INSTRUCTION BOOK

PIERCE-ARROW

38 HORSE-POWER 6-CYLINDER

(S. A. E. RATING, 38 H. P.)

THE PIERCE ARROW MOTOR CAR CO.

BUFFALO, N. Y.

MODEL 38-C3

Instructions for the Care and Operation of 38 H. P., Six Cylinder, PIERCE-ARROW Model C-3.

A. L. A. M. RATING
38 HORSE-POWER

SPECIFICATIONS:—Motor—6 cylinder, 4-inch bore by 5½-inch stroke. Revolutions per minute, 200 to 2,000.

RUNABOUT.— Gasoline capacity, 26 gallons. Wheelbase, 134″. Steering post, 40°. No other body fits this chassis.

FOUR PASSENGER TOURING.— Gasoline capacity, 26 gallons. Wheelpost, 134″. Steering post, 46°. Tire equipment, all around, 36″ x 4½″.

FIVE PASSENGER TOURING, BROUGHAM AND LANDAULET, VESTIBULED BROUGHAM AND LANDAULET.—Gasoline capacity, 26 gallons. Wheelbase, 134″. Steering post, 46°. Tire equipment, all around, 36″ x 4½″.

LIST OF TOOLS, ETC.— The following spare parts, tools and supplies are furnished with each car, and if any of these are missing, kindly communicate with us or our agents.

IN CABINETS ON DASH.

1 Universal Key to Yale Locks.
6 Spark Plugs.
1 Valve, complete with Spring, Spool and Cotter.
2 Small Monkey Wrenches.
1 Large Monkey Wrench.
1 Large Screw Driver.
1 Small Screw Driver.
2 Files. One flat, 1 round.
1 Grease Pump.
1 Can of Lubricating Oil.
1 Can of Neat's-foot Oil.
1 Fan Belt.
1 Instruction Book.
1 Combination Pliers.
1 Special Long-nosed Pliers for Friction Clutch.
1 Package of Cotters and Taper Pins.
1 Hammer.
1 Punch.
1 Wrench for Magneto.
3 Double-ended Wrenches.
1 Wrench for Gasoline Tank.
2 Fuses, 30 Amperes. 2 Fuses, 10 Amperes. 2 Fuses, 5 Amperes.
1 Wrench for Adjusting Headlamps.
1 Wrench for Terminal Nuts on Starting Switch.
1 Pressure Gauge for Tires

UNDER REAR SEAT.

1 Dust Cover for top.

UNDER FRONT SEATS.

1 Inspection Lamp.
Hose for inflating tires.
1 Gallon Can of Motor Oil.
One 5-lb. Can of Duplex Liquid Grease.
One 2-lb. Can of Cup Grease.
One 1-lb. Can of Water Pump Grease.
1 Jack
1 Wheel Remover.
1 Box Wrench for Caps over Valves, 1 Bar for same.
1 Hub Cap Wrench.
1 Tire Repair Kit.
1 Rubber Pail.
1 Starting Handle.

THE CARE OF THE CAR.

In the following description of the care of the 38-C 3 Pierce-Arrow motor car, all points for lubrication will be indicated, as well as the oil and grease to be employed. In the condensed lubricating schedule found at the end of this section, all points will be gathered together and given in proper sequence. This lubrication schedule will include a plan of the chassis on which are indicated all the grease cups and points for lubrication herein mentioned.

CAUTION.— We want to caution you to use special care during the first 1,000 miles that the car is run. The greatest care should be given to the oiling system, and excessive speed should positively be avoided. While ten pints of cylinder oil are normally sufficient for 375 miles, any car consumes more oil when it is new. We, therefore, suggest that you keep close watch of the oil gauge, and advise, as a matter of fact, that the oil be changed during the first 1,000 miles at least once in every 275 miles.

RUNNING GEAR FRAME.—The frame of the running gear will require no attention, though it may be remarked that unobstructed access to the motor may be had by removing the front cross bar, after dismounting the radiator. This cross bar is secured by four bolts.

SPRINGS.—The proper lubrication and care of the springs is a matter frequently neglected. Grease cups are provided on all of the 12 spring support, or eye bolts, and these cups should be given a turn every day. Two cups are provided, one each on the oscillating spring seats; and it is very important that these cups should be turned not less than once every 300 miles of running. About once a month, the car should be jacked up in such a manner as to relieve the pressure on the springs, the leaves pried apart slightly with a screw driver, and lubricant applied to the surface of the leaves in the shape of a thickish paste composed of a mixture of flake graphite and lubricating oil. This graphite paste forms the best and most lasting lubricant for spring leaves, but if the objection is raised that the graphite soils the paint, heavy lubricating oil may be used, though it will be necessary to apply this more frequently than the graphite paste.

We are using, at the recommendation of the spring makers, solid metal blocks for the spring seats between the springs and the axles. We find that with a new car, the nuts on the spring clip bolts require tightening up occasionally, probably for the first 500 miles—due to the gradual settling of the springs, and the metal block being without spring.

SHOCK ABSORBERS.—The central articulations of the shock absorbers and those on the frame and axles should be lubricated with cylinder oil at least once every week.

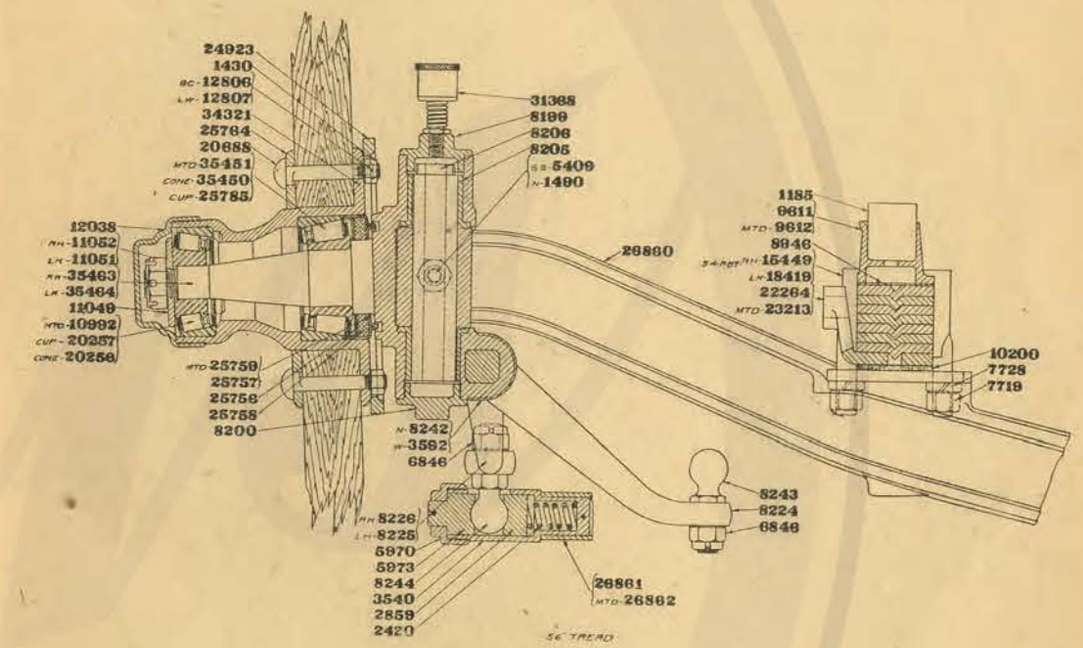

Fig. 1. Arrangement of Front Axle.

FRONT AXLE.— (See Figure 1).—The front axle will require no attention.

STEERING KNUCKLES.—(See Figure 1).—The care of the steering knuckles 35463 and 35464 and the spindles 8206 consists of lubricating these by means of the grease cups 31368 provided at the outer ends. These cups should be given a turn every day when the car is in use. Duplex Cup Grease should be used, and we recommend that each time these cups are filled, a quantity of lubricating oil be forced in, in advance of the grease. It is advisable to jack up the front axle and take the weight off the spindles before lubricating same.

BALL AND SOCKET JOINTS.— (See Figure 1).—The leather boots protecting the ball and socket joints on the steering rod connections should be kept filled with grease. These boots should be removed and the joints cleaned and inspected at least once every 1,000 miles. Care should be taken to see that the springs 2420

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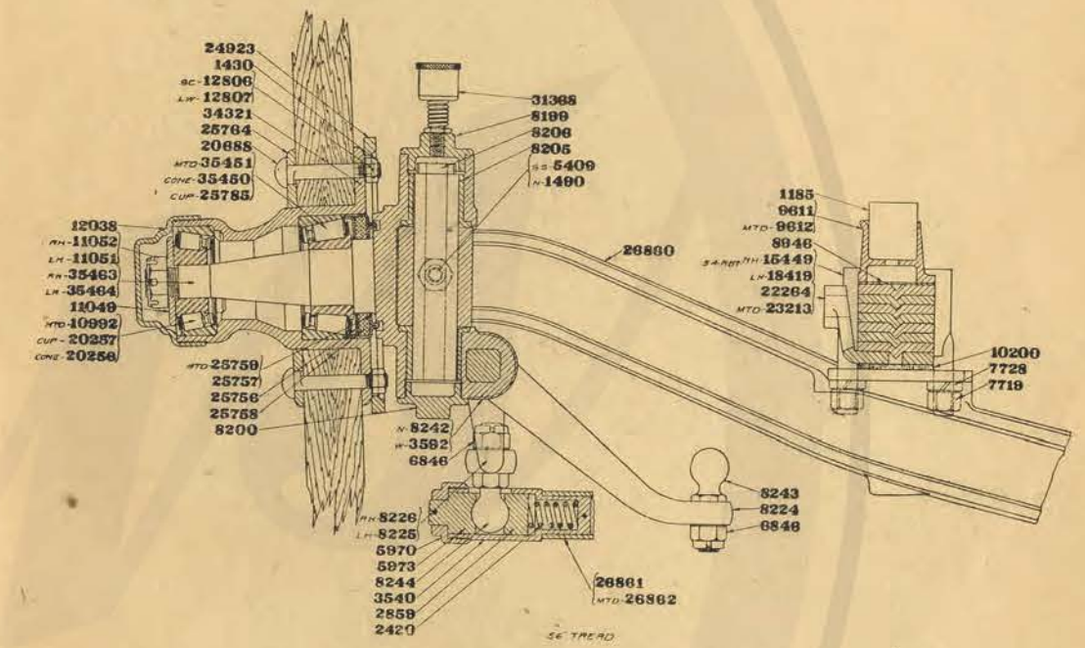

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are in good condition, and that the nuts 5970 are tightly screwed up and securely cotter pinned. These steering connections are of the utmost importance and neglecting to properly care for them may cause a serious accident.

TIMKEN BEARINGS.—Timken bearings have been adopted in the front wheel hubs and we wish to notify all concerned that great care must be taken when, for any reason, one of these bearings is adjusted. It is possible to nip these so tight that it is impossible to turn the wheels freely, in which case the bearings will soon be cut to pieces. Whenever a wheel is taken off for fitting speedometer gears, or for any cause, none but an expert mechanic should be allowed to adjust the bearings, and he should thoroughly acquaint himself, by reference to Figure 1, as to the design of the front hubs. If the bearings are screwed up snug, the nuts should be backed off about one-sixth to one-quarter of a turn, and the wheel puller should then be put on the hub and the hub and cone drawn tight against the nut and tongued washer, thereby insuring an end motion of about .010 inch. It is absolutely imperative that this end motion be given, otherwise the bearings will be ruined. See that the split cotter pin is replaced.

The front wheel hub caps 12038 should be filled with grease every 1,000 miles. If the hub caps are removed for any reason, great care should be taken to see that they contain no particles of grit or dirt when they are replaced.

ALIGNMENT OF FRONT WHEELS.—It is advisable, from time to time, to check up the alignment of the front wheels, as this alignment may be disturbed by striking some heavy obstruction in the road with the steering rods or levers. This will cause undue wear on the front tires.

ENGINE.—(Figures 2 and 3).—The cylinders are numbered 1, 2, 3, 4, 5, 6, beginning with the front end of the engine. All valves, and valve caps are numbered 1, 2, 3, 4, 5, 6, on the inlet side, and 7, 8, 9, 10, 11, 12, on the exhaust. While these valves are interchangeable as far as new valves are concerned, valves that have been temporarily removed should be replaced in the seats from which they were taken.

If, for any reason, the engine has been dismantled, it will be noticed that the pistons, connecting rods, large end connecting rod bearings and other parts are numbered in such a way that they may be replaced in the exact positions in which they were found. If the piston rings are removed from the piston, care should be taken to replace them in the same position and in the same order in which they were originally found. The gudgeon pin locking screw is placed at the front end of the piston. Care should be taken to return the piston to the cylinders in the same position.

LUBRICATION of the engine is accomplished by means of a pressure feed system. This is effected through the medium of a gear oil pump located at the exhaust side of the engine and driven by worm gearing from the cam shaft. This pump draws oil from the well in the crank case, forcing it up through a long horizontal pipe to the central and rear crank shaft bushings, also to the valve gear case and the oil gauge on the dash. The crank shaft journals and the arms of the crank are drilled through their centers and the crank shaft is also provided with

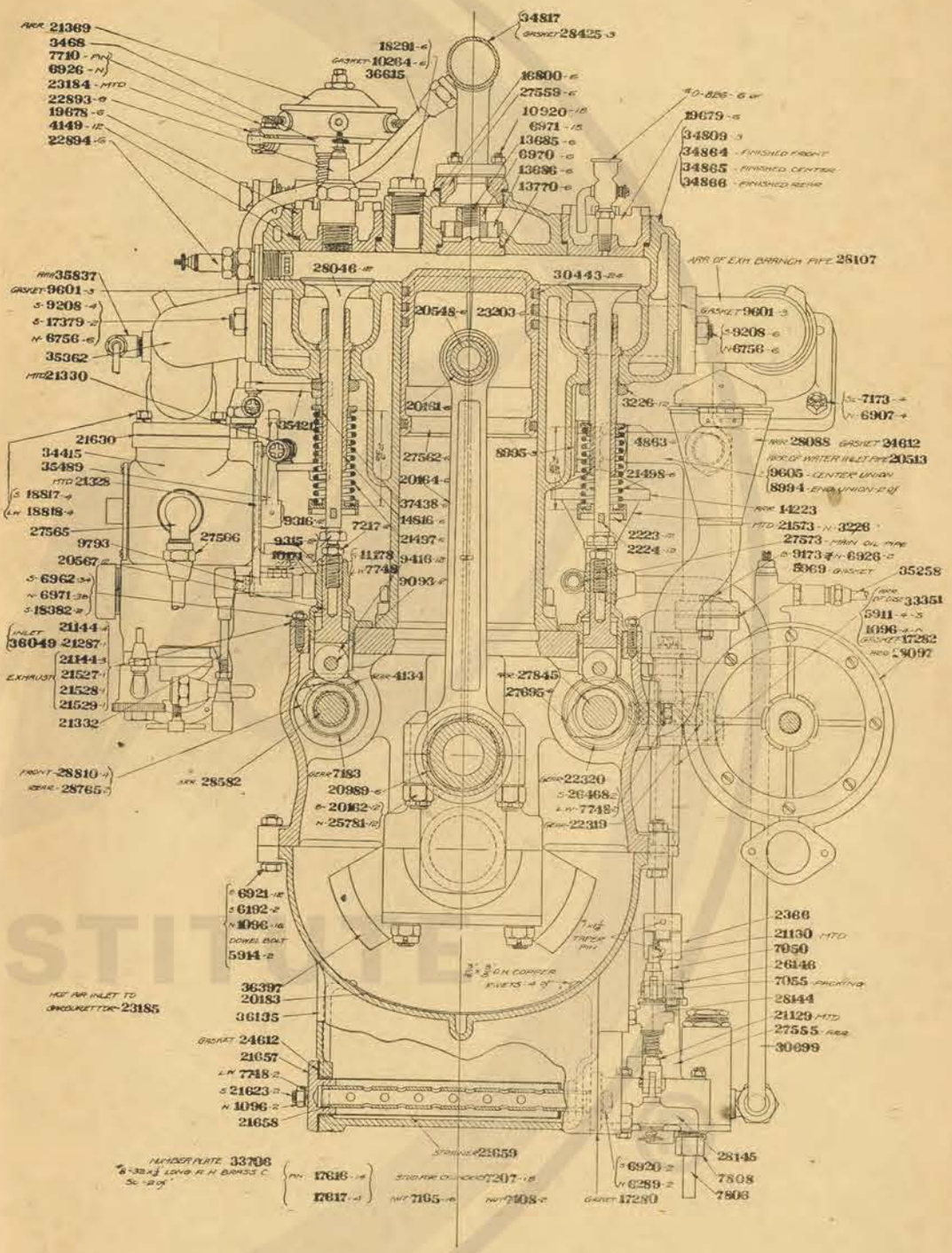

Fig. 2. Cross Section Through Engine.

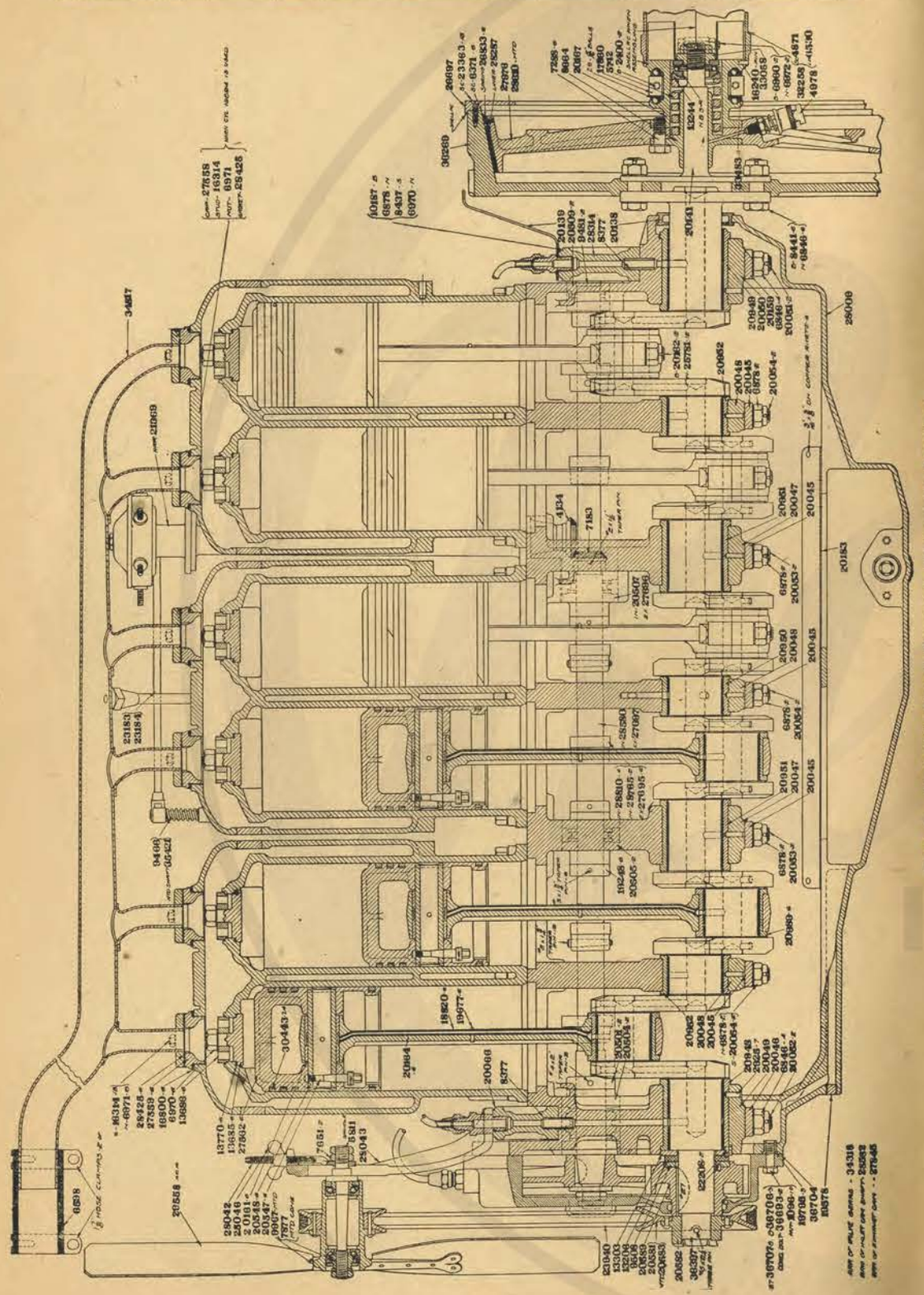

Fig. 3. Longitudinal Section Through Engine.

