supply Co.
Honolulu, T. H.	Von Hamm-Young Co.
Indianapolis, Ind.	Gus Habich.
Kansas City, Mo.	Kansas City Auto Supply Co.
Los Angeles, Cal.	E. A. Featherstone.
Manilla, P. I.	Erlanger & Galinger (11 Broadway, N. Y.)
Memphis, Tenn.	Ozburn Auto Supply Co., Inc.
Milwaukee, Wis.	Lemke Electric Co.
Minneapolis, Minn.	Western Motor Supply Co.
Omaha, Neb.	Powell Supply Co.
Philadelphia, Pa.	Motor Parts Co.
Pittsburgh, Pa.	Doubleday-Hill Electric Co.
Portland, Oregon	Ballou & Wright
Richmond, Va.	Dallas A. Shafer & Co.
Sacramento, Cal.	Kimball-Upson Co.
Salt Lake City, Utah	Bertram Motor Supply Co.
San Juan, P. R.	Pietrantoni & Sojo
Seattle, Wash.	Ballou & Wright
St. Louis, Mo.	Phoenix Auto Supply Co.
Toledo, Ohio	W. Nagel Electric Co.

Bosch Supply Stations.

Aberdeen, Wash.	Poulson Auto Co.
Akron, O.	The Motor Supply and Tire Co.
Albany, N. Y.	Albany Garage Co.
Altoona, Pa.	Eleventh Ave. Garage
Amarillo, Texas	T. M. Caldwell
Ampterdam, N. Y.	Greene & Warnick
Anaconda, Mont.	Frank Osborne

Annapolis, Md.	The H. B. Myers Co.
Astoria, Ore.	Astoria Hardware Co.
Atlantic City, N. J.	Cuskaden Auto Supply Co.
Auburn, Me.	Darling Automobile Co.
Augusta, Me.	Augusta Garage
Babylon, L. I.	Harnell Garage
Bakersfield, Cal.	Bakersfield Garage & Supply Company.
Bangor, Me.	Bangor Motor Co.
Bar Harbor, Me.	Ellsworth Foundry & Machine Company.
Belleville, Ill.	Modern Auto & Garage Co.
Bellingham, Wash.	Bellingham Auto Supply Co.
Birmingham, Ala.	Drennen Motor Car Co.
Bloomington, Ill.	Hackett-Harvey Garage Co.
Boise, Idaho	Bertram Motor Supply Co.
Bridgeport, Conn.	Erwin M. Jennings Co., Inc.
Brooklyn, N. Y.	The Martin-Evans Co.
Camden, N. J.	New Jersey Automobile & Supply Co.
Cape Girardeau, Mo.	Cotner Auto Supply Co.
Carlsbad, N. M.	Ohnemus Shops
Carroll, Ia.	Swaney Auto Co.
Casper, Wyo.	Casper Machine Shop & Garage
Centralia, Wash.	St. John & Titus
Charleston, S. C.	Clude Garage
Charlotte, N. C.	Woodside Motor Co
Chattanooga, Tenn.	Southern Auto & Supply Co.
Cherokee, Iowa	North West Garage
Cheyenne, Wyo.	Plains Auto Co.
Circleville, O.	I. P. Todd
Clearfield, Pa.	Orcutt & Buchanan
Cleveland, O.	The Motor Supply & Tire Co.
Cohoes, N. Y.	Troy Automobile Exchange
Colorado Springs, Col.	Markshaffel Motor Co.
Columbia, S. C.	Gibbes Machinery Co.
Columbus, Nebr.	Max Gottberg Auto Co.
Columbus, O.	The Motor Supply & Tire Co.
Cumberland, Md.	Queen City Garage.
Dallas, Texas	Electric Service Co.
Danville, Va.	Dan Valley Motor Co.
Davenport, Ia.	Mason Carriage Works
Dayton, Ohio	G. W. Shroyer & Co.
Decatur, Ill.	Motor Car Supply House
Dixon, Ill.	Geo. Nettz Garage
Dothan, Ala.	Clendinen & Co.
Dover, N. H.	Franklin Square Garage
Elko, Nev.	Elko Auto Co.
Ellsworth, Me.	Ellsworth Foundry & Machine Co.
Elkhart, Ind.	Warren Garage Co.
El Paso, Tex.	Western Battery & Magneto Co.

