

INSTRUCTIONS—KING MOTOR CAR COMPANY

valve head, and rotate the valve back and forth with quite a little downward pressure; lift the valve occasionally, turn it part way round, insert the screwdriver and repeat rotating. This allows the emery to shift around, grinding the valves evenly. When the valve seat shows up clean and smooth, the work is finished and the valves should be replaced in the same opening from which they were removed. Do not interchange them after grinding. Pry up on the spring as before and slip the valve spring cup key through end of the valve stem. To prevent the necessity of taking these valves out for grinding too often (which should be done under ordinary conditions about once a month unless compression seems to be very weak before this time) we advise a couple tablespoonfuls of kerosene or alcohol be poured into each cylinder through the pet cocks (34) two or three times per week after the car has been put up for the night. This will give the kerosene time to soak into the carbon deposits while the engine is hot, loosening it up, and when started in the morning the particles of carbon will be blown out through the exhaust or by opening the priming cock valves, and with it a cloud of white smoke, which will soon cease. It is best to push the car out into the open before starting the motor as you will find the smoke quite obnoxious.

Kerosene or alcohol poured into the cylinders, as previously advised, will help remove the carbon from the piston heads and combustion chamber; however, the carbon in time will accumulate to such an extent that it will be necessary to remove the cylinders and scrape the carbon from the piston heads and combustion chamber. This work should be done by a KING dealer at least once a season. (Note:—The oxygen process of burning out carbon is highly recommended and by far more satisfactory.)

Removing
Carbon from
Cylinders

Motor Troubles

Spark plugs (31) may be short-circuited. Possibly the porcelain may be cracked or soaked with oil. Firing points may be set too close or too far apart. There should be about the distance between them of a worn dime. Clean them thoroughly with a small brush in gasoline.

Missing
Explosions

Wires may be very wet at connections. The distributor terminals may be wet. This is frequently caused by lack of care on the part of the washer, who uses his hose too freely in cleaning the car. Detach the wires, but before doing so we would suggest that you tag each one of them according to positions, and examine the wires, connections, etc. If any water is found, wipe it off thoroughly. In replacing the wires on the distributor (33) it may be possible that they will become mixed, in which case have a good mechanic make wire connections.

A lack of compression in any of the four cylinders will naturally weaken the power of that cylinder. This is caused by an accumulation of carbon on the valve seats, which tends to hold the valve from closing tightly, thereby allowing the gas to escape. Again, the oil may become thickened around the valve stem, causing the valve to stick partly open, with the same results.

Lack of
Power

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Overheating

(1) If the motor should overheat, the radiator being full, it might be possible that the fan belt is too loose or too tight to turn the fan (adjust the fan belt by adjusting the fan eccentric). It is also possible that the car has been driven too long a time on the lower speeds. It is not necessary, unless water has been lost through boiling over, to cool the radiator by refilling with cold water, as, if the car is run on third or high speed for a short time the water will cool sufficiently by the process of circulation, aided by the draught from the fan. Overheating may be caused by wornout hose connections allowing fabric to close up water circulation, in which event see that new hose is installed.

(2) The motor will also overheat if driven with a retarded spark. The spark should be carried as far advanced as possible without causing the motor to knock, or about $\frac{2}{3}$ way upon sector.

Causes for Sudden Stop

- (1) Gasoline exhausted.
- (2) Grounded or broken wires or connections.
- (3) Oil exhausted, causing bearings to "bind."
- (4) Choked carburetor.
- (5) Imperfect contact at starting switch plug.

Cause of Knocking in Motor

- (1) Spark too far advanced.
- (2) Loose connecting rod bearing.
- (3) Carbon accumulation in the cylinders.
- (4) Taking too steep a grade on third or high speed. Use the lower speeds.
- (5) Lean mixture of gas.
- (6) Cylinders loose on crank case.

Cold Weather Suggestions

When cranking the motor in extremely cold weather it is often necessary to prime the cylinders with gasoline. About a tablespoonful poured into each priming cock on top of the motor will suffice. An ordinary squirt can carried during this season, full of gasoline or ether will be found to be a handy article for this purpose. Be sure to close the priming cocks after this operation. When gasoline vapor is cold it is not as combustible as when warm. It is necessary to have a richer mixture in this instance. Therefore, the raw gasoline, being extremely rich, will explode more quickly. When starting car with self-starter it is advisable to release clutch, thereby relieving motor as much as possible from lack of pressure caused by oil being thick.

In cold weather a stiff motor is caused by the oil hardening on the cylinder walls, which, after the motor is started, will flow freely. If the water is allowed to freeze great damage will result in the cylinders and radiator cracking open.

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Do not allow your car to remain during freezing weather without a solution of anti-freeze in the radiator. A simple and effective solution for this purpose is as follows:

- 10 degrees above zero—denatured alcohol, 1 gal., water, 3½ gal.
- 5 degrees below zero—denatured alcohol, 1½ gal., water, 3 gal.
- 15 degrees below zero—denatured alcohol, 2 gal., water, 2½ gal.