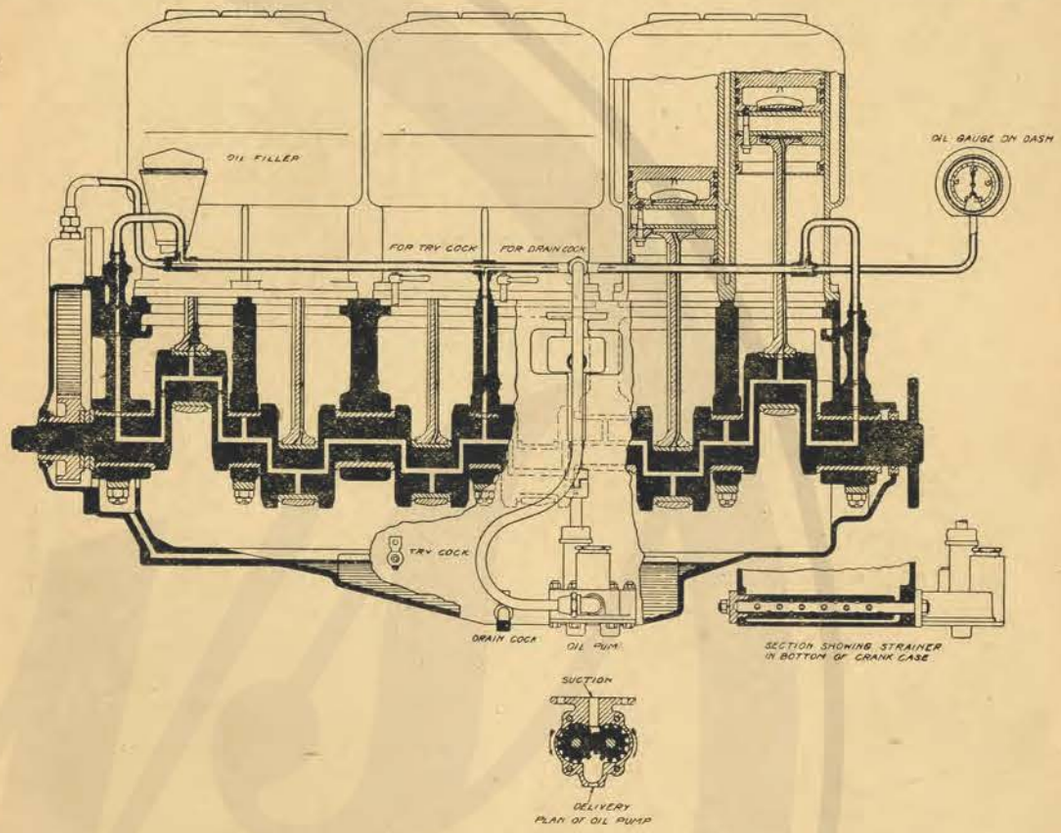

Fig. 4. Diagram Showing Lubricating System.

radial holes at the center of the journals so as to provide a passage for the oil from the main journal bearings to the crank pin bearings. There is, therefore, a continuous flow of oil under pressure to all bearings of the crank shaft. Pipes running up the connecting rods to the gudgeon pins take a portion of the oil from the crank pins to the gudgeon pins, lubricating these most effectually. The surplus oil from the gudgeon pin bearings passes through holes in the hollow gudgeon pins and thence out to lubricate the upper portions of the cylinder walls. After performing its various functions, all the oil finds its way back to the well in the lower half of the crank case and is drawn through the strainer (Fig. 4) by the pump.

Before charging with lubricating oil, all old oil in the engine should be drained off by turning the drain cock, (Fig. 4) found towards the rear on the exhaust side of the engine, ¼ turn. Close this cock, then pour in 10 pints of special cylinder oil through the filler funnel which is at the front of the engine on the exhaust side. The oil should flow out of the small pet cock located towards the front on the exhaust side of the engine. This may be opened to determine when the proper level is reached. It should then be closed. If the exact quantity of oil be poured in, it will not be necessary to fill up until oil flows out of this cock. One charge

of 10 pints should be sufficient for 375 miles of running on direct drive. This, however, does not apply when the engine is new or if much low gear work is done. In this case it will be advisable to add more oil from time to time, during the first 375 miles, but in the case of a new car, the oil should be changed entirely at least once every 275 miles, and in any case, at least once in every 375 miles. The strainer in the oil well (Fig. 4), which can be reached through the opening provided in the lower right hand side of the crank case, should be removed and carefully cleaned after every 1,000 miles of running.

The pressure is shown on the oil gauge, mounted on the dash, and should be from 1 to 1½ pounds per square inch when the engine is throttled down to its lowest speed, and from 9 to 14 pounds when running at high speed. These pressures are when the oil and the engine are hot. When they are cold, they will be considerably higher.

The adjustment of this oil pressure is effected by means of two regulating valves on the oil pump. The low speed pressure adjustment is obtained in the following manner: First screw up on the small high speed adjusting valve, No. 22790 (Fig. 5), which is found on the side of the pump next to the crank case, until this valve is entirely open. Then throttle the engine down to its lowest free running speed and adjust the low pressure at this speed by means of the outer regulating valve (the large one), No. 18830 (Fig. 5), on the oil pump. When adjustment has been effected, taking care that the motor is hot, lock the locking nut, No. 18831, on this valve. Then speed up the motor to about 1,600 to 1,700 r. p. m. and screw down on the high speed adjustment, No. 22790, until the indicated pressure on the gauge is about 14 pounds. Then lock the locking nut, No. 1096, on this adjustment.

VALVE LIFTERS.— The clearances between the valve lifters and the valve stems should be adjusted to, on the inlet side, a uniform .003 inch each, and on the exhaust side to a uniform .004 of an inch. It will be found, when the motor is new, that these clearances will require some attention. If they are too great, the motor will be noisy, while if they are too scant, the valves will fail to close, the seats will pit, and the engine lack power.

If it is found that the valves require grinding, care should be taken that none of the emery paste used for this purpose be allowed to enter the cylinders. Also, after grinding the valves, it will be found necessary to re-adjust the lifter clearances.

It will be found advantageous, about every 2,000 miles, to run the engine at a reasonably slow speed and inject such quantities of kerosene through the reed valves of the carburetor as will permit the engine to continue to run. A gallon of kerosene should be used in this manner and this process will be found to remove any accumulation of oil or carbon in the combustion chamber most effectively. Care should be taken, when pouring this kerosene through the reed valve, not to strain these valves or in any way disarrange them so that they will not seat properly.

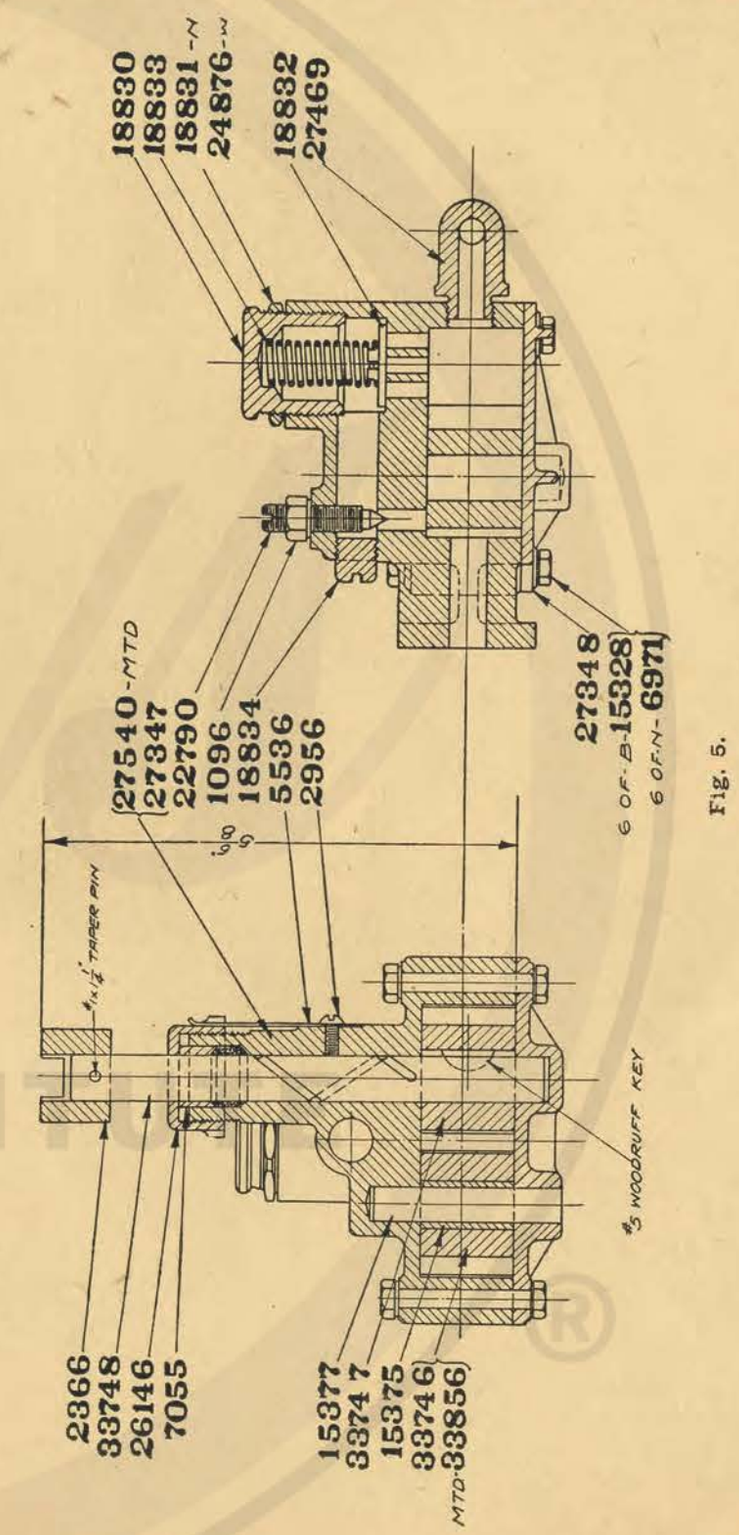

Fig. 5.

COOLING SYSTEM.— A circulating water pump is attached to the exhaust side of the engine crank case, and is driven by means of a gear from the exhaust cam shaft gear. There is a grease cup on each end of the pump case. These should be screwed up a turn every 200 miles, and filled when necessary. The stuffing box will need screwing up occasionally, whenever the pump shows a leak. Be careful not to screw this up too tightly, otherwise the pump spindle will not revolve freely. A few drops of oil around the gland nuts will keep this lubricated. Care should be taken to see that mud is not allowed to accumulate in the honey-comb sections of the radiator. The radiator and water jackets should be washed out occasionally by means of a continuous flow of cold water. This must be done to maintain the efficiency of the cooling. Care should be taken to maintain tension on the fan belt.

CAUTION.— Caution should be exercised in winter. This car can be run all winter if the water circulating system is guarded against freezing. During the cold weather, to prevent accident to cylinders and pipes, it is absolutely necessary that the following instructions be rigidly attended to. If the car be stored in a room heated to a less degree than 40° F., all water in the radiator and cylinders should be drawn off whenever the machine is not in use. A plug on the under side of the radiator is provided for this purpose, and also the plugs in the water pump. It is advisable to leave these plugs out when shipping the car by rail. If the car be stored in a room heated to 40° F. or above, the above precautions are not necessary. In winter weather, it will be necessary to cover the radiator from one-half to two-thirds its surface, according to the temperature. In hot weather, the ventilating doors on the bonnet should be open; in cold weather, these doors, of course, should be closed. Care should be exercised when leaving the car standing in cold weather. The motor should then be kept running to maintain the heat of the water. It may be advisable to take off the fan belt in very cold weather.

In zero weather greater care must be exercised, as the above recommendations apply only to ordinary winter conditions in the North. We recommend for use in our car a wood alcohol and glycerine solution of the following proportions:

30 to 15 above zero.

Wood Alcohol	10	per cent.
Glycerine	10	per cent.
Water	80	per cent.

15 to 8 above zero.

Wood Alcohol	12½	per cent.
Glycerine	12½	per cent.
Water	75	per cent.

8 above to 10 below zero.

Wood Alcohol	25	per cent.
Glycerine	12	per cent.
Water	63	per cent.

10 to 20 below zero.

Wood Alcohol	50	per cent.
Glycerine	25	per cent.
Water	25	per cent.

THE AUTOMATIC CARBURETOR.

Pat. Sept. 9, 1909

Figure No. 6 shows sections through our Special Automatic Carburetor. The constant level gasoline chamber is concentric with the spray nozzle A. This is in communication with the gasoline tank, which must be under pressure when the car is running. The float, No. 16631, is annular. This keeps the height of the gasoline at the spray nozzle constant, at whatever inclination the car may stand. The opening in the spray nozzle is regulated by the needle valve, No. 21585. When the gasoline gets below its proper level, the float drops, raising, by means of a lever, the float valve, No. 32352. This allows the gasoline to fill up the chamber to its proper level.

The gasoline from the supply tank passes through a fine gauze strainer. The screw cap, to which is fastened this strainer, should be withdrawn occasionally to allow the water and dirt to be drained off, first shutting off cock on gasoline line. There is also a drain plug on the bottom of the gasoline tank. This should be opened once a month to drain off the water.

When the engine is running slowly, the throttle, No. 35396, is just open and the auxiliary air inlet reed valves, Nos. 22152 and 22153, are on their seats. All the air is taken in at the lower inlet and, coming from the proximity of the exhaust pipe, is warm. It passes up the contracted passage around the spray nozzle at high speed and so vaporizes the proper amount of gasoline. When the engine runs faster, the more intense suction opens the light auxiliary reed valve, No. 22153, admitting air above the spray nozzle. When the engine runs still faster, the heavier reed valve, No. 22152, is opened, admitting still more air. In replacing these valves, care must be taken to have them fit snugly all around their seats, with slightest possible pressure.

The supplementary springs, No. 22151, form gradual stops of a progressive strength on the reed valves. When the needle valve, No. 21585, is once adjusted and locked by means of the nut, No. 23264, it is not likely to require any further attention. There is a supplementary spray nozzle, B, provided with an adjusting needle valve, No. 19414. This comes into action at high speed, admitting of the spray nozzle being adjusted more particularly for low speed. This carburetor is water-jacketed and is also provided with a helical mixer to assist in vaporizing the gasoline in cold weather.

The wire gauze screen, No. 8035, around the auxiliary air inlet valves, should be removed occasionally and cleaned out. There is also a wire gauze screen on the air pipe near the exhaust pipe. This should be kept clean, for if this screen becomes clogged with dust and dirt, the engine will not run properly.

There is a glass window provided in the float chamber to ascertain at once the height of the gasoline. All connections between the carburetor and motor should be tight.

There is a hot water jacket, C, around the mixing chamber. The pipe, No. 36615, has a cock on it. This may be closed in hot weather, but must be full open in cold weather. The throttle valve spindle should be oiled occasionally.

In hot weather, the air regulator, No. 36604, should be open full to admit cold air around the spray nozzle, also the ventilators on top of the hood should be opened. In cold weather these should be closed. The gauze screen on the air regulator should be kept clean. The air vent into the float chamber of the carburetor should be kept free from dust and dirt.

ADJUSTMENT OF THE CARBURETOR.

REED VALVE OPENING.—The distance between the reed valves, Nos. 22152 and 22153, and the supplementary springs, No. 22151, should be: For the light reed, 1/8″; for the heavier reed, 5-32″. When these reeds are once set, they should need no further attention in the adjustment of the carburetor. If, for any reason, it is necessary to remove the float chamber from the carburetor, first remove the needle valve, No. 19414, from the mixing chamber. If it is not removed, it is liable to become bent and would then be useless.

Run the motor long enough to bring it up to its normal working temperature. Adjust the level in the float chamber to notch on standard, No. 13789, seen through the window of the float chamber, when the motor is not running. This adjustment is made by increasing or decreasing the pressure on the spring, No. 21624, by means of screwing up or down on the adjusting nut, No. 13826. Increasing the pressure, screwing down, lowers the level, decreasing the pressure; screwing up, raises the level. This adjustment should be locked, when correct, by means of the locking nut, No. 13825. When the motor is running, the float will drop somewhat, depending upon the speed. It should never go lower than one-fourth inch below the mark at highest speed. After this level is adjusted, close the supplementary needle valve down on its seat. Then close the lower adjusting needle, No. 21585, and back off two whole turns on the needle. With the throttle closed as far as possible and the switch arm in the position marked M, make the adjustment on the lower needle, No. 21585, for low speed, by shutting off on same until the motor runs at its lowest steady speed. The throttle adjusting screw, No. 6681, will have to be adjusted for more or less opening to suit the conditions of each motor. As light a mixture as can be used to give low speed adjustment is desirable. At low speeds there is no air coming through the auxiliary valves, and the reeds should be on their seats and closed.

After the slow speed adjustment is made, switch on the battery and advance the spark lever one-fourth of its travel on the quadrant. Now open the throttle slowly and as soon as the mixture shows light by indications of popping, open the high speed needle, No. 19414, until the motor runs at its best. Continue until the throttle can be opened wide with the spark in the same position. NEVER RACE

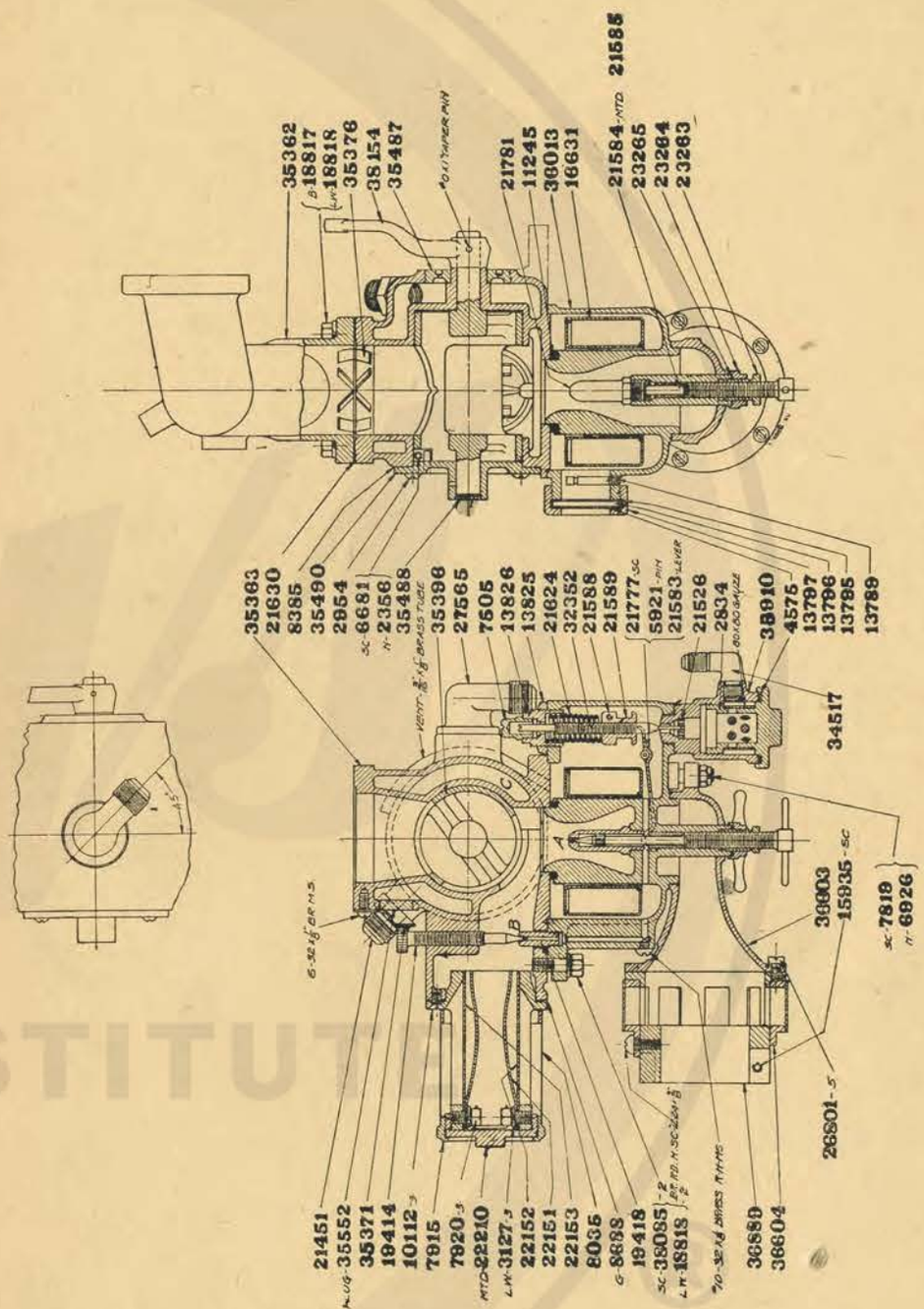

Fig. 6. Arrangement of Parts of Pierce Carburetor.

A MOTOR IN ADJUSTING THE CARBURETOR, AS INJURY MAY BE DONE. After the above adjustments are made, the car should be tried out on the road for final adjustment. If the car throttles down on magneto to seven or eight miles per hour and accelerates up to twenty miles per hour, the low speed adjustment may be considered correct. If beyond twenty miles per hour, the car is logy or slow, the high speed needle should be opened one notch at a time until the adjustment is satisfactory at high speed. If properly adjusted and with the motor warm, the throttle can be opened to the full extent of its travel at any speed without any popping back in the carburetor. Care should be taken to have as light an adjustment as possible on both needles.

