



Ford

THE UNIVERSAL CAR

STARTING
AND
LIGHTING
SYSTEM



Ford Motor Company
DETROIT, MICHIGAN

Introduction

IN this pamphlet we describe the type of starting and lighting system, also the care and operation of the different units making up the system.

We do not discuss repairs to the starter or generator, as dealers and customers should not attempt repairs when it is necessary to tamper with the mechanism.

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Instructions on the
Care and Operation
of the Ford Starting
and Lighting System

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The Ford Starting and Lighting System

Of what does the Starting and Lighting System consist?

The starting and lighting system is of the two unit type and consists of the starting motor, generator, storage battery, ammeter, and lights, together with the necessary wiring and connections.

Where is the Starter located?

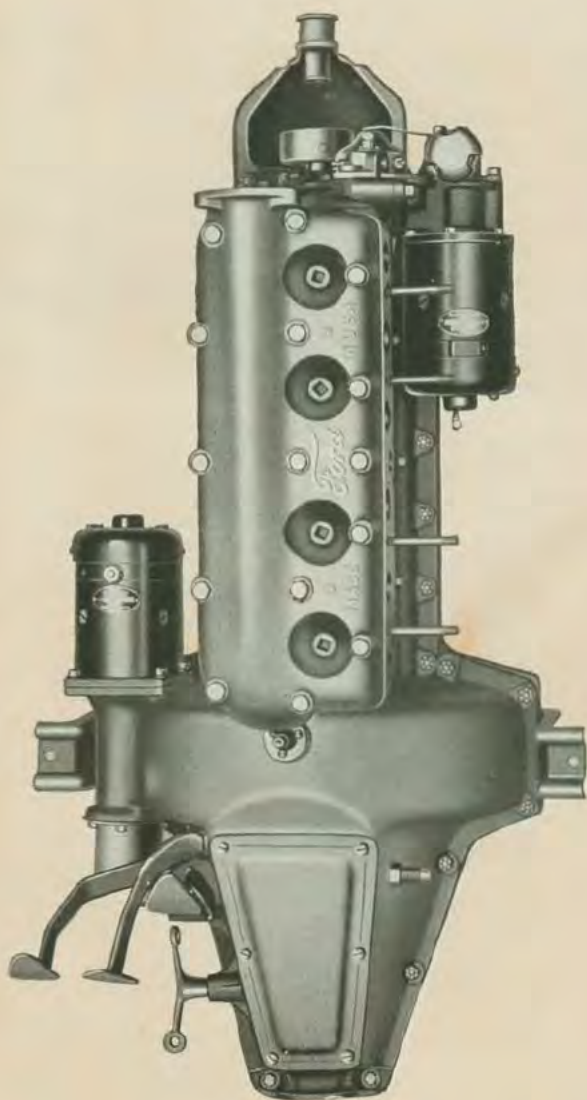
The starting motor is mounted on the left-hand side of the engine and bolted to the transmission cover. When in operation the pinion on the Bendix drive shaft engages with the teeth on the flywheel.

What must be done before starting the Engine?

The spark and throttle levers should be placed in the same position on the quadrant as when cranking by hand, and the ignition switch turned on. Current from either battery or magneto may be used for ignition. When starting, especially if the engine is cold, the ignition switch should be turned to "battery." As soon as the engine is warmed up, turn switch back to "magneto." The magneto was designed to furnish ignition for the Model T engine and better results will be obtained by operating in this way. Special attention must be paid to the position of the spark lever as a too advanced spark will cause serious backfiring which in turn will bend or break the shaft in the starter. The starting motor is operated by a push button, conveniently located in the floor of the car at the driver's feet. With the spark and throttle levers in the proper position, and the ignition switch turned on, press on the push button with the foot. This closes the circuit between the battery and starting motor, causing the pinion of the Bendix drive shaft to engage with the teeth on the flywheel, thus turning over the crank shaft. When the engine is cold it may be necessary to prime it by pulling out the carburetor priming rod, which is located on the instrument board. In order to avoid flooding the engine with an over rich mixture of gas, the priming rod should only be held out for a few seconds at a time.