In cold weather a light or thin grade of oil should be used in the motor. If a medium or heavy grade is used, the cold congeals or thickens this oil to such an extent as to render it a poor lubricant. Heavy oil will also cause the clutch to drag and turn the counter-shaft gears in the transmission, thereby easy starting will be impaired.

Adjustments

To tighten or adjust the service brake on pedal (35) the service brake rod will be found connected by a clevis yoke to the lever on the brake rock shaft and the emergency brake rod connected directly to the hand brake lever (25). In each case, back off the lock nut at the slotted clevis yoke the required distance (usually about one-quarter inch); remove the cotter pin and stud, then screw the slotted clevis yoke back to the nut and lock it again by tightening the nut. In order that the brakes will hold evenly when applied, it is necessary to jack up the rear wheels, apply the brakes separately and try to turn each wheel by hand. One will probably turn easier than the other, in which case disconnect the slotted clevis yoke, tightening it until it holds equally as well as the other. Do not tighten them too much or they will "drag" while running, wearing them unnecessarily and retarding the speed of the car. To overcome brakes setting, we use above mentioned slotted clevis yoke on forward service and emergency brake rods.

Brakes

Tightening the steering gear to overcome end play in worm shaft is accomplished by loosening the clamp screw in the adjusting nut, which is located on the under side of the steering post. To overcome looseness caused by worm or worm gear being worn, turn the gear and shaft one-fourth distance of entire circumference.

Steering
Gear

The lost motion in the steering reach rod (36) may be taken up by removing the cotter pin in the end of the rod, tightening up the slotted screws and replacing the cotter pin.

After the motor has been run for some time the valves become settled and may need setting up a little closer. This condition will be audible by a slight, regular tapping sound coming from the valve stems. Remove the valve chamber cover. It will be noticed that the valve stem is raised by the push rod, which in turn is operated by the rotation of the cam shaft, housed in the crank case. The distance between the valve stem and the push rod should be .004 inch, just enough to allow the thickness of an ordinary newspaper to pass between. This adjustment is made by loosening the check nut and adjusting screw at the top of the push rod just under the spring, which allows the adjusting screw to be turned up against the valve stem or down to the required position, after which it should be held in place with one wrench and the lock nut should be tightened with

Valve
Tappets
or Push
Rods

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another, being careful not to allow the adjusting screw to turn during this latter operation. If this adjustment is made too close it will hold the valve open a trifle in the cylinder, causing loss of power. If too much play is given, no harm will be done, but it will increase the tapping sound which you have endeavored to correct.

Before adjusting be sure that the push rod is down so that roller on valve lifter will rest on the body of the cam and not on the high point.

Connecting Rods

A loose connecting rod bearing may be tightened by removing the oil pan from under the motor crank case—drain out the oil first—which will expose the crank shaft, connecting rods and bearings. Unscrew the nuts that hold the connecting rod bearing cap in place and remove one brass shim from each side and replace the cap, setting the nuts up tight. This will take up .002 inch play in the bearings. Be careful not to get this bearing too tight—it is a delicate adjustment and we recommend its being done by a KING dealer.

Instructions for Adjusting Differential and Propeller Shaft

The differential driving gear and pinion should be adjusted so there will be about .010 of an inch back lash. The adjustment of differential is obtained by adjusting the adjusting nuts, which you will find located on the differential, one on each side. If the differential is adjusted too tight, loosen the left hand adjusting nut, after loosening the lock screw, and turn it away from the differential about .010 of an inch, then loosen the adjusting lock screw which fastens to the adjusting nut on the right hand side of the differential and tighten this nut so as to throw the differential over to the left hand adjusting nut. Then tighten both adjusting nuts and lock screws. This will give your differential gear .010 of an inch back lash, which will be the proper adjustment.

The propeller shaft at the lower end is supplied with two bearings, a lower and upper. Between these bearings the adjusting cage is located. This adjusting cage is stationary in the housing and is moveable on the shaft. At the top of the upper bearing you will find a split collar or adjusting collar, which runs on a threaded shaft. To adjust the propeller shaft properly the lower bearing should fit up tight against the bevel pinion on the lower end of the shaft. If you find play between the propeller shaft cage and bearings, turn the cage to the right so that it will fit snugly against the lower bearings. Then turn the pinion shaft split collar to the right so as to hold the upper bearing down so that the cage will have about .010 of an inch play. If you find that the thread of the shaft is not long enough to enable you to obtain this adjustment, then we would suggest that you have a shim put between the split collar and upper bearing. With this adjustment you should overcome all noise in the differential, if caused by too much end play in the propeller shaft.