In very hot weather, the water should be partially or entirely shut off from the carburetor and the hot air regulator entirely opened. In some localities, the hot air funnel should be moved away from the exhaust pipe as far as possible. In the winter time, all the heat is required that can be had. The hot water must be turned on full, the cold air regulator must be closed, and the funnel must be moved close to the exhaust pipe. The ventilators in the hood should also be closed. In Northern sections, a part of the radiator should be covered in order to vaporize the gasoline. The lowest grade of gasoline can always be used if enough heat is available to vaporize it. The necessity of having the valves in good condition, ignition good, and all flange connections between the motor and carburetor tight, so that they cannot suck in air when running with closed throttle, is very real if slow, smooth running is required. Flooding of the carburetor, causing a leakage of gasoline when the motor is not running, is usually caused by improper seating of the needle valve in the float chamber. This may be caused by dirt on the seat of this needle valve or by improper seating of the same, caused by wear or bending of the needle valve stem or strainer case. If in good condition, this carburetor will positively not leak.

IGNITION.—We are providing two ignition systems, each entirely independent, and each having its own set of spark plugs. The first system employs "Bosch" high tension magneto. The second system draws its primary current from the storage batteries. This current is distributed by the commutator to the master vibrator and unit autocoils where it is stepped up to high tension secondary and then to each spark plug operated from the inlet cam shaft. Either of these systems may be switched on at will, or they may used together.

Fig. 7 gives a diagram of this double ignition system. The battery is not shown, the battery lead being indicated as running to the junction box.

THE MAGNETO.—This is of the enclosed "Bosch" high tension type, Z. R. 6, Model 4. The spark plugs for the magneto ignition are on the top of the cylinders.

The variation in the time of the ignition is effected by causing the interruption of the primary circuit to take place earlier or later. This is effected by moving the lower lever on the steering column. Full retard position is the one occupied when the lever is at the end of the notched quadrant nearest the driver. Full advance, when running on the magneto, is about half way up on this quadrant.

CARE AND MAINTENANCE.— The magneto bearings should receive not more than five drops of good machine oil for every 500 miles, and it should be remembered that over-lubrication is to be guarded against. The oil holes are located at the top of the distributor plate and at the top of the bonnet.

The interrupter does not require lubrication, and as oil on the platinum points will result in their burning or pitting, and also misfiring, these parts are to be kept free from it. The distributor should be removed occasionally and the segments wiped clean, to rid them of any carbon dust that may collect.

The interrupter may be exposed for inspection by removing the interrupter housing cover which is secured by a snap spring. For closer inspection, cleaning or replacing of platinum screws, the lock ring should be given a quarter turn to the right or left and removed with the interrupter housing. The withdrawal of the long hexagon-headed bolt which passes through the center of the interrupter will permit the interrupter to be lifted off complete. Dirt and oil may be removed from the interrupter by brushing with gasoline. In returning the interrupter to position, great care should be taken to register its key with the keyway in the shaft, and care should also be exercised to replace the interrupter housing properly, the marks on the locking ring registering with the marks on the magneto end plate before being pushed into position. It should be given a quarter turn until the pins catch.

The platinum points should be so adjusted that they are separated by a distance of 0.4 m|m when the lever is resting on one of the segments. To make this adjustment, the lock nut on the outer end of the long platinum screw is loosened and the screw itself is turned by means of the hexagon nut at the platinum point. The strip of steel pivoted to the Bosch magneto adjusting wrench is the gauge for this distance.

When the adjustment is complete, the lock nut is to be returned tightly to position; the backing off of this lock nut may cause a serious injury to the interrupter parts.

LOCATING TROUBLE.—Ignition troubles are generally found to be due to faulty spark plugs. The intensity of the spark will eventually burn away the spark plug electrodes and widen the gap, which will cause a missing at low speeds. The spark plug gaps should not be less than 1-50", not greater than 1-32", and the spark plugs should be inspected occasionally for assurance that this distance is maintained. The best results can only be obtained by using a high class spark plug. The characteristics of a satisfactory plug are an unbreakable and positive insulator, solid construction, which absolutely prevents leakage, multipoint electrodes of such metal as will resist burning, and a design that will tend to allow the proper path for a good spark, despite the effects of excessive oiling and over-rich mixture.

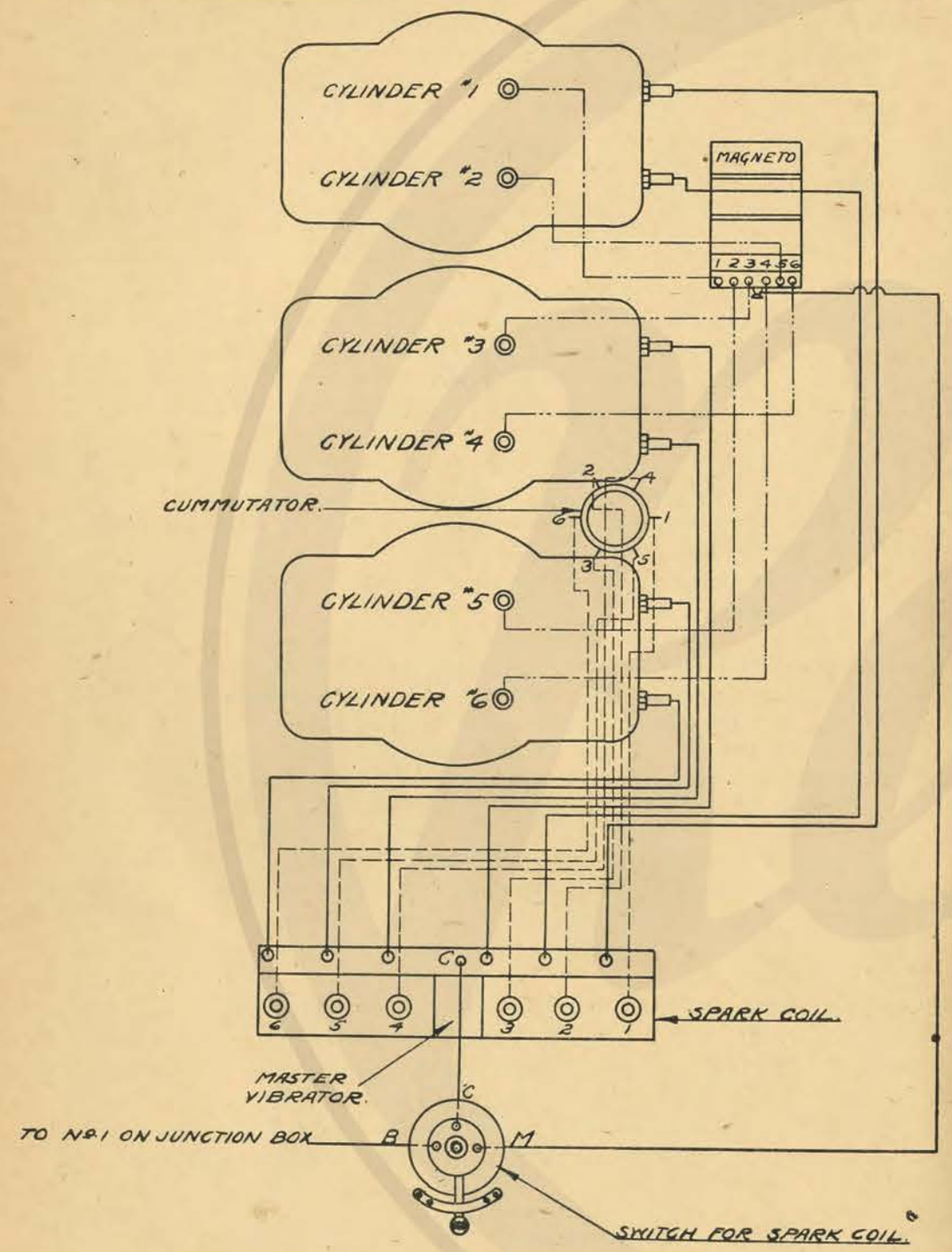

Fig. 7. Diagram of Ignition System.

MAGNETO INSPECTION. Trouble with the magneto itself is almost invariably due to dirt and to over-lubrication. If the magneto is suspected of being at fault, one of the spark plug cables should be detached, and supported so that its terminal is one-fourth inch from the metal of the engine. The engine is then to be cranked briskly, and a spark will indicate that the magneto is in good condition. Should no spark appear, the switch wire is to be detached from the magneto terminal on the interrupter housing cover and the test repeated. A spark under this condition will indicate a short circuit in the switch or switch cable. If no spark appears, the interrupter should be inspected for assurance that the platinum points are clean and smooth, and that the interrupter lever moves freely on its pivot. If the interrupter was removed, it should be determined that in returning it to position its key registered in the keyway.

If the fault still exists, the spark plug cables should be detached, the aluminum bonnet removed from the shaft end of the magneto and the engine cranked briskly, noting whether sparks appear in the safety spark gap. If this is the case, the fault will be located in the distributor, in the spark plugs or spark plug cables.

If these tests do not determine the location of the fault, the magneto should be returned to its makers or one of their branches for inspection.

Under no conditions should the magneto be disassembled beyond the removal of the interrupter, the distributor plate and the dust cover or bonnet. Nothing can be accomplished by taking off the end plates of the magnets, and the guarantee of the makers will not hold good if these parts have been removed.

Ignition troubles will be as follows:

Engine stops abruptly—
- Short circuit in switch or switch cables.
- Switch closed.

Missing at low speeds—
- Spark plug gaps too wide.
- Spark plug cable disconnected or short circuited.
- Dirty interrupter.
- Spark plugs dirty or defective.

Missing at all speeds—
- Spark plugs dirty or defective.
- Spark plug cable loose or defective.
- Platinum points dirty or burned.

Occasional miss—
- Defective spark plug or spark plug cable.
- Loose switch parts.

Engine will not start—
- Dirty or defective spark plugs.
- Switch closed.
- Switch defective.

TIMING.—Fig. 8 gives a diagram of the timing of both magneto and battery ignition systems. If, for any reason, it has been necessary to remove the magneto, care should be taken to replace it in the exact relation to piston position indicated.

No. 1 piston will be approximately in the magneto timing setting position just as No. 5 inlet valve is closing. Turn over the motor until No. 5 inlet valve is just closing; look for the magneto mark on the flywheel and continue turning until this mark arrives beneath the pointer.

The order of engine firing is 1-5-3-6-2-4. The secondary lead terminals at the magneto end are marked to indicate their proper position. No. 1 terminal is attached to the lead running to No. 1 spark plug; No. 2 lead runs to No. 5 spark plug; No. 3 to No. 3; No. 4 to No. 6; No. 5 to No. 2, and No. 6 to No. 4 spark plug.

SPARK COILS.— A Synchronized (multiple unit) autocoil is used in conjunction with the battery system only. The coil case contains six Non-Vibrator Units and a Master Vibrator. Each Unit has a Safety Gap or tell-tale device to indicate the accidental opening of the secondary circuit. Set the Master Vibrator Trembler to draw as little current as possible to properly fire the engine at high speed. Don't attempt to adjust the coils with any secondary wire disconnected from the Plug. If the engine misses when the Trembler is properly adjusted, examine the Plugs, Timer, Wiring and Valves in the order named. First—See that the batteries are in good condition (see battery instructions). Second—Locate the troublesome cylinder by short circuiting spark plugs with screw driver (being careful not to grasp metal part with the hand) until missing is located. If the Trembler contacts become sharply pointed, remove point with a very fine, sharp new file.

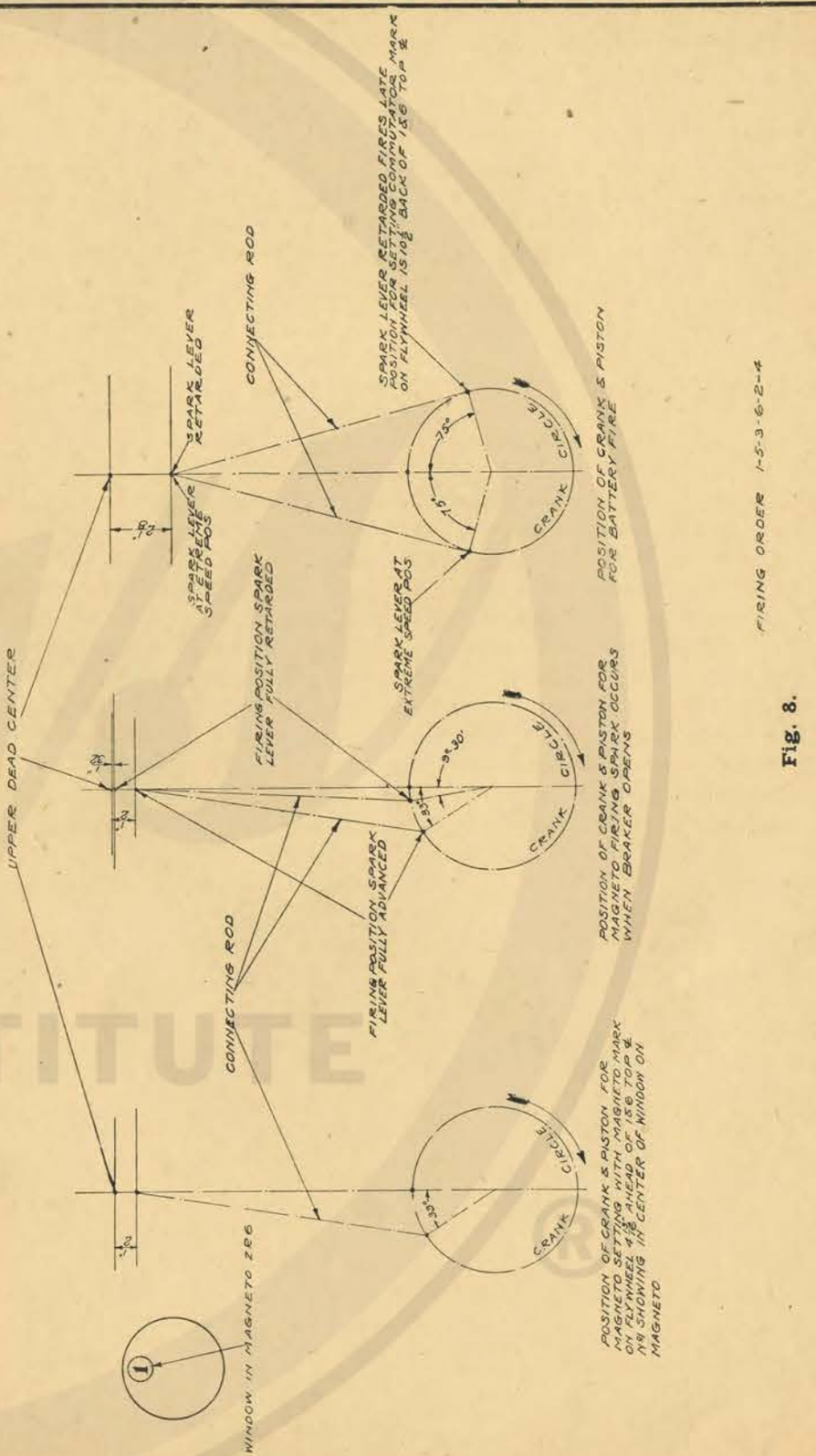

Fig. 8.

THE COMMUTATOR.—(See Fig. 9) for BATTERY IGNITION.—The commutator is of the roller type and is placed on a vertical shaft between the fourth and fifth cylinders on the inlet side.

The inside of the commutator should be kept clean and lubricated with cylinder oil in not too large quantities. Graphite should never be used.

The grease cup, No. 13280, on commutator spindle, should be given one complete turn every 150 miles.

TIMING.—With the "commutator" mark on flywheel directly under the pointer, as indicated in Fig. 8, and with spark lever fully retarded, the roller, No. 3530 (Fig. 9), should be just making contact with number one commutator segment. The contact posts connecting with these segments are numbered on the outside of the commutator.

If, for any reason, the factory setting of the commutator has been disturbed, the correct setting may be regained as follows:

Place switch in "Off" position, loosen the two screws, No. 3525 (Fig. 9), holding the roller in place. Set mark on flywheel. This can be done most conveniently by turning over the motor by hand until No. 5 inlet valve is just closing. This will make sure that the piston is nearing the proper position on its firing stroke. Continue turning until the commutator mark on the flywheel is beneath the pointer. Have spark lever fully retarded. Disconnect lead to No. 1 battery spark plug and secure it in position so that a small gap will separate its points from the body of the motor. This may be conveniently done by inserting it between two of the magneto leads quite close to the fibre guide on No. 1 cylinder and allowing the points to remain about one-eighth inch away from the cylinder casting. Move roller, No. 3530, until it is just making contact with No. 1 segment. Move switch to position marked B. If roller is making contact with No. 1 segment, a spark will occur between the disconnected lead and the cylinder casting. Move roller so that the least further backward movement will shut off this spark. Set the two screws, No. 3525, and the timing is complete.

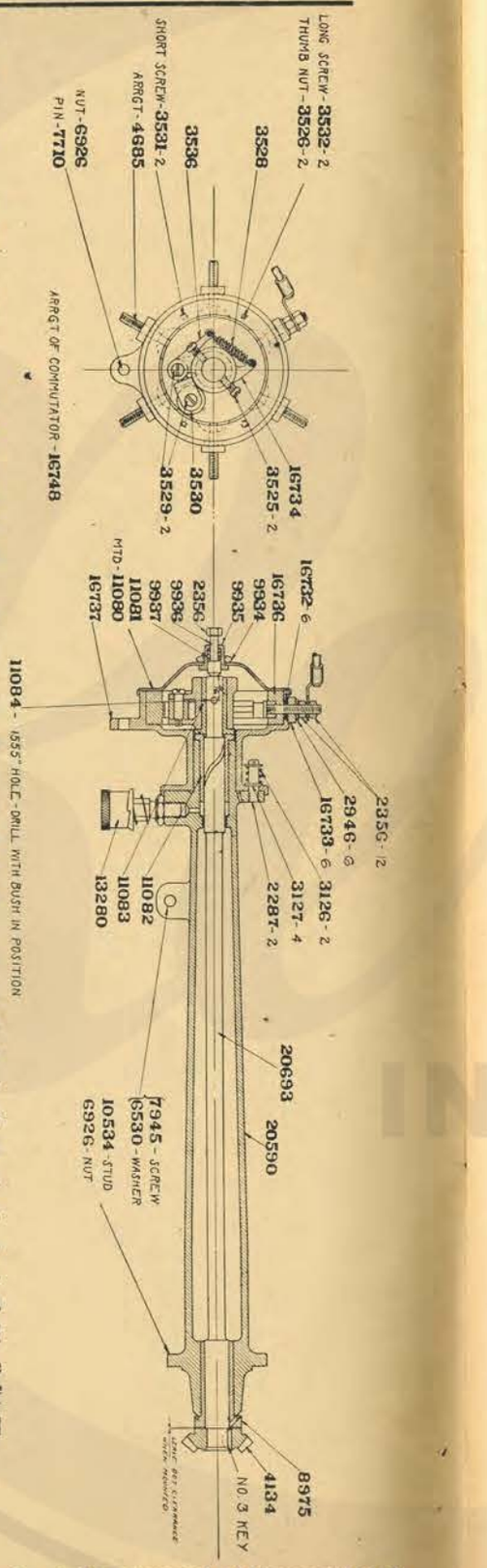

Fig. 9. Arrangement of Commutator.

The battery spark plugs are mounted in the sides of the cylinders. The central electrode of these plugs should be centered in the hole in the disc electrode.

THE IGNITION SWITCH.—This switch is mounted in the dash panel. It has four positions. Reading from right to left these are: B, battery ignition alone; M & B, battery and magneto combined; "Off" position, and M, magneto ignition alone. A switch key is provided, without which the electric starter cannot be used nor the battery ignition employed. No other key should be employed, as, otherwise, the switch may be damaged.

LIGHTING SYSTEM.—(See Figs. 10 and 11).—The Electric Lighting System used is the Pierce-Arrow Westinghouse System. This is a single wire system, the chassis, frame and metal body forming one branch of the circuit of the system. This makes the wiring simple and there is less chance for trouble with short circuits. Each circuit of lamps terminates in a junction box which is accessibly located, the cover of the box having a printed index showing the circuit and current capacity of the fuse required. The junction box, switch wires, etc., are all numbered, as shown on the diagram, and are so arranged that the touring body can be changed to enclosed body without rewiring. All that is necessary is to couple the terminals on corresponding terminals in the junction box. We urgently request that no changes be made in any way in connecting up this system.

All lamps should be securely fastened to supports, as shell of lamp and support complete the circuit to chassis frame and positive side of battery. The volt-meter is located on the dash and gives a true reading of the condition of the battery when the engine is not running. The generator is so designed as to give a low charging rate without lights on and automatically take care of the additional load when the lights are turned on. If lights are burned for a long time when generator is not running, the drop in voltage will be noticed on volt-meter and when five and one-half volts are reached, the battery is very nearly discharged and lights should not be left burning after this until the generator has been run and battery voltage raises, as it is injurious to the battery to stand in a discharged condition and on starting the motor there may not be current enough to operate the spark coil.

THE GENERATOR.—The most important part of the system is the low speed generator, which is designed to automatically regulate the current it supplies, according to the demand on the system.