What if the Engine fails to start?

If the starting motor is turning the crank shaft over and the engine fails to start, the trouble is not in the starting system. In this event, release the button at once, so as not to unnecessarily discharge the battery and inspect the carburetor and ignition system to determine the trouble.



Top view of Model T Motor, showing Starter and Generator in position (Cut No. 1)

What if the Starting Motor fails to act?

If the starting motor fails to act, after pushing the button, first inspect the terminal on the starting motor, the two terminals on the battery and the two terminals on starting switch, making sure all of the connections are tight; then examine the wiring for a break in the insulation that would cause a short-circuit. If the wiring and connections are O. K. and the starting motor fails to act, test the battery with a hydrometer. If the hydrometer reading is less than 1.225 the trouble is no doubt due to a weak or discharged battery.

What if the driver steps on Starting Button when engine is running?

Should the driver accidentally step on the starting button while the engine is running, no harm will result. The pinion merely touches the revolving flywheel gear once and immediately rotates with the threaded shaft out of contact with the flywheel, in the same manner as when it has been demeshed by the engine's starting. (See Cut No. 2.)

How is the Generator operated?

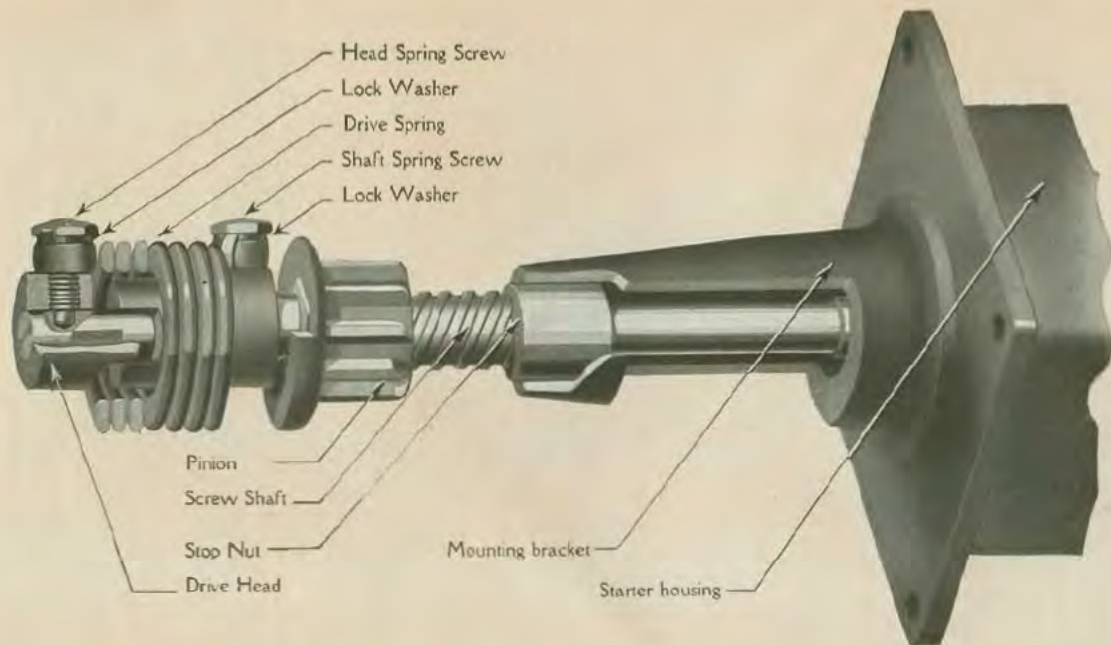
The generator is mounted on the right-hand side of the engine and bolted to the cylinder front end cover. It is operated by the pinion on the armature shaft engaging with the large time gear. The charging rate of generator is set so as to cut in at engine speeds corresponding to 10 miles per hour in high speed and reaches a maximum charging rate at 20 miles per hour. At higher speeds the charge will taper off, which is a settled characteristic of battery charging. This operation of cutting in and cutting out at suitable speeds is accomplished by the cut-out, which is mounted on the generator. This cut-out is set properly at the factory and should not under any circumstances be tampered with.