Note:—To adjust the propeller shaft, as above mentioned, it is best to remove the propeller shaft. Therefore, to remove the propeller shaft disconnect the front end, also take off differential cap

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on the back of the rear axle, pull out the rear axle main shafts, take off differential caps, and pull out the differential. Then remove plate on top side of propeller shaft housing at the lower end and turn the cage in the housing until it is free from the housing. This will enable you to pull the propeller shaft clear out of the car through the hole in the differential housing.

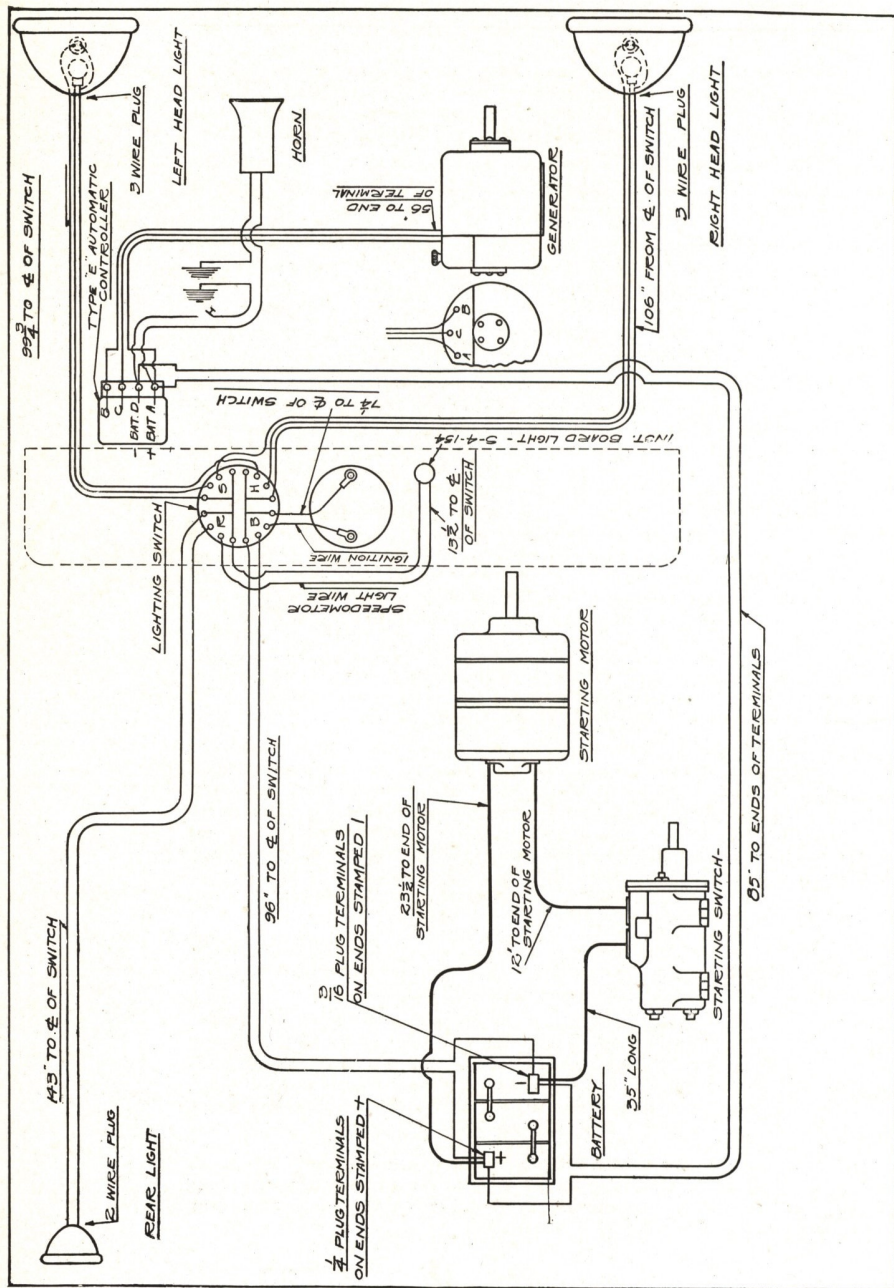
Instructions for Operation of Ward Leonard Self Starter

The lighting generator (43) is a 6-volt shunt wound dynamo which needs no re-setting or adjusting and will outlast any car. It is suspended underneath the distributor and driven from the distributor gear shaft by a silent chain (44), and is geared so that for average driving conditions it will keep the battery fully charged with current and is controlled by an automatic controller or cut-out which governs the amount and rate of current supplied to the battery. This automatic controller is the rectangular box carried on the left side of the dash, just under the hood. It is an electrical control of the electrical circuit—not a mechanical control—and needs no re-setting or adjusting of the parts. The generator supplies current enough to carry the full lamp load when the motor is running, thus leaving the current stored in the battery for use in turning the electric motor when starting the motor, or to furnish current for the lamps when the car is not in motion. The car should not be left standing for a long period of time with all the lamps on, as this will pull the battery down and make it less powerful for starting. Use dimmer and rear lights instead.