When the engine speed is lower than that at which the proper voltage is generated, a magnetic switch on the generator automatically disconnects the generator from the circuit. The switch is so adjusted that the generator is connected to the battery and the lighting circuit, at a generator speed of about 360 r. p. m., and disconnected when the sp ed drops to about 300 r. p. m. These speeds correspond to about twelve and one-half and ten and one-half miles per hour respectively. The difference in speed between "connection and disconnection" provides against the switch operating continuously when the car is running at

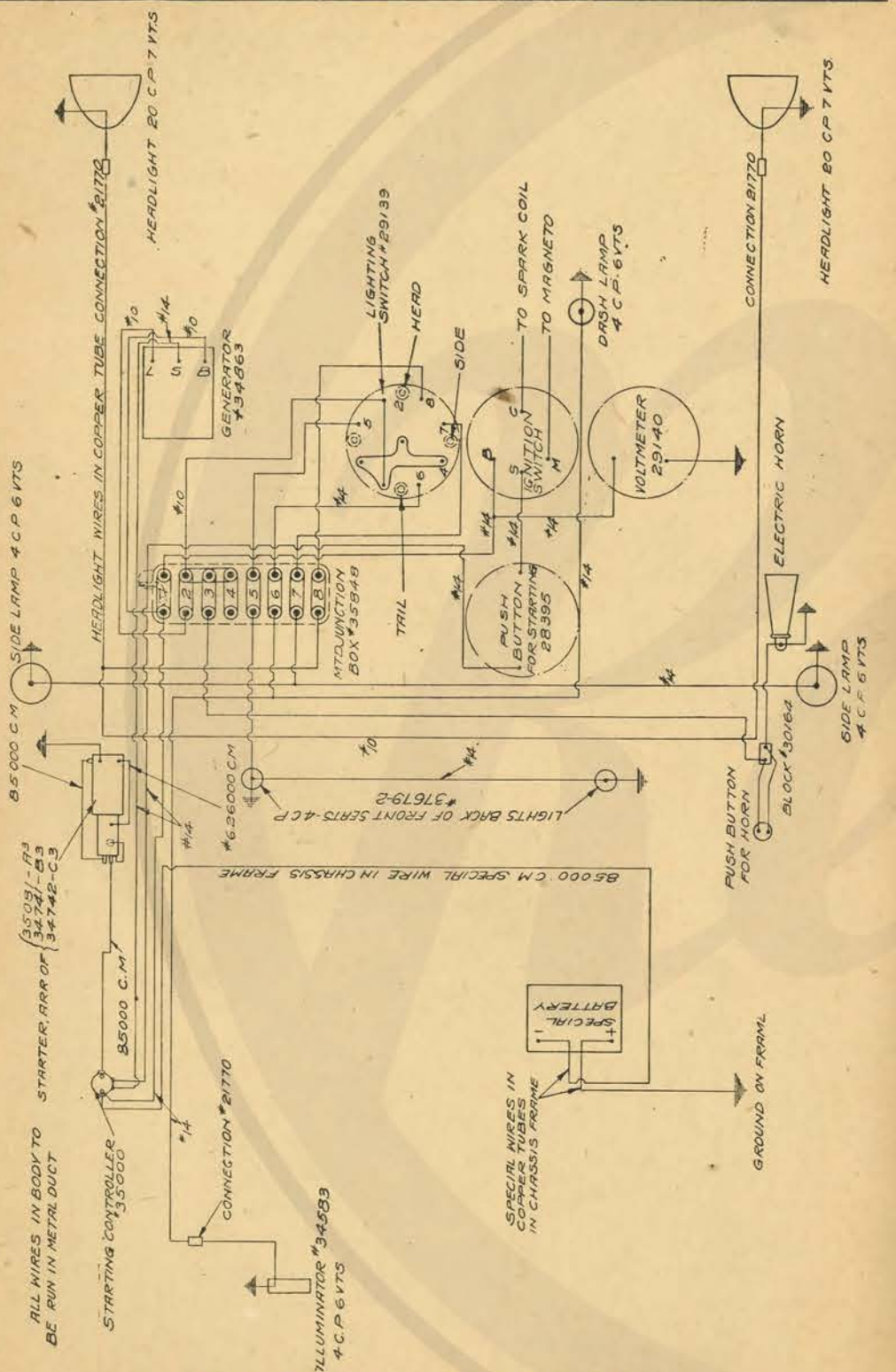

Fig. 10. Wiring Diagram for Touring Cars.

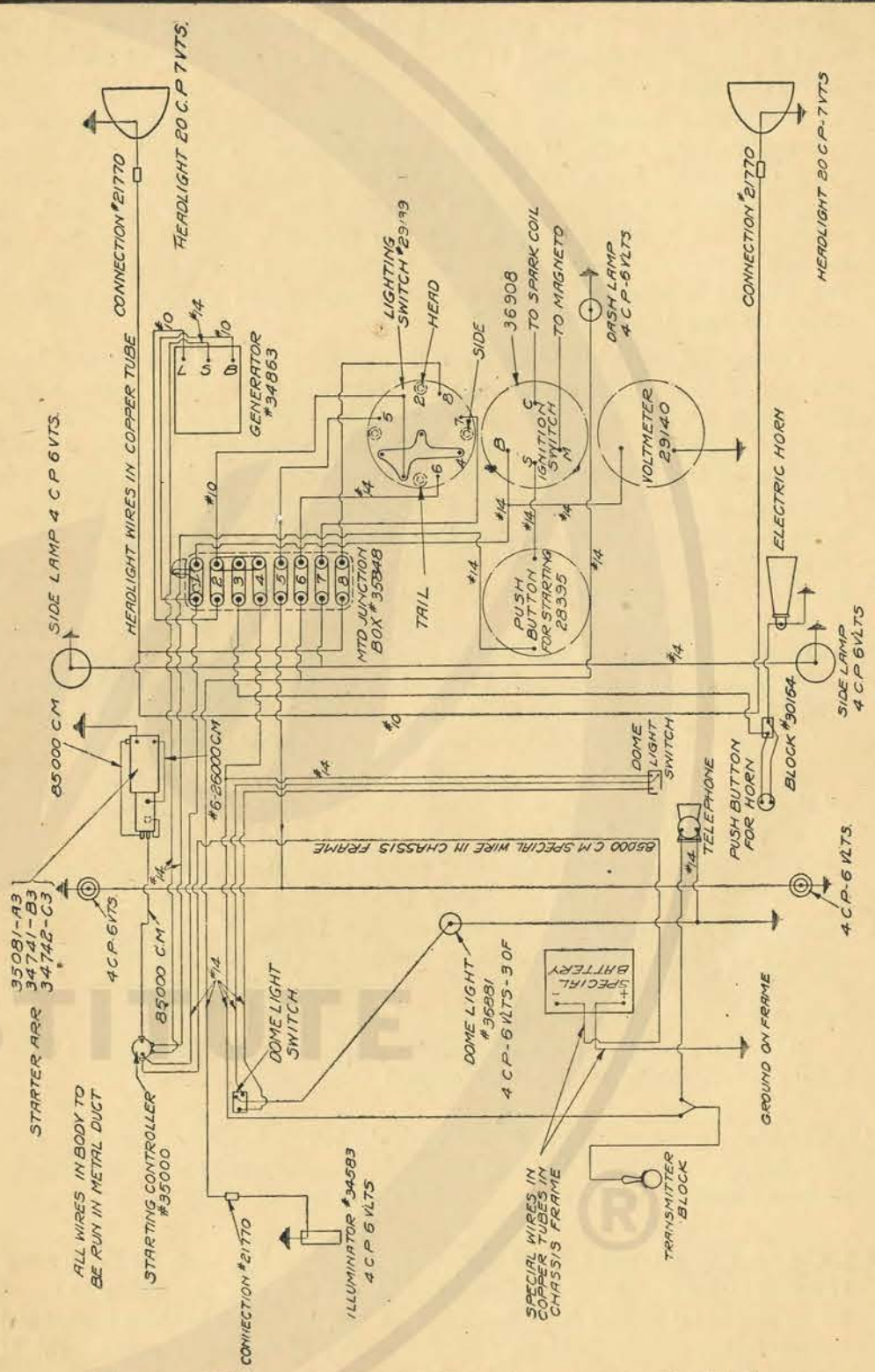

Fig. 11. Wiring Diagram for Brougham and Landaulet Cars.

the critical speed. As the generator is able to deliver normal voltage at any speed at which it is connected in circuit, there is no possibility of the battery discharging into the generator.

When the automatic switch connects the generator to the battery, the current rises rapidly until a value of from five to seven amperes is attained, if the lamps are not burning. Above this value the charging current rises slowly as the speed increases, but does not reach an excessive value at the highest speeds at which a car can be operated. This regulating feature is attained by connecting the battery through a reversed compound field winding on the generator. It is, therefore, an inherent characteristic of the generator and requires no relays or other regulating devices.

Current for the lights does not pass through the compound field winding, however, and when the lights are turned on the output of the generator automatically increases to supply them. With the usual lamp equipment this increase in generator capacity is sufficient to operate the lamps without any demand whatever on the battery, at all ordinary running speeds. At low speeds, the battery supplies a certain proportion of the lighting current, and when the engine is not running the battery supplies the entire demand. The current supplied by the battery is returned to it by the generator when running without lights in the day time, and at moderately high speeds at night with lamps burning.

Mechanically, the generator is designed particularly for its location alongside the engine, under the hood. As it is entirely enclosed, it is not affected by oil, dirt, grit or water. All windings are given a heat-resistant treatment, which prevents injury from the temperature to which they are subjected because of the location, and solidly cements them together so that they are not affected by vibration.

The shaft is carried on imported annular ball bearings. A felt wick in the oil ducts leading to the external cups prevents flooding of the generator with oil and at the same time furnishes a reserve supply for the bearings.

The commutator and brushes are of proper proportions, with ample allowance for wear. The brushes may be removed by unscrewing the black fibre caps and withdrawing with their connecting springs. The brushes should be replaced in the same holders from which they were removed and the same side up. The construction of the brush and its mounting are such that the current is conducted through a low resistance copper shunt and not through the brush springs.

As no permanent magnets are used the generator is not demagnetized if the battery is accidentally connected up reversed.

CAUTION.—Do not run the generator when the battery is not connected up, as if the lights are on they will be burnt out. Always make battery and generator connections secure, so that they cannot work loose or fall off.

IF LAMPS DO NOT LIGHT UP.—(a) Examine fuse block for blown fuses. If fuse is blown do not replace it immediately, but look over the wiring or lamps for an accidental ground or short circuit. When the trouble has been located and corrected, then replace the blown fuse with another of the same capacity. (b) If

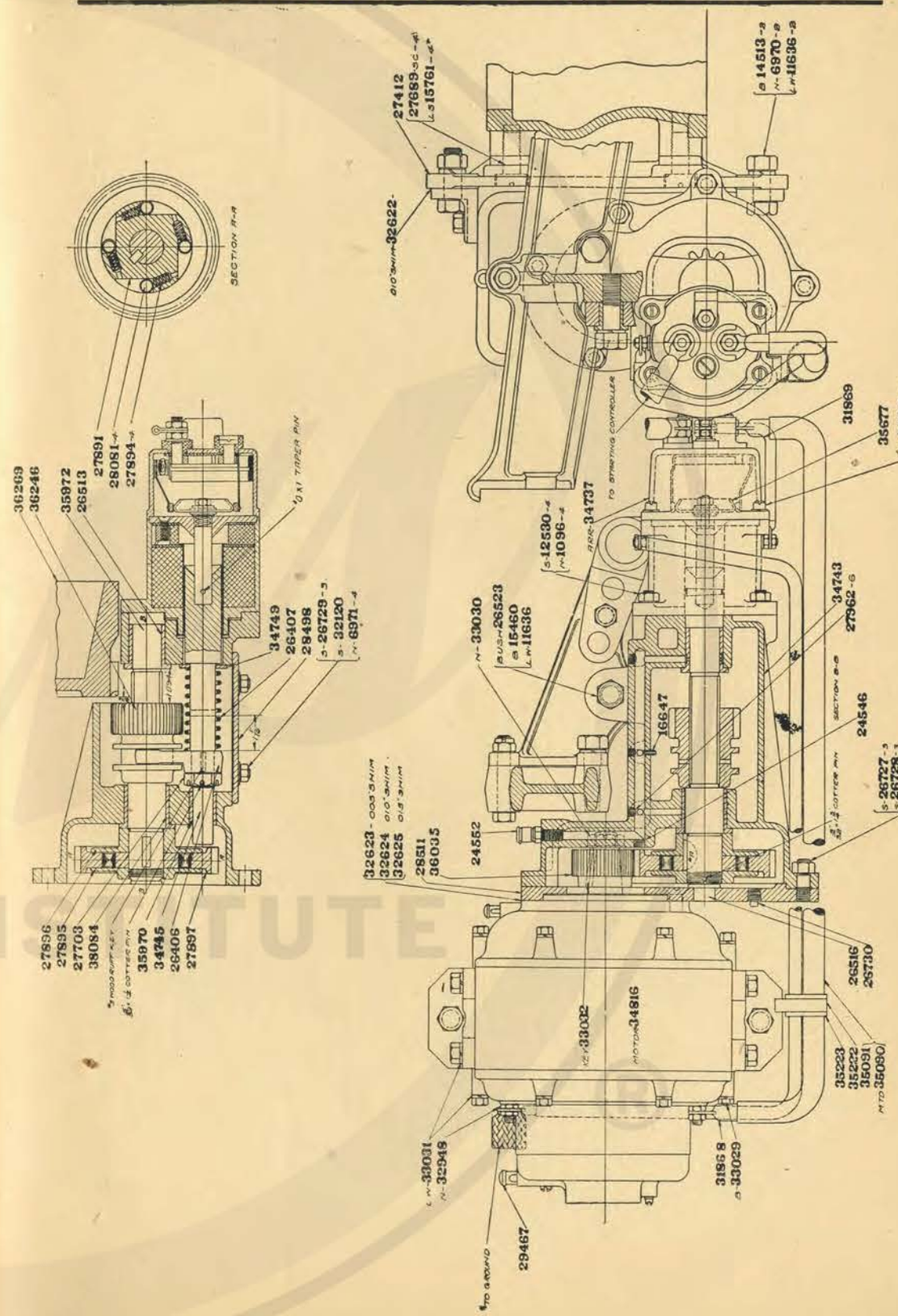

Fig. 12. Side View of Electric Starting Motor, showing arrangement of Gearing, Free Clutch and Starting Switch.

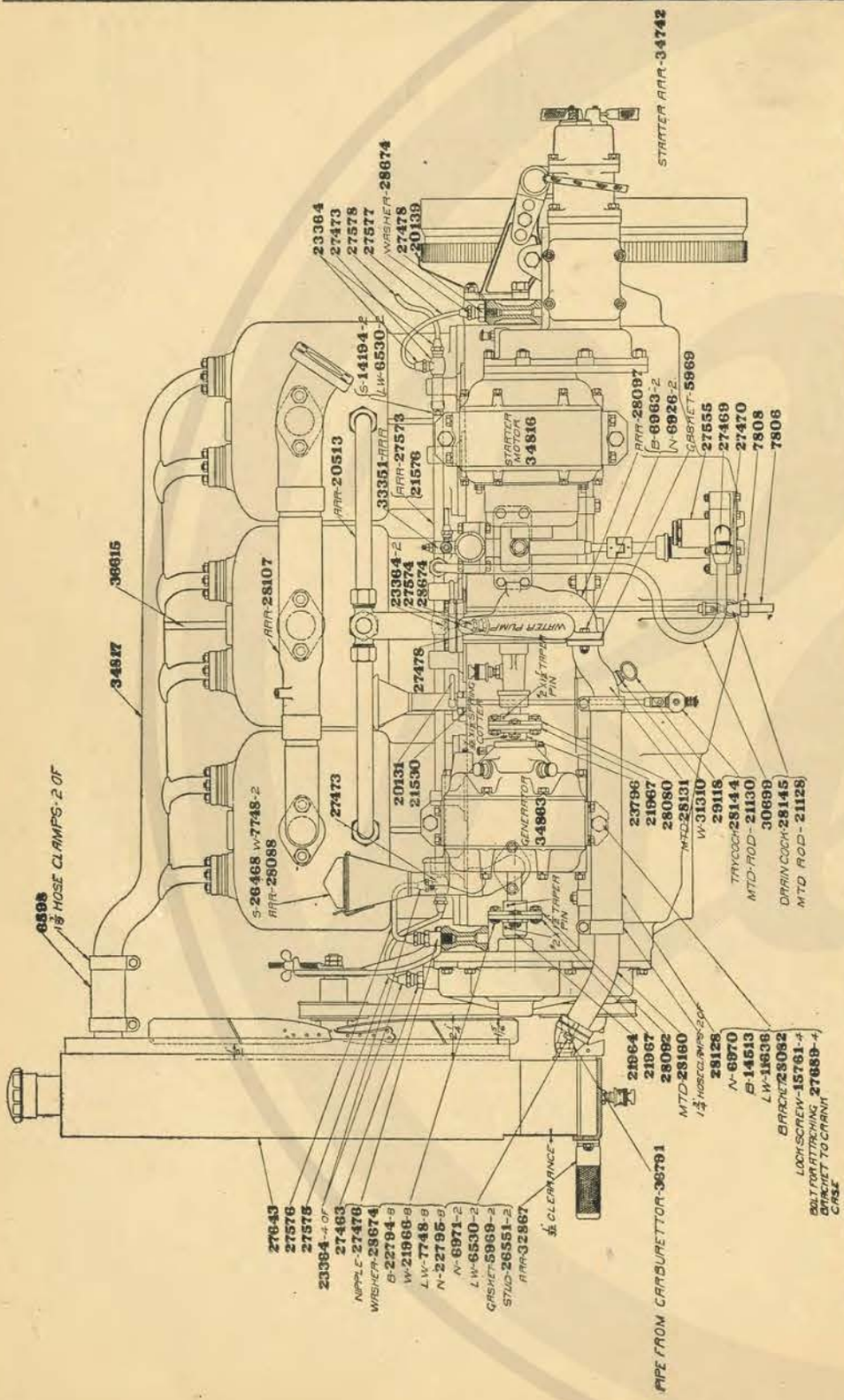

Fig. 13. Left-hand side view of Engine, showing location of Lighting Generator and Electric Starting Motor.

no fuse is blown, look for open circuits, loose contacts, battery disconnected or accidentally run down, or burned out lamps. (c) In case battery is run down, recharge it immediately by running car without lights or at high speed. (d) In case trouble is due to short circuit in some particular lamp socket, disconnect the attachment plug leading to this socket until the difficulty can be remedied.

IF LAMPS BECOME DIM WHEN ENGINE STOPS.—This indicates an under-charged battery. Endeavor to run with fewer lamps turned on than normal for a few days, or until the battery voltage picks up again. Battery should charge at high speeds with lamps turned on, or at any engine speed above 250 to 330 r. p. m., with lamps turned off. There is a switch mounted in the back of the junction box with "on" and "off" positions. If the battery does not keep charged during the winter months, this switch should be turned on, as it increases the capacity of the generator. It should be turned off as soon as the battery shows 7¾ or 8 volts to prevent battery gassing.

CAUTION.—The junction box switch should not be left on in summer, or when driving at high speeds.

THE LIGHTING SWITCH, mounted on the dash, has four buttons controlling the following lights:

Top one, headlights. This has three positions, "off," "on;" "off," "dim;" "off," "on."

Right Hand; side lamps.

Bottom; tail, dash and speedometers.

Left Hand; tonneau or pillar lamps. Inside of all enclosed bodies is the switch for dome lamps and two push buttons for buzzer. Each style of body is furnish completely wired and terminals are marked so that changing from touring to enclosed and from enclosed to touring is accomplished by simply making proper connections at the junction box.

We are providing an inspection lamp as regular equipment. This is made with a lamp base connection. To make use of it, the lamp bulb is removed from the dash illuminator and the inspection lamp connection is used in its place. The tail lamp switch is then pressed on.

CARE OF LIGHTING OUTFIT.—Oiling.—Each of the oil cups marked "oil" should be given three or four drops of oil about once every month. Use only the best quality of machine oil.

Lamp Bulbs.—The head lights are 21 candle power, 7 volts.
The dash sidelights are 4 candle power, 6 volts.
The dash illuminating light and trouble lamp are 4 candle power, 6 volts.
The tail lamp is 2 candle power, 6 volts.
The number illuminator is 2 candle power, 6 volts.
The dome light is 6 candle power, 6 volts.
The pillar and tonneau lights are 4 candle power, 6 volts.

THE ELECTRIC STARTER.—This equipment consists of a Westinghouse electric starting motor, Fig. 13. with Magnetic pinion shift, Magnetic control switch and starting button on dash.

TO START THE ENGINE.—Put key in ignition switch and turn to the right, move switch lever to position marked M-B. If cold, prime engine by pulling out on handle of primer and then releasing same. Open throttle lever about 1 inch on quadrant and set spark lever directly under it. Pushing the starting button will now cause the gear to go in, and the engine should start. It it does not, release the starting button and push again, as occasionally, the gear may not engage the first time. As soon as the engine starts, release the starting button.

IF THE ENGINE DOES NOT PICK UP WITHIN 5 SECONDS, release the starting button and locate the trouble, in carburetor, ignition system or spark plugs.