What about Oiling?

The starting motor is lubricated by the Ford splash system, the same as the engine and transmission. The generator is lubricated by a splash of oil from the time gears. In addition an oil cup is located at the end of the generator housing and a few drops of oil should be applied occasionally.

What should be done when repairing the Ignition?

The introduction of a battery current into the magneto will discharge the magnets and whenever repairing the ignition system or tampering with the wiring in any way, do not fail to disconnect the positive wire from the battery. The end of this wire should be wound with tape to prevent its coming in contact with the ignition system or metal parts of the car.



Bendix Drive Assembled to the Ford Starting Motor (Cut No. 2)

How does the Ammeter operate?

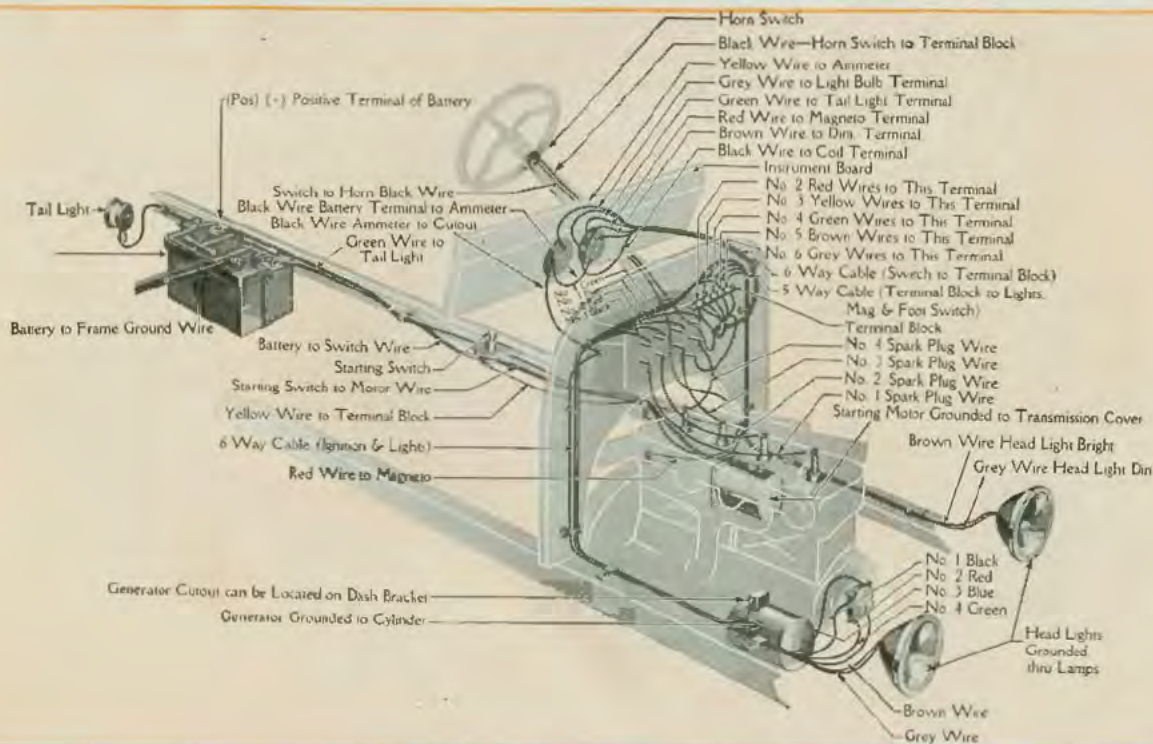
The ammeter is located on the instrument board. This ammeter registers "charge" when the generator is charging the battery and "discharge" when the lights are burning and the engine not running above 10 miles per hour. At an engine speed of 15 miles per hour or more the ammeter should show a reading of from 10 to 12, even with the lights burning. If the engine is running above 15 miles per hour and the ammeter does not show "charge," first inspect the terminal posts on the ammeter, making sure that the connections are tight, then disconnect the wire from the terminal on generator, and with the engine running at a moderate speed, take a pair of pliers or a screw-driver and short-circuit the terminal stud on the generator to the generator housing. If the generator is O. K., a good live spark will be noted. (Do not run the engine any longer than is necessary with the terminal wire disconnected.) Next inspect the wiring from the generator through the ammeter, to the battery for a break in the insulation that would result in a short-circuit. If the trouble is not located then remove the dust cap from the end of generator and thoroughly clean the commutator, using for this work a fine grade of sand paper which has been slightly oiled. With the motor running, hold the sand paper against the commutator with the fingers until all dirt has been removed and a bright surface obtained.