If at any time the generator fails to conduct current to the storage battery, the cause may be due to the brushes in the generator not pressing down tight enough on the armature. This trouble can be easily overcome by adjusting the brush spring behind the brushes and fastened to the brush holders in the rear end of the generator. Loss of current conductive power of generator may be due to worn or defective brushes, in which event see that new brushes are installed immediately.

To guard against the possibility of battery becoming run down, due to generator not conducting sufficient current, we suggest that you occasionally remove the automatic controller cover (located under the hood at the left hand side of the car), and while cover is removed, start the motor to run idle at a running rate of speed of from twelve to fifteen miles per hour. If you find that the lower contact is then vibrating and the upper contact is holding together you may rest assured that the generator is working properly, but before again installing the controller cover stop the motor to a dead standstill and then note if the upper contact falls apart and if it does not then the battery is being constantly drained of current when motor is standing idle. This is what is called reversed polarity and can be easily repaired by shorting A and B terminals on the bottom of the controller, and unless the upper contacts are burned they will immediately fall apart, thereby assuring that the controller will work properly.

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Cut C—Starting and Lighting Wiring Diagram

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Condition of the generator can easily be determined by attaching an ammeter to A and B terminal poles in generator. Then if ammeter registers ten or above at a reasonable running road rate of speed of the motor you will know that the generator is O. K.

Extreme care should be taken not to turn switch button on the lighting switch backward. By doing so you will put the lighting switch entirely out of commission.

Lighting
Switch on
Instrument
Board

The starting motor (45) carried at the right of the transmission case is so arranged by means of a sliding gear in the oil pan that it can be engaged with teeth cut on the flywheel of the motor. This electric motor is wound to run at the rate of 2700 to 2800 R. P. M., and the 6-volt battery circuit when cranking the motor will turn it over at the rate of about 90 R. P. M. for starting.

The operation of starting the motor is controlled entirely by means of a rod called the starting lever (46) at the center of the front floor board. The spark and throttle levers (26 and 27) should be set in the same position as for cranking by hand, and the carburetor should be choked in extreme cold weather by means of the choke rod, which is brought up through the toe board between the pedals and close to the steering wheel. Push down on the handle of the starting lever (46) as far as it will go. The pull should be strong and steady. Do not hesitate when the gears start to mesh, as at this point the starting switch (47), which is placed in the frame side member on the right side under the floor board, is only partly engaged, and if held in this position the resistance ribbon will be burned out.

Never hold starting lever down if electric motor stalls, as this causes a heavy drain on the battery. In such case push lever all the way down and pull all the way up again.

The starting switch (47) is so constructed that it must be moved at the same time as the sliding gear which is brought into mesh with the flywheel, and so that at the instant the sliding gear starts to engage with the flywheel, a small amount of current is allowed to flow through the electric motor (45). This current turns the motor over very slowly, and the gears will engage and can be brought fully into mesh. At the same time that the gears come fully into mesh, the full current from the battery is thrown into the electric motor, which will immediately start cranking the motor.

Type "C"
Starting
Switch

The instant the engine starts to run, the handle (46) should be released and pulled up as far as it will go, and the starting motor will automatically be thrown out of engagement with the engine.

If for any reason the gear does not disengage itself from the flywheel a slight pull on the starting lever will disengage it. If the electric motor is not thrown into gear when the lever is pushed down as far as it will go, the connecting rod should be shortened by tightening up the switch control rod sleeve on back to starting switch shaft.

If the gears of the electric motor clash when thrown into mesh with the flywheel of the motor, the switch is too fast and the connecting rod should be lengthened by unscrewing the connecting rod sleeve until the proper length is obtained.

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Cut 5

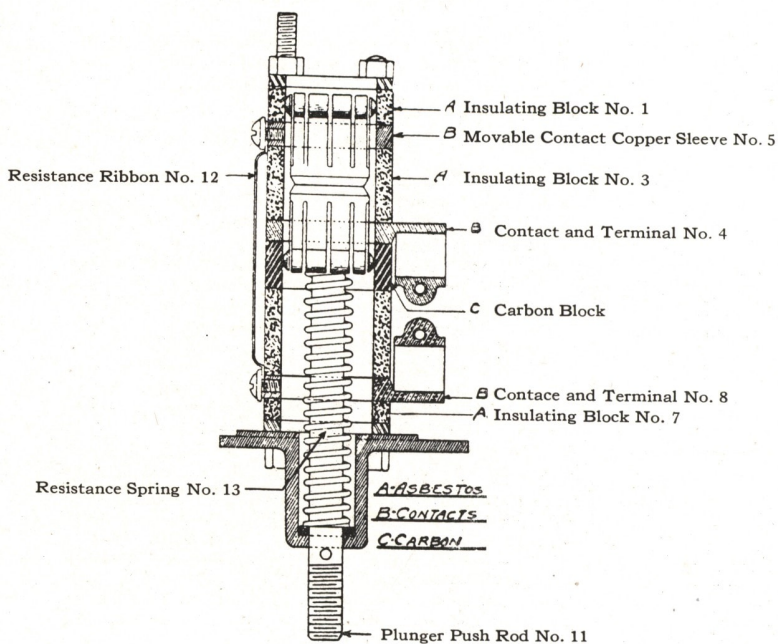


Fig. No. 11
Starting Switch, Type "C"