IF STARTING MOTOR FAILS TO START, look for open circuit or loose connection in wiring. See that the battery is not discharged.

Operation.—In Fig. 14 is shown a schematic diagram of starting motor, switch, battery, etc. When ignition switch is unlocked and on position marked M-B, pressing the starting button completes the circuit in the magnetic control switch, which, in turn, closes the main battery circuit contact in the magnetic pinion shift, engages the gear and starts the engine. As soon as the engine is running and the lighting generator generates current, the starting switch and magnetic control switch automatically disengage and cannot be used while engine is running. This prevents throwing in starting motor while engine is in operation. Removing key from ignition switch locks the starting mechanism, and prevents the car from being operated.

CAUTION.— If, for any reason, the connections are removed from the battery or from any part of the system, they should be well tightened up again when replaced, as the efficiency of the electric starting system depends largely upon proper connections.

Care of Motor.— The starting motor needs no attention except oiling. About once a month, a few drops of best quality machine oil should be placed in each of the two oil cups provided.

Repairs.— In case any difficulty arises that cannot be readily located, notify the nearest local agent of the Westinghouse Electric & Manufacturing Co. Responsibility will not be assumed for repairs made by outside parties.

Instructions for Care of Storage Battery.

1. The storage battery used with the lighting and starting equipment is a three cell "Exide" battery, fifteen plates per cell, known as 3x15-1 and is made by The Electric Storage Battery Co., Philadelphia, Pa.

2. The few simple rules herein given, if methodically followed, will insure the best results being obtained.

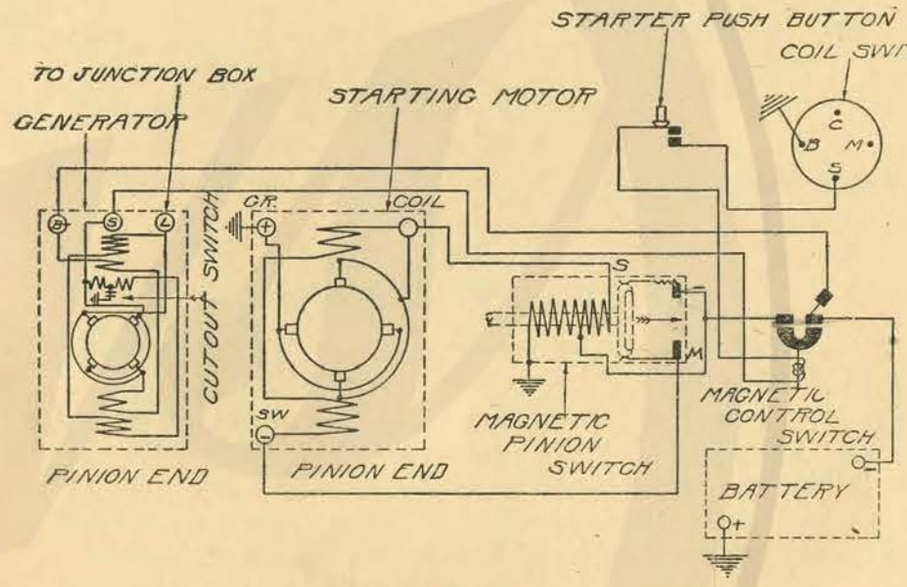

Fig. 14.
Diagram of the Connections of Starting Motor, Switch and Storage Battery.

OPERATION.

3. When the battery is fully charged, the electrolyte or solution in the cells should have a specific gravity of from 1.275 to 1.300 as indicated by the Hydrometer Syringe (see Fig. 15). The gravity will lower due to discharge. When completely discharged, it will be about 125 points less than when charged, or from 1.150 to 1.175. The gravity is, therefore, an indication of the state of the battery.

Fig. 15. Hydrometer Syringe.

4. At regular intervals, once every two weeks or so, read the specific gravity of the electrolyte. If it shows a tendency to lower from normal (1.275 to 1.300), the car should be operated at higher speeds, or a larger proportion of the time without lights until the gravity rises. If the gravity has fallen 50 points or more i. e., down to 1.225, it is advisable to give a charge from an outside source (see paragraph 16). A charge from an outside source should be given about every two months or more often if necessary, if it is found that the operation of the car is not sufficient to keep the battery fully charged.

REPLACING EVAPORATION.

5. The electrolyte must always cover the plates. Replace evaporation BY ADDING PURE, FRESH WATER; NEVER ADD ACID.

6. Once every week, unscrew the vent plugs and observe height of the electrolyte. If electrolyte is below hole in the perforated inside cover, add pure water to bring the level back to hole.

7. The water used must be pure:

1. Distilled water.
2. Melted artificial ice.
3. Fresh rain water.

Never keep the water in metal containers, such as bucket or can. It is best to get a bottle of distilled water from a druggist or an ice plant.

8. If electrolyte has been spilled from a cell, replace loss with new electrolyte (of the same specific gravity as in the other cells) and follow by an over charge by running the car for several hours, or charge the battery from an outside source (see paragraph 16).

9. Never add electrolyte or acid to a cell except to replace loss by spilling or broken jar or when removing sediment.

ELECTROLYTE.

10. When new electrolyte is required, either to replace loss by spilling or when removing sediment or replacing a broken jar, the electrolyte should preferably be obtained from The Electric Storage Battery Company (communicate with

nearest Sales Office, see paragraph 21), but electrolyte of 1.300 specific gravity can be made by mixing especially pure sulphuric acid (1.840 specific gravity) and distilled water in proportion of two parts of acid to five of water, by volume. THE ACID MUST ALWAYS BE POURED INTO THE WATER, and not the water into the acid. A glass, earthenware or other acid-proof vessel thoroughly cleaned, should be used, and the electrolyte allowed to cool before using.

SEDIMENT.

11. The sediment, which gradually accumulates in the bottom of the jars should be removed before it reaches the bottom of the plates, as, if it does, it is very harmful to them. The need of cleaning is indicated by lack of capacity, excessive evaporation of the electrolyte and excessive heating when charging. When a battery requires removal of sediment, better results follow if the work is done at a place where they are accustomed to it; so, if a battery is in need of cleaning or repairs, it is best to communicate with the nearest Sales Office of The Electric Storage Battery Company (see paragraph 21) and it will advise where to send the battery.

CARE OF BATTERY WHILE OUT OF SERVICE.

12. If the car is not to be used for some time, say for the winter months or longer, care should be taken that just before the last time the car is used, water should be added to the cells (see paragraph 5), so that it will be thoroughly mixed with the electrolyte, due to the operation of the car. If this is done, there will be no danger of freezing, as thoroughly mixed electrolyte will not freeze solid.

13. The battery should be charged at intervals of every two months during the out of service period, from an outside source (see paragraph 16), adding water before charging when necessary. If the above is not possible, and there is no garage equipped for charging batteries, to which the battery can be conveniently sent, the battery may be allowed to stand during the winter period without charging, though much better results will be obtained by giving the periodic charges.

PUTTING BATTERY INTO SERVICE AGAIN.

14. Before putting the battery into service again, inspect and add water, if necessary. If the battery has not been kept charged during the winter, it will be advisable to give it a charge from an outside source before putting into service.

15. When connecting up the battery leads to the battery, be sure that the brass studs are free from corrosion. The greenish deposit can be removed from the studs and nuts by cleaning them in a solution of bicarbonate of soda (cooking soda) and water. After the deposit is removed, wash the connectors in warm water, allow them to dry and apply a light coat of vaseline. When making the connections be sure that the lead nuts are drawn up tight and wires are connected to their proper terminals. In replacing the battery in the battery box, be sure that it rests squarely on the base, and that it is so secured that it cannot shift in the battery box.

CHARGING FROM AN OUTSIDE SOURCE.

Battery Removed from Car

16. It is necessary that the charging be done with "direct current." The simplest method is, when there is a 110 or 120 direct current circuit available, to connect eight 110 volt, 32 candle power, 100 watt, carbon lamps parallel with each other and in series with the battery to be charged, this combination giving approximately the proper charging rate (8 amperes).

17. The positive terminal of the battery must be connected to the positive side of the charging circuit and the negative terminal to the negative side. IF CONNECTED IN THE REVERSE DIRECTION, VERY SERIOUS INJURY to the battery will result.

18. Figure 22 illustrates just how the connections should be made. The charge should be continued until all the cells have been gasing or bubbling freely for five hours and there is no further rise in the voltage of the battery or specific gravity of the electrolyte over the same period.

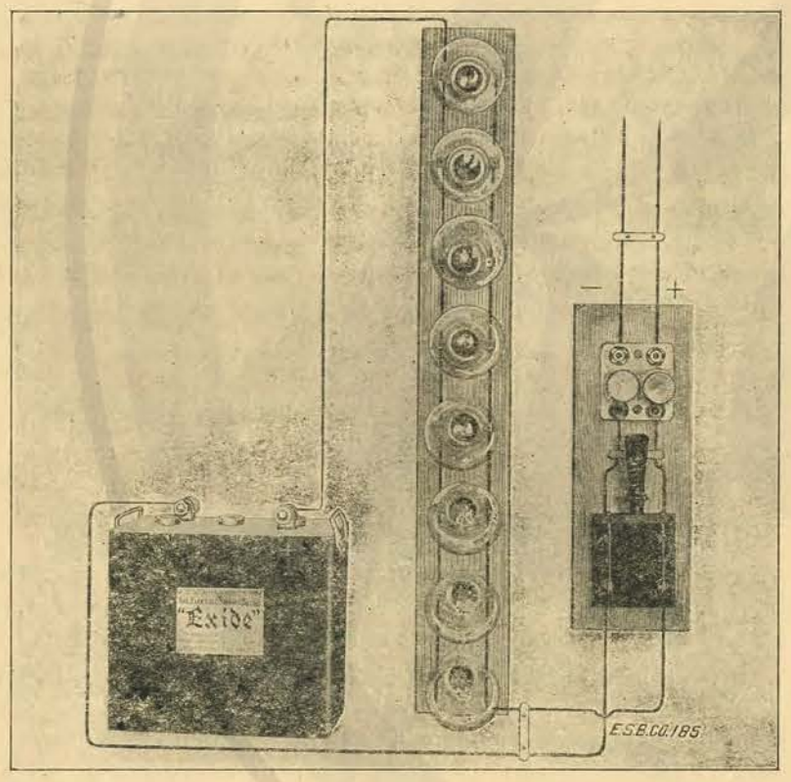

Fig. 16.

19. If only alternating current is available, a current rectifier must be used.

20. To determine the polarity of the charging circuit, if a suitable voltmeter is not at hand, dip the bared ends of the two wires from the charging source into a glass of water, in which a teaspoonful of salt has been dissolved,

care being taken to keep the wires at least an inch apart; when current is turned on, fine bubbles of gas will be given off from the negative wire.

21. If further information is desired in regard to the storage battery, write to the nearest local office of the Electric Storage Battery Company, as given in the list below:

PHILADELPHIA,
Allegheny Ave. and 19th St.

BOSTON,
60 State St.

ST. LOUIS,
Fullerton Building.

DENVER,
1424 Wazee St.

ATLANTA,
Candler Building.

SEATTLE,
Colman Building.

LOS ANGELES,
Pacific Electric Building.

NEW YORK,
100 Broadway.

CHICAGO,
Marquette Building.

CLEVELAND,
Citizens Building.

DETROIT,
Ford Building.

SAN FRANCISCO,
118-130 New Montgomery St.

PORTLAND, OREGON,
Spalding Building.

TORONTO, CANADA,
Canadian Electric Co., Ltd.

INSTRUMENTS ON DASH.—

The Clock is an eight day clock. It is wound up by means of a knurled knob. The hands are set by pulling out the knurled knob and turning.

The Auto-meter shows the total miles run on the upper dial and the lower gives the trip mileage. The knob on the left of the auto-meter is for setting the trip figures back to zero; this is done by turning this knob to the left. The knob on the right of the auto-meter is for setting the tenths of a mile; this is turned to the right.

The Speedometer shows the miles per hour, the dial turning on a horizontal axis.

The Dash Illuminating Lamp has a four candle power bulb. This is switched on or off by pressing the bottom push button on the lighting switch, which also lights the tail lamp. The dash illuminating lamp can be covered so as to shut out light by sliding the sleeve provided over the slots in the dome. When it is desired to use the inspection lamp, the dash illuminating bulb is taken out and the connection on the inspection lamp cord is coupled in this socket, the bulb being placed in the inspection lamp.

The Oil Pressure Gauge indicates the pressure in the oiling system. This should not get below ½ pound even when running very slowly and it rises to as high as 14 pounds at the highest car speed.

Hand Pump for gasoline pressure. Use when no pressure shows on gasoline gauge. Do not pump over four pounds. When the engine is running, the power-driven pump supplies a constant pressure. When the handle of the hand-operated pump is turned to vent position, the pressure on the tank is relieved. This should be opened before unscrewing the filling cap on the gasoline tank or when leaving car in garage for an extended time.

The Gasoline Pressure Gauge indicates pressure in gasoline tank. The pressure should not be less than one pound nor more than four pounds.

The Voltmeter shows the voltage in the battery when the engine is stopped and it shows the voltage supplied by the generator when the engine is running. This battery voltage should not be less than 6 volts when the engine is not running.

The Lighting Switch has four buttons controlling the following lights: top button, headlights; right button, side lamps; left button, used on enclosed bodies for pillar lamps and on open cars for tonneau lamps. Bottom button controls the tail and dash illuminator lights. The headlights are provided with a dimming arrangement which can be used when ruuning in town. This gives about one-third of the full light. The headlight switch is operated as follows: one position "off," push button gives full on, push button turns off, push button again gives dim light, push button again turns off, push button again gives full on.

The Starting Switch Button. To operate this, the key must be inserted in the ignition switch, turned on, and the switch lever placed on the M-B or B contacts, as the starting arrangement cannot be worked without this switch being unlocked by means of the key.

The Ignition Switch. This has four positions. The extreme left is magneto ignition only; the next position is off; the next is magneto and battery ignition and the extreme right is battery ignition only. The key must be in the switch. Do not use any other; if lost, order by number from the factory.

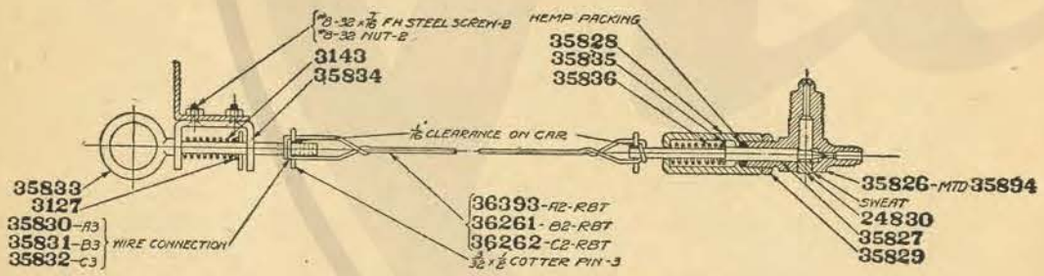

Fig. 17. Priming Device.

PRIMER.— This is a needle valve held on its set by spring pressure and is operated by pulling out on a ring at the bottom of right hand dash cabinet. Do not hold out long as gasoline is fed to it by pressure, although in cold weather, it may be held out longer than when the weather is warm. The gasoline gauge must show pressure or the primer will not work. Be sure the valve seats properly, or it will leak and cause unsteady running of engine.

THE FRICTION CLUTCH.—The inside of the rim of the flywheel forms the external conical, friction clutch, and with it engages an internal, conical clutch, made of aluminum, faced with leather, and provided with flat springs under the leather for easy engagement. The clutch is partially enclosed by a plate over the flywheel. This admits of running the clutch in oil. This oil (must be either neat's-foot or castor oil) should be brought to a level corresponding to a depth of about ¼ inch in the bottom of the front of the flywheel, once a week. Judgment should be used in applying this oil, as the amount will require variation, depending upon the usage of the car. The purpose of this clutch is to allow the motor to be disengaged from the gears when changing them; also to allow the car to be started and stopped without shock. Should the clutch grip too suddenly so as to start the car with a jerk, apply castor oil, or preferably, neat's-foot oil, to the leather surface of the clutch. When engaging the clutch, always let it go in as gently as possible, so as to start gradually. Allowing it to go in suddenly strains the gears, besides starting the carriage with an uncomfortable jerk.

Care must be taken to fill up the grease cups on the aluminum clutch, and to screw them down one turn daily, so that the clutch will not bind on the shaft. Also oil the clutch collars daily. Should the clutch slip, it can be adjusted by tightening up the nut 33058, behind the ball thrust bearing, HB-5R, Fig. 3. To do this, the split cover 32258 is removed by unscrewing the two bolts that clamp it on; then revolve the engine crank shaft until the nut 33058 and cotter pin are exposed. To reach the latter, use the special pliers provided.

THE CLUTCH AND FOOT BRAKE PEDAL SHAFT.—This shaft must be oiled where the oil holes are provided, also the clutch and various pins and joints of the rods that are attached thereto. At the right hand end of this shaft is fixed a lever with an adjusting screw and lock nut. This is for a stop to limit the travel of the foot brake.

THE TRANSMISSION.—(Fig. 18)—The transmission is of the selective type, with four forward speeds and reverse. The direct drive is on the fourth speed.

This is enclosed in an aluminum gear case, fitted with a large hand hole cover, which can easily be removed to examine the gears, or put in grease. One pint of Duplex Liquid Grease should be put in the transmission every 500 miles.

Great care should be taken to allow no dirt or grit to enter the gear case. It is not necessary to draw off the old grease, though this should be done every 5,000 miles. The level should be kept up so that the smallest gear shall just dip. Do not allow level to be higher than is necessary.

THE SPEED CHANGE CONTROL.—(Fig. 19).—The changing of gears is effected by the side lever 34575. This lever works in a gate having two longitudinal slots and a cross slot corresponding to the neutral position, through which the lever can be moved to engage in either longitudinal slot. This lever is fixed to a tube 34573 on the other end of which is a lever 15925, which engages with either of the two shifting bars 27420 and 27421. It cannot engage with both except when in the neutral position which is that shown in Fig. 18. The bar 27420

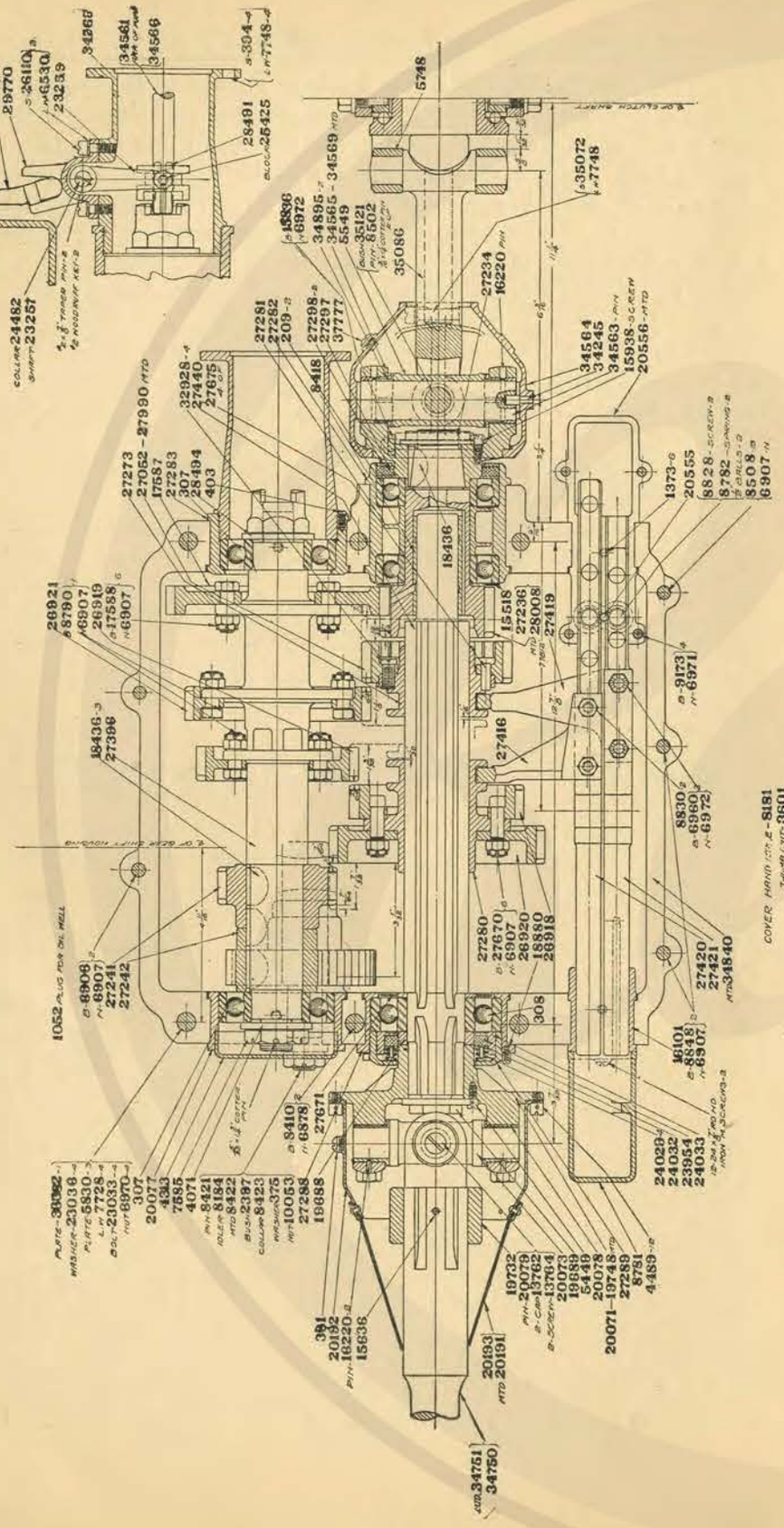

Fig. 18. Arrangement of Transmission Gear.

controls the gears 26920 and 26918. These give first and second speeds and reverse, according to which gears they are moved into mesh with. The bar 27421 controls the gear 27052; this gives the third speed and direct fourth speed. The bars are locked when the gears are in full mesh by means of the ½" ball pressed into the notches in the bar.