How are the Lights operated?

The lighting system consists of two 2-bulb headlights and a tail light operated by a combination lighting and ignition switch located on the instrument board. The large bulbs are of 6-8 volt, single contact, 17 candle power type. The small bulbs of 6-8 volt, single contact, two candle power type. The small bulb is also used in the tail light. All of the lamps are connected in parallel, so that the burning out or removal of any one of them will not affect the other. Current for the lamps is supplied by the battery. Do not connect the lights to the magneto, as it will result in burning out the bulbs and might discharge the magnets. Cut No. 3 shows the different circuits and the course of the current.

What about repairing Starter and Generator?

If either the starter or generator fails to give proper service, the owner should at once consult an authorized Ford dealer. If the trouble is not found in the wiring, connections, commutator, etc., as outlined, the dealer *will remove* the starter or generator, or both if necessary, and *return them intact* to the nearest branch for repair or replacement. *Dealers or owners should not attempt to repair or tamper in any way with the mechanism of the starter and generator.*



Wiring Diagram Cars Equipped with Starter (Cont. No. 3)

How is the Starter removed?

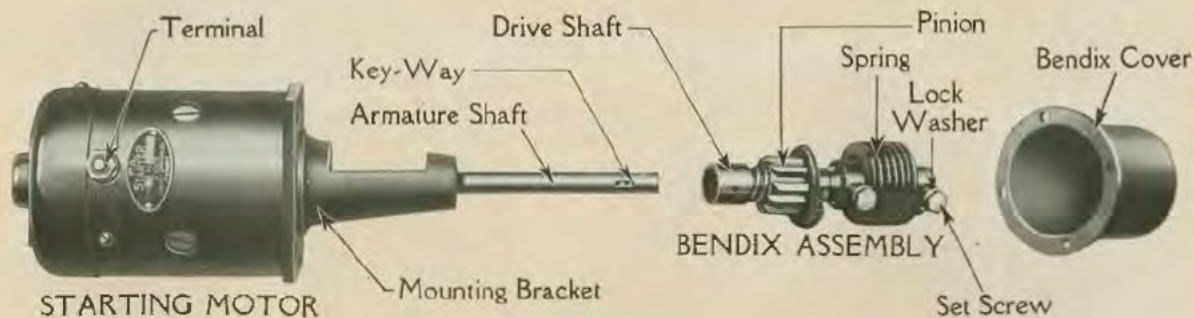
When removing the starter to replace transmission bands, or for any other reason, first remove the engine pan on the left-hand side of the engine and with a screw-driver remove the four small screws holding the shaft cover to the transmission cover. Upon removing cover and gasket, turn the Bendix drive shaft around so that the set screw on the end of the shaft, as in Cut No. 4, is in the position shown. Immediately under the set screw is placed a lock washer, designed with lips or extensions opposite each other on the outside diameter. One of these is turned against the collar and the other is turned up against the side of the screw head. Bend back the lip which has been forced against the screw and remove the set screw. As the lock washer will no doubt be broken or weakened in removing the starter, a new one must be used when replacing it. Next, pull the Bendix assembly out of the housing, being careful that the small key is not misplaced or lost. Remove the four screws which hold the starter housing to the transmission cover, and pull out the starter, taking same down through the chassis—this is why it was necessary to remove the engine pan. Extreme care should be used in removing the Bendix drive and other parts that none are misplaced nor lost and that they are replaced in their former position. In replacing the starter, be sure that the terminal connection is placed at the top. If the car is to be operated with the starter removed, be sure to put the transmission cover plates in position. These plates may be obtained from the nearest dealer.