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Back-firing cannot reverse the motor unless the reduction gears are seized because the power of the electric motor is sufficient to overcome the greatest back-pressure obtained by pre-ignition. Lack of oil and kerosene lubrication in the reduction gear case will cause the reduction gears to seize.

Complete Instruction Covering Starting with Unit. Type C Resistance Switch.

This switch is intended for starter systems where a sliding pinion meshes with a gear on the fly wheel. It is important on such a system that the gears mesh easily and without clashing or friction. It is obvious that this cannot be accomplished if the full current of the battery is at once impressed on the motor, and therefore resistance is employed to cut down the current and cause the motor to spin slowly until the gears are meshed.

The Type C switch shown in Fig. 11 is the last word in starter switches of the resistance type. It embodies the result of two years' experience, not alone in the construction of switches of this type, but in the careful observation of defects and troubles which have arisen in actual operation in both our own and other makes of starter switches. The switch has frequently proved to be the weak point in the starter system. The trouble experienced is generally due to the excessive heating of the resistance element. In the normal and proper operation of the switch, the latter is closed and the motor pinion meshed with the fly wheel gear by a reasonably quick movement of the foot pedal. No undue heating will then result, as the contact through the resistance is of such short duration that the resistance has no chance to heat up. Very often, however, an inexperienced person in attempting to start the car, will not push the foot pedal through the full throw of the switch or will in some way leave the resistance contact in circuit for too long a period, with the result that the resistance becomes white hot and will ignite any inflammable material within the switch case. It will also draw the temper from the flexible contact element, if this is not well protected. By the combination of the following features we have succeeded in eliminating every possible cause of trouble within the starter switch:

First—The contact through the resistance is only momentary and the circuit is broken before the gears start to mesh. The momentary contact is sufficient to turn the motor and the gears are meshed without clashing or grinding. As the travel of the plunger contact through the resistance contact is only $\frac{3}{16}$ inch of the total travel of $1\frac{3}{8}$ inches, there is little likelihood of the driver leaving the switch making contact through the resistance for too long a period.

Second—All insulation within the switch is made of moulded asbestos. There is nothing within the switch case which can burn. Neither can the plunger contact be affected by the heating of the resistance element, as by reference to Fig. 11, it will be seen that there is a solid barrier between the two. Therefore the accidental overheating of the resistance element cannot affect anything within the switch case.

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Third—In leaving the resistance contact the circuit is broken on a carbon block. This is a well known feature of circuit breaker construction, where the final arc is broken on carbon blocks and by this construction enormous currents are broken without injury to the main contacts. While the arc on a 6 volt circuit is comparatively small, yet in the course of time it is liable to burn the metal contacts and cause sticking. We have inserted the carbon block at the point where the heaviest current is broken to prevent any possible injury to the main contact.

The construction of the Type C starter switch is shown in Fig. 11. The plunger contact is made of hard drawn copper, slotted to give it flexibility and expanded at the ends, where contact is made with the metal and carbon blocks. The standard throw of the push rod is $1\frac{3}{8}$ inches, although this can be increased to $1\frac{1}{2}$ inches if desired. As shown in Fig. 11, in the "Off" position, the contact ends of the plunger rest on the upper insulating block "A" and carbon block "C". A movement of $\frac{1}{8}$ inch brings the upper end in contact with the upper metal contact "B", while the other end is still in contact with the carbon block. This completes the circuit through the resistance. In the further movement of the push rod the contact leaves the carbon block first so that the circuit is broken at this point. The circuit remains broken for a further travel of 15-16 inch, which allows the motor pinion to engage fully with the fly wheel gear before the main contacts are reached. The resistance is then cut out and full current of the battery is impressed on the motor. There is absolutely no burning or pitting of contacts and the surfaces remain clean and bright for an indefinite period of service. We guarantee the switch to show a voltage drop of less than .02 volts with 200 amperes going through. Copper sleeves are provided for soldering in the terminals. These are inserted in the holes bored in the terminals and clamped. The advantage of this feature is that there are no bare current carrying parts exposed outside of the containing case and it also renders it an easy matter to disconnect the cable when desired. By removing the small plate shown in Fig. 8 access is gained to the clamping screws.

