SERVICE MANUAL

of STARTING
LIGHTING
IGNITION

BY

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Adopted and Approved by

American Association of Starting, Lighting and Ignition Engineers

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FOREWORD

THIS manual was written primarily for the use of those engaged in the repair and upkeep of automotive electrical equipment.

It contains (1) the wiring diagrams for the more important models of the leading makes of automobiles, and the chief starting, lighting and ignition systems. (2) The explanations of these diagrams. (3) The instructions for the care, adjustment, "trouble shooting" and repair of the equipment.

A study of these pages will show that the material herein contained may be used as a guide to give "service" on automotive electrical equipment wherever found, as on tractors, trucks, aeroplanes, motor-boats, motorcycles, etc.

The SERVICE MANUAL has been issued in loose-leaf form because practical shop work requires that the diagrams be used separately.

To protect the plates when in use "on the job", each should be placed in a celluloid-faced envelope.

As new material becomes available, additional plates will be issued, thus providing a source of "up-to-date" information on automotive electrical equipment.

Grateful acknowledgement is hereby made to the automobile and to the starting, lighting and ignition equipment manufacturers, and to the service foremen, who have so courteously furnished material without which this work would have been impossible.

The author wishes to express his sincere appreciation to his pupil, Mr. W. L. Mitchell, for his able and faithful co-operation throughout the tedious process of arranging the material of the SERVICE MANUAL.

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Packard Twin Six

SERIES 1, 2, AND 3

BIJUR 6-VOLT, SINGLE-WIRE, TWO-UNIT STARTING AND LIGHTING SYSTEM
DELCO IGNITION

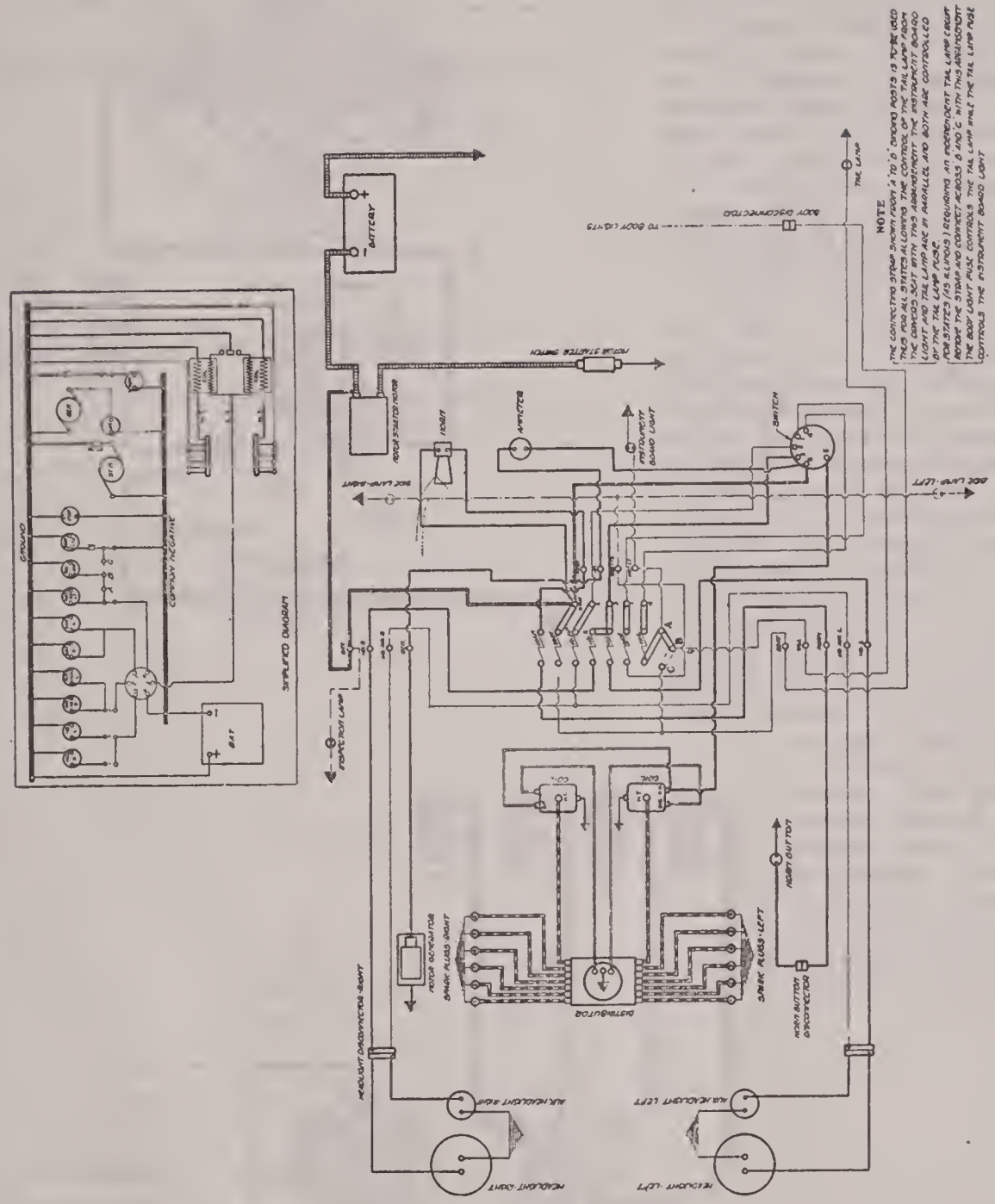


PLATE NO. 1

Battery is 6 volt, 120 ampere-hour. The positive terminal is grounded.

The starter is connected to the flywheel by non-automatic mechanical shift on the Series 1 and 2, and by automatic mechanical shift on the Series 3 cars. The positive terminal of the battery is grounded on Series 3. Series 1 and 2 use two-wire system. There is an emergency battery of five dry cells on Series 1 cars.

To remove the motor, remove nuts at the rear of the motor; the motor may then be pulled forward and removed, leaving the screw shaft and gears still in gear housing. Then by removing the nuts which hold the gear housing to the crank case, the housing can be pulled forward and removed. *Do not attempt to remove the screw shaft, gears and clutch without first removing the gear housing, as the screw shaft spring and washer may drop into the flywheel housing.*

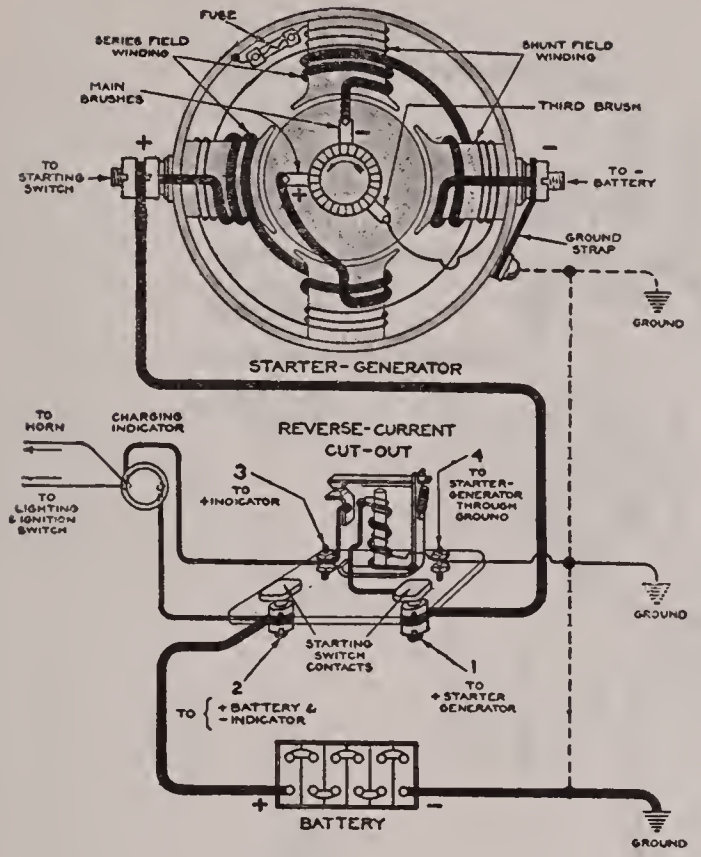
The breakers are operated by a three-lobe cam turning at crank shaft speed. The firing order is 1R, 6L, 4R, 3L, 2R, 5L, 6R, 1L, 3R, 4L, 5R, 2L.

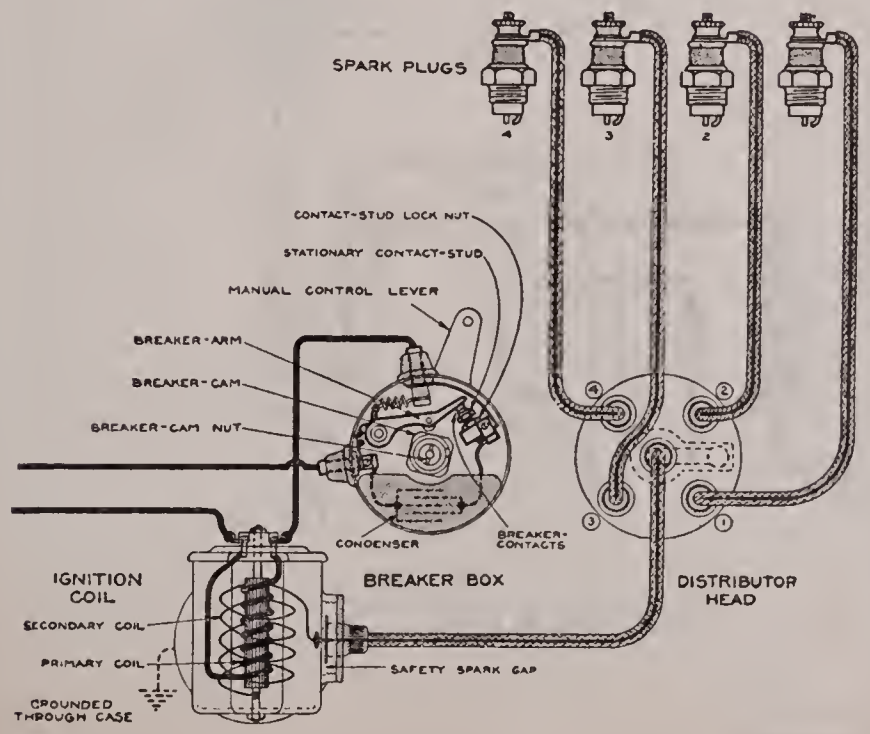
TO CHECK TIMING: With spark fully advanced, open pet cocks on all cylinders except number 1 on the right-hand block. Turn engine over by hand until compression begins, then open pet cock and continue to turn until letters SR are 2⅝ inches before center line of the engine, measured around the flywheel. Break should occur at this time. On Series 1 and 2 break occurs ⅞ inches past indicator, spark retarded. The breaker should open .015 in. to .020 in. Spark plugs should be adjusted to .032 in. There is a gauge on the distributor wrench. See Plate No. 3.

TO CLEAN BREAKER: Put a drop of light oil on each breaker with engine still running. Let the engine run until violent sparking caused by the oil stops. Then take some clean gasoline and clean it up well.

THE GENERATOR: The generator is two-brush, having vibrator regulating device mounted on top of generator. This regulator enables the generator to furnish electrical power for lights and ignition with the batteries disconnected, providing the speed of 20 miles per hour is not exceeded. There are three sockets on the top of the generator into which the three split plugs of the regulator should be inserted. The regulator disconnecting switch should be pushed in and turned completely around each 1,000 miles to reverse the current across the contact points. The regulator is the source of practically all the trouble.

Tail and body light wires are carried in flexible metal conduit attached to the left frame member. The head light wires are carried in flexible metal conduit on either side of the frame members. The ammeter, which is located on the instrument board, is connected between the generator and the battery through the switch. With the engine idle it should not register, whether lights are on or off. Should it register to the left, the meter is at fault or there is some circuit allowing a current to flow which is not intended to flow. With the engine running about 750 R.P. M., or over 20 miles per hour, the ammeter should register the current which is being used to charge the battery and light the lights. If it fails to register, look for loose connections or for broken wires between the generator and the battery. Also see that the commutator is clean and that the brushes are making good contact. Every 1,000 miles fill two oilers on starter. On the Series 3 the large oiler lubricates the starting mechanism. On the 1 and 2 fill the oilers. Oil distributor, spiral gears and shaft bearing liberally. Put a few drops of oil in generator oiler. Every 2,500 miles put a very small amount of vaseline on distributor cam. Wipe distributor head and brushes inside, apply small amount of cylinder oil and wipe again with a clean rag. Once a season repack ignition apparatus gear housing and advance yoke with vaseline.





North East Single-Unit System. Delco or North East Ignition

Battery is 12 volt, 80 ampere-hour. The negative terminal is grounded.

Starter-generator is on an adjustable support at left of engine and is chain driven. Chain is adjusted by moving starter-generator unit as required. Chain should have about ½ in. up and down play. As starter, it runs as a cumulatively compound-wound motor, as a generator it is differentially wound and has third brush control.

Normally, battery starts to charge at 10 miles per hour, and increases to maximum of 6 amperes at 17 miles per hour, and begins to decrease at 21 miles per hour. Third brush can vary current several amperes. Charging rate should not vary below a minimum of 4 and above a maximum of 10 amperes. Previous to 1918 the Delco distributor was used. On the 1918 models the ignition is North East Model O breaker and distributor. The accessories are not manufactured by them. Ignition unit is bolted on right-hand side of the engine and is direct connected to the pump shaft. The vertical shaft operating breaker is driven at one-half engine speed.

There is an automatic spark advancer operating from the rear of the horizontal shaft. It is accessible by removing the ignition coil, but should rarely need adjustment, as there is also a manual control lever on the steering gear. This is intended for retarding the spark when engine is idling, for starting, or to facilitate carburetor adjustment. Breaker contacts should open .020 in. For breakers see Plate No. 3. Spark gap should be .030 in. Firing order is 1, 3, 4, 2.

Timing: With ignition switch in off position, spark at full retard and No. 1 piston at about 5 engine degrees past upper dead center on power stroke, loosen nut holding breaker cam in place and move cam forward until breaker points just begin to open. Place rotor in position to make contact with No. 1 cylinder plug. Now rock vertical shaft back and forward as far as slack in the gears will permit. Contacts should just open when shaft is rocked forward and close when shaft is rocked backward. To test this, turn on the ignition current and place a 12-volt test lamp across the two terminals of the breaker, then rock shaft. Lamp will light when contacts open and go out when contacts close. If lamp cannot be extinguished and lighted by rocking the breaker, the cam must be readjusted.

Starting switch and relay are both in same case at center of the toe board. Relay is permanently adjusted at factory and will need no attention except to keep connections tight and contacts clean. Fuse is located on commutator end of generator. It is the first thing to inspect in case generator fails to work. If generator must be operated with battery out, short circuit terminals, or remove fuse.

Trouble Shooting: Use test lamp in series with 110-volt circuit.

Grounded Relay: Close contacts of relay and test between switch plate and either No. 3 or 4 terminal. A ground will cause lamp to light. Test between No. 1 and 4 terminals. Normally, lamp will burn dim. Bright light indicates connection between shunt and series coils. With contacts open, test between No. 1 and 3 terminals. A circuit indicates a ground between contacts. Test between No. 1 and 4 terminals. No circuit indicates an open in shunt coil. Close cutout contacts and test between No. 1 and 3 terminals. No circuit indicates an open in series coils.

Starter-Generator Test: Remove fuse before testing. Insulate all three of the brushes from the commutator. Test between frame and positive terminal. Circuit indicates ground in that half of series field. Test between left-hand fuse clip and frame. Circuit indicates a ground in shunt field. Test between frame and negative terminal. Circuit indicates a ground in that half of the series field. Right-hand fuse clip should always be grounded. Test for ground between commutator and shaft. Test from terminal to terminal with brushes on commutator, and rotate armature slowly by hand. No circuit indicates opening in series field, armature or brushes. Insulate third brush from commutator and test between left fuse clip and positive terminal. Circuit indicates a connection between shunt and series field. Give armature bar-to-bar test if there is any more trouble after wiring, fuse and switches are inspected.