How is the Bendix Drive assembled to the Starting Motor?

When assembling the Bendix Drive to the starting motor shaft, care must be used to see that the stop nut or bearing which enters the mounting bracket on the starting motor is not too tight; also that the bearing is in proper alignment with the bracket. (See Cut No. 2.) The bearing should be oiled and then fitted so that it can be turned readily with the fingers. If the bearing is too tight, it should be dressed down with an oil stone. Too tight a fit will cause the bearing to freeze to the bracket, resulting in serious damage to the starter.

How is the Generator removed?

If it is found necessary to remove the generator, first take out the three cap screws holding it to the front end cover and by placing the point of a screw-driver between the generator and front end cover, the generator may be forced off the engine assembly. Always start at the top of the generator and force it backward and downward at the same time. Plates may be obtained from the nearest dealer to place over the timing gear if the car is to be operated with the generator removed.



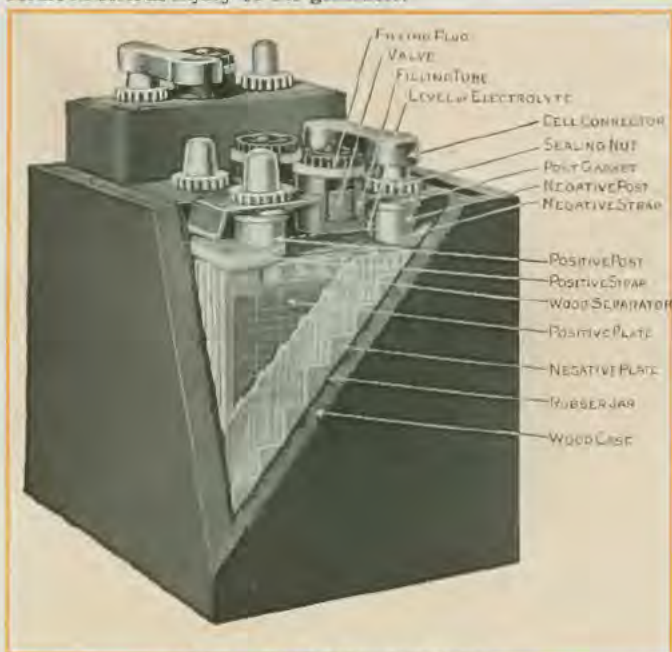
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What should be done when replacing the Generator?

When installing the generator, the drive pinion must be properly meshed with the large time gear. The generator bracket, that is, the section to which the generator is bolted, is separate from the cylinder block and the meshing of the generator driving pinion with the large time gear can be regulated by the use of one or more paper gaskets between the bracket and the cylinder block. The bracket should rest tightly on the crankcase gasket and line up with the face of the time gear case. If these gears are meshed too tightly, a humming noise will result, also the generator shaft will be thrown out of alignment.

Can the Engine be run with the Generator disconnected from the battery?

If for any reason the engine is run with the generator disconnected from the battery, as on a block test, or when battery has been removed for repair or recharging, be sure that the generator is grounded to engine by running a wire from the terminal on generator to one of the valve cover stud nuts. A piece of wire $\frac{3}{16}$ " or more in diameter may be used for this purpose. Be sure that the connections at both ends of the wire are tight. Failure to do this when running the engine with the generator disconnected from the battery will result in serious injury to the generator.



Battery Cut-Out view (Cut No. 5)

***What type of Battery
is used?***

The Ford Starting System uses a six-volt, 3 cell battery.

***What should the customer
do before starting the car?***

1. Locate the battery. 2. Examine the battery to see that it is firmly secured in place. 3. Examine the wiring connections to see that they are tight and clean. 4. Remove all the filling plugs and test the strength of the solution by taking a hydrometer reading in each filling tube.