Elyria, O.	Jackson & Harrison Co.
Englewood, N. J.	Stillman & Hoag.
Erie, Pa.	LeJeal Cycle & Mobile Works
E. St. Louis, Ill.	W. F. Rothe & Co.
Eugene, Ore.	Sweet-Drain Auto Co.
Evanston, Ill.	Washington Garage..
Evansville, Ind.	J. F. Charley Auto Co.
Everett, Wash.	Haley & Sheraton Co., Inc...
Fall River, Mass.	J. Edward Newton Co.
Fargo, N. D.	H. B. Tilden
Flagstaff, Ariz.	Babbitt Bros.
Flushing, N. Y.	John F. Esser.
Fort Wayne, Ind.	Fort Wayne Overland Auto Co.
Fort Dodge, Ia.	Hanson & Tyler Auto Co.
Freeport, Ill.	Freeport Garage
Fresno, Cal.	Waterman Bros. Co.
Galesburg, Ill.	Galesburg Machine Works
Galveston, Tex.	Christensen & Co., John
Geneva, N. Y.	Fay & Bowen Engine Co.
Glen Cove, L. I.	Frank Dudgeon, Jr.
Glens Falls, N. Y.	Empire Automobile Co.
Glenwood Springs, Col.	J. F. McCoy
Gloucester, Mass.	Gloucester Garage
Gloversville, N. Y.	Kathan & Petrie
Grand Rapids, Mich.	Michigan Tire Co.
Great Falls, Mont.	Lee Forest
Green Bay, Wis.	West Side Garage
Hanford, Cal.	Cousins-Howland Auto Co.
Harrisburg, Pa.	Front-Market Motor Supply
Hartford, Conn.	Robert R. Ashwell.
Hastings, Neb.	Kister Garage.
Helena, Mont.	Swendeman Automobile Co.
Houghton, Mich.	Northern Garage & Supply Co.
Houston, Texas	Bering Tire & Rubber Co.
Huntington, L. I.	Sammis & Downer
Hutchinson, Kan.	Auto Supply Co.
Idaho Falls, Idaho	Clay Auto Co.
Jackson, Mich.	Central Automobile & Supply Co.
Jacksonville, Fla.	Joseph H. Walsh
Jersey City, N. J.	H. G. Kotten Co.
Johnstown, Pa.	The Johnstown Automobile Co.
Joliet, Ill.	Joliet Motor Co.
Kalamazoo, Mich.	Harry A. Scott & Co.
Kalispell, Mont.	Frank D. Stoop
Kankakee, Ill.	G. A. Fortin
Kingston, N. Y.	Stuyvestant Garage
Knoxville, Tenn.	Rodgers & Co.
Lancaster, Pa.	H. M. Vondersmith

Lawrenceville, Ill.	Lawrenceville Auto Co.
Lincoln, Neb.	Pinney's Garage
Logansport, Ind.	Carter & Stukey
Logan, Utah	Blair Motor Co.
Long Branch, N. J.	R. V. Dorbeck.
Lorain, O.	Rathwell's Garage
Louisville, Ky.	Andrew Cowan & Co.
Lynchburg, Va.	Hudson Morgan Electric Co.
Lynn, Mass.	C. E. Whitten
Macon, Ga.	S. S. Parmalee Co.
Manchester, N. H.	J. B. McCrillis & Son.
Manitowoc, Wis.	L. J. Anderson Co.
Marietta, O.	Court Motor Car Co.
Marquette, Mich.	Cloverland Auto Co.
Marshfield, Ore.	Smith & Wade
Marysville, Cal.	Roberts Electrical Works
Mason City, Ia.	Mason City Auto Co.
Mattoon, Ill.	Mattoon Motor Car Co.
Medford, Ore.	Crater Lake Motor Car Co.
Menominee, Mich.	Dugas Motor Car Co.
Milton, Ore.	Milton Garage
Minot, N. D.	Minot Auto Co.
Mitchell, S. D.	Central Auto & Supply Co.
Mobile, Ala.	Cadillac Motor Co.
Montgomery, Ala.	Hobbie Motor Car Co.
Morristown, N. J.	Victor A. Wiss & Bros.
Mt. Vernon, N. Y.	Mt. Vernon Auto Works
Muskegon, Mich.	Koelbel-Bennett Auto & Supply Co.
Nashua, N. H.	Pollard Auto Co.
Nashville, Tenn.	Dorris Auto Shops
Nebraska City, Nebr.	J. H. Markel
Newark, N. J.	Tire Trading Co.
Newburgh, N. Y.	Sloan & Clapper, Inc.
New Bedford, Mass.	William Law Co.
Newburyport, Mass.	Ingalls Garage Co.
New Haven, Conn.	Geo. B. Wuestefeld Co.
New Orleans, La.	Fairchild Auto Co.
New York, N. Y.	John F Esser, 1908 Broadway Magneto Sales Co., 1777 Broadway Geo. H. Tyrell Co., Inc., 2659 Webster Ave. Bronx
Newport News, Va.	J. P. Gayle Supply Co.
Newport, R. I.	Newport Engineering Works.
New Rochelle, N. Y.	G. O. Reynolds, Inc.
Norfolk, Va.	Reliance Electric Co.
Ogden, Utah	James Auto Co.
Oklahoma City, Okla.	Severin Tire & Supply Co.
Olympia, Wash.	Olympia Auto Supply Co.