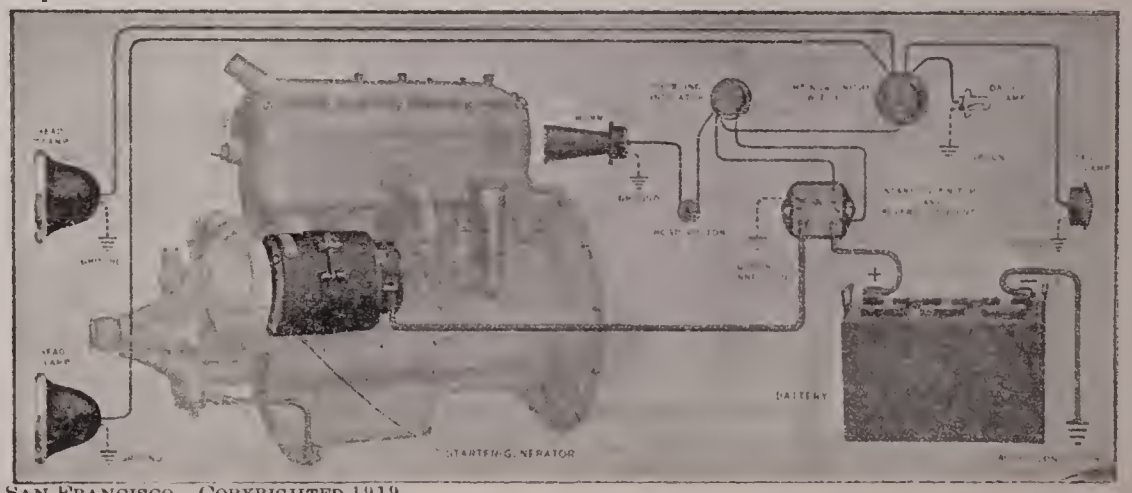
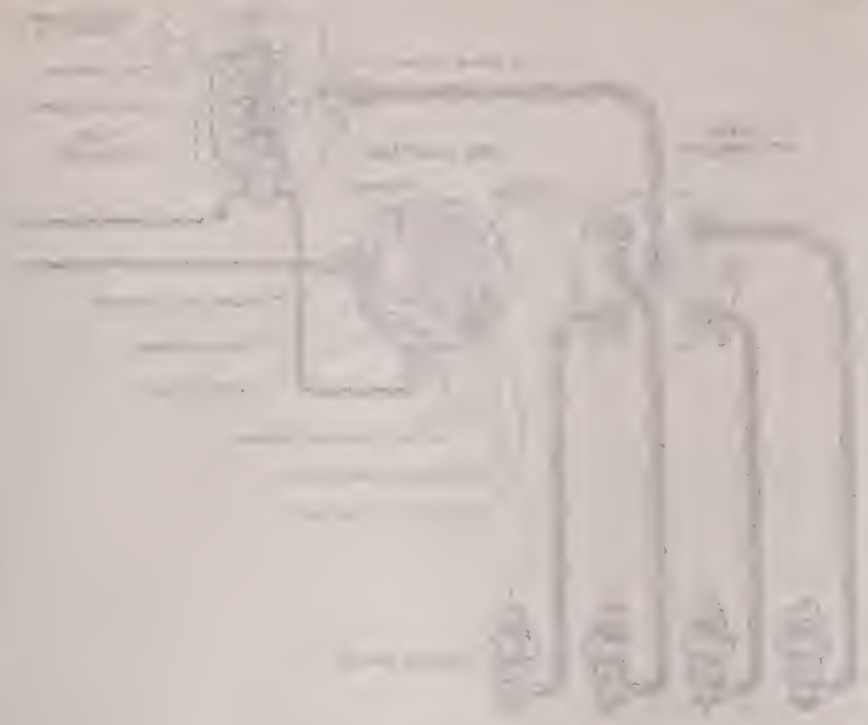
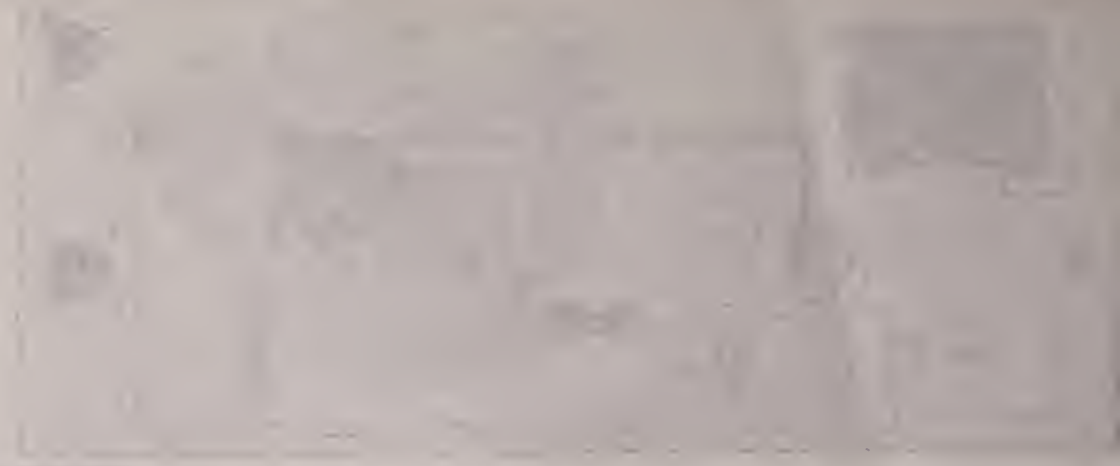
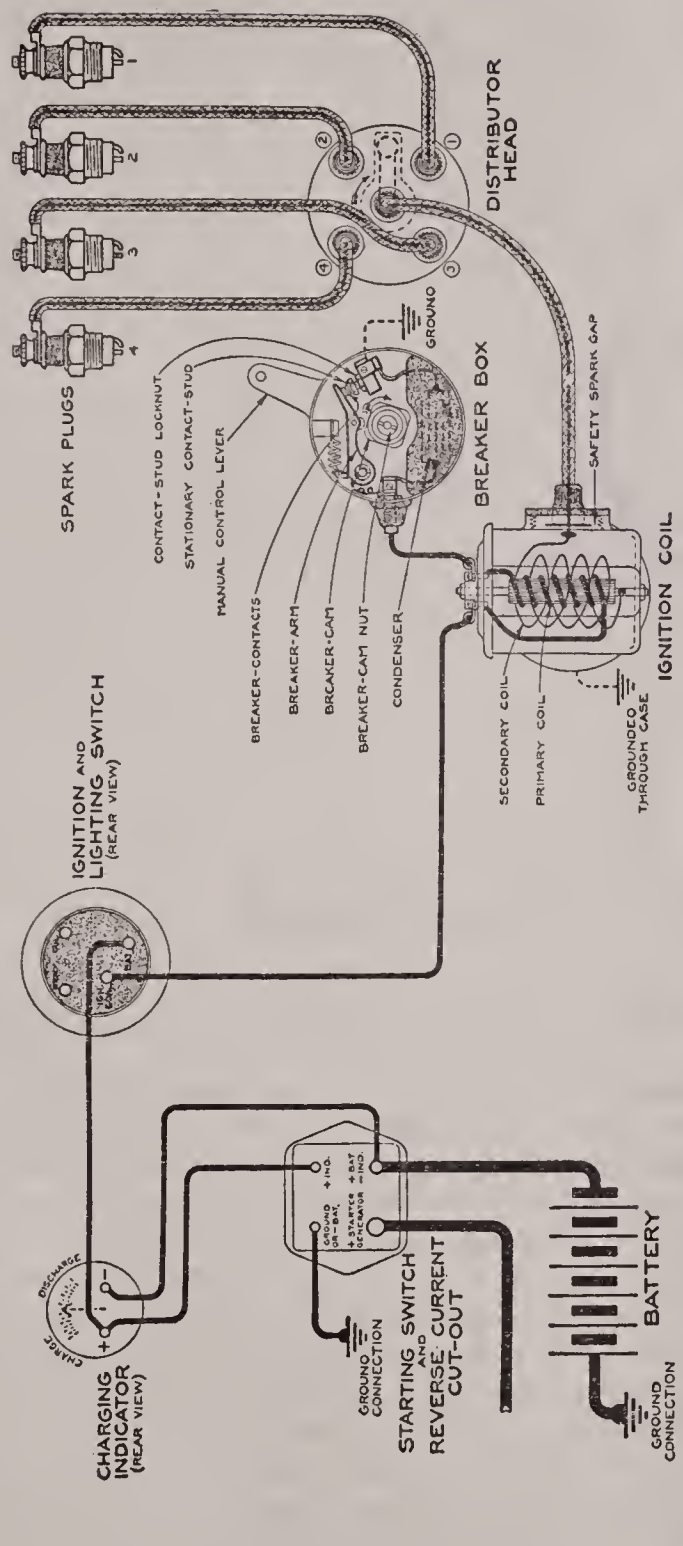


Plate No. 2







Circuit Diagram of the Model O Ignition System on the Dodge Brothers Motor Car. Type 10004 Distributor Unit—Ground Return

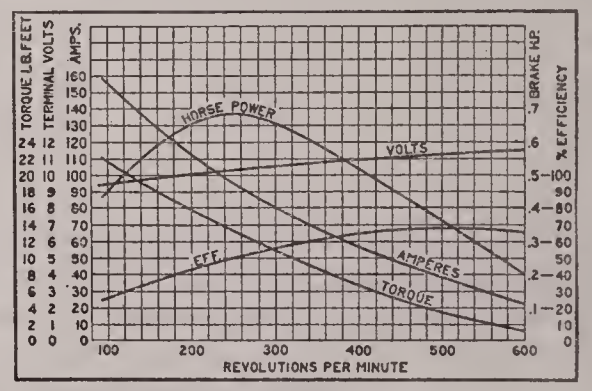
PLATE NO. 2A

Dodge

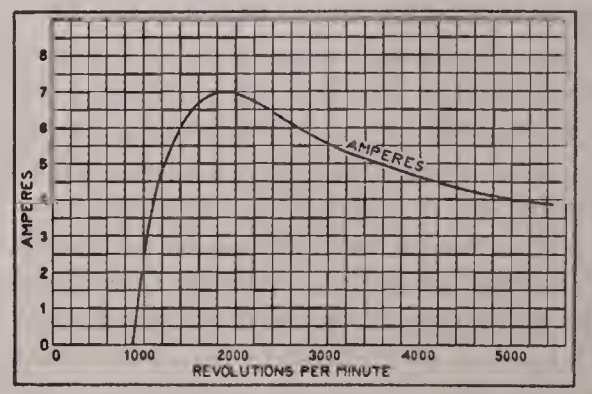
1918-19 MODELS

NORTH EAST SINGLE-UNIT STARTING AND LIGHTING SYSTEM
NORTH EAST IGNITION

Directions given on Plate No. 2 also apply to this model, the switch being changed and the ignition changed slightly. Output curves given on this page apply to both systems. The reason for changing from the polarity reversing switch to the new type was to avoid accidental short circuiting of the battery, which frequently occurred when making connections on the coil or breaker. With the new type switch, should a short circuit occur, due to the screw driver coming in contact with the metal parts of the car while making connections, the current will flow through the ignition coil, thus the battery will not be injured.



STARTING CHARACTERISTICS
Model G Starter-Generator



GENERATING CHARACTERISTICS
Model G Starter-Generator

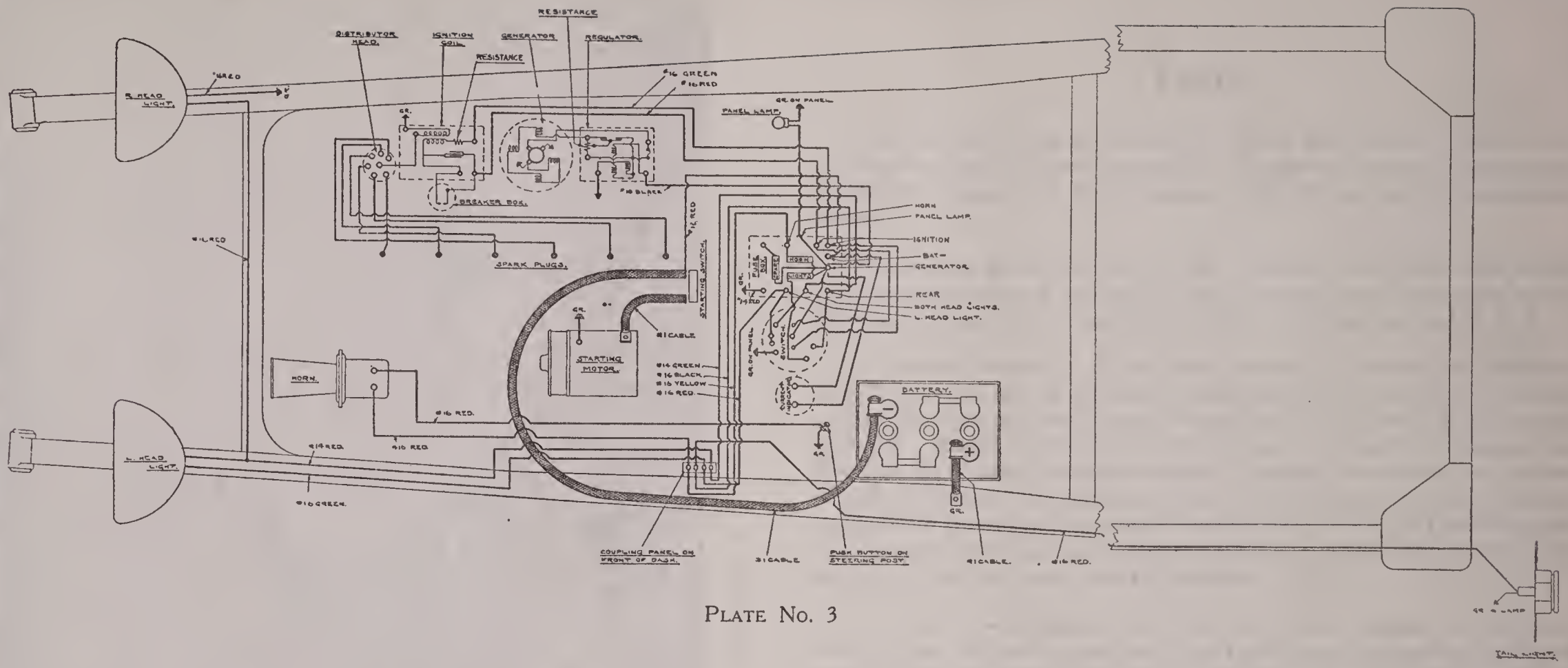


PLATE NO. 3

Kissel Kar

HUNDRED POINT SIX

REMY GENERATOR. REMY OR KISSEL STARTER. REMY IGNITION

Battery is 6 volt, 110 ampere-hour. The positive terminal is grounded.

Breaker and distributor are carried vertically in front of the generator, being driven by spiral gears operating from the generator shaft. Breaker points should have a silvery appearance and be kept perfectly smooth and flat with a very fine jeweler's file or by drawing a piece of No. 00 sandpaper between them, after which all dust must be carefully blown out. Never oil the contact points. The grease cup under the breaker head should be kept full of medium cup grease and tightened two or three turns, occasionally. If a wick is supplied, use only pure vaseline in the grease cup. The cam should be oiled with a very small amount of vaseline about each 1,000 miles. Adjust contact points with wrench provided. Contacts should open about .025 in., or the thickness of a gauge on breaker wrench. The current across the contacts should be reversed occasionally, as it tends to keep them true. This is usually done automatically by the ignition switch. Firing order is 1, 5, 3, 6, 2, 4. Break should occur when mark 1-6 T. C. on the flywheel is 1¼ in. past the indicator, spark fully retarded.

Starter is connected to engine by Bendix drive.