Due to a very simple interlocking device, the speed change lever cannot be moved until the clutch is disengaged and the clutch cannot be engaged until the gears are in proper mesh. This is a great safeguard against the breakage or mutilation of the gears. The interlocking lever is shown at 34629, the bolt 34001 being connected to the clutch lever so that when the clutch is disengaged, this bolt is withdrawn.

The hand brake lever 34576 should always be pulled so as to apply the brakes when the car is stopped after first bringing the speed change lever into its neutral position.

A clutch brake is provided and when depressing the clutch pedal to change gears, care must be exercised not to depress this pedal too far, especially when running very slow.

The grease cup 13280 at the inner end of the hand brake shaft should be given a full turn every 300 miles and the change speed sleeve should also be freely oiled through the cup 24552 provided.

THE STEERING GEAR.—(Fig. 20.)—The steering gear is of the screw and nut type. The three grease cups on the steering gear case should be given a whole turn once every 150 miles. The steering column should be oiled freely every 300 miles at the oil hole provided in the column. One gunful of grease should be injected into the steering gear case every 500 miles.

THE UNIVERSAL JOINTS.—Four universal joints are provided, one at either end of the short shaft 35086 between the engine and transmission (see Fig. 18) and one at either end of the propellor shaft 25647 (see Figs. 18 and 21). IT IS VERY NECESSARY TO OIL THE SQUARE BLOCKS IN THE UNIVERSAL JOINT DIRECTLY BEHIND THE CLUTCH EVERY DAY. THIS HAS MUCH TO DO WITH THE EASY ENGAGEMENT OF THE CLUTCH.

The universal joints at either end of the propellor shaft are fitted with metal covers and leather boots. There is a screw hole in each of these metal covers into which should be injected a charge of cup grease and oil every 300 miles.

THE FORWARD YOKE OF THE REAR UNIVERSAL JOINT, Fig. 27, HAS A SQUARE HOLE IN WHICH THE REAR END OF THE PROPELLOR SHAFT IS FREE TO SLIDE. THIS END OF THE SHAFT IS HOLLOW AND PROVIDED WITH A SCREW HOLE FOR FILLING WITH GREASE. THIS SHOULD BE DONE EVERY 1,000 MILES.

THE LUBRICATION OF THESE FOUR JOINTS IS OF THE UTMOST IMPORTANCE.

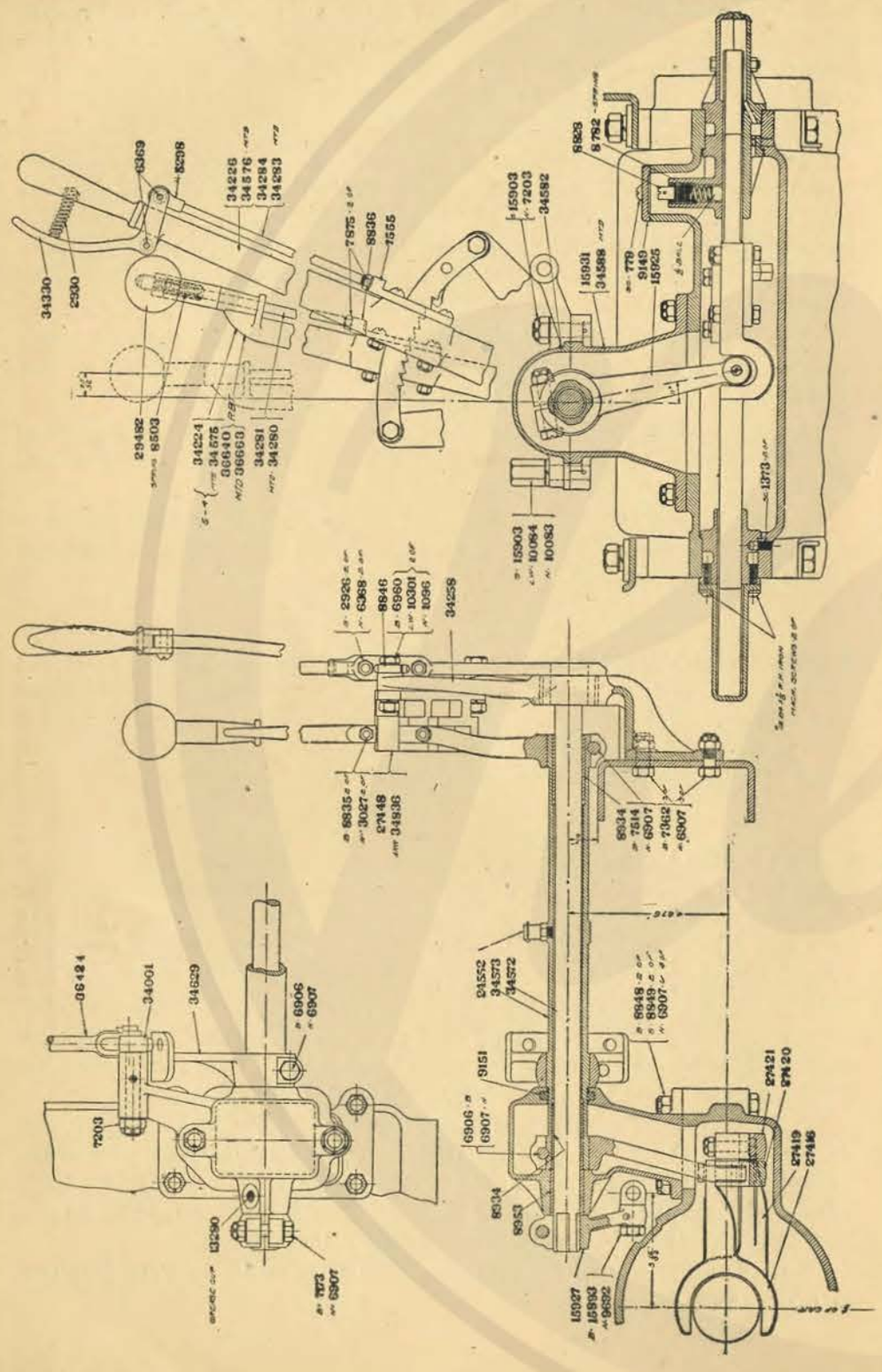

Fig. 19. Arrangement of Speed Change Control.

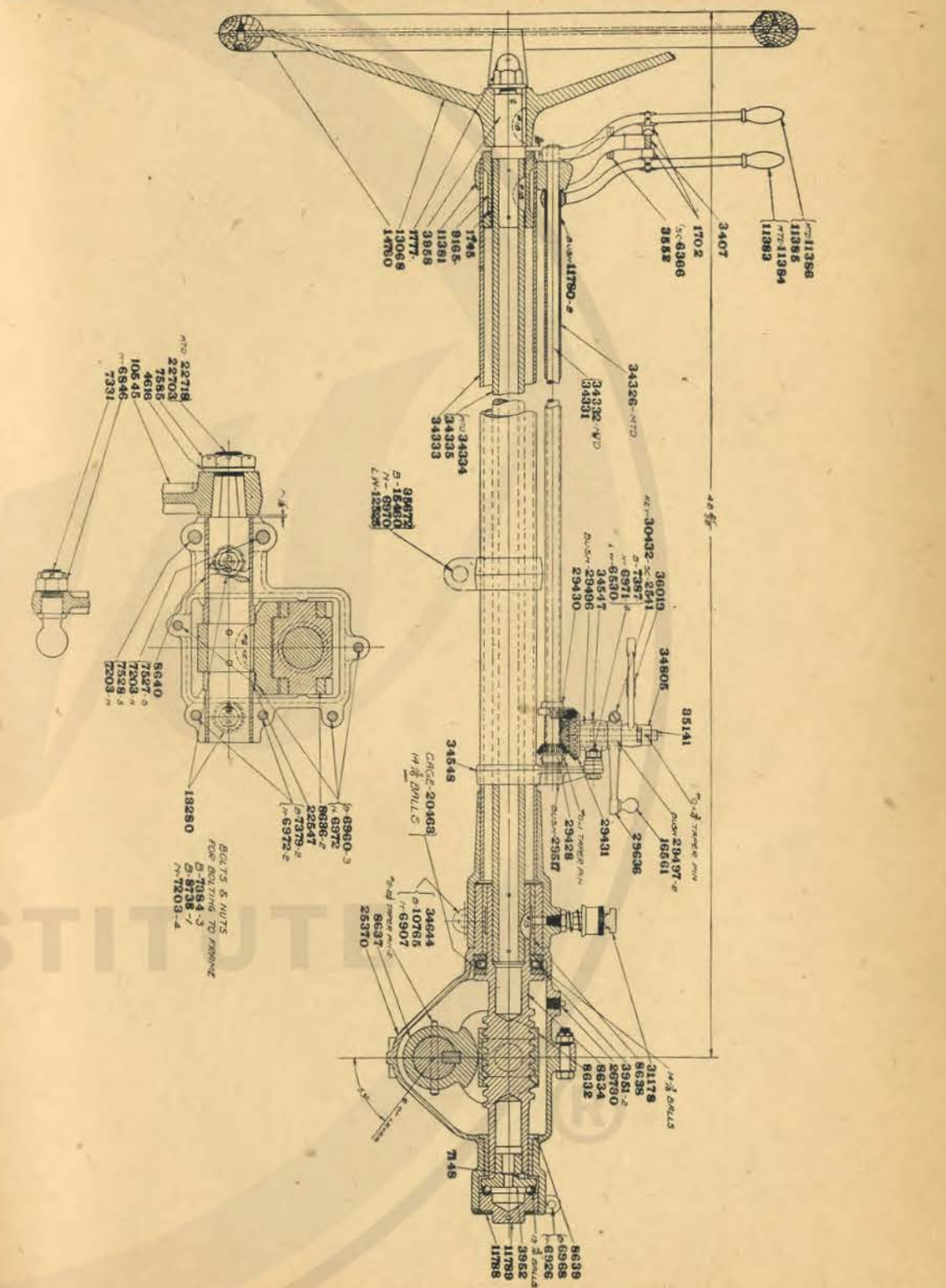

Fig. 20. Arrangement of Steering Gear.

THE REAR AXLE.— (Fig. 21).—There are two ¼" pipe plugs on the right hand side of the bevel gear case. The upper one is for filling the case with the special lubricant (Duplex Liquid Grease) up to this level. The lower plug is for testing the level of this grease which should not be allowed to get below the level of this lower hole. To maintain this level, it will be found necessary to inject one grease pumpful of lubricant every 500 miles.

There is a ¼" pipe plug on the right hand side of the bevel pinion shaft housing 28703 into which should be injected a pumpful of liquid grease once every 1,000 miles.

It is possible to withdraw the axle shafts, should it become necessary to clean surplus grease from the housing, without disturbing any other part of the rear axle casing. This may be done after the cases 26418 have been unscrewed.

In this connection, the following CAUTION should be observed. Care must be taken in replacing these cases 26418 for whatever reason they may have been removed, not to nip the roller bearings too tight. If no need for adjusting the bearings exist, the cases should be returned in such a manner that the locking key 11259 fits in the same notch in the case in which it was found. If an adjustment of the bearings is required, it may be necessary to remove these brass cases and machine them off a trifle to enable them to be screwed in a notch or two. Each side should be screwed up an equal amount and .010 inch end play allowed. The cases should not be machined off to a greater extent than will allow of one notch of additional adjustment after the proper end play is secured.

It is most important that the two grease cups at the outer ends of the rear axle housing, which serve to lubricate the roller bearings at these points, should be given a turn every day the car is in use.

THE BRAKES.— (Fig. 22).—Both the foot brake and emergency hand brake operate directly on the rear wheels. The foot brake is of the internal expanding type; the hand brake, external contracting. The external brake shoes are lined with woven asbestos strips. The internal shoes are lined with a special bronze.

THE BRAKE SHOES ARE PIVOTED AT THE LOWER ENDS AND THE GREASE CUPS FOR THE LUBRICATION OF THESE PINS 26815 AND 26813 SHOULD BE GIVEN A TURN EVERY DAY THE CAR IS IN USE.

All joints and articulations from the brake pedal and hand lever to the toggles and cam operating the two sets of brakes should be kept clear of mud and grit and frequently lubricated with an oil can.

The brakes are adjusted by means of the nuts 6756 at the after ends of the brake rods. Care must be taken to make adjustments equally on both sides and not to such an extent as to cause the brakes to drag.

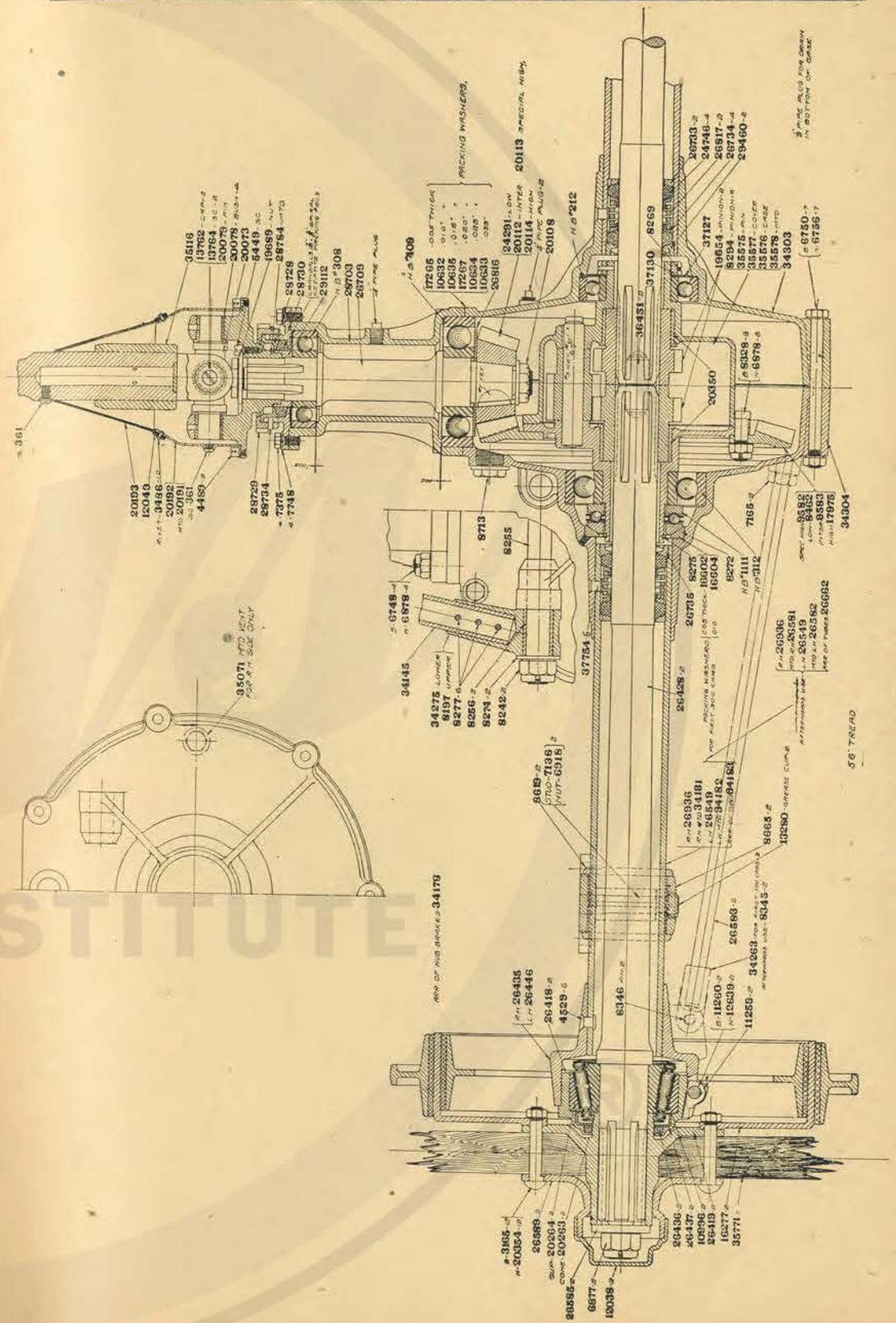

Fig. 21. Arrangement of Rear Axle.

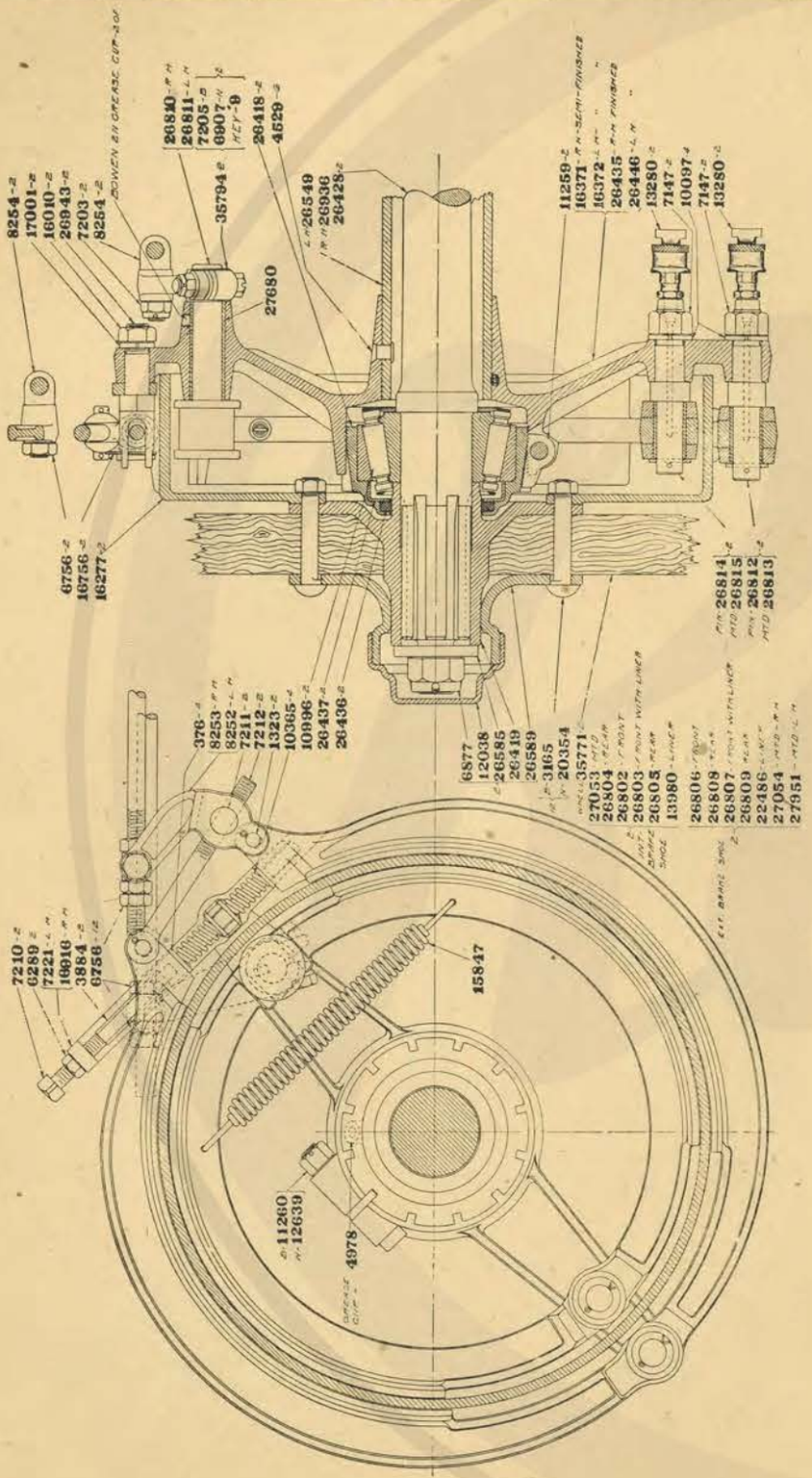

Fig. 22. Arrangement of Brakes.