Ottawa, Ill.	H. J. Hilliard Garage
Ottumwa, Ia.	Ottumwa Auto Co.
Parkersburg, W. Va.	G. C. Wilderman Co.
Paterson, N. J.	Reliable Magneto Repair Co
Pendleton, Ore.	Pendleton Auto Co.
Penn Yan, N. Y.	Joseph T. Cox.
Peoria, Ill.	Graham-Seltzer Co.
Petersburg, Va.	George B. Carter
Phoenix, Ariz.	Motor Supply Co.
Pittsfield, Mass.	J. & B. Mfg, Co.
Plainfield, N. J.	Laing Machine-Auto Repair Co.
Pocatello, Idaho	Trist Automobile Co.
Port Chester, N. Y.	W. A. Raban.
Portland, Me.	Maine Motor Car Co.
Portsmouth, N. H.	Portsmouth Motor Mart, Inc.
Poughkeepsie, N. Y.	Tiffany Diamond Garage
Prescott, Ariz.	Arthur Hendey
Providence, R. I.	American Ball Co.
Provo, Utah	Provo Machine & Foundry Co.
Quincy, Ill.	Nichols Motor Car Co.
Reading, Pa.	Central Motor Car Co.
Roanoke, Va.	Virginia Motor Car Co.
Rochester, N. Y.	J. Lawrence Hill Co.
Rockford, Ill.	Eric J. Gustafson
Rock Island, Ill.	Sauermann Motor Co.
Rock Springs, Wyo.	Western Auto Transit Co.
Saginaw, Mich.	S. H. Heginbottom & Son
San Antonio, Texas	H. G. Guenther.
San Diego, Cal.	Gavin-Williams Co.
San Jose, Cal.	Letcher Garage
Sanford, Me.	York County Garage.
Santa Barbara, Cal.	Western Machine & Foundry Co.
Santa Cruz, Cal.	Jensen Bros. Auto Co.
Saratoga Springs, N. Y.	Ross-Ketchum Co.
Savannah, Ga.	T. A. Bryson
Schnectady, N. Y.	MacDonald Garage Co., Inc.
Scranton, Pa.	Chas. B. Scott Co.
Sheridan, Wyo.	D. & D. Auto Co.
Shreveport, La.	Henderson's Garage.
Sioux City, Iowa	Wyckoff-Cord Auto Co.
South Bend, Ind.	Frazier & Frazier
Spokane, Wash.	Child, Day & Churchill.
Springfield, Ill.	Springfield Auto Sales Co.
Springfield, Mass.	Motor Parts Co.
Stamford, Conn.	Rippowam Garage
Staunton, Va.	Beverly Garage, Inc.
St. Albans, Vt.	St. Albans Foundry Garage
St. Joseph, Mo.	Armstrong Auto Co., Inc.