Generator is driven from same shaft as the water circulator. Voltage control is by vibrating regulator. Relay and regulator are located at rear of generator. If the battery should be disconnected and engine run, the relay regulator fuse would blow, rendering the generator inoperative, but damage-proof. Use 15-ampere fuse. Battery will supply current for lights and ignition if this fuse is blown.

Generator brushes should make perfect contact and swing freely on their pivots. Never change position of rocker ring, as it is determined by one accurately set at the factory. Brushes are of a special copper carbon composition and should never be substituted by ordinary carbon brushes. A good test for the generator is to turn on the lights in a dark place with engine idling. Speed up engine considerably and lights should brighten some. If failure to spark cannot be traced to defective wiring or plugs, look at resistance unit under cap on top of coil and see that it is intact. Test primary by placing 110-volt terminals in series with a lamp across the two top terminals of the coil. Circuit indicates that both primary and resistance units are all right. If one terminal of a 220-volt line is joined to the metal base of the coil and the other is brushed across the side terminal, a small spark will result if secondary is intact. Spark plug gap should be about .025 in. If engine misses when running idle or pulling light, gap should be made wider. If engine misses when running at high speeds, the gaps should be made narrower. Of course this is providing there is no other defect causing the trouble, such as lack of compression, leaky valves, carburetor adjustment, etc.

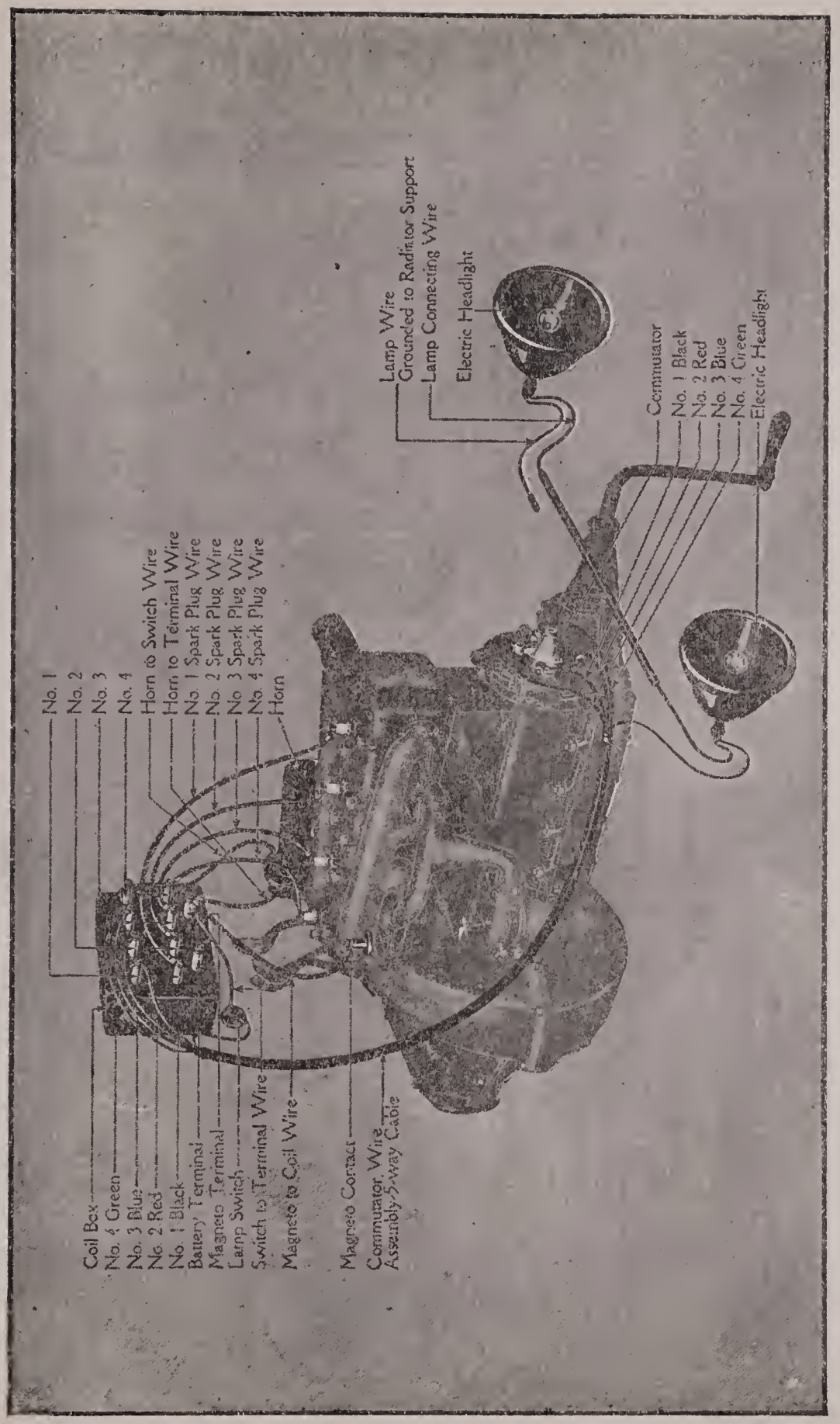


PLATE No. 4

Ford

The Ford Motors Company manufactures its own ignition system. Gray & Davis head lamps are used. Current is supplied by a magneto, delivering alternating current. The magneto is carried in the flywheel housing. The coils remain stationary and magnets revolve.

The timer should be set so that with No. 1 cylinder on top dead center, entering power stroke, the rotor will just begin to make connection with the commutator segment delivering current to No. 1 coil, spark fully retarded. The firing order is 1, 2, 4, 3.

TO REMOVE MAGNETO: Remove engine, and then the crank case and transmission cover. Take out the four cap screws that hold the flywheel to crank shaft. In removing magneto, parts must be carefully marked to insure ease of re-installing. When a new set of magnets is received from the service station they are on the board in their proper order. Two north and two south poles must be together. Connecting a storage battery to magneto terminals may charge or discharge the magnets, depending on their position. Coil spool surface should be separated from magnets by just 1/32 in. To take out the old magnets, simply remove the cap and brass screws holding them in place. See that the binding post on top of the crank case cover is free from dirt.

The timer (or commutator, as it is called) must be kept clean and well oiled at all times. In very cold weather about one-fourth kerosene and three-fourths lubricating oil should be used on commutator, as oil alone will often form a film over contacts which roller cannot remove, preventing electrical connection. Commutator spring should be strong enough to insure a good contact between roller and segments. If badly worn, commutator should be replaced. To remove commutator, remove cotter pin from spark rod and detach latter. Loosen cap screw which goes through breather pipe. This will release the spring which holds the commutator case in place, and it can easily be removed. Unscrew lock nut, withdraw steel brush cap and drive out the retaining pin. It can then be removed from the cam shaft. When replacing the brush be sure that the exhaust valve on No. 1 cylinder is closed when brush points upward. This may be ascertained by removing the valve door and watching valve.

Constant buzzing of one or more coils will indicate a ground in wiring from commutator. If the spring on the vibrators is too tight it will take an excessive amount of current to pull it down, making starting hard. Pitted or dirty contacts will cause hard starting and missing. Smooth with a fine flat double-faced file. To find a missing cylinder hold down vibrators on Nos. 1 and 4 coils. If 2 and 3 fire regularly, hold down the vibrators on coils 1 and 2 and free 1 and 4. If one of the two then free to operate is missing, hold down one more vibrator. Examine spark plug, vibrator and wiring of the missing cylinder.

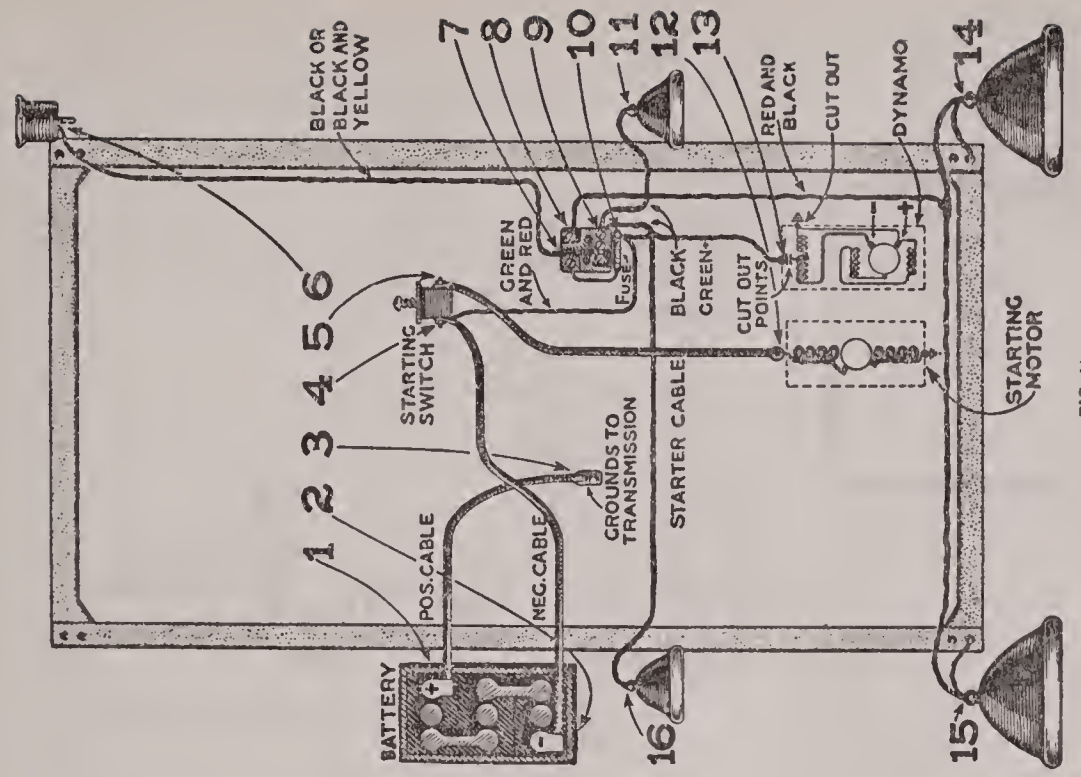


FIG. 14
WIRING DIAGRAM OF SYSTEM USING 3RD BRUSH REGULATION
If the units on your car resemble Fig. 2 follow this diagram

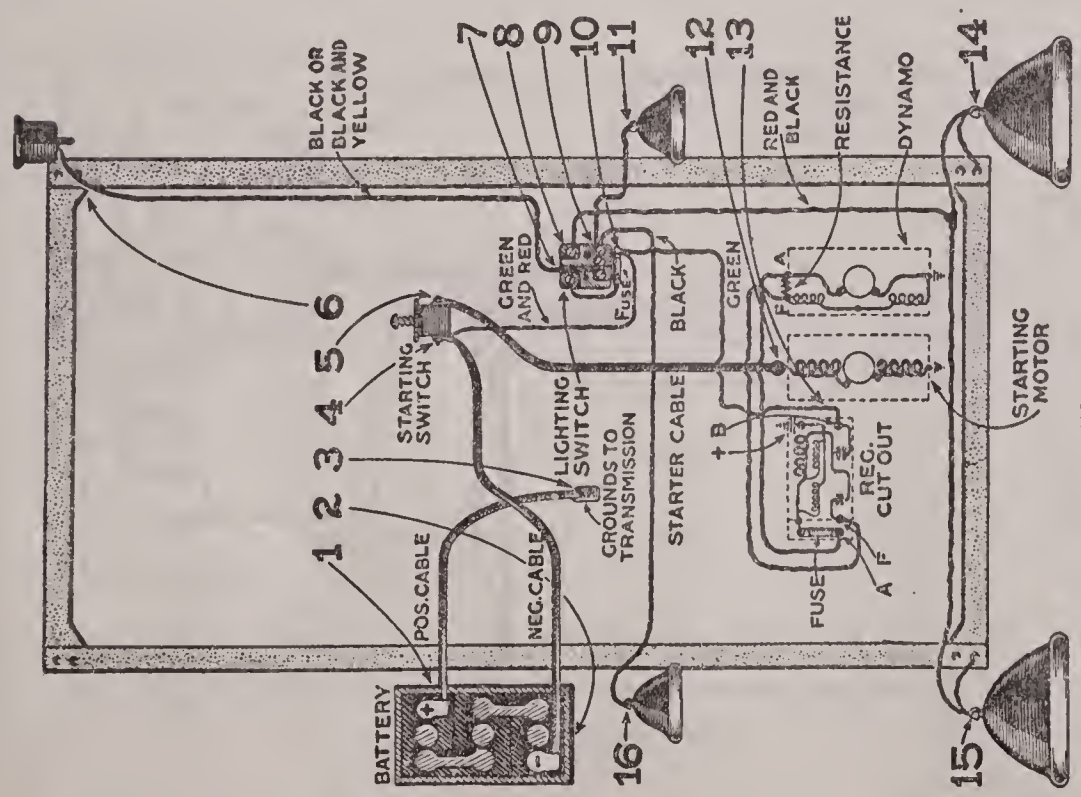


FIG. 13
WIRING DIAGRAM OF SYSTEM USING REGULATOR CUTOUT
If the units on your car resemble Fig. 1 follow this diagram

PLATE No. 5

Gray and Davis

FOR FORD CARS

TWO-UNIT, SINGLE-WIRE, 6-VOLT STARTING AND LIGHTING SYSTEM

Generator is chain driven from crank shaft. Starter is connected to large gear on generator by Bendix gear. Keep chain well lubricated. Oil the two bearings on generator and motor every 200 miles. Use medium oil.

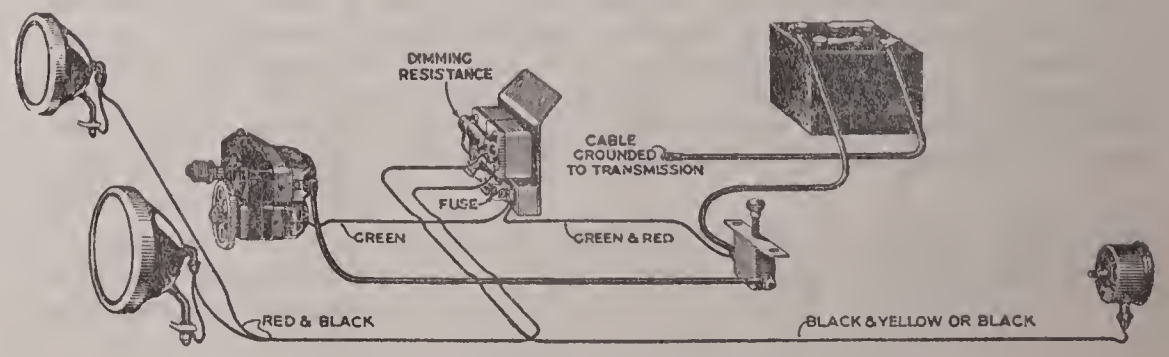
Two types of generators are used. One type has third brush, and the other has vibrating regulator system of voltage regulation. When possible, regulator should be adjusted with battery fully charged. Decreasing the gap decreases the output. Increasing the gap increases the output.

Charging current should be 1 to 3 amperes immediately after relay closes. Relay should open when discharge is ½ to 2 amperes. Test with an accurate ammeter and adjust regulating screw to bring action in the proper limits.