The resistance consists of non-oxidizable nickel alloy ribbon. Whereas on all other starter switches the resistance is a single unit and the heat is thus concentrated at one point, we divide the resistance into three units mounted on different sides of the switch, and the heat is thus distributed. The resistance is varied to meet the requirements of the particular starting system, some motors requiring more initial current than others.

Battery The storage battery, which is found suspended under the front R. H. seat, is an 80 ampere hour starting and lighting battery, designed for high ampere discharge rates, and will give the best service and last longer if kept fully charged. The jars should always be kept filled up to inside cover with distilled water so that the plates will be fully submerged in liquid. On account of evaporation, it will be necessary to fill the jars once a week, and only distilled water should be used for this purpose.

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Instructions for Care of Ward Leonard Starting and Generating System

Light machine oil or cup grease must be put upon the chain (44) every two weeks. Do not use graphite or graphite grease.

One or two drops of light oil should be put in the oiler at each end of the dynamo two or three times a year. Do not put in too much oil.

Occasionally inspect the commutator of the dynamo by removing the small cover (51) at the end farthest from the sprocket. If the commutator soils your finger when rubbed against it, clean while running by rubbing with a piece of dry waste. Put no oil in commutator, and do not use sand paper or emery cloth. (May be necessary to install new brushes.)

The starting motor (45) is equipped with an oiler (49) located at the front end. Oil often with light oil and kerosene.

The starting motor armature box is filled with grease and should not need re-filling.

Card outlining instructions, care, etc., of the electric self-starter and lighting system will be found tacked on the wood panel under the right hand front seat cushion, and should be read carefully, and also instruction booklets furnished in tool equipment.

Instructions for Lubricating King Car

For lubricating the motor use only best grades of gasoline motor oil, King motor oil or Haveline oil. Four quarts is a sufficient quantity. First, pour oil in the motor through the filler tube (1) at the right hand side of the motor, after removing the filler tube cap (30). Pour the oil in until the gauge wire (2) rises to a point about 2" above the top of the case or at high oil level. Motor

The oil is forced through a distributing channel in the upper crank case to the pockets over the main bearings and front gears, by splash feed from flywheel.

The oil level is accurate for the reason that the point of overflow is machined to dimension. This insures equal distribution (look at oil level daily).

The motor should be drained of unclean oil once a month by removing the plug at the rear of the bottom of the lower oil pan.

Do not use grease or non-fluid oil in the front gears. They receive their lubrication from the motor.

The transmission should be lubricated with heavy transmission oil. First, remove the transmission case filler plug (4). Pour in two quarts transmission oil, which is a sufficient amount to bring the oil to a point to cover the transmission countershaft. Hyatt high duty roller bearings are provided in the transmission throughout and they receive their lubrication from the splash of the transmission gears. The oil should be a heavy fluid oil (No. 600-W or steam engine oil). Transmission

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The transmission should be drained of old oil about once a month, by removing the plug at the bottom of the case. To keep a sufficient quantity of oil in transmission, add necessary amount once a week.

Clutch The clutch is automatically lubricated from the motor.

Universal Joint The Spicer universal joint (6) which connects the rear axle pinion drive shaft to the transmission, is provided with a pipe plug, which should be removed at least as often as once a month and the joint filled with a light grease.

Pinion Housing The pinion shaft housing torque yoke located at the extreme front end of the pinion shaft housing, directly behind the Spicer universal joint, is lubricated with Arctic cup grease through grease cup (7). This cup should be watched closely and refilled once a week.

Brakes The brake rocker shafts are lubricated with light oil, put on by the use of a squirt can. At each end of the rocker shafts 9 and 10, oil hole (8) is drilled to receive this lubrication. Watch these closely so the brakes will work freely, and see that these parts are lubricated after car is washed.

Springs Rear springs rear bolts on rear axle are provided with oilers (11), one on each side. Use light oil and watch the lubrication closely so that the spring will work freely on the rear axle housing spring seats and allow free spring motion. Refill these oilers once a week.

Differential To lubricate the rear axle differential gears and differential bearings, remove cap (12) and fill every 2500 miles with a heavy transmission grease called rear axle dope—about 3 or 4 lbs. in hot weather and slightly more in cool weather. Arctic cup grease No. 4 is a good compound to use at this point. With ordinary driving fill differential every four months.

Wheels The rear wheels are equipped with ball bearings, which run inside the hub and on the axle housing at the outer end. To keep sufficient lubrication in the rear wheel bearings the rear wheels should be removed once a month, or every 1,000 miles, and bearings packed with light grease or very heavy oil.

Grease cups (13) lubricate the rear spring center bearing, or trunnion bolt. (Arctic Cup Grease preferred.)

Rear axle service brake shaft on axle is equipped with grease cups (14). Use light Arctic Cup Grease frequently. Refill grease cups (13 and 14) at least once every two weeks.