St. Paul, Minn.	Reed Motor Supply Co.
Tacoma, Wash.	Automobile Supply Co.
Tampa, Fla.	G. Norman Baughman Co., Inc.
Trenton, N. J.	The Motor Shop, Inc.
Trinidad, Col.	Trinidad Novelty Works
Troy, N. Y.	Troy Automobile Exchange
Tucson, Ariz.	Motor Supply Co.
Tulsa, Okla.	Auto Repair and Mfg. Co.
Union Hill, N. J.	Clifton Automobile Co.
Uniontown, Pa.	Shaw Motor Co.
Walla Walla, Wash.	Dahlen Auto Co.
Warren, O.	Morgan & Williams Co.
Washington C. H., O.	C. A. Gossard Auto Co.
Washington, D. C.	The Miller-Dudley Co.
Waterbury, Conn.	The Brass City Auto Co.
Waterloo, Iowa	Repass Auto Co.
Wausau, Wis.	Hall's Garage & Supply House
Wheeling, W. Va.	Lavender Auto Supply Co.
White Plains, N. Y.	Tri-State Supply Co.
Wichita, Kan.	Wichita Automobile Co.
Wilkesbarre, Pa.	Susquehanna Motor Car Co.
Worcester, Mass.	Morgan & Corey
Yonkers, N. Y.	Shrive, Inc.
Youngstown, Ohio	Stambaugh-Thompson Co.

Canadian Service.

Canadian Fairbanks-Morse Co., Ltd.

Montreal, Quebec	Canadian Fairbanks-Morse Co., Ltd.
Calgary, Alta.	Canadian Fairbanks-Morse Co., Ltd.
St. John's, N. B.	Canadian Fairbanks-Morse Co., Ltd.
Ottawa, Ont.	Canadian Fairbanks-Morse Co., Ltd.
Vancouver, B. C.	Canadian Fairbanks-Morse Co., Ltd.
Saskatoon, Sask.	Canadian Fairbanks-Morse Co., Ltd.
Victoria, B. C.	Canadian Fairbanks-Morse Co., Ltd.
Winnipeg, B. C.	Canadian Fairbanks-Morse Co., Ltd.

WILLARD STORAGE BATTERY CO.

Branches.

Chicago, Ill.	2241 South Michigan Avenue.
Detroit, Mich.	1191 Woodward Avenue.
Indianapolis, Ind.	438–439 Indiana Pythian Building.
New York City	136 West 52d Street.
San Francisco, Cal.	243 Monadnock Block.

Service Stations.

Akron, Ohio	(New Batteries) The Motor Supply & Tire Co., 201 South Main Street. (Repairs and Service) Baker Electric Vehicle Company.
Anaheim, Cal	Anaheim Ignition Depot.
Appleton, Wis	Appleton Motor Car Co.
Athens, Tenn	Athens Automobile Co.
Augusta, Ga	Whitney-Ingram Co., 1053 Broad Street.
Austin, Minn	Ward Electric Company.
Austin, Texas	Tom L. Gray.
Battle Creek, Mich	Central Electric Co., 21 Jefferson Avenue, North.
Baltimore, Md	Auto Electric Co., 2 West Preston Street.
Beaumont, Texas	Beaumont Electric Company.
Belleville, Ill	Western Automobile & Electric Company
Binghamton, N. Y	Blanding Electric Supply Co.
Billings, Mont	Billings Electric Supply Co.
Birmingham, Ala	Turner Electric Supply Co.
Boise, Idaho	Bertram Motor Supply Co., 106 North 10th Street.
Boston, Mass	W. H. & Webster Jones Co., 410 Newbury Street.
Brockton, Mass	Howe Auto Electrical Company.
Buffalo, N. Y	Theo. P. Meinhard, 846 Main Street.
Butte, Mont	Butte Electric Supply Co., 44 East Broadway
Canton, Ohio	Canton Engineering & Electric Co., 411 North Market Street.
Catskill, N. Y	Amos Post.
Cedar Rapids, Iowa	Parlor City Supply Company.
Charlotte, N. C	Charlotte Storage Battery & Mfg. Co., 9–11 North Brevard Street,.
Chippewa Falls, Wis	Chippewa Valley Auto Company.
Cheyenne, Wyoming	Dildine Garage Co., 315 West 19th Street.
Cincinnati, Ohio	Motor Supply & Tire Co., 919–921 Race St.
Columbia, S. C	John A. Hamilton, 1216 Main Street.
Columbus, Ohio	W. E. Evans & Co., 167 North 4th Street.
Des Moines, Iowa	Herring Motor Supply Co., 912–14 Locust Street.
Douglas, Ariz	Frank Lohman.
Elkhart, Ind	Brice H. Reed Company.
Fall River, Mass	Robert W. Powers.
Faribault, Minn	Auto Supp.y Company.
Fargo, N. D	Fargo Plating & Metalizing Company.
Fitchburg, Mass	Welch & Suthergreen, 80–86 Lunenburg Street.
Fon du Lac, Wis	The Service Motor Company
Fort Wayne, Ind	Electric Garage Co., 323 East Main Street.