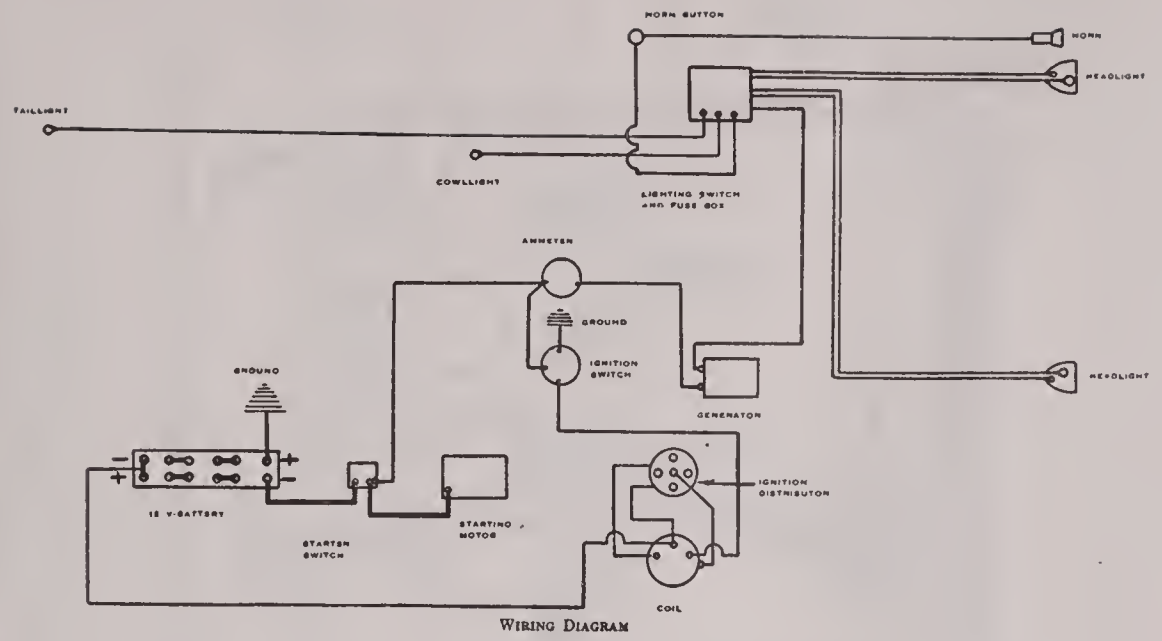
To adjust regulator, speed engine up to 18 to 20 miles per hour and turn regulator adjusting screw to bring current down to 9 amperes. Meter should indicate 9 to 10 amperes at all speeds higher than 12 to 13 miles per hour, all lights off. To clean contacts, draw a piece of soft paper between them.

On generator having third brush control relay should close at 7 to 10 miles per hour. Charging current should be 0 to 3 amperes immediately after relay closes. Relay should open when discharge current is 0 to 2 amperes. Clean contacts by drawing a piece of paper between them. Maximum generator output reaches 12 to 15 amperes at 18 to 20 miles per hour and drops 9 to 10 amperes at very high speeds.

Relay is mounted in generator housing. Relay regulator is mounted on top of motor. There is a fuse on regulator base to protect generator windings.



Wiring showing the simplicity of the GRAY & DAVIS system



WIRING DIAGRAM

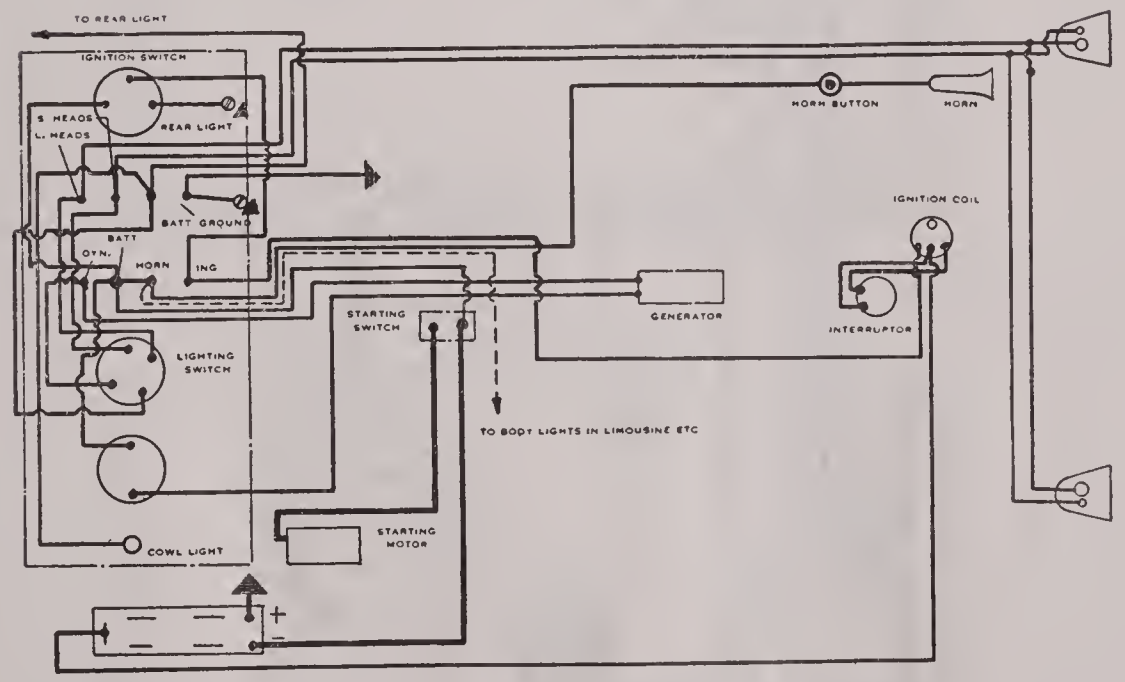


PLATE NO. 6

Stearns-Knight, 4 and 8

WESTINGHOUSE TWO-UNIT GROUNDED STARTING AND LIGHTING SYSTEM

REMY IGNITION

Battery is 12 volt, 80 ampere-hour. The positive terminal is grounded.

Starting switch is of manual control type. Starter is connected to flywheel by means of Bendix gear. Oil ball oiler on motor with three or four drops of oil monthly. Starting and lighting circuit is 12 volt. There is a 6-volt tap for ignition. Contacts open .025 in. Firing order of the Eight is 1R, 4L, 3R, 2L, 4R, 1L, 2R, 3L. Firing order of the Four is 1, 2, 4, 3. Break should occur on upper dead center, spark lever advanced one inch.

Generator is Westinghouse No. 208. On the Eight it is located between the two cylinder blocks. On the Four it is at the right of engine, being driven from the water circulator shaft in both cases. Voltage regulation is by vibrating regulator. The cut-out relay is combined with the regulator. Regulator should seldom need adjustment. If the battery will not stay charged, first look for grounds in the car wiring. This may also be caused by too frequent use of the starter, too much use of lamps, or car not driven fast enough to charge battery. If none of these faults are found, remove the cover of the regulator case and see if the relay is working properly. If it fails to close there may be oil or dirt on the commutator or brushes, or one of the brushes may be worn too short to make proper contact. If relay is working, the regulator may need adjustment. With ignition turned off, crank the engine with the starter for a few seconds to partially discharge the battery. This is not necessary if the battery is known to be partially discharged. Then turn on ignition and race the engine. With engine racing, ammeter should show battery to be charging at a rate between 15 to 20 amperes. If generator does not give this output, clean the regulator contacts by drawing a piece of soft paper between them. Test again, and if generator does not give proper output adjust vibrator regulating screw until the proper charging rate is obtained. Be sure to replace cover so as to keep out grease and dirt.

SEATING BRUSHES: The brushes should have a concave surface on the contact side, of the same curvature as the commutator, so that they will have contact on their entire surface. To grind them in, a strip of No. 00 sandpaper the width of the commutator, should be inserted between the brush and commutator, with sanded side next to brush. Keeping the sandpaper in contact with at least one-half of the commutator (the half on the brush side), move it back and forth until the brush is worn down to the proper curvature. By drawing the sandpaper from side to side, and not keeping it in contact with one-half of the commutator, the edges of the brush will be worn away, thus reducing the contact surface. Care must be taken to avoid this. The brushes supplied should never be substituted by other or plain carbon, as the ones furnished are of a composition found suited to that particular machine. Before sanding in brushes, see that the commutator is smooth and that there is no high mica.

There is a device on the Eight for city running which throws the switch under the hood and doubles the charging rate. It must be open for running over 30 miles an hour, as it damages the generator.

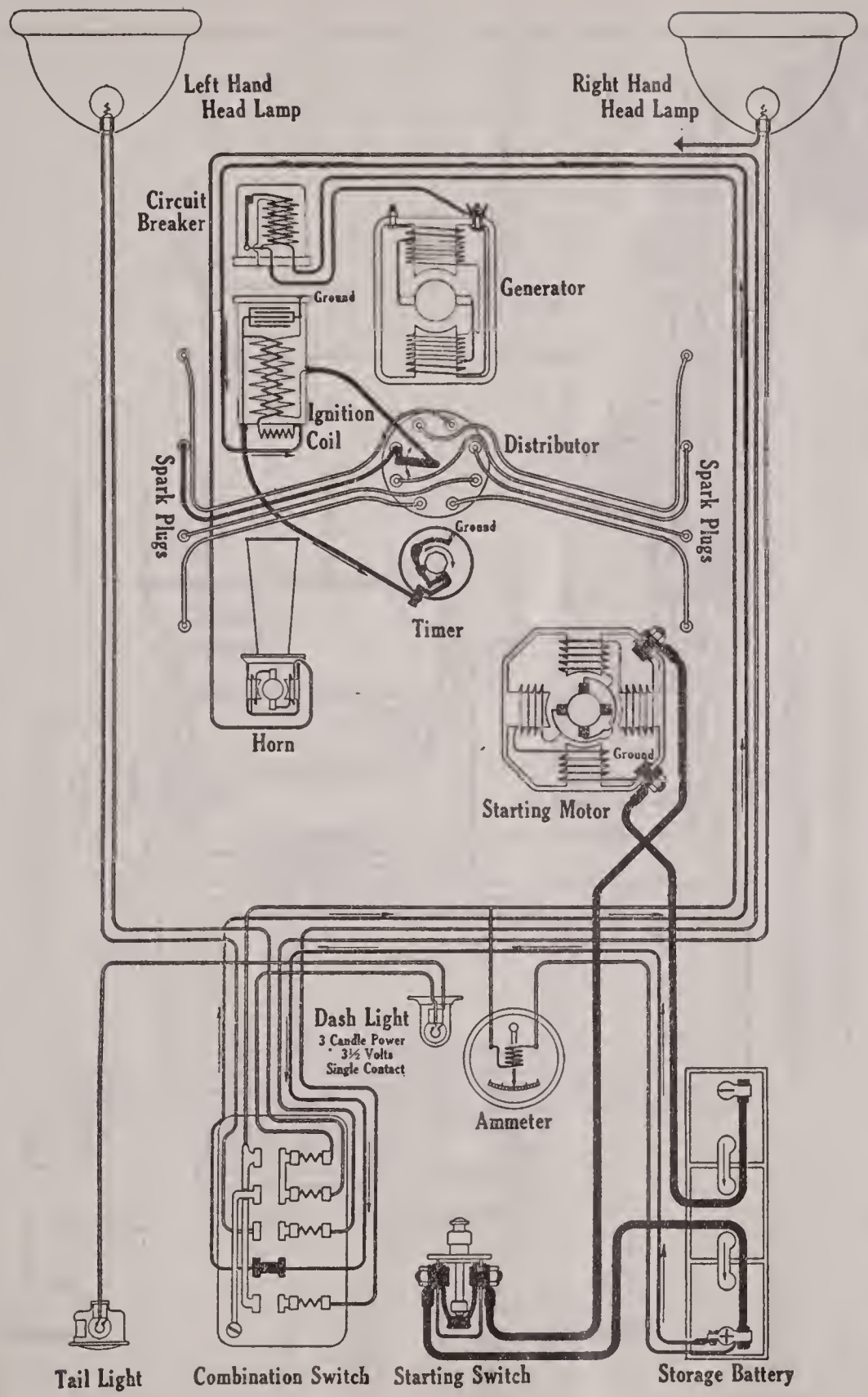


PLATE No. 7

Willys-Knight, 4-8, and Willys, 6

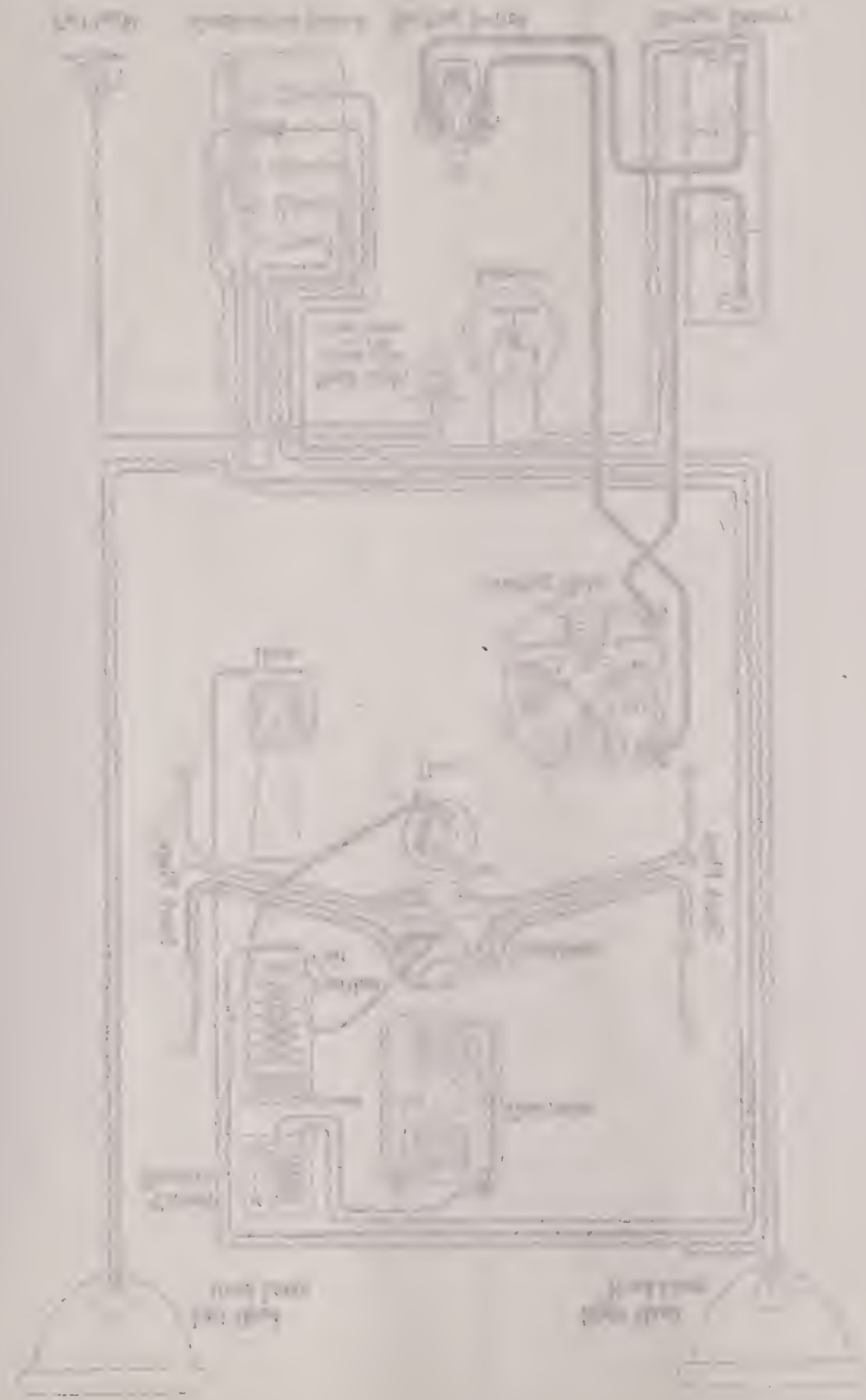
AUTO-LITE TWO-UNIT STARTING AND LIGHTING SYSTEM. CONNECTICUT IGNITION

Battery is 6 volt, 120 ampere-hour.

Positive of battery is grounded. Starting motor is connected to flywheel by a Bendix gear. The screw shaft should not be oiled, as the oil may gum and cause the pinion to stick. If the motor rotates when current is turned on, but the pinion does not engage the flywheel gear, clean the screw with gasoline and see that the spring is not broken or pinion too tight for shaft. If motor rotates until pinion engages flywheel and then stops, engine may be turning hard or battery in a discharged condition. If engine does not start after several trials, look for other trouble. Clean motor bearing with gasoline and repack with medium cup grease at least once a year.