The front wheels should be removed as often as every 1,000 miles, or once a month, and ball cups filled with Arctic cup grease. This should not be neglected.

Steering Knuckles and Front Axle Tie Rod Fill grease cups (20) once a week on front steering knuckle bolts.

The front axle tie rod bolts are lubricated through grease cups (21) with Arctic cup grease and should be looked after at least once every two weeks.

Steering Gear To allow the steering gear to operate freely, the housing should be packed quarterly with light grease through pipe plug (15). Keep grease in cup (16) to lubricate the steering gear shaft bearings.

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The top bearing in the steering column is lubricated by means of an oiler (17) located in the steering gear wheel spider, near the hub. Lubricate with light oil once a week.

Oilers (18) are for lubrication of the front spring front bolt and should be kept full of light oil. Also oil cups (19), four in number, at the front spring rear shackle bolts. **Spring Bolts**

Refill the oil screw cap at rear of distributor base (18 and 19) once a week. **Distributor**

All wearing parts of the distributor (33) are oiled from an oiler on the front of the distributor base. Before starting the distributor which holds about two ounces, fill with light sewing machine oil. Fill this through one of the oilers (22).

Distributor instruction books are furnished with each car when shipped.

The fan is run on a plain bearing and is lubricated with Arctic cup grease through grease cup (23; not shown in cut) located at the side of the fan bearing. The fan belt should not be allowed to run too tightly, and grease cup on fan shaft bearing should be filled once a week. To adjust fan turn the eccentric bearing. **Fan**

Extreme care should be used at all times to see that plenty of water is in the water jacket and radiator. About four gallons of water are necessary to fill the water circulation space in the motor and radiator combined, which should be filled with clean water daily. **Water Supp'y**

As a caution against allowing any of the wearing parts of the car to run without sufficient lubrication, it is well to go over the car once a week and see that all grease cups are properly filled. It is also well when contemplating taking a long tour to see that they are filled before starting. This caution might save a considerable amount of trouble, delay and expense. **Special Caution Covering Lubrication**

Instructions for General Care of Batteries Used in King Motor Cars

Examine each cell upon receipt of the car. Remove vent plug from each cell, and if electrolyte has been spilled and is not up to inside or bottom hole it should be compensated for by adding electrolyte or battery solution, which is composed of one part pure sulphuric acid and three parts pure water by volume. Never add acid to a cell unless acid has been removed from the cell.

Inspect each cell on receipt of a car, once a week in the summer time, and once every two weeks in the winter time. At these inspections, remove all vent plugs to ascertain the level of the electrolyte which is lowered by evaporation of the water in the electrolyte. This evaporation should be compensated for by adding pure distilled water (no acid) to the cells to bring the solution up to the level of the inside covers.

Preferably take specific gravity readings when battery is inspected to check performance of the generator. The specific gravity should be between 1.280 and 1.300 when battery is fully charged. The specific gravity is a check on the generator and indicates whether it is performing properly and is keeping the battery fully

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charged. It is therefore advisable to take specific gravity readings of each cell at the time the regular inspection is made, and before any water has been added to the cells. The specific gravity is taken with a hydrometer syringe, which the Willard Storage Battery Company can supply, and is shown on page 6 of their bulletin No. 40. If the machine is performing properly and is keeping the battery fully charged the gravity will read between 1.280 and 1.300 from time to time.

If the machine is not charging the battery properly it may be due to any of the following causes:

- (A) Insufficient output from the generator caused by defective brushes or reversed polarity.
- (B) Too extravagant use of electricity.
- (C) A leakage of current through a ground.
- (D) A break in circuit between generator and battery. The cause should be remedied before the battery is again connected in the circuit.

If the battery has fallen behind it should be removed from the car and the positive pole of the charging source should be connected to the positive (+) terminal of the battery and negative pole of charging source to negative (—) terminal of battery, and charged immediately at the $4\frac{1}{2}$ ampere rate until the solution has a gravity of 1.290, and then charge two more hours. Overcharging at this rate is beneficial at all times.

Battery Box Keep the box, under the R. H. front seat, containing the battery perfectly dry. If any acid is spilled in the box, wipe out carefully with a piece of waste dipped in ammonia water.

Care of Battery When the battery is not to be used for some time the owner of the car should arrange so that he can run the engine and charge the storage battery at least once every three weeks, one hour usually being all that is required, provided the gravity reading is taken each time and is up to 1.280 each time. If the owner has no specific gravity hydrometer the engine should run two or three hours every two weeks to allow a safe margin. The engine speed should equal a car speed of 20 miles per hour to properly charge the battery.

If it is not convenient to charge the battery by running the engine, we recommend having the battery charged once a month at a garage which makes a business of charging batteries.

Keep the battery in a dry place. Inspect before charging to see that each cell has the proper amount of solution.