Fresno, Cal.	Chanslor & Lyon Co., 1261 K Street.
Galveston, Texas	Cgas. Newding, 2216 Post Office Street.
Grand Forks, N. D.	Monley & Smith, 3d Street and DeMers Avenue.
Grand Rapids, Mich.	Michigan Tire Company.
Grand Rapids, Wis.	Jensen Bros.
Great Falls, Mont.	Great Falls Electric Supply Company.
Green Bay, Wis.	Washington Garage.
Hannibal, Mo.	E. C. Long Mfg. Co., 903–905 Broadway.
Helena, Mont.	Helena Electric Supply Company.
Houston, Texas	Hurlburt-Still Electrical Co., 1015 Texas Avenue.
Indianapolis, Ind.	Electric Vehivle Service Co., Meriden and Walnut Streets.
Jackson, Mich.	Central Automobile & Supply Co., 103 North Pearl Street.
Jacksonville, Fla.	Fred E. Gilbert Co., 925 Main Street.
Kansas City, Mo.	E. S. Cowie Electric Co., 1517 Grand Avenue.
Lansing, Mich.	Storage Battery Supply Co., 114 E. Ottawa Street.
Laramie, Wyo.	Lovejoy Novelty Works, 412–414 Second Street.
Lawrence, Mass.	C. I. Alexander & Company.
Leadville, Colo.	Mandy & Belz, 312–14 Harrison Avenue.
Lima, Ohio	Reed Bros. Electric Company.
Little Rock, Ark.	W. E. Bell Auto Co., 910 Main Street.
Logansport, Ind.	Rutenbur Electric Company.
Long Beach, Cal.	A. C. Walker, 352 American Avenue.
Los Angeles, Cal.	Western Auto Electric Corporation, 308 West Pico at Olive.
Louisville, Ky.	Rommel Motor Car Co., 901 East Broadway
Macon, Ga.	Morris Putzel.
Manitowac, Wis.	The Dickey Motor Car Company.
Mankato, Minn.	C. H. Perron.
Marshfield, Wis.	Hub City Auto Company.
Memphis, Tenn.	Lilly Carriage Co., 197–213 Union Avenue.
Milwaukee, Wis.	Julius Andrae & Sons Co., 358 Broadway.
Minneapolis, Minn.	Western Motor Supply Co., 1016 Nicollet Avenue.
Minot, N. D.	Minot Auto Co., Inc.
Missoula, Mont.	Missoula Electric Supply Company.
Montgomery, Ala.	Montgomery Carriage Works Co., 215 Bibb. Street.
Muskogee, Okla.	Oklahoma Auto Supply Co., 216 N. 4th St.
Nashville, Tenn.	Whiteman-Kirkpatrick Co., 1209 Broad St.
Newark, N. J.	Electric Garage Co., 123 Washington Avenue.
New Bedford, Mass.	The S. C. Lowe Supply Co., 22 Fourth St.
New Britain, Conn.	G. K. Spring Company.