THE POWER AIR PUMP.—Fig. 23.—This is provided for pumping up the tires. It is put into action by unlatching the operating lever and throwing over quickly against the opposite stop. This must be done when the engine is running slowly. It cannot be engaged when the engine is stopped. Make sure that the lever is fully over before pumping up a tire. The latch provided keeps the lever in the engaged position. Oil the pump before using. Keep the gauze on the air inlets clean. A pressure gauge is provided on the hose at the tire valve end. When pumping up a tire, this gauge should be closely watched and the pump thrown out of engagement when the proper pressure is attained—this is 65 to 75 pounds for a 36″ x 4½″ "Silvertown" tire. The lower pressure gives the most comfortable riding, while with the higher the life of the tire and the speed of the car are increased. Never allow a greater pressure or the tire may burst. Keep the oil in the pump crank case at the level of the bottom of the hole below the inspection plate 14167. Fig 23.

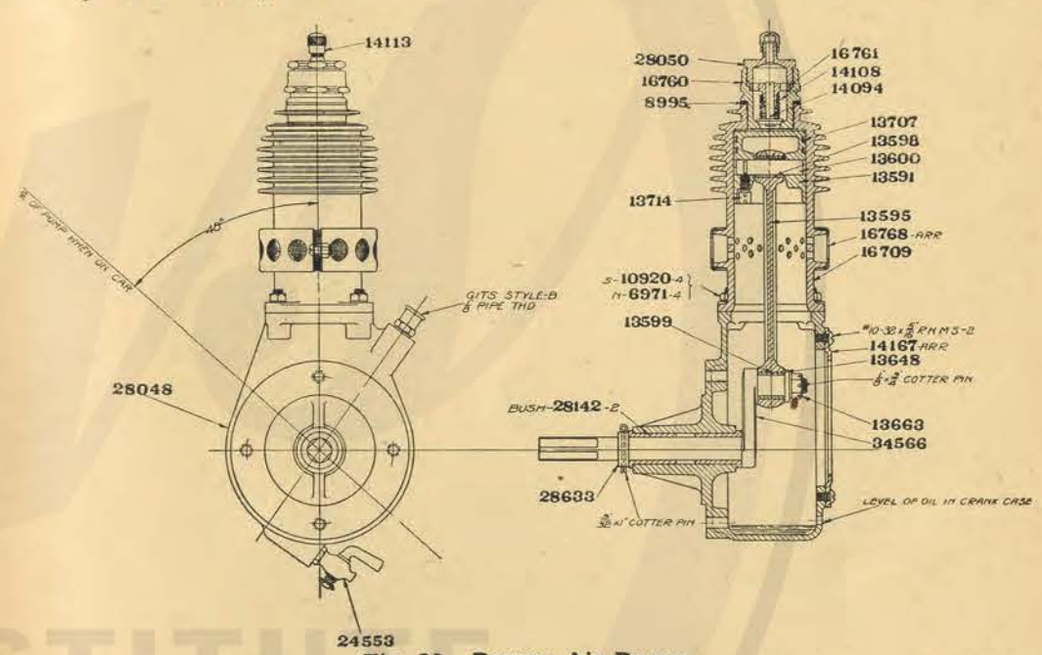

Fig. 23. Power Air Pump.

AIR PUMP INSTRUCTIONS.— The engine should never be run at a high speed when pumping. The pump itself will pump up a tire more quickly if run at 300 revolutions per minute than it will at greater speed. This is because the tire valve is too small to take care of any greater volume of air, and excessive speed in operation merely wastes power by heating up the pump. As the pump runs half the speed of the engine, this means that the engine should not be run more than 600 revolutions per minute when pumping up a tire.

If the pump does not appear to be inflating the tire quickly enough, examine the hose pipe connections. See that these are screwed up sufficiently tight to prevent any leakage. It is best not to rely altogether on the gauge, as being a small and somewhat delicate instrument, it is liable to derangement. We, therefore, advise when the tire is fairly well inflated, letting down the jack and noting the

hardness of the tire by observing the flattened portion of its circumference where it is in contact with the ground. When this flattening disappears, the tire is usually well inflated.

DEMOUNTABLE RIMS (Johnson Patent).—In using the demountable rims, care should be exercised to see that all nuts are securely turned up, both for the sake of safety and to eliminate unnecessary wear.

All surfaces should be kept clean and free from rust to insure easy operation.

TIRES.—Tires should be kept inflated to the pressure recommended by their makers and it will be found to greatly prolong the life of all tires if small stone cuts, etc. be promptly and efficiently repaired. The car should never be allowed to stand in oil or grease, nor is it advisable to leave the car standing in the very hot sun. Both of these have a serious effect upon tire wear.

CLEANING.—When washing the vehicle, care should be taken that water does not get into any of the vaporizing pipes, or upon the spark coils, ignition plugs, commutator, exposed connecting wires, or in the clutch.

Caution should be exercised to keep the dust pan as clean as possible. Accumulations of oil, grease, etc., constitute a serious danger from fire that should not be overlooked.

In order that the finish of the car shall not be quickly destroyed great care should be taken in washing. It is advisable that nothing but a special automobile soap should be used, which is one free from uncombined alkali. It is very desirable that soft, pure water should be used in washing automobile bodies. Water containing lime deposits, or the like, should be avoided. The very best water for washing bodies is rain water, which may frequently, in the case of cars kept in private garages, be collected in sufficient quantities from the roof drains. When washing the car, it is advisable to place a cover over the motor in order to prevent large quantities of water from accumulating in the valve caps and other places where it would be most undesirable. Special care should be observed in connection with the oil retaining rim on the flywheel, used to maintain oil in contact with the clutch leather. It will serve equally well in retaining water in this position, which will be very damaging. DO NOT ALLOW WATER TO GET ON THE CLUTCH OR WITHIN THE PERIPHERY OF THE FLYWHEEL.

It is most necessary to keep the six window pocket drain holes, in all enclosed cars, open. Four of these are in the bottoms of the window pockets of the doors, two in each door, and open through the under sides of the lower door rails. The other two open from the side window pockets into the tops of the body recesses for the rear wheels. Allowing these drain holes to become plugged is liable to cause serious damage to the upholstery.

In cleaning the motor, kerosene should always be used—never gasoline, on account of its highly inflammable nature. It is advisable to disconnect one of the battery terminals before cleaning with kerosene.

NOTICE.—GRIT, MUD AND DIRT ARE THE SOURCES OF GREATEST WEAR TO AN AUTOMOBILE. IF ALL SUCH DEPOSITS ARE PROMPTLY REMOVED AFTER EVERY RUN, THE LIFE OF THE CAR WILL BE GREATLY PROLONGED.

CAUTION.—IF, ON ACCOUNT OF ACCIDENT OR ANY OTHER REASON, AN AXLE, FRAME MEMBER OR OTHER HEAT TREATED STEEL PART HAS BECOME BENT, IT IS MOST INADVISABLE TO USE HEAT IN STRAIGHTENING SUCH PARTS. THESE PARTS ARE ALL MADE OF SPECIAL STEEL WHICH HAS BEEN MOST CAREFULLY AND ACCURATELY HEAT TREATED. IF THEY BE STRAIGHTENED BY MEANS OF HEAT THE EFFECTS OF THIS HEAT TREATMENT WILL BE DESTROYED AND THE FRAME AND OTHER MEMBERS WEAKENED TO A VERY SERIOUS EXTENT.

OILING INSTRUCTIONS.—Keeping the motor and gear properly oiled is one of the main things to look after, and the following directions should be precisely carried out:

Ordinary lubricating oil must on no account be used for filling the crank case; only special, gasoline motor cylinder oil must be used. The grease we recommend for the gear case and rear axle is Duplex Liquid Grease, and no grit or dirt should be allowed to enter.

The following oiling directions must not be taken to cover all cases, as when running under very muddy conditions or on the lower gears for any length of time it may be necessary to oil much oftener. Also in the case of the engine, the gauge should be frequently looked at to see that there is pressure in the system when the engine is running. When the engine is not running, no pressure will show on the gauge, the oil running to the bearings and thence to the well in the crank case. IN CASE A LEAK DEVELOPS, OR THE ENGINE USES MORE OIL THAN ORDINARILY, THE SUPPLY MAY NEED REPLENISHING SOONER THAN THE DIRECTIONS INDICATE. When the engine is running at a medium speed, of 15 to 20 miles per hour on the direct drive, see that the oil in the gauge shows at least 3 to 4 pounds; if less, give more oil or examine oil system.

Too little attention is given to the proper lubrication of automobiles. The best lubricating oil or grease is the one which, to the greatest degree, overcomes friction, and by overcoming friction, reduces to a minimum the wear and tear of the working parts. We have given the subject much thought and have spent a great deal of time experimenting along these lines and we have adopted and now recommend for use in our car, the Duplex Motor Oil Duplex No. 1, the Duplex Liquid Grease for Transmission and Rear Axles and the Duplex Gear or Cup

grease for Grease Cups, Hub Caps and Universal Joints, all of which are manufactured by the Enterprise Oil Company, of Buffalo, N. Y. If these lubricants are not handled by your garage, we would advise that you order them from the Enterprise Oil Company. The oil is put up in 1 and 5 gallon cans, half-barrels and barrels; the cup grease in packages of 5, 10, 30, 40, and 60 pounds, half-barrels and barrels, and the liquid grease in 5, 10, and 40 pound cans, half-barrels and barrels.

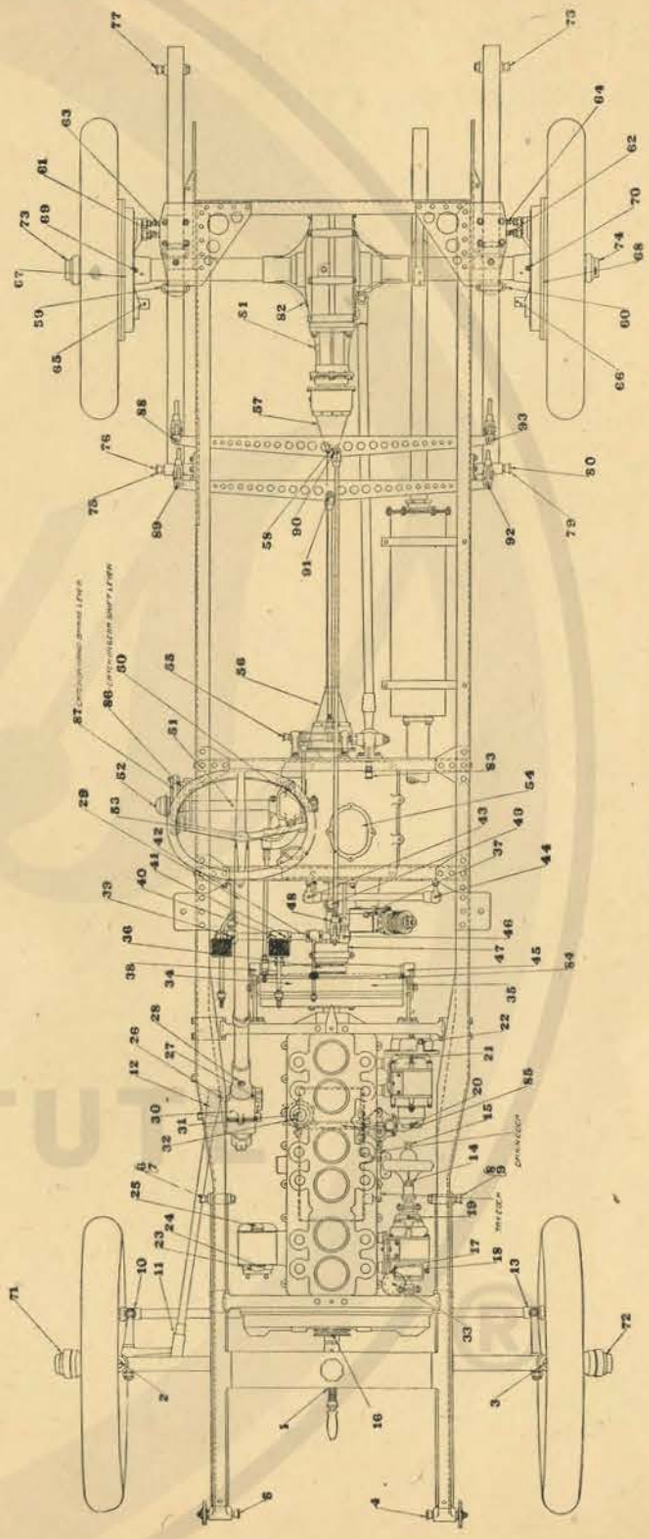

Fig. 24. Plan of Chassis showing Lubricating Points.

Oiling and Greasing Instructions for Pierce-Arrow 38 Horse-power, Six Cylinder Car. Model C-3.

Note.—Oil oftener if necessary.

Lubricating Groups

GROUP NO. 1:

Daily —Give a turn to two grease cups on outer bearing of driving (rear) axle, Nos. 69 and 70; Fig 24.

Give a turn to two grease cups on pins for brake shoes, Nos. 61, 62, 63, 64; Fig. 24.

Give a turn to two grease cups on steering knuckle sockets, Nos. 2 and 3; Fig. 24.

Give a turn to two grease cups on friction clutch, Nos. 34 and 35; Fig. 24.

Give a turn to the grease cups on spring eye bolts, Nos. 4, 5, 6, 7, 8, 9, 75, 76, 77, 78, 79, 80; Fig. 24.

Oil clutch collar, No. 36; Fig. 24.

Oil clutch blocks, No. 47; Fig. 24.

GROUP NO. 2:

Every 150 Miles: —Give a turn to grease cup on commutator spindle, No. 31, Fig. 24.

Give a half turn to two grease cups on water pump, Nos. 14 and 15; Fig. 24.

Give a turn to three grease cups on steering gear case, Nos. 26, 27, 28; Fig. 24.

GROUP NO. 3:

Every 250 Miles: —Gunful of Duplex Liquid Grease in bevel gear case, No. 82; Fig 30.

Tablespoonful of neat's-foot oil on clutch leather, No. 84; Fig. 30. (Use judgment—more or less oil as necessary.

GROUP NO. 4:

Every 300 Miles: —Charge two rear universal joints with cup grease and oil, Nos. 56 and 57; Fig. 24.

Oil steering column, No. 29; Fig. 24.

Give a turn to two grease cups on spring seats, rear axle, Nos. 59 and 60; Fig. 24.

Give a turn to grease cup at inside end of hand brake shaft, No.50; Fig. 24.

Put some oil in commutator, No. 30; Fig. 24.

Fill the following grease cups: Two on outer bearings of driving (rear) axle, two on steering knuckle sockets; one on commutator spindle, Nos. 2, 3, 31, 69 and 70, Fig. 24.

Oil change speed sleeve, No. 51; Fig. 24.

Gunful of liquid grease in bevel pinion shaft housing, No. 81; Fig. 24.

GROUP NO. 5:

Every 375 Miles: —Ten pints of cylinder oil in crank case. Oil oftener if necessary. No. 33; Fig. 24.

Drain old oil out first.

GROUP NO. 6:

Every 500 Miles: Transmission gear case, one pint of Duplex Liquid Grease, No. 54; Fig. 24.

Gunful of grease in steering gear case, No. 30; Fig. 24.

Oil in lever joints below foot board, Nos. 38, 39, 40, 41, 42, 43, 44, 45, 46, 48; Fig. 24.

Oil brake lever and joints on hub brakes, Nos. 65, 66, 67, 68; Fig. 24.

Oil starting handle, No. 1; Fig. 24.

Oil generator, Nos. 17, 18, 19; Fig. 24.

Oil outer end of hand brake shaft, No. 52; Fig. 24.

Oil catches on hand brake and gear shift levers, Nos. 86 and 87; Fig. 24.

Oil equalizing bars and brake rod joints, Nos. 88, 89, 90, 91, 92 and 93; Fig. 24.

Give a turn to grease cups on emergency brake rod connecting spindle, No. 55; Fig. 24.

Oil shock absorbers.

Oil magneto at three places. A few drops only, Nos. 23, 24, 25; Fig. 24.

GROUP NO. 7:

Every 600 Miles: —Oil on pin and interlocking quadrant, No. 53; Fig. 24.

Give a turn to grease cup on front torsion rod bearing, No. 83; Fig. 24.

Fill grease cups in spring eye bolts.

Fill the following grease cups: Two on clutch, one on water pump (use Casson Compound for water pump only), three on steering gear case, two on spring seats rear axle.

GROUP NO. 8:

Every 1,000 Miles:—Fill hollow rear end of propellor shaft, No. 58; Fig. 24.

Fill front hub caps with grease, Nos. 71 and 72; Fig. 24.

Fill leather boots over steering rod joints with grease, Nos. 10, 11, 12. 13; Fig. 24.

Oil radiator fan, No. 16; Fig. 24.

Oil and grease universal joint between engine and transmission, No. 49; Fig. 24.

Take out oil strainer in oil tank and clean, No. 85; Fig. 24.

Oil starting motor, Nos. 20, 21, 22; Fig. 24.

Fill rear hub caps with grease. Nos. 73 and 74; Fig. 24.

GROUP NO. 9:

Every 2,000 Miles: Wash out crank case and engine with kerosene oil. Run into shop and have car looked over.

IT IS STRONGLY ADVISED THAT THE GROUPS BE ATTENDED TO AS FOLLOWS.

Group No. 1. Should be Attended to Daily, In Case the Car is Used.

ODOMETER MILES.	
200	Attend to Lubricating Groups Nos. 2, 3.
300	Attend to Lubricating Groups Nos. 2, 4.
375	Attend to Lubricating Group No. 5.
500	Attend to Lubricating Groups Nos. 2, 3, 6.
600	Attend to Lubricating Groups Nos. 2, 4, 7.
750	Attend to Lubricating Groups Nos. 2, 3, 5.
900	Attend to Lubricating Groups Nos. 2, 4.
1,000	Attend to Lubricating Groups Nos. 2, 3, 6, 8.
1,125	Attend to Lubricating Group No. 5.
1,200	Attend to Lubricating Groups Nos. 2, 3, 4, 7.
1,350	Attend to Lubricating Group No. 2.
1,500	Attend to Lubricating Groups Nos. 2. 3, 4. 6.
1,650	Attend to Lubricating Group No. 2.
1,800	Attend to Lubricating Groups Nos. 2, 3, 4, 7.
1,875	Attend to Lubricating Group No. 5.
2,000	Attend to Lubricating Groups Nos. 2, 3, 6, 8, 9.
2,100	Attend to Lubricating Groups Nos. 2. 4
2,250	Attend to Lubricating Groups Nos. 2, 3, 5.

2,400	Attend to Lubricating Groups Nos. 2, 4, 7.
2,500	Attend to Lubricating Groups Nos. 2, 3, 6.
2,625	Attend to Lubrication Group No. 5.
2,700	Attend to Lubricating Groups Nos. 2, 3, 4.
2,850	Attend to Lubricating Group No. 2.
3,000	Attend to Lubricating Groups Nos. 2. 3, 4, 6, 7, 8.
3,150	Attend to Lubricating Group No. 2.
3,300	Attend to Lubricating Groups Nos. 2, 3, 4.
3,375	Attend to Lubricating Groups No. 5.
3,500	Attend to Lubricating Groups Nos. 2, 3, 6.
3,600	Attend to Lubricating Groups Nos. 2, 4, 7.
3,750	Attend to Lubricating Gr oups Nos. 2, 3, 5.
3,900	Attend to Lubricating Groups Nos. 2, 4.
4,000	Attend to Lubricating Groups Nos. 2, 3, 6, 8, 9.

Continue as indicated above up to 20,000 miles, when we advise having the car overhauled.

OPERATION OF THE CAR.

Make sure that the gasoline tank and radiator are filled, that the motor has received its proper charge of cylinder oil (10 pints) and that all grease cups are filled. See that the gasoline cock is turned on. There is an opening in the dust screen over the right hand running board for access to this cock. See that there is pressure in the gasoline tank; if not, use hand pump below left hand dash cabinet. Prime the engine by means of the primer. Insert the switch key in the battery switch and turn to the right. Move the switch lever to the point marked B and M. See that the spark lever is in the starting position (Fig. 25), that is, nearest the seat; that the throttle lever (the upper one) is in its starting position (see Fig. 25). Press the starting button on the dash, and the engine should then start.

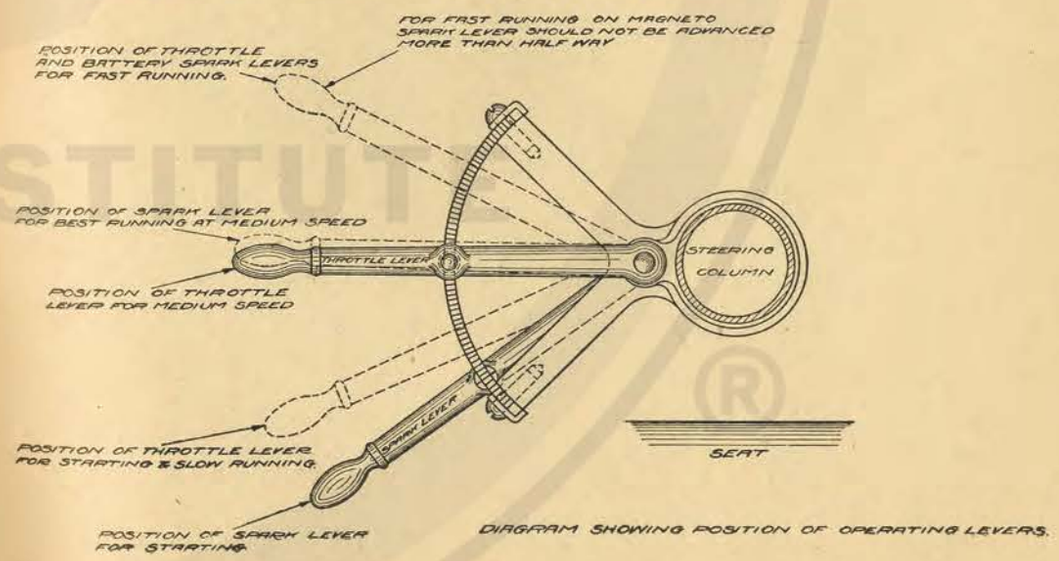

Fig. 25.