Special instruction booklets as furnished in all tool equipments:

- (A) Ward Leonard booklet (LS* No. 32).
- (B) Willard Battery Bulletin No. 40.
- (C) Model K-1 Stromberg carburetor instruction card.

See special wiring diagram for all locations of wires and parts for starting and lighting systems.

Instructions for Installing and Timing of Atwater Kent Ignition System When Installed as Special Equipment on King Cars in Place of Briggs Magneto Originally on the Car

First install the coil on the dash. Connect the black or negative wire to the negative post on coil. This wire runs to the storage battery. Connect the red or positive wire to the positive post on coil. This wire also runs to the storage battery.

The center brass terminal on the bottom of the coil is for the ground wire. The terminal with the insulated cover is for the high tension wire. On the left hand side of the coil are two brass terminals, to which are connected the black wire fastened to the distributor.

The right hand outside terminal on the distributor connects with the wire on No. 1 spark plug. The front terminal on distributor connects with the wire on No. 2 spark plug. The inside terminal on distributor connects with No. 4 spark plug, and the rear terminal on distributor connects with the wire on No. 3 spark plug.

The center terminal on distributor connects with the high tension pole on coil, or to the terminal on coil covered by the insulator, by way of a thirty-two inch high-tension wire furnished with the distributor. The black wire on the distributor as above mentioned, connects to the interrupter poles on the left hand side of the coil.

First, assemble the magneto coupling to the horizontal shaft the same as in mounting the magneto.

Second, mount the distributor in place of the magneto and fasten down with two cap screws screwed in from underneath through the two holes on the side away from the cylinder, or in other words the two holes which are not used in bolting the generator bracket to the magneto support bracket, being sure that the instrument is lined up with the gear shaft so that it will revolve freely.

Third, turn the distributor head around so that the car on the side of the case comes next to the cylinder, and fasten in this position with the bent rod having an eye on one end to sit over the cylinder stud and under the cylinder stud nut, and remove the hard rubber cap.

Fourth, turn the engine until No. 1 piston is coming up on the firing stroke, and bring it to a point where the dead center mark on the flywheel for No. 1 and 4 cylinders is in line with the center of the hole in the top of the flywheel housing.

Fifth, with the crank shaft in this position loosen the inner sleeve of the magneto coupling and turn the distributor shaft backwards or contrary to the direction the motor rotates, until the interrupter snaps, turning slowly and being sure to stop just at the instant the interrupter snaps.

Fasten the magneto coupling in this position and replace the hard rubber cap, with the wire to No. 1 spark plug connected to the terminal which is over the brass pointed distributor block, and continue in a clockwise direction to connect the spark plug wires in the following order: 1, 3, 4 and 2.

INSTRUCTIONS—KING MOTOR CAR COMPANY

The center terminal is to be connected with the high tension connector on the under side of the coil box. The top wire coming out on the right hand side of the lighting switch case (when standing in front of the car), is intended for ignition and is also to be used for the horn circuit. Tap in the two-way wire to this wire (leave the horn wires connected) and connect this two-way wire to the two terminals on the coil box marked "Battery."

The spark advance is automatic and does not need to be connected to the hand control, the spark always occurring late when the motor is running slow and is advanced automatically when the motor speeds up. (Hand control spark advance is preferable.)

A small amount of light machine oil should be used in the two ball oilers, one of which is over the horizontal shaft bearing, and the other between the two interrupter contact screws in the case. Light grease or oil should be put in the bevel gear case through the hole filled with the brass thumb screw.

Hints on How to Keep Your Car in Good Running Order

Don't slide your wheels by locking the brakes too suddenly.

Don't allow your car to stand in puddles of oil or water, as neither one is good for your tires.

Remember that the pan, engine and other mechanical parts of the car should be kept clean.

Don't turn corners too fast. While this may seem spectacular, it is always hard on tires.

Never open the throttle too quickly, but give the motor a chance to pick up gradually.

Keep your brakes adjusted.

Familiarize yourself with the use of the hand lever brake and thus be prepared for emergencies.

Be sure to release the clutch before shifting gears.

Don't accelerate too quickly; this causes the car to jump and the motor to pound.

Should you detect any unusual noise while running, stop and investigate the cause at once.

Examine the car occasionally for loose nuts and bolts.

Don't race your engine under any circumstances.

Remember that a squeak from the car means oil needed.

Never take your car out until you are sure it is properly lubricated.

Be sure your brakes are released before attempting to move car.

When you undertake to make any adjustments on your car, be sure you are right and then go ahead.

Never fold the top back when it is wet, as this will cause the top to deteriorate rapidly.

Don't let your engine labor going up a steep hill—drop back to a lower gear if necessary.

Don't fail to cover the radiator and hood with a blanket or robe when the car is left standing in the cold. This keeps much of the heat in the cooling system and facilitates the starting of the motor.