Generator is driven from same shaft as the water circulator on all three cars. On the eight it is between the two cylinder blocks, and on the four and six it is at the right of the engine. Voltage control is by series bucking field. Cut out relay (or circuit breaker, as it is called by this firm) is located at the right of generator frame on the Four and Six, and on a special bracket at left of generator on the Eight. Relay is set to cut in at a high gear speed of 7½ miles per hour and cut out at 6 miles per hour. If relay is removed generator must be short circuited. Generator reaches its maximum output of a charging rate of about 14 amperes at a high gear car speed of 20 miles per hour. Oil oiler at each end of generator with several drops of good oil each 500 miles. If generator is removed, ignition must be retimed, as the breaker and distributor are carried vertically on the generator frame, being driven by spiral gears from the generator shaft. On the Eight the break should occur when the mark $\frac{1\text{-}4}{TC}R$ on the flywheel is 1½ in. past the indicating mark, No. 1 piston on firing stroke. Firing order of Six is 1, 5, 3, 6, 2, 4. On the six the break should occur when the mark 1-6 DC is 1¼ in. past dead center mark with No. 1 piston on firing stroke. Firing order of Six is 1, 5, 3, 6, 2, 4. On the Four the break should occur when the mark 1-4 TC is 1¼ in. past dead center mark with No. 1 piston on firing stroke. Firing order is 1, 3, 4, 2. Spark should be at full retard while timing.

There is a combination lighting, horn and ignition switch mounted on the steering-post. Fuses are in the case. In the case there is also a thermostatic ignition relay or overload cutout. If the ignition button is left in with engine idle, the current flowing through the ignition coil and thermostat, which are in series, will heat the thermostat, causing it to expand and release the ignition button. As the current is intermittent when the engine is running, being interrupted by the breaker, the thermostat coil does not have time to get so hot and therefore allows the ignition button to remain in the "on" position. If ignition button will not remain in when engine is running, bend the stationary contact, with which the thermostat operating spring makes contact, away, so that the amount of expansion needed to make contact will be increased. For lamp trouble see Plate No. 5.



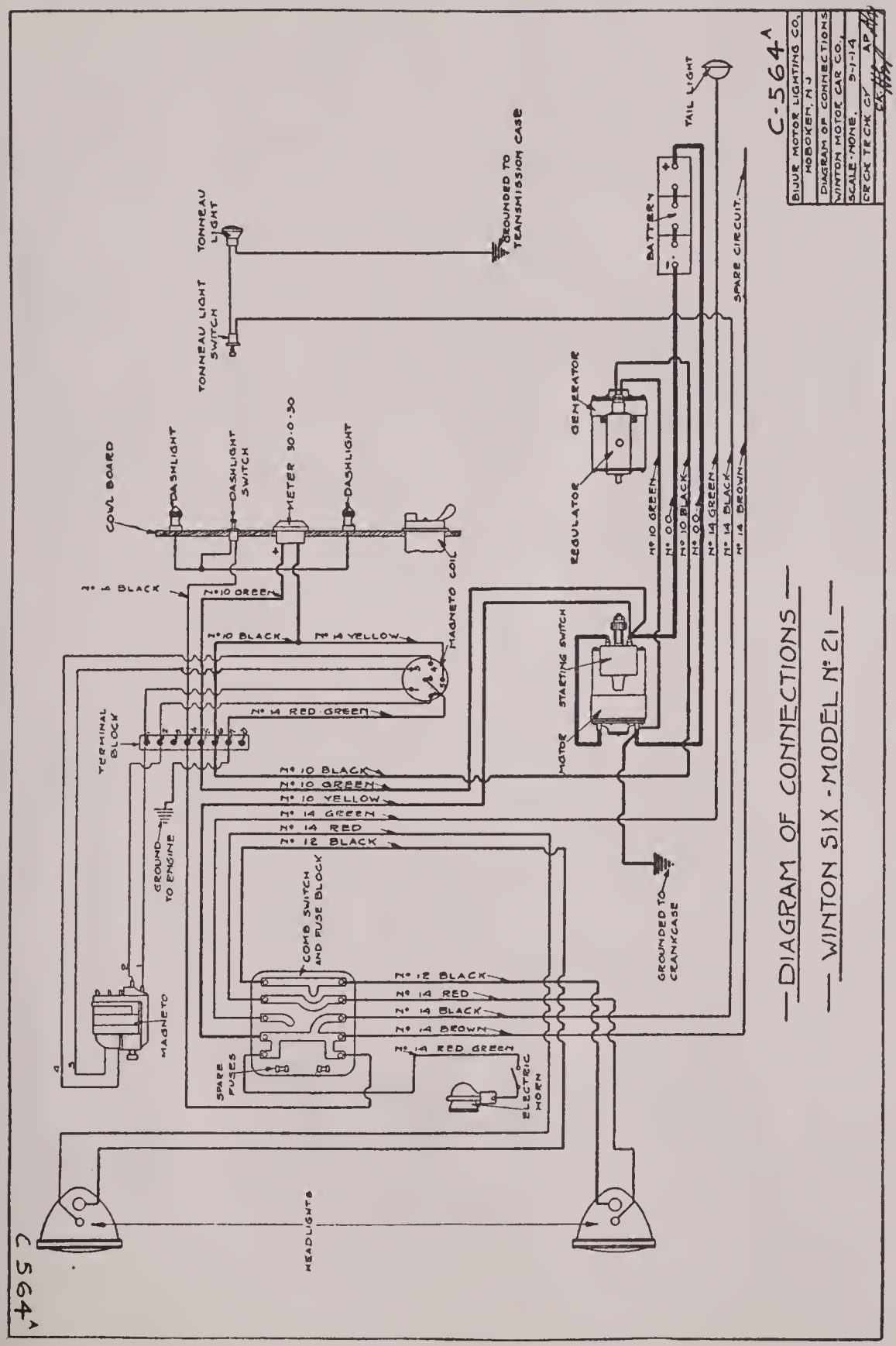


PLATE NO. 8

Winton Six

BIJUR TWO-UNIT STARTING AND LIGHTING SYSTEM. BOSCH IGNITION

Battery is 6 volt, 120 ampere-hour. The positive terminal is grounded.

Break should occur when the piston is .125 in. past top dead center, spark fully retarded. Firing order is, 1, 5, 3, 6, 2, 4.

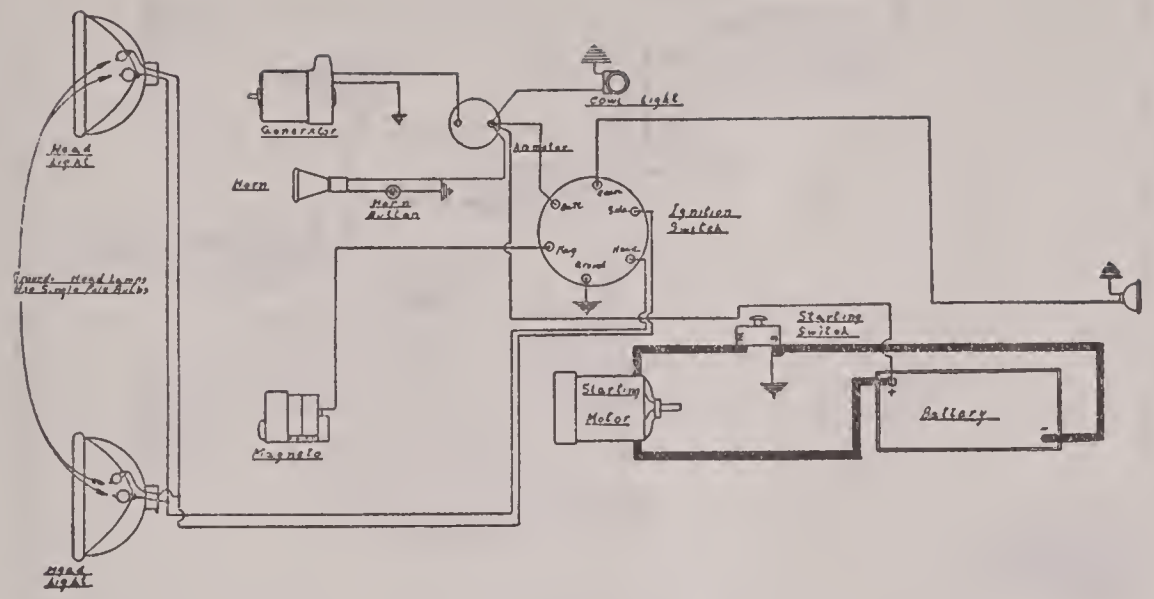
At present starter is connected to flywheel by Bendix gear. Previous to 1917 the non-automatic, mechanical shift was used. This device consists of a sliding gear on a square or keyed shaft, resistance and starting switch. When the starting switch is depressed just a little it turns the current into the motor in series with a resistance, which rotates the motor slowly, allowing the pinion to be meshed with the flywheel gear. The pinion is meshed to the flywheel gear by a lever working from the starting switch. When gear is meshed the full battery pressure is placed on the motor, cranking the engine. An over-running clutch in the reduction gears prevents engine driving motor.

The generator is mounted on a special platform cast integral with the left side of the crank case. Generator is driven by a V belt from flywheel. Should belt break or slide off the pulley, raise floor boards, and if generator is running stop it by grasping the pulley. Voltage regulation is by vibrating regulator. Regulator and relay are in case mounted on top of generator. Case is sealed and should be returned to factory if repairs are needed, as guarantee ceases if seal is broken. Relay closes at 12 miles per hour and opens at 10 miles per hour. As generator voltage is constant, charging rate depends on state of charge battery is in. The charging rate when battery is very low will run as high as 15 or 20 amperes, and when battery is charged will drop to 4 or 5 amperes. Battery will supply current for lights and ignition if generator or regulator is removed, without any additional connections. If relay does not cut in when engine is running at a car speed of about 12 miles per hour, the belt may be slipping. To tighten the belt loosen bolts holding generator to frame and adjust tension screws until belt is tight, after which the bolts must again be tightened. No care need be taken as to which terminals of the battery are connected to the generator, as the generator will automatically assume the right polarity to charge the battery. Oil the oiler at each end of generator and motor with several drops of light neutral oil each 500 miles or every two weeks. At the same time put a small amount of thin grease on starting switch shaft, on stud carrying movable crosshead for operating switch and motor pinion and on the four sides of motor shaft.

Ammeter registers the current being supplied to charge the battery and light the lights. Meter should register 7 amperes at over 12 miles per hour. Failure to do so is probably due to a slipping belt. There is no fuse in the ignition circuit. Combination lighting and ignition switch is located on back of dash. It controls the head, tail and marker lights. Body lights, dash lights, etc., are controlled by separate switches. Each circuit is protected by a separate fuse. The tail-light wire may be removed from its terminal and placed on the spare circuit and the light controlled by a switch at the light if desired. The different circuits are all covered with different colored braids to facilitate tracing them. Disconnecting plug which protrudes from the rear of the regulator box should be pushed in and turned one-half around, until it locks, once every 500 miles.

TROUBLE SHOOTING: If meter does not register at a car speed of over 12 miles per hour, there are loose connections, loose belt, or generator inoperative. To test this, remove black wire from No. 6 post on terminal block which goes into aluminum box above it. Connect a voltmeter between chassis and this wire. With engine running equal to a car speed of 15 miles per hour voltage should be 7.3 to 7.4.

If motor fails, see that commutator and brushes are clean and in proper adjustment, also that wiring and starting switch make good connections. If it is desired to operate generator system with motor removed, the ends of the two cables leading to the motor should be joined and well taped. The terminal on the heavy cable D should be removed and taped. For lights, see Plate No. 5.



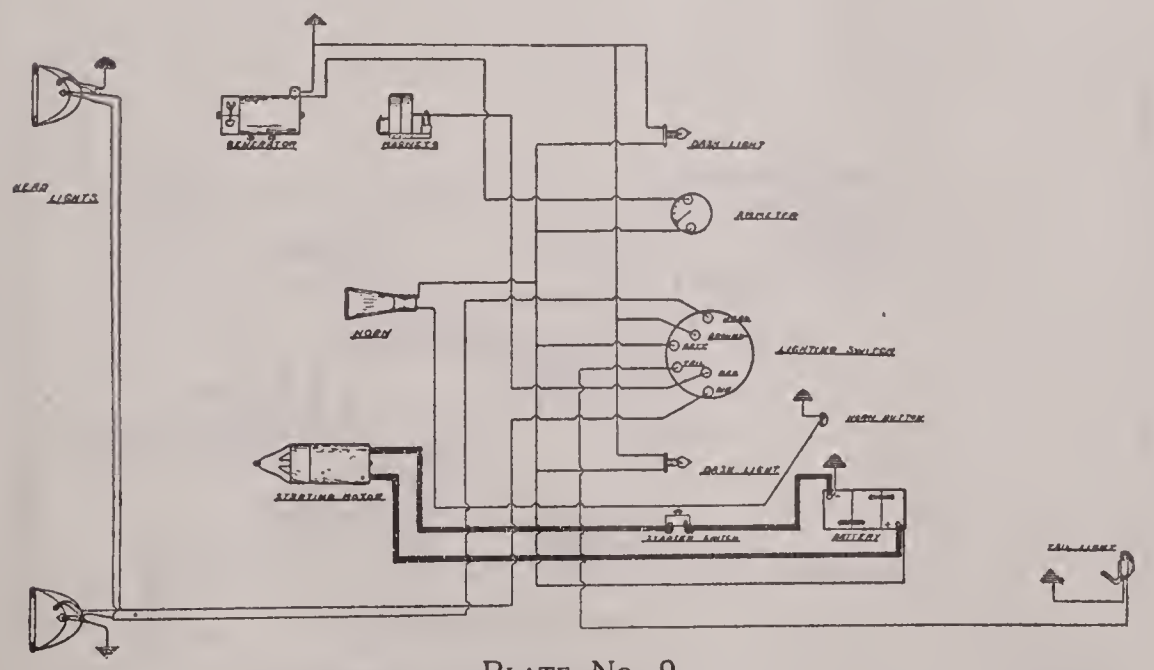


PLATE NO. 9

Roamer

BIJUR TWO-UNIT, GROUNDED, STARTING AND LIGHTING SYSTEM. BOSCH IGNITION

Negative of battery is grounded. Battery is Willard 6 volt, 80 ampere-hour.

IGNITION: Ignition is by Bosch DU6 magneto. Contacts should open 1/64 in. Put several drops of light machine oil in oil ducts at each end of magneto each 500 miles. Never use cylinder oil. Firing order is 1, 5, 3, 6, 2, 4. Spark plug gaps should be .025 in. Break should occur on upper dead center, spark fully retarded. For care of the magneto see Plate No. 182.

On the 1916 cars having the "6-45" engine, the starting motor is connected to the flywheel by the non-automatic, mechanical shift. See Plate No. 8. On all other models the starter is connected to engine by a Bendix gear. See Plate No. 7. Starting switch is of the manual control type.

Generator is driven from same shaft as the water circulator. Voltage control is by third brush. Relay (or automatic switch, as this firm calls it) is built into the generator. Relay closes at about 10 miles per hour. Generator output increases to a maximum at 20 to 25 miles per hour. All of the current furnished by the generator to charge the battery or light the lights flows through the ammeter. There is a fuse in the small aluminum case on the front of the generator. This fuse will blow and open the circuit in the shunt field in case the generator is operated with the battery circuit of high resistance. When connecting battery to generator no attention need be paid to which terminal the wires are connected to, as the generator will automatically assume the right polarity to charge the battery. Put a few drops of light neutral oil in the oilers at each end of the generator every two weeks or 500 miles.