Having started the engine, take seat in the car and put the spark lever at about its central position. The change gear lever is in the neutral position, to which it should always be brought when the car is stopped. See that the hand brake is off. Depress the clutch lever with the left foot, holding it down long enough to allow the clutch brake to stop the spinning of the clutch, put the change gear lever into first speed position, then let the clutch go in very gently and the car will move forward. To change to second speed, accelerate the motor a little by advancing the throttle lever, depress the clutch, put the change speed lever into second speed position, and let the clutch go in gently again. Follow the same procedure for the third and fourth speeds. The spark lever should not be advanced beyond half way when running on the magneto.

CAUTION.—Always take great care to leave the speed lever in the neutral position when stopping the car; otherwise, if the switch is on and the hand brake off, if the spark lever be moved, the car is liable to start up and run away. It is very necessary, then, in stopping the car, to put the switch in the "off" position, to put the speed lever in the neutral position, and to have the hand brake locked on hard. Never start the engine without seeing that the hand brake is on.

THE CLUTCH BRAKE.—To facilitate the meshing of the first speed gears, a clutch brake is provided. This clutch brake should be adjusted to give a very light pressure on the ring provided on the clutch for that purpose. This brake is not designed to assist gear changing to any great extent.

GEAR CHANGING.—A good method to follow in changing gears is the following: When it becomes necessary to change from first to second speed, depress the clutch pedal and move the gear shift lever into neutral position. Allow the clutch to engage, and at the same time, retard the throttle lever, depress the clutch once more, move the gear shifting lever into second speed position. By following this procedure, which can be done quite rapidly with a little practice, it will be found that the speed of the counter shaft in the gear box will be brought to a speed corresponding to that of the main shaft and these gears will mesh absolutely noiselessly. In passing from second to third speed, it will be found that the change can be made without any manipulation of the clutch. From third to fourth speeds, however, the same process should be followed as from first to second. In changing from fourth to third speeds, a similar process with the following difference, should be followed. Depress the clutch pedal and move the gear shifting lever into neutral position. Then, WITHOUT RETARDING THE ENGINE, let the clutch engage. This will have the effect of increasing the speed of the countershaft, just as in the reverse direction, it decreases its speed. Depress the clutch pedal once more and move the gear shifting lever into third speed position. Care should be taken not to let the engine race too rapidly while performing these changes, and if the speed of the engine is properly timed, it will be found that the change from fourth to third speeds can be made quite silently, while running anywhere below thirty miles per hour. This method of changing gears requires a little practice, but once mastered, it will be found, by far, the most satisfactory to follow.

TO SLOW DOWN.— When the car is in motion and it becomes necessary to retard the speed, press down on both pedals. This will apply the foot brake and release the clutch.

TO STOP THE CAR.—Simply apply both pedals, and if necessary, the hand brake at the right hand side, and when the car has stopped, take care that the change speed lever is placed in a neutral position, so that when releasing the pedals after a short stop, with the engine running, you are not likely to start the car with the wrong gear.

When braking, use the foot brake and hand brake gently, otherwise they are liable to lock the wheels, which is detrimental to the gears and tires, besides having a tendency to cause the car to skid.

ASCENDING HILLS.— When approaching a hill of about 5 per cent. grade, accelerate the engine and the car will travel up the hill at about 15 miles per hour. When striking a stiff grade and it becomes necessary to change gears, let the speed of the car come down to the proportion of the speed of the gears, but do not let the engine come almost to a stop before changing. In this connection, it may be said that the tendency of most drivers is to remain in the high gear longer than is desirable, thus causing undue strain on the engine and decreasing the speed with which a grade may be surmounted.

DESCENDING HILLS.— When descending hills, throw in the high gear, if not already in, and pressing on the clutch pedal, allow the machine to coast, but do not put in the clutch again until the speed of the engine and that of the car agree.

In coasting, care should be taken not to depress the clutch pedal to its full extent, as if this is done, the clutch brake will be rapidly worn out.

NOTICE.— In very hilly country, it may be desirable to use the engine as a brake. First put in one of the intermediate gears before descending the hill, then gently let in the clutch. The brakes may be used as usual. In using the engine as a brake, it is desirable to cut off the ignition while descending the hill. In doing this, be sure that the gears are in mesh and that the clutch is in engagement before the ignition is switched off, otherwise the motor will be dead when the clutch is let in again, subjecting the machine to a shock which is liable to cause damage to both the engine and the gears.

IN GENERAL.— In order to save wear on the tires and mechanism, it is desirable that curves should be taken at a low rate of speed. There is nothing more harmful to tires than running around curves at great speed. This caution applies to the use of the brakes for stopping or slowing down. Drive your car at such speed that you will be obliged to use the brakes as little as possible. Very little time is saved by rushing up to the point at which you wish to stop. Reduce the speed of the car gradually when approaching this point, and it will come to rest practically with no use of the brakes and very little wear on tires. In starting the

car from a standstill, reverse the process. Too rapid acceleration causes damage to the tires in the same proportion as too harsh braking. Swift changes in direction when running at any speed are dangerous, and when running at very high speed, almost sure to cause a serious accident.

IN THE MOUNTAINS.—It will be found advantageous, after a long steep climb of several miles, after which a stop is made at the top, to allow the engine to run slowly for a short time before switching off the ignition. If this is done, the engine will return to its normal heat and will be found in much better running condition when starting again, than if it be stopped entirely when it is very hot.

IMPORTANT.

IN ORDERING RENEWALS AND SPARE PARTS.—We have numbered the parts on the various figures in this Instruction Book and when ordering renewals, if such parts are shown in these illustrations, we wish that the NUMBER OF THE PART be given, THE HORSE-POWER OF THE CAR, AND ALSO THE FACTORY NUMBER OF THE CAR, which is stamped in the plate on left side of body, directly back of the dash. There will then be no possibility of error. In addition to this, it will be necessary in some few parts, such as front and rear axles, etc., to state whether the part required is for the LEFT or RIGHT hand side of the machine.

STANDARD WARRANTY under which all Automobiles made by the PIERCE-ARROW MOTOR CAR CO. are sold. Adopted May 4, 1910.

WE GUARANTEE the motor vehicles manufactured by us for ninety days after the date of shipment, this warranty being limited to the furnishing at our factory of such parts of the motor vehicle as shall, under normal use and service, appear to us to have been defective in material and workmanship.

This warranty is limited to the shipment to the purchaser without charge, except for transportation, of the part or parts intended to replace the part or parts claimed to have been defective, and which, upon their return to us at our factory for inspection, we shall have determined were defective, and provided transportation charges for the parts so returned have been prepaid.

We make no warranty whatever in respect to tires and rims.

The condition of this warranty is such that if the motor vehicle to which it applies is altered, or repaired outside of our factory, our liability under this warranty shall cease.

The purchaser understands and agrees that no warranty of the motor vehicle is made, or authorized to be made, by the company, other than that herein above set forth.

SPECIAL TELEGRAPHIC CODE
The Pierce-Arrow Motor Car Co.

Stanhope Model,	BEFIT.
24-28 H. P. Car,	CAPTIVE.
28-32 H. P. Car, 1906,	DAMASK.
30 H. P. Car, 1907,	DAME.
40 H. P. Model, 1905,	EASTWARD
40-45 H. P. Model, 1906,	EATABLE.
45 H. P. Model, 1907,	EDICT.
65 H. P. Model, 1907,	EDITOR.
40 H. P. 4-Cylinder, Model 1908,	EDIFY.
40 H. P. 6-Cylinder, Model 1908,	ELASTIC.
60 H. P. 6-Cylinder, Model 1908,	ELUSIVE.
24 H. P. 4-Cylinder, Model 1909,	ELVINA.
36 H. P. 6-Cylinder, Model 1909,	EMETIC.
40 H. P. 4-Cylinder, Model 1909,	EMIGRANT.
48 H. P. 6-Cylinder, Model 1909,	EMOTION.
60 H. P. 6-Cylinder, Model 1909,	EMPIRE.
36 H. P. 6-Cylinder, Model 1910,	EMULATE.
48 H. P. 6-Cylinder, Model 1910,	EMULSION.
66 H. P. 6-Cylinder, Model 1910,	ENGULF.
36 H. P. 6-Cylinder, Model 1911,	ENHANCE.
48 H. P. 6-Cylinder, Model 1911,	ENIGMA.
66 H. P. 6-Cylinder, Model 1911,	ENVIRON.
36 H. P. 6-Cylinder, Model 1912,	ENVY.
48 H. P. 6-Cylinder, Model 1912,	EPICURE.
66 H. P. 6-Cylinder, Model 1912,	EPISTLE.
1903 Model,	MAROON.
1904 Model,	MARQUIS.
1905 Model,	MARSHALL.
1906 Model,	MASONRY.
1907 Model,	MEDICAL.
1908 Model,	MEEKLY.
1909 Model,	METROPOLIS.
1910 Model,	MINERAL.
1911 Model,	MIRACLE.
1912 Model,	MIGRATE.
Model 66-A,	FACTOTUM.
Model 48-B,	FAGOT.
Model 38-C,	FALLACY.
Model 48-D,	FAMISH.
66-A-2	MINUET.
48-B-2	MISBEHAVE.
38-C-2	MISGRAFT.
48-D-2	MILL POND.
66-A-3	NAUTICAL.
48-B-3	NAVIGATE.
38-C-3	NAVY.
When will you ship,	HALYARD.
Ship by express as soon as possible,	LAMENESS.
Ship by freight as soon as possible,	LAMENT.
I (we) am (are) sending you today by express	LANCELOT.
Can you furnish,	LADYLIKE.
We cannot furnish,	LADYHOOD.
We can furnish,	LAITY.
At what price can you furnish,	LAGOON.
Ship by express and advise when,	LANDSLIDE.
Ship by freight and advise when,	LARBOARD.

EXPLANATION OF SPECIAL TELEGRAPHIC NUMBER CODE EMPLOYED BY THE PIERCE-ARROW MOTOR CAR CO. AND ITS AGENTS IN ORDERING NUMBERED SPARE PARTS.

b=1	l=6
c=2	m=7
d=3	r=8
f=4	s=9
g=5	z=0

"a" between two other letters indicates that they represent figures in units column.

"e" between two other letters indicates that they represent figures in hundreds column.

"a" in seventh position represents 10,000.

"e" in seventh position represents 20,000.

"i" in seventh position represents 30,000.

"o" in seventh position represents 40,000.

"u" in seventh position represents 50,000.

EXAMPLE.

49 4="f" 9="s". Number is in units, therefore "a" is used. Use prefix to show no hundred. Code word "zezfas."

6149 6="l" 1="b". These figures in hundreds column, therefore "e" used between "l" and "b". "Leb" then is first part of number. Add to this the 49 above. Code word, "lebfas."

Gemdac "g"=5 "m"=7. "e" shows these figures to be in hundreds column. Thus far number is 5700.

"d"=3 "c"=2. "a" shows these figures to be in units column. Therefore number is 5732.

Reszaz "r"=8 "s"=9 "z"=0. Hence number is 8900.

Where numbers are over 9999 a single letter prefix is used, thus

azezzaz=10,000

First 3 letters represent units.

Second 3 letters represent hundreds.

Seventh letter represents ten thousand.

1	00	00
a	zez	zaz

IMPORTANT INSTRUCTIONS.

If the following instructions are adhered to in ordering parts it will greatly facilitate our handling of the orders and aid us in giving you prompt and efficient service.

1. Always give the factory number of car. (See number plate on left side of body, directly back of dash).

2. Give number and name of part.

3. State definitely the shipping instructions—express, freight or mail.

4. On some parts, such as front and rear mud guards, specify if they are to be used on right or left side of car. The driver's seat is on the right side. Also in ordering finished parts, state if they are wanted painted or in lead color only. When telegraphing for parts, the code may be used; explanation will be found on pages 56 and 57. When returning parts for exchange or credit, shipper's name and address must appear on all boxes and packages. Transportation charges must be prepaid. All express shipments should be directed to the Pierce-Arrow Motor Car Co., 1695 Elmwood Avenue, Buffalo, N. Y. All freight shipments should be consigned to the Pierce-Arrow Motor Car Co., Black Rock, N. Y., and freight bill covering shipment should be mailed us promptly.

Definite instructions advising disposition of goods returned should be mailed us immediately (do not include with shipment), and should cover the following points:

1. Factory number of car from which parts are taken.

2. Name of part, also drawing number if possible.

3. As near as possible, the mileage the part has given, also;

4. All goods returned should be tagged, giving the shipper's name and address and points 1, 2 and 3 given above. Each part should be tagged as soon as removed from the car, marking thereon at once the correct name of the part, part number and car number.

When goods are returned for credit, the letter should give the date of our charge made for new goods which we sent to replace the ones returned. If the goods are returned for repairs, state specifically what is to be done, and if they are painted parts, directions should be given stating whether we shall return them in lead or painted complete in a finished color.

As varied conditions exist under which additional stock is manufactured to meet renewal demands, our list prices are necessarily subject to change without notice.

THE PIERCE-ARROW MOTOR CAR CO.

SEASON 1914 - 1915

This list is liable to be changed during the season.

New York, N. Y.,	Harrolds Motor Car Co,	233-239 West 54th Street.
Boston, Mass.,	J. W. Maguire Co.,	743-745 Boylston Street.
Philadelphia, Pa.,	Foss-Hughes Co.,	21st & Market St.
Chicago, Ill.,	H. Paulman & Co.,	2420-2422 Michigan Boulevard.
Buffalo N. Y,	Pierce-Arrow Sales Co. of Buffalo,	752-756 Main Street.
Pittsburgh, Pa.,	McCurdy-May Company,	Center & Negley Avenue.
Newark, N. J.,	Ellis Motor Car Co.,	416 Central Avenue.
San Francisco, Cal.,	Pierce-Arrow Pacific Sales Co, Inc.,	Geary and Polk Sts.
Los Angeles, Cal.,	William E. Bush,	1701-1711 South Grand Avenue.
Portland, Ore.,	Pierce-Arrow Pacific Sales Co, Inc.,	45 North 14th Street at Couch.
Spokane, Wash.,	The Northwest Auto Supply Co,	1201 First Avenue.
Seattle, Wash.,	Pierce-Arrow Pacific Sales Co, Inc,	1000-6 East Pike Street.
Eureka, Cal.,	H. A. Hine,	
Honolulu, T. H.	Schuman Carriage Co.	Merchant & Bishop Streets.
Santa Barbara, Cal.	El Camino Real Motor Car Co.	
Atlanta, Ga,	John M. Smith,	120-124 Auburn Avenue.
Austin, Texas	Thompson-Halff Co.,	
Baltimore, Md.,	Foss-Hughes Co,	810 North Charles Street.
Binghamton, N. Y.,	Davidge Motor Car Co.,	201-203 Water Street.
Birmingham, Ala,	Birmingham Motor Co.,	
Butte, Mont.	Silver Bow Automobile Co.,	Park & Idaho Streets.
Cincinnati, O.,	Hanauer Automobile Co.,	115-119 East Seventh Street
Cleveland, O.,	Weaver-Twelvetree Co.,	1821 East 13th St., N. E.
Columbus, O.,	The Broad-Oak Automobile Co,	621-627 East Broad Street.
Corning, N. Y.,	Corning Automobile Co., Inc.,	81-87 Wall Street.
Dallas, Texas,	The Halff Company	
Davenport, Ia.,	Mason's Carriage Works	4th & Perry Streets.
Dayton, O.,	Geo. W. Shroyer & Co.,	102-106 North Main Street.
Decatur, Ill.,	Geo. W. Ehrhart,	209-210 Citizens Title & Trust Bldg.
Denver, Col.,	Tom Botterill,	1272-78 Broadway.
Detroit, Mich.,	Neumann-Lane Co,	1342-1352 Woodward Avenue
Elmira, N. Y.	Wolcott Motor Car Co.,	106-108 W. Church St.
Erie, Pa.	Stirling Bros. Company,	121 East 12th Street.
Geneva, N. Y.	The Geneva Automobile Co,	145 Castle Street.
Grand Rapids, Mich.,	Adams & Hart,	53-55 Division Avenue, N. W.
Hartford, Conn.,	Miner Garage Co.,	High and Allyn Streets.
Houston, Texas,	The Halff Co.,	Main and Dallas Streets
Indianapolis, Ind.,	Fred P. O'Brien,	431 N. Capital Avenue Boulevard.
Jacksonville, Fla.,	Winchester Motor Car Co.,	928 Main Street.
Kansas City, Mo.,	Dey Motor Car Co.,	1723 McGee Street.
Knoxville, Tenn.	Rodgers & Company,	900-902 Gay Street.
Louisville, Ky.,	Hite D. Bowman,	1148 South 4th Ave.
Milwaukee, Wis.,	American Automobile Co.,	187 Wisconsin Street.
Minneapolis, Minn.	D. A. Odell Motor Car Co.,	101 South 10th Street.
Nashville, Tenn,	Tennessee Auto Co.,	1308-1312 Broadway.
New Haven, Conn.,	The Geo. B. Wuestefeld Co.,	Temple and Commerce Streets.

New Orleans, La.,	The Lyons-Barton Motor Car Co.,	748 Baronne Street.
Newport, R. I.,	Foss-Hughes Co.,	Casino Terrace.
Norfolk, Va.,	C. L. Young,	719 Granby Street.
Omaha, Neb.,	Stewart-Toozer Motor Co.	2044-2048 Farnam Street.
Pittsfield, Mass.,	The Sisson Co.,	55-63 West Street.
Portland, Me.,	F. A. Nickerson Co.,	642 Congress Street.
Providence, R. I.,	Foss-Hughes Co.,	206 Elmwood Avenue.
Richmond, Va.,	Foster Motor Car Co., Inc.	605-613 West Broad Street.
Rochester, N. Y.,	Robert Thomson,	245-247 East Avenue.
Salt Lake City, Utah,	The Tom Botterill Automobile Co.,	36-42 State Street.
San Antonio, Tex.,	Alamo Auto Sales Co.,	
San Antonio, Tex.,	G. A. C. Halff,	328 Bedell Building.
Scranton, Pa.,	Standard Motor Car Co.,	322-328 Forest Ave.
Springfield, Mass.,	Stoddard Motor Car Co.,	461-463 Worthington Street.
St. Louis, Mo.,	Western Automobile Co,	4701 Washington Avenue.
St. Paul, Minn.,	Waldref Motor Car Co.,	183 W. 6th Street.
Syracuse, N. Y.,	A. A. Ledermann Co.,	Rosenbloom Bldg.
Titusville, Pa.,	Modern Garage Co.,	Central Avenue and Martin Street.
Toledo, O.,	The Union Supply Co.,	231-233 Superior Street.
Troy, N. Y.,	The Troy Automobile Exchange, Inc.,	22-24 Fourth Street.
Utica, N. Y.,	A. A. Ledermann Co.,	231 Genesee Street.
Waco, Texas	Willis-Halff Co.,	
Washington, D. C.,	Foss-Hughes Co.	1220 Connecticut Avenue.
Wausau, Wis.,	Marathon Motor Car Co,	204 Third Street.
Wheeling, W. Va.,	Woodsdale Motor Car Co.,	National Road.
Wichita, Kan.,	The Wichita Automobile Co.,	Lawrence and William Streets.
Williamsport, Pa.,	Keeler Motor Car Co.,	315 West 3rd Street.
Wilmington, Del.,	Foss-Hughes Co.,	1021 Gilpin Avenue
Winston-Salem	The Motor Co.	

FOREIGN

Buenos Ayres, Argentine,	Pratt & Co.,	108 San Martin.
Calgary, Alberta, Canada	McLaughlin Motor Car Co	
Mexico City, D. F., Mexico	Mohler & DeGress,	Ave 16 de Septiembre No. 18.
Montevideo, Uruguay	Carlisle, Crocker & Co.,	
Moncton, N. B.	E. W. Givan,	King Street.
Montreal, P. Q., Canada	Grenier-Warrington	21 Phillips Square.
Winnipeg, Man.,	McLaughlin Motor Car Co.	204 Princess Street.
Regina, Sask.,	McLaughlin Motor Car Co.	
Saskatoon, Sask.,	McLaughlin Motor Car Co.,	
Sidney, Australia,	Hugh D. McIntosh,	
Toronto, Ont., Canada,	The Automobile & Supply Co., Ltd.,	24 Temperance Street.
London, England,	De Silva & Wallace, Ltd.,	3 Northumberland Avenue, Trafalgar Sq.