New Haven, Conn.	The Holcomb Co., 97–105 Goffe Street.
New Orleans, La.	Interstate Electric Co., Baronne & Perdido.
New Rochelle, N. Y.	F. M. Henkel & Company.
Norfolk, Va.	Reliance Electric Co., 131 W. City Hall A–
Oakland, Cal.	Electric Vehicle Maintenance Company, Richard Scraba, Mgr., 426 20th Btreet.
Omaha, Neb.	Drummond Motor Co., 26th and Farnum St.
Oshkosh, Wis.	Oshkosh Metal Products Company.
Oskaloose, Iowa	States Auto Supply Company.
Owatonna, Minn.	Zamboni & Sons.
Pawtucket, R. I.	New England Machine & Electric Company.
Pendleton, Ore.	J. L. Vaughan, 831 Main Street.
Peoria, Ill.	Graham–Sekzer Co., 122 Main Street.
Petaluma, Cal.	Independent Machine Works, 264 Main St.
Philadelphia, Pa.	J. H. McCullough & Son, 219 North Broad St.
Pittsburgh, Pa.	Robbins Electric Co., 830 Liberty Avenue.
Portland, Me.	L. W. Cleveland Co., 441–443 Congress Ave.
Portland, Ore.	Chanslor & Lyon Co., 627 Washington Street.
Providence, R. I.	The Elmwood Garage, 420–450 Potter Ave.
Pueblo, Colo.	Kyle Electric Company
Rawlins, Wyo.	W. E. Bible & Company
Reading, Pa.	C. J. Rathje, 1041 Franklin Street
Richmond, Ind.	Richmond Electric Co., 17–18 Comstock Bldg.
Rochester, Minn.	A. H. Foster Company.
Rochester, N. Y.	Oliver Bros., 111 Monroe Avenue.
Rock Island, Ill.	Totten Auto Co., 1708 Third Avenue.
Sacramento, Cal.	Sacramento Ignition Works, 1217 K Street.
Saginaw, Mich.	Tromley Electric Company.
St. Louis, Mo.	Moerschell Electric & Supply Co., 3685 Olive Street.
St. Paul, Minn.	Electric Mfg. Co., 164 West 6th Street.
Salt Lake City, Utah	Bertram Motor Supply Co., 251 South State Street.
San Antonio, Texas	S. X. Callahan, 419 North Flores Street.
San Diego, Cal.	J. Stanley La Sha.
San Francisco, Cal.	Chanslor & Lyon Co., 501–7 Golden Gate Avenue.
San Jose, Cal.	Consolidated Garage Co., Market and James Street.
Santa Ana, Cal.	Orange County Ignition Works.
Santa Barbara, Cal.	Western Machine & Foundry Co.
Savannah, Ga.	Savannah Electric Garage & Tire Co.
Schenectady, N. Y.	A. A. Seeley, Jr., 521 Smith Street.
Scranton, Pa.	Ralph A. Amerman.
Seattle, Wash.	Chanslor & Lyon Co., 916 East Pike Street.
Sheybogan, Wis.	Rummele Auto Co.
Sioux City, Iowa	Bennett Auto Supply Co., 514–18 Nebraska Street.

South Bend, Ind.	Shaffstall Bros., 521 West Washington Street
Springfield, Ill.	Electrical Vehicle Co., 84 Dwight Street.
Springfield, Ohio.	Howard B. DeWitt.
Stevens Point, Wis.	Stevens Point Garage.
Sumter, S. C.	Van Deventer & Warren.
Syracuse, N. Y.	W. D. Andrews Co., 216 East Washington St.
Tampa, Fla.	Pierce Electric Company.
Taunton, Mass.	Frederick Shaw.
Terre Haute, Ind.	John S. Cox, 222 South 7th Street.
Toledo, Ohio.	Keeler Battery Co., 134 Ontario Street.
Topeka, Kan.	Southwick Auto Supply Co., 925 Kansas St.
Troy, N. Y.	Hinsdill Electri Co., 550 Fulton Street.
Waco, Texas	Waco Tire & Battery Exchange, 617 Franklin Street.
Walla Walla, Wash.	City Garage, 225 East Alder Street.
Warren, Ohio	Warren Auto Lighting Co., John Cooper, Manager, 26 First Street.
Warsaw, Ind.	Warsaw Auto Co., 108–12 West Main St.
Washington, D. C.	Carroll Electric Co., 514– 12th Street, N.W.
Wausaw, Wis.	S. Karas & Son, 908 Third Street.
Wichita, Kan.	Hockaday Auto Supply Co., 416 East Douglas Avenue.
Wilkesbarre, Pa., Kitsee Battery Co.	62 North Main Street.
Winona, Minn.	Winona Motor Car Co.
Youngstown, Ohio	The Motor Mart, 128 West Rayen Avenue.

Canada.

Calgary, Alberta	Motor Car Supply Co., 607 First St., West.
Ottawa, Ont.	Herbert Kingsland, 5 Graham Building
Regina, Sask.	W. H. Hodgson, 8th Avenue.
Swift Current, Sask.	Saskatchewan Motor Car Co., 1947 Rose St.
Toronto, Ont.	Veralls Garage, 47 Pearl Street.
Vancouver, B. C.	Canadian Electrical Power Storage Co., 557 Homer-Richards Lane.

Cuba.

Havana,	E. E. Tolksdorff.

England.

London	Rushmore Lamps, Ltd., 76 Brewer St., Piccadilly Circus.