TROUBLE SHOOTING: When ammeter does not register "Charge" with car running over 10 miles per hour: Look for loose or high resistance connection between generator and battery. Generator fuse may be blown, commutator or brushes may be dirty or greasy. The ammeter inoperative or generator inoperative. Loose or high resistance connections between generator and battery will cause fuse to blow. Remove wires from generator terminals and place a 6-volt lamp similar to the large one used in the head light across the terminals. If lamp burns brightly and ammeter does not show a discharge, the fault is there, and meter should be replaced. If lamp burns dimly or does not burn at all, there are defective connections, or the jar of a cell in the battery may be cracked, allowing the electrolyte to leak out. This will cause generator fuse to blow. Never replace the fuse with anything except a similar fuse. Remove the brass band from commutator end of generator and see that all three brushes are bearing on the commutator and that they are free to move in their holders and are free from oil and grease. Never run generator without battery unless the fuse is removed. If motor fails to start, first see that the battery is properly charged. If battery is all right, inspect the wiring to see if there are loose or high resistance connections. Switch may not be making proper contact and motor commutator may be dirty or greasy, or motor otherwise at fault. If wiring and battery are not at fault and commutator and brushes are clean and making good contact, make a temporary connection between ground and terminal of motor, which is connected to starting switch. If motor does not then spin it is at fault. Never lubricate the commutator. Place a voltmeter across the battery terminals. Note the voltage and then depress the starting switch. If voltage does not drop some, the switch or wiring is at fault and must be repaired or replaced. The warranty on the generator, motor, starting switch and the ammeter ceases if any repairs or adjustments are attempted by any unauthorized parties, or if inferior brushes are substituted. For lamp trouble see Plate No. 5.

All lamps are 6 volt. Head lamps are 15 cp. Dimmer lamps are 4 cp. Dash and tail lamps are 2 cp.

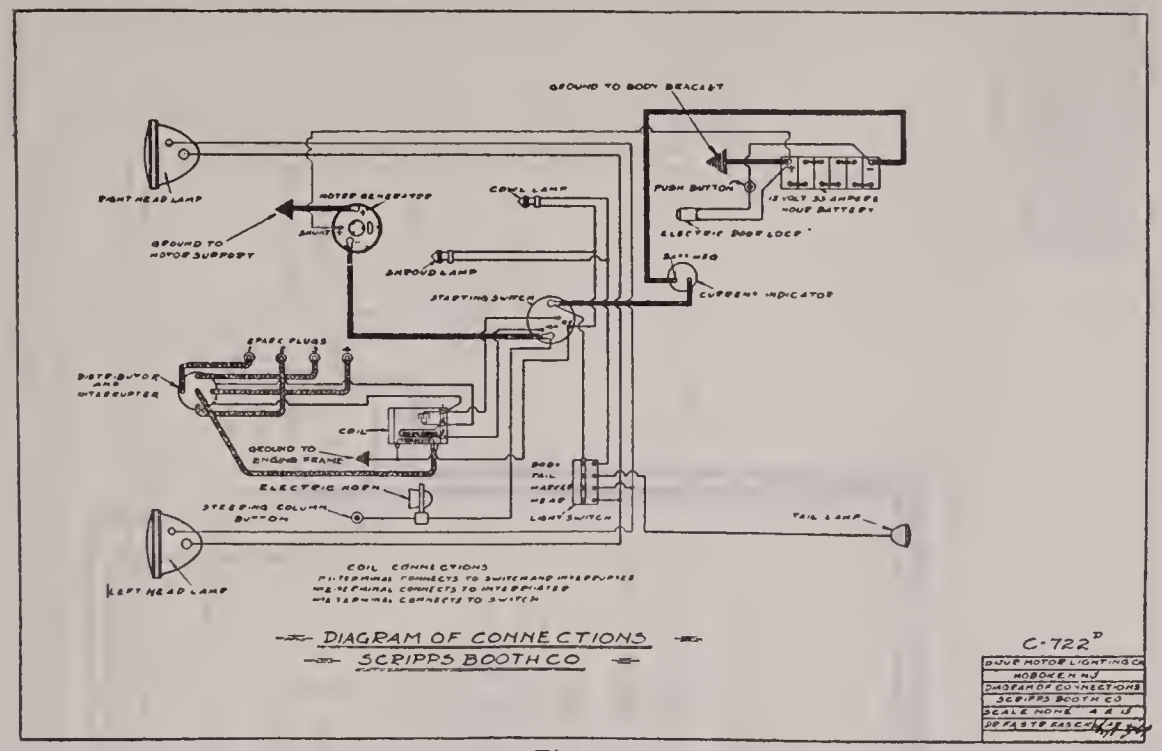


Figure 1

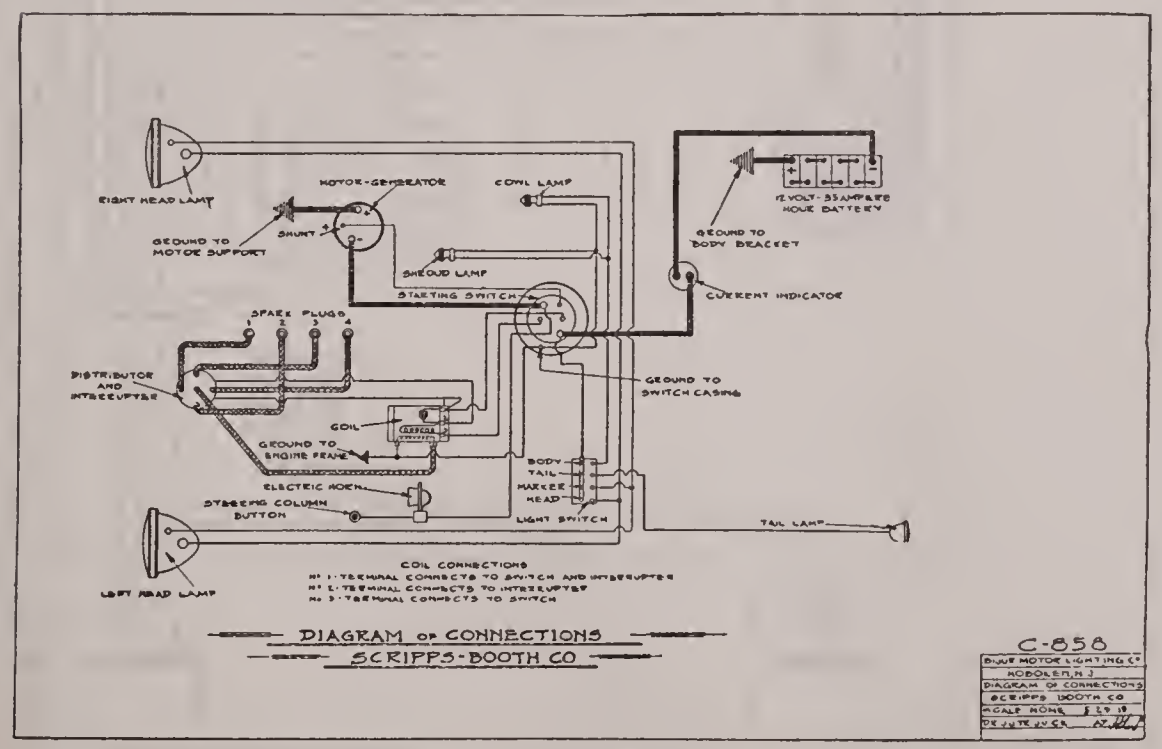


Figure 2

PLATE No. 10

Scripps-Booth

1916 AND 1917

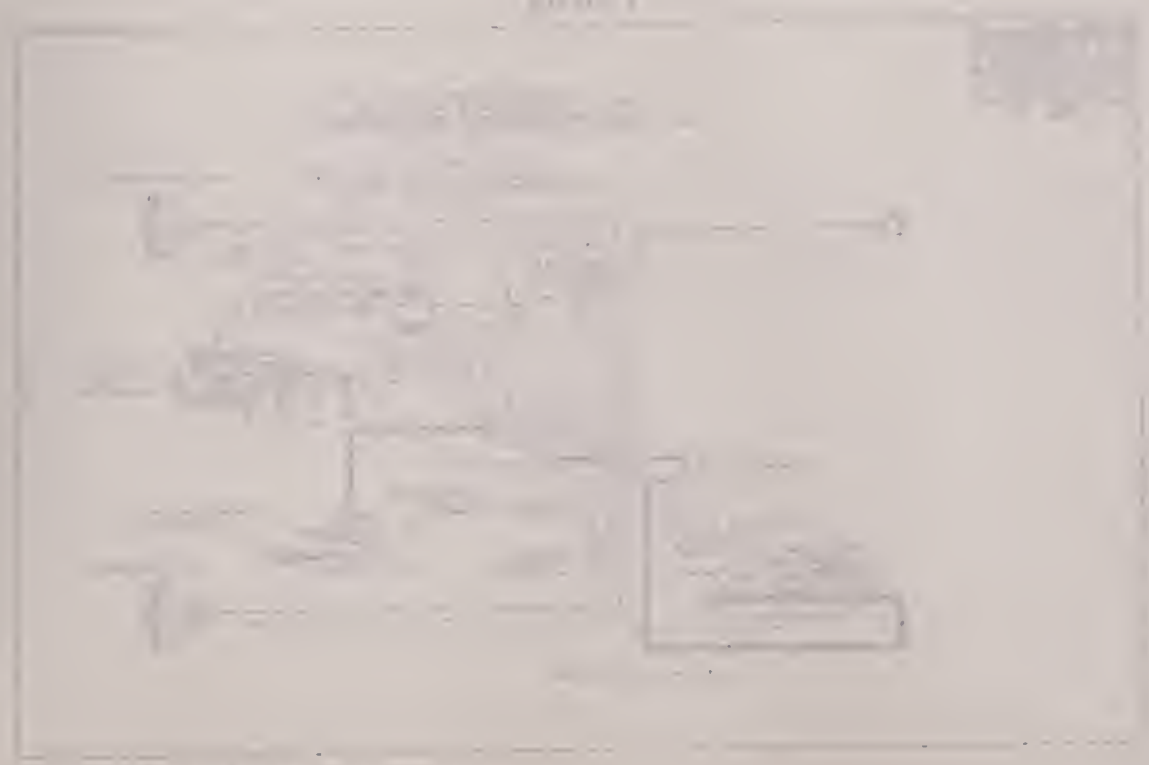
BIJUR SINGLE-UNIT STARTING AND LIGHTING SYSTEM. REMY IGNITION

Battery is 12 volt, 35 ampere-hour. The positive terminal is grounded.

Break should occur on the upper dead center, spark fully retarded. The firing order is 1, 3, 4, 2.

The motor-generator is chained to the crank shaft just in front of the flywheel. As there is no relay, the outfit possesses the non-stalling feature, the motor helping to propel the car at speeds of 6 miles per hour or under. At 10 miles per hour or over the generator should supply all of the current for the lights, ignition, and charge the battery. Voltage regulation is by third brush. Each car numbered between 1 and 1100, inclusive, is equipped with a two-position starting and ignition switch marked "On" and "Off." Wiring diagram is shown in Figure 1. With this arrangement the engine should not be used as a brake when coasting down hills, as it is apt to injure the motor-generator. Beginning with car No. 1101, each car is equipped with a three-position switch for controlling starting and ignition. With switch in "Off" position ignition is cut out and motor-generator is disconnected from battery and generator field is opened. With switch in the "On" position ignition is on and motor-generator is connected to battery and motor field circuit is completed. This is the normal operating position. Between these two positions is a position marked "Idle." With switch in this position ignition is on, but motor-generator is disconnected from battery and generator field is open. Switch should only be in "Idle" position with engine idling or when driving very slowly, as in congested traffic. With this system the engine may be used as a brake with switch in the "Off" position. Wiring diagram of this system is Figure 2. A current indicator is located on the cowl. When the battery neither gives nor receives current, indicator stands at "Floating." When charging current of battery exceeds 2 amperes the indicator swings over to "Charge." When the battery discharging current is over 2 amperes the indicator swings over to "Discharge." At car speeds of over 12 miles per hour and no lights burning, indicator should show "Charge," or with lights burning it should show "Charge" or "Floating." It should show "Floating" with no lights burning and engine idle. The four-gang lighting switch on the dash controls each lighting circuit separately. Oil motor-generator with two or three drops of thin neutral oil every 500 miles. In cold weather, only light oils should be used for gas motors, as heavy oils become stiff and make cranking difficult. Should the starter chain become loose enough to slap against the motor frame, it should be tightened by placing thin washers or shims between starter brackets and the bolts on the engine. Every few thousand miles the chain should be taken off, soaked thoroughly in kerosene and cleaned, after which it should be dipped in melted tallow to fill all the joints with lubricant, and the tallow on the outside will harden and prevent dust from entering the chain.

If motor fails to start gas motor when starting switch is moved to "On" position: First see if battery is in the proper state of charge. Next inspect wiring to see that all connections are tight and free from dirt. See that commutator is clean and that brushes make proper contact with it. (See Plate No. 9.) If lamp bulbs burn out frequently, examine all connections to see that they make good electrical contact. If car is to be run with battery disconnected, motor-generator wires must be disconnected at the machine.



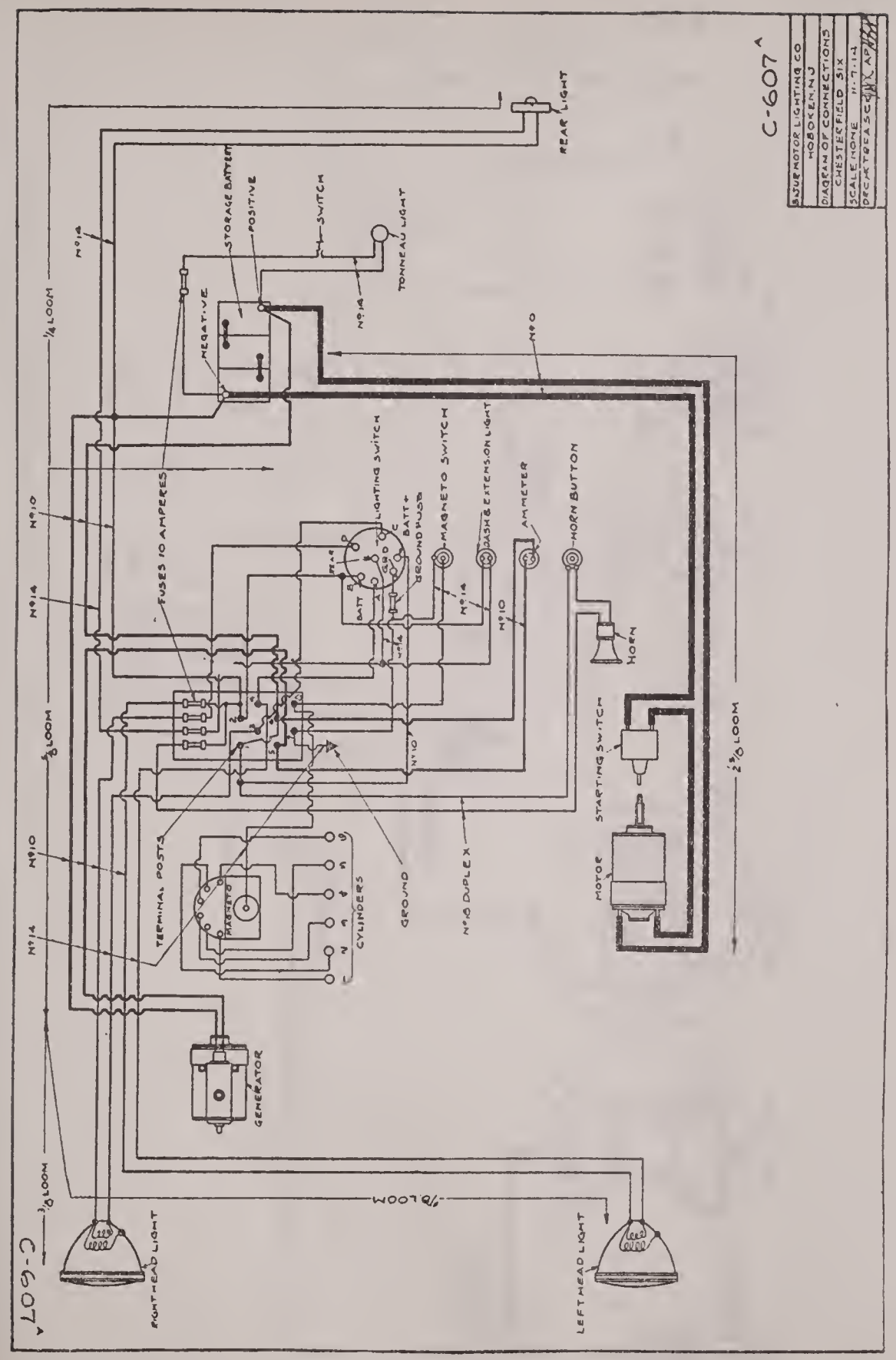


PLATE NO. 11

Nash 671

BIJUR TWO-UNIT, 6-VOLT, STARTING AND LIGHTING SYSTEM. DIXIE MAGNETO IGNITION

Battery is 6 volt, 80 ampere-hour. The positive terminal is grounded.