***How are Hydrometer
Readings taken?***

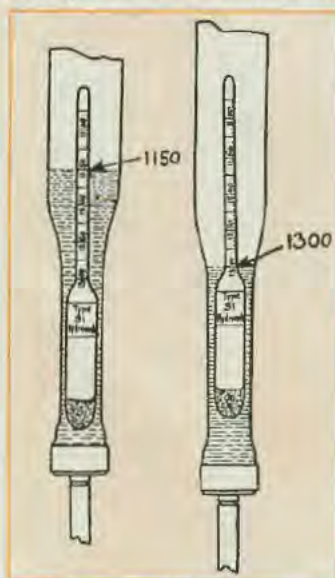
Hydrometer readings should be taken about every two weeks to make sure that the generator is keeping the battery charged. To take a hydrometer reading, remove the filling plugs by turning them one-quarter turn to the left and lifting them out (remove the plug



Testing Battery (Cut No. 5)

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from only one cell at a time). Next, insert the hydrometer syringe in the filler tube (See Cut No. 6) and draw up enough of the solution to float the glass bulb inside the instrument. The reading of the scale at the surface of the liquid (See Cut No. 7) gives the strength of the solution. Be sure to return the electrolyte to the cell from which it was taken. Following is a list of the readings with their indications. The readings in parentheses apply to batteries used in tropical climates where water never freezes. Readings of 1.275



Hydrometer Readings (Cut No. 7)

(1.200) or more indicate a fully charged battery. Readings of less than 1.225 (1.130) but more than 1.150 (1.080) indicate complete discharge. Hydrometer tests taken immediately after filling with water and before it has become thoroughly mixed with the electrolyte will not show the true condition of the battery. If the hydrometer reading shows the battery less than one-half charged, it should be taken to the nearest authorized Battery Service Station for recharging. Continued operation in a less than half-charged condition is injurious to the battery somewhat as running on a soft or deflated tire is injurious to the tire. Before replacing the battery, the cause of the discharged condition should be removed. It may be due to leaks or grounds in the car wiring or to the electric

system having gotten out of adjustment so that the battery is not kept supplied with the proper amount of current from the generator. If the reading in one cell is more than 50 points different from the others, it indicates that the cell is not in good order and the battery should be taken to a skilled service man for attention.

When should water be added to the Battery?

Add nothing but pure water to the cells and do it often enough to keep the plates covered at all times. The solution (Electrolyte) should be maintained at a level with the bottom of the filling tube. (See Cut No. 5.) Distilled water, melted artificial (but not natural)

ice and rain water, if obtained in the open country from a clean slate or shingle-covered roof are generally satisfactory. All water for battery use should be kept in clean, covered vessels of glass, china, earthenware, rubber or lead. In cold weather add water only immediately before running the engine so that the charging will mix the water and electrolyte, and avoid freezing. If, for any reason, it is necessary to add acid, the battery should be taken to an authorized Service Station.

***What care should be given the
Filling Plugs and Connections?***

Keep the filling plugs and connections tight and the top of the battery clean. Wiping the battery with a rag moistened with ammonia will counteract the effect of any of the solution which may be on the outside of the battery. A coating of heavy oil or vaseline will protect the connectors from corrosion. Keep the battery firmly screwed in place. If hold-downs are loose, the battery will shift about in the compartment and result in loose connections, broken cells and other trouble. If repairs are necessary or if the car is to be laid up for the winter, take the battery to a skilled service man for proper attention and storage. Do not entrust the battery to inexperienced or unskilled hands.

***What about Battery
Guaranty?***

The batteries are guaranteed by the manufacturers to be free from defects in material and workmanship.

At any time within three months from date of delivery to the purchaser any battery which may prove to be defective or incapable, when fully charged, of giving its rated capacity, will be repaired or replaced free of expense on receipt, transportation charges prepaid, at any authorized Battery Service Station. This guarantee does not cover the free charging of batteries nor the making good of damage resulting from continued lack of charge or from failure to keep the plates covered with solution by filling the cells from time to time with pure water. No claims on account of alleged defects can be allowed unless made within three months of date of delivery of battery to purchaser, and the right is reserved to refuse to consider claims in the case of batteries opened by other than authorized Battery Service Stations.

Purchasers of cars equipped with batteries are earnestly urged to cooperate with the battery manufacturers by taking their cars as promptly as possible after receipt, to the nearest authorized Battery Service Station in order that the battery may be tested and its condition and installation checked. No charge is made for this inspection.