Break should occur when the mark 1-6 DC on the flywheel is just past indicator, spark fully retarded. The firing order is 1, 5, 3, 6, 2, 4.

Motor is connected to flywheel by a Bendix drive working in connection with a set of reduction gears. The starting switch is of the manual control type and direct, double contact.

Generator is driven by same shaft as magneto and water circulator. The regulator and relay are built into the generator and should not be adjusted except by authorized Bijur agents, as warranty ceases if repairs are attempted by any other parties. Due to the reversible characteristics of the generator, no care need be taken when connecting it to battery, as it will automatically assume the right polarity to charge the battery. There is a fuse in the small aluminum case at the top of the front end of the generator. In case the generator should be run with the battery disconnected the fuse will blow, thereby protecting the shunt field of the generator. Oil the two generator and three motor oilers with several drops of thin neutral oil every 500 miles.

The combination ignition and lighting switch is located on the cowl. When switch is in "Off" position, no lights burn. When it is in "On" position, large head, dash and tail lamps burn. When on "Dim" position, small head, dash and tail lights burn.

Lower fuse is in large head lamp circuit, and fuse above it is in small head lamp circuit. Upper left-hand fuse is in circuit with the horn, and the upper right-hand one is in the dash and rear lamp circuit. Ammeter is located on the cowl. On cars below serial number 87,686 the ammeter shows only the current the generator is supplying to battery and lights, and will not indicate the rate battery is discharging through lights. Above this number the meter indicates rate of charge or discharge.

If generator fails to charge the battery with car running at 10 miles per hour or over, it may be due to defective or loose connections, generator field fuse blown, oil or grease on commutator or brushes, dead battery, or inoperative generator. Loose connections in charging circuit will cause the field fuse to blow. Remove connections from generator terminals and place one of the large head lamp bulbs across the loose connections leading from battery. If light fails to light there are open circuits or very high resistance joints. Battery is discharged if lamp burns dimly. If lamp burns brightly and meter does not indicate to the left of zero, it is at fault and should be replaced. If none of the lights will operate, battery may be too low or have a cracked jar in one or more of the cells, thereby allowing the electrolyte to escape. This will also cause the generator fuse to blow. If battery and wiring is found to be in good order and fuse is not blown and is making good contact with the clips at both ends, see that brushes make good contact with commutator and that both are free from dirt and grease. A slight pressure applied to the top of the brushes with the fingers, while machine is running, will cause them to seat properly. Oil or grease on commutator will cause foreign matter to collect and short circuit the commutator. Failure of one lamp circuit to burn indicates a blown fuse, loose connections or poor contact in switch. Failure of all lights is due to discharged battery, cracked jar or loose connections between battery and switch. Running generator with battery disconnected will burn out lights unless fuse in field is removed.

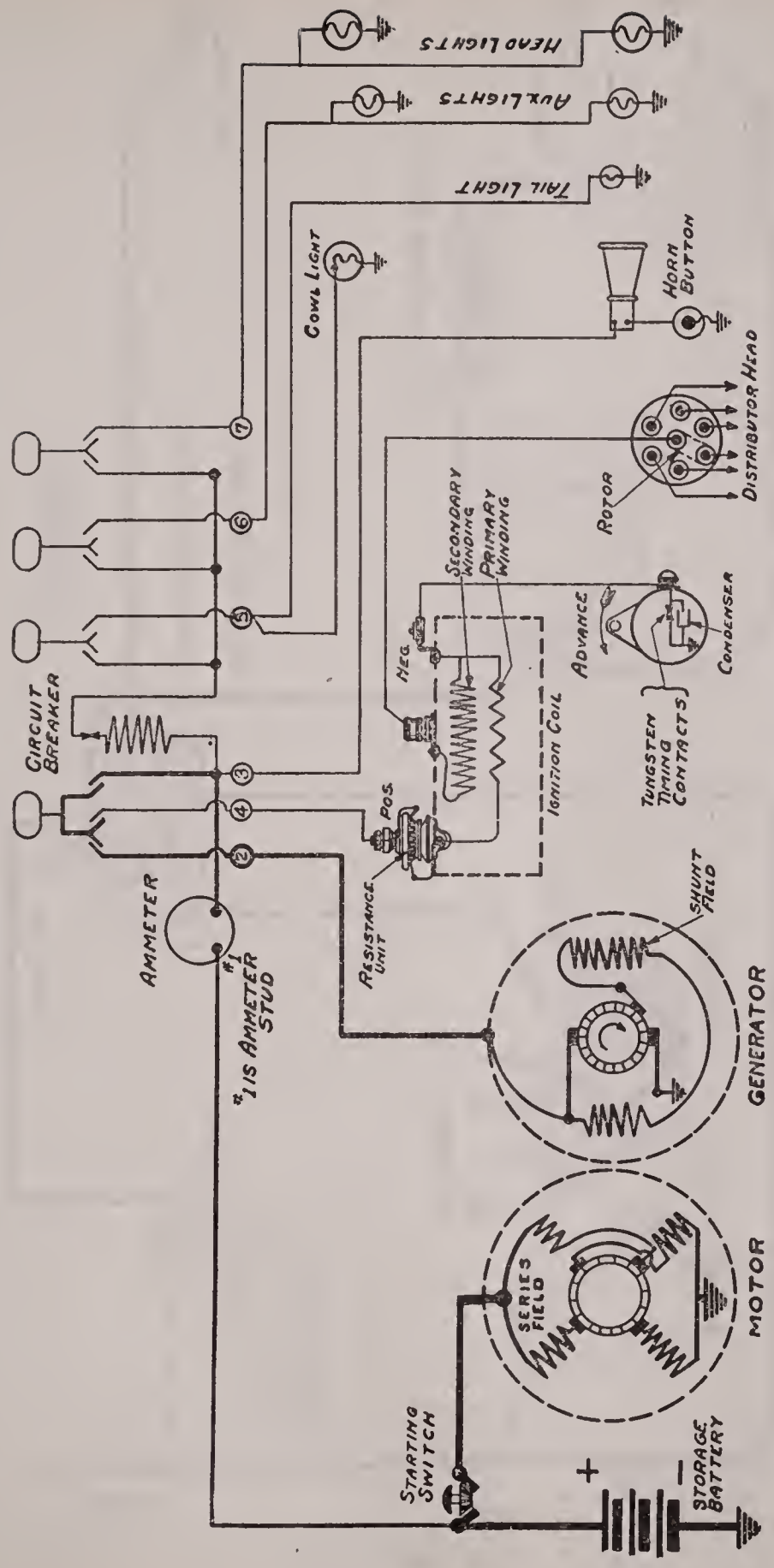


PLATE NO. 12

Nash 681

DELCO TWO-UNIT, 6-VOLT, STARTING AND LIGHTING SYSTEM. DELCO IGNITION

Battery is 6 volt, 80 ampere-hour.

The distributor is mounted on cylinder casting and is driven at one-half engine speed by spiral gears from the camshaft. Spark control is by both automatic and manual advancer. The breaker cam is secured to its shaft by an arrangement which permits it to be placed in any angular position. This is to facilitate timing of the spark. Condenser is enclosed in a moisture-proof metal case and is mounted in the distributor casting. The distributor is provided with two oilers. The upper one is to supply oil to the ball bearing, and should receive four or five drops of engine oil every two weeks. The lower one is to supply oil to the lower part of the vertical shaft. It is supplied with a wick, and should be filled with oil every two weeks. The rubber track inside the distributor should be lubricated a few times with a small amount of vaseline until the rotor button polishes it. The rotor button should be kept polished.

Center contact should always make good contact with the rotor. Due to wearing to a seat of fiber bumper, the contacts will require one or two adjustments during the first season. The contact points are of tungsten metal and will require no attention except to be properly adjusted. They should open .018 in. Spark gaps should be .030 in. Resistance unit is on top of coil.

TIMING: With spark at full retard, turn engine by hand until mark DC 1-6 on flywheel is at indicator, No. 1 piston just over compression stroke. Loosen timing adjustment screw in center of distributor shaft and place cam in position so that the contacts will open when distributor is rocked forward as far as slack in gears will allow and close when it is rocked back. Place distributor rotor in postion to be under No. 1 plug and tighten screw again. Firing order is 1, 5, 3, 6, 2, 4. The combination lighting and ignition switch is located on the cowl. Ammeter indicates rate battery is charging or discharging. On the back of the combination switch is located a circuit breaker. This is to take the place of the fuses. In case of an overload, as a ground, the circuit breaker will rapidly interrupt the current, thereby cutting down its effective value. It will continue to do this until the circuit is opened or the overload is removed. In diagram the numbers on the switch correspond with the numbers on instruments.

Negative of battery is grounded. Starting motor is connected to flywheel by Bendix gear. The commutator end of the motor has what is known as an oiless bearing. It requires no lubrication. The other two bearings on the motor are supplied with oilers. They should receive four or five drops of engine oil every two weeks. Motor is No. 126. Starting switch is No. 1966. Generator is No. 125. Generator is belt driven from a pulley on the crank shaft at about 1½ times engine speed. Voltage regulation is by third brush. Generator will charge battery at a car speed of 7 miles per hour. Charging rate increases until 18 to 25 miles per hour is reached. Above this speed the rate gradually decreases. There is no relay. To adjust the charging rate loosen the two screws on the movable arm holding the third brush. If it is desired to decrease the charging rate the arm should be shortened, and if increased, the arm must be lengthened. Each time the brush is moved it must be sanded in properly. After brush is adjusted be sure to tighten the two screws on the movable arm. Put a few drops of oil in the oilers at each end of the generator weekly.

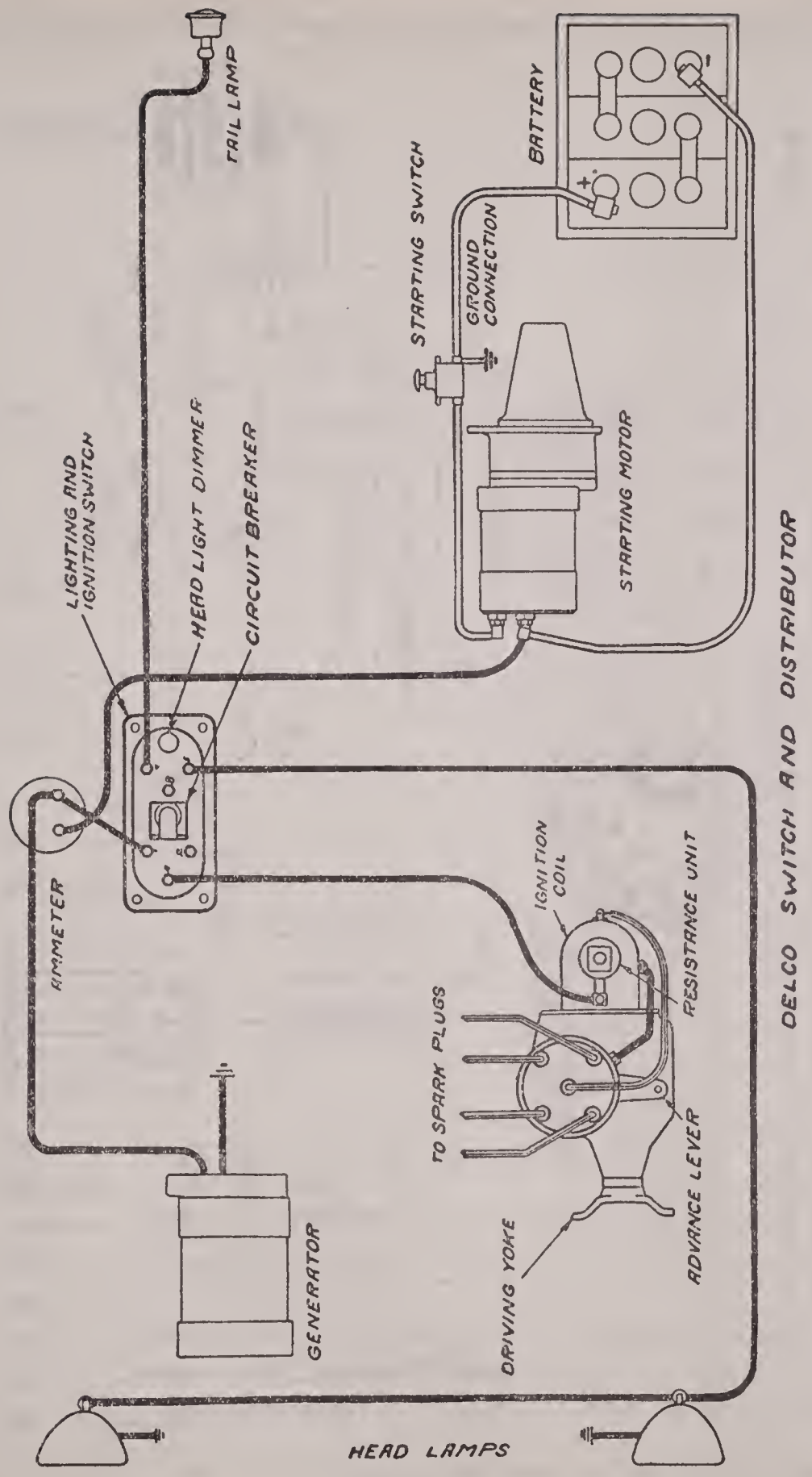


PLATE No. 13

Nash Trucks 2017 and 3017

BIJUR TWO-UNIT, 6-VOLT, STARTING AND LIGHTING SYSTEM. DELCO IGNITION

Battery is 6 volt, 80 ampere-hour. The positive terminal is grounded at the starting switch.

Contacts are of tungsten metal and open .018 inch. Spark plug gap is .030 inch. There is a resistance unit on top of coil. TIMING: Place spark lever one-third full advance. Turn engine until No. 1 cylinder is on upper dead center, firing stroke. Loosen timing adjustment screw in center of vertical shaft and turn cam so that the breaker contacts will open when distributor is rocked forward as far as slack in gears will permit and close when it is rocked back. Tighten the adjustment screw and place rotor so that it will make connection with No. 1 cylinder plug. Firing order is 1, 3, 4, 2.

Positive of battery is grounded. Delco distributor No. 5164 is used for ignition purposes. Automatic and manual spark control is provided. Automatic control is under breaker and needs no adjustment. Manual control is to retard spark for starting, idling and carburetor adjustment. At least once a season the ignition coil, which is fastened to the rear of the breaker unit, must be removed and the spiral gears packed with soft cup grease. The oil cup at the bottom of the breaker head is to provide lubrication for the vertical shaft bearings. The oiler on the side of distributor head is to lubricate the driving shaft bearing. Both should receive four or five drops of engine oil every 1,000 miles. The distributor head should be wiped clean and a very small amount of vaseline applied to the track to prevent the rotor button wearing it. After rotor button and distribuor head become thoroughly polished it will only be necessary to keep it clean.

Motor is bolted to rear end of crank case. It is connected to flywheel by means of a Bendix drive operating with a set of reduction gears. Starting switch is bolted to dash. It is direct contact, manual control. Should engine fail to start the instant switch is released, do not again depress the starter button until engine has completely stopped.

Generator is driven by helical gears from the cam shaft. Due to its reversible characteristics, no care need be taken as to which terminal is connected to positive of battery, as the generator will automatically assume the proper polarity to charge the battery. Vibrating voltage regulator and relay are built into the generator, and no change in them by other than Bijur representatives should be made, as warranty ceases if repairs are attempted by unauthorized parties. Relay cuts in at 8 to 10 miles per hour.

Ammeter is in circuit between generator and battery. It only indicates charging rate, as lighting circuit does not pass through it. A fuse is in the small aluminum case in front of the generator. In case generator is run with battery disconnected this fuse will blow and open the shunt field circuit.

Oil generator and motor oilers with two or three drops of thin neutral oil every 500 miles. Oil or grease on the commutators will collect dust and other foreign matter, thus short circuiting and scoring the commutator bars and putting the machine out of operation. Never lubricate the commutators. If greasy or dirty, wash them and the brushes in gasoline, and if necessary undercut the mica. For motor troubles see Plate No. 9. There is a circuit breaker located back of the combination switch to take the place of the fuses.

For further generator troubles see Plate No. 11.

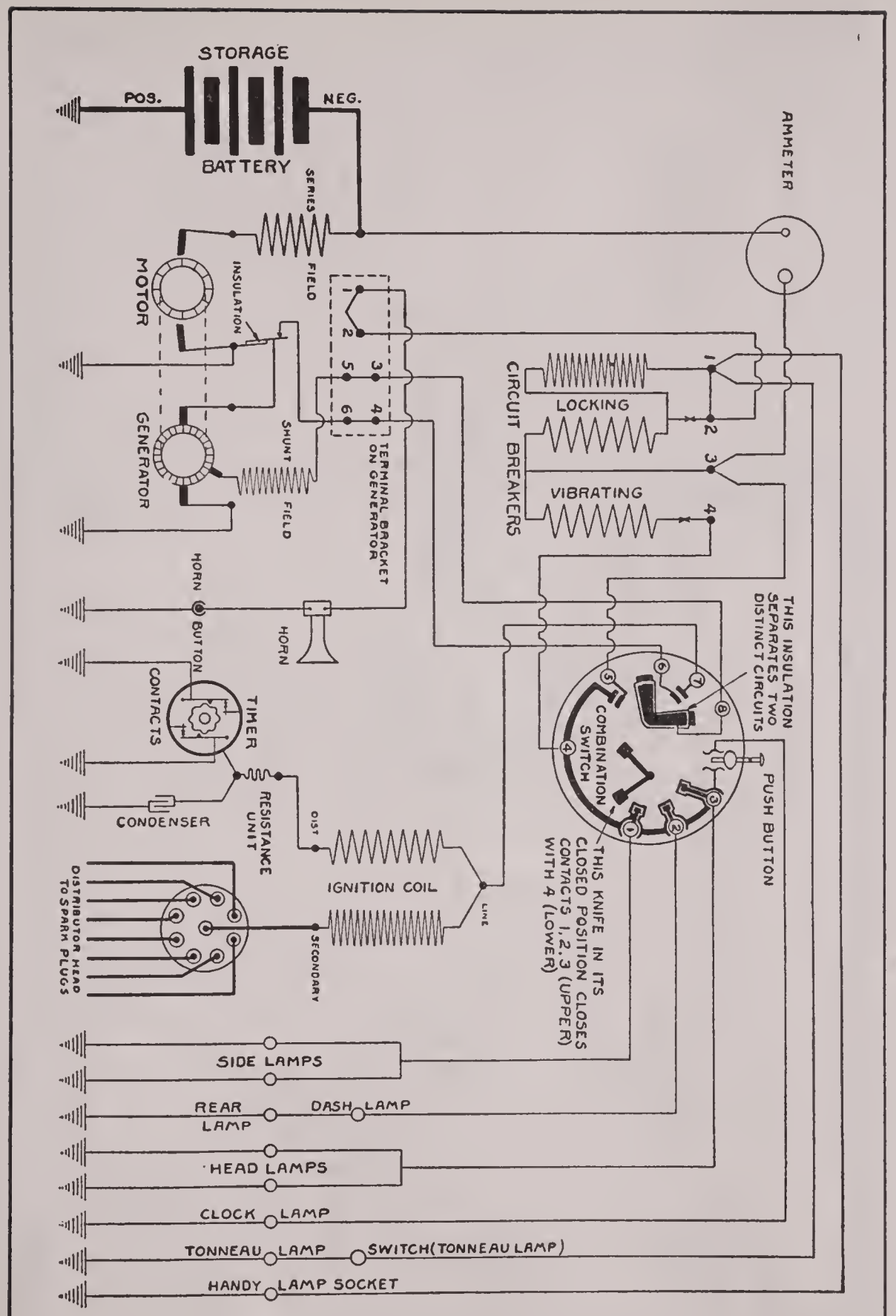


PLATE NO. 14

Cadillac 8

(1916-17-18)

DELCO 6-VOLT, DOUBLE-UNIT STARTING AND LIGHTING SYSTEM
DELCO IGNITION

Battery is 6 volt, 120 ampere-hour. The positive terminal is grounded.

Distributor is driven by spiral gears from fan shaft. There are two breaker arms, operating together. Cam has eight lobes. There is both automatic and manual spark control. High tension terminal from ignition coil goes to center terminal of distributor. Adjust contacts to .020 in. Do not use file or sandpaper on contacts. Remove, and smooth on oil stone.

TIMING: With spark fully retarded, break should occur when mark 1 G A is directly under indicator, No. 1 piston of left-hand block entering power stroke. Be sure to use the right mark, as there are four of the same kind on the flywheel. To adjust breaker cam, remove distributor head and loosen lock screws just enough to allow cam to be turned by hand, and turn it so that it just opens contacts when the center mark for No. 1L cylinder is under indicator. Tighten lock nut and replace rotor brush so that it will be under No. 1 plug. Firing order is 1L, 2R, 3L, 1R, 4L, 3R, 2L, 4R. Spark plug gap is 0.28 in.

Circuit breakers take the place of fuses. Those in the horn, handy lamp and body light are of the lock-out type. Others are of the vibrating type.

Motor generator has two commutators. When ignition switch is closed the battery pressure is put on the generator, running it slowly as a motor. There is a ratchet clutch on the generator end to allow the armature to rotate without turning the driving shaft. When the operator steps on the starting switch the gears are meshed and after gears are entirely meshed full battery pressure is applied to motor, cranking engine. There is an overrunning clutch to prevent engine running motor. Motor is connected to engine by non-automatic mechanical shift. Voltage regulation is by third brush. Generator is driven at engine speed from fan shaft, which in turn is driven by silent chain from cam shaft.

With no lights burning, generator should start to charge battery at 4 to 6 miles per hour on high gear. Ammeter indicates rate of charge or discharge. Ignition should take 2 to 3 amperes. Maximum charging rate with no lights burning should not exceed 15 amperes. Current increases to maximum at an engine speed of between 950 and 1200 R. P. M. and then gradually decreases.

Do not oil the commutators under any circumstances. Every 500 miles inject Cadillac rear axle and transmission lubricant in elbow oiler at rear of starter shaft with grease gun. Oil fan bearing with a few drops of engine oil. Every 1,000 miles oil motor generator bearing oil cup with a few drops of engine oil. Every 2,000 miles remove the breather on the ignition unit and pack the gears with soft cup grease.

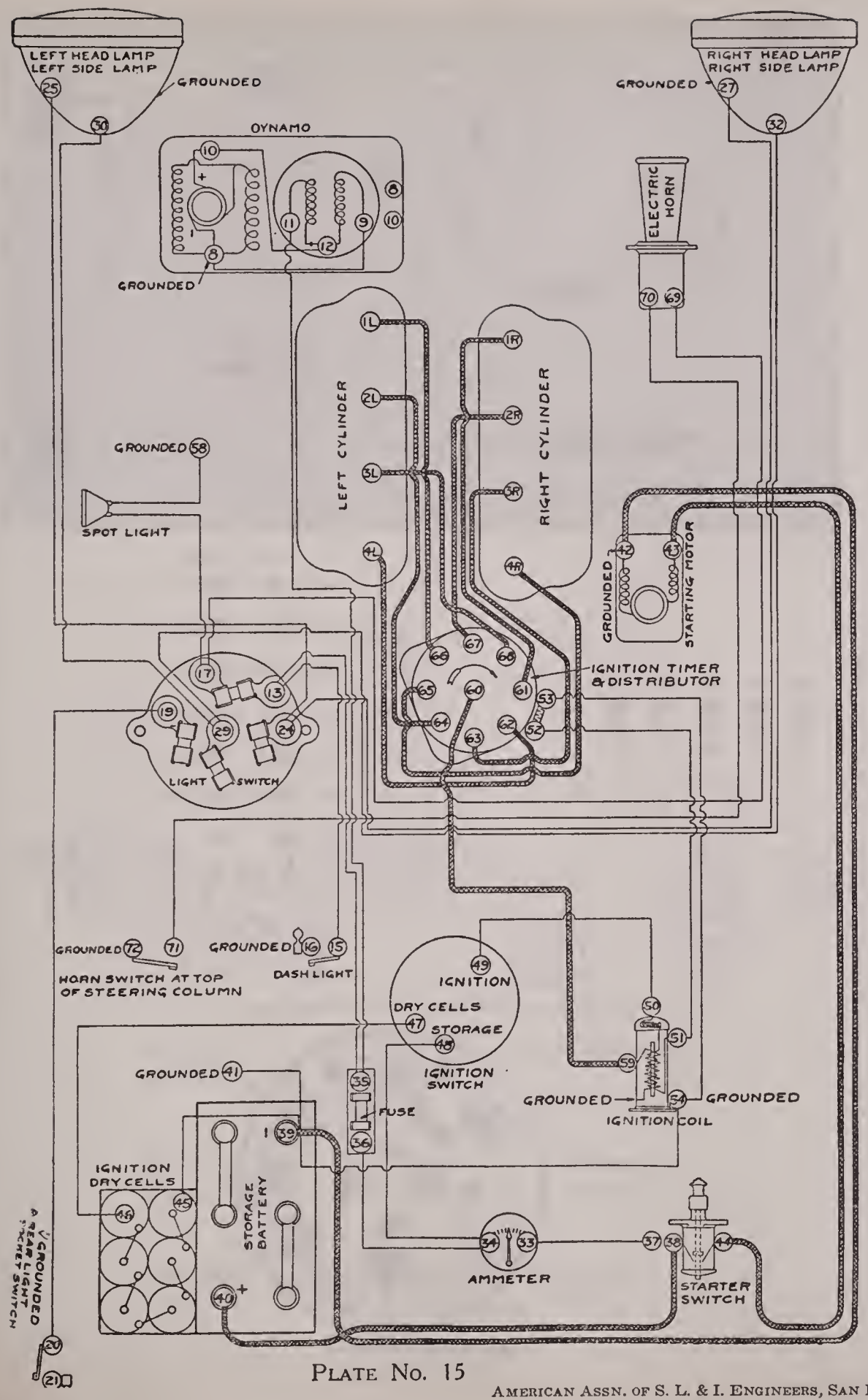


PLATE No. 15

Peerless 8

AUTO-LITE TWO-UNIT STARTING AND LIGHTING SYSTEM
ATWATER-KENT IGNITION

Battery is 6 volt, 125 ampere-hour. The negative terminal is grounded. There is an emergency battery of six dry cells.

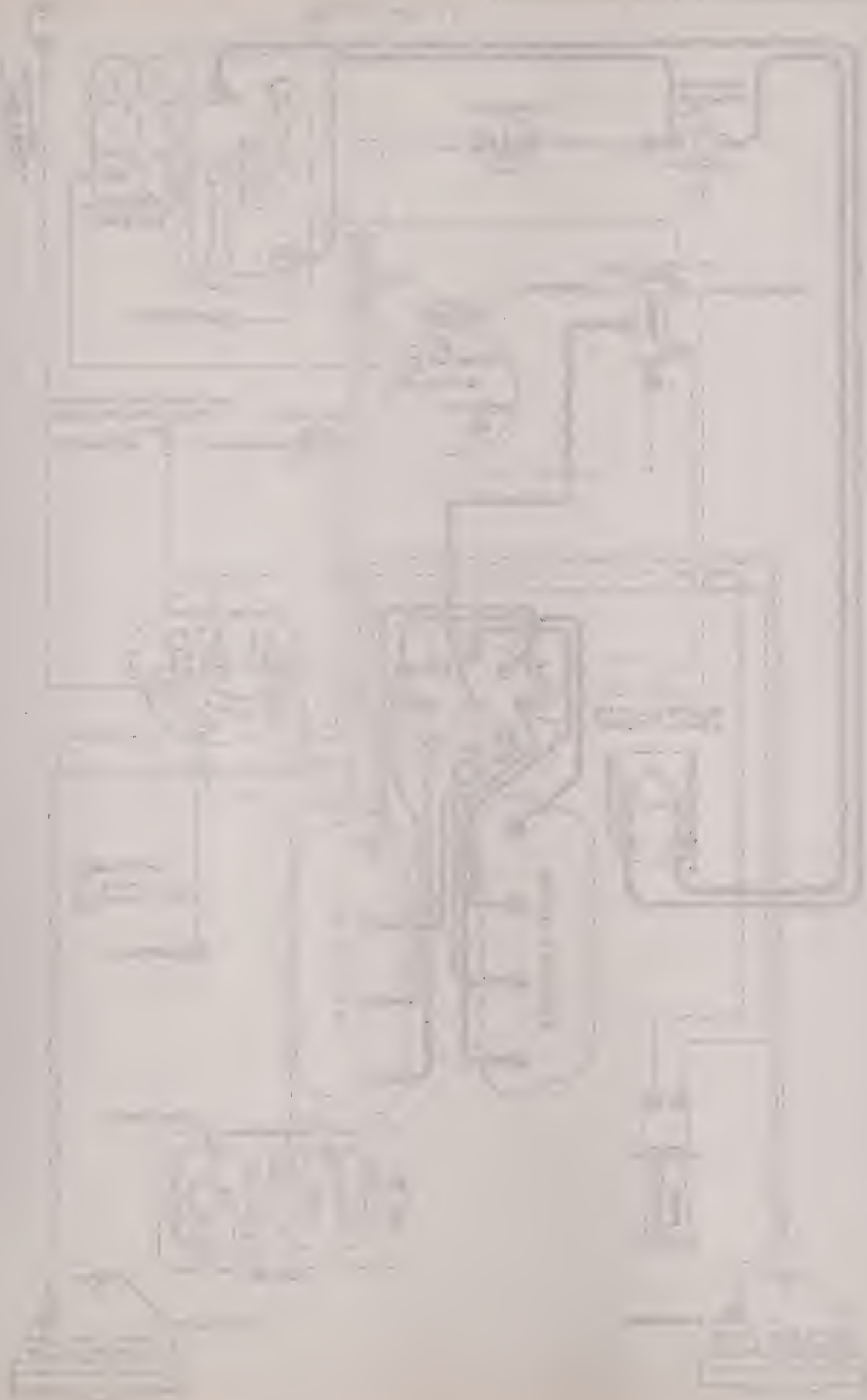
To inspect and adjust breaker take off cover, leaving wires on. Remove the unit by a slight upward pull and take to a convenient place to work. To inspect contacts remove screw holding it in and remove the piece from dowel pin. Contacts should open .004 in. to .006 in. In replacing unit to motor, rotate cam shaft until tongue and groove on drive shaft match. After distributor base is in place, oil hole until it overflows, from small hole at back. The position of the distributor is fixed by pinning driving gear to vertical shaft, hence in taking down motor care should be taken to mark timing gears so that they may be placed back in same position; in which case the distributor gears may also be placed in same position and no change in timing will be necessary. Timer is located to break on dead center, compression stroke, with control lever in middle of quadrant. There is also an automatic spark control. Firing order is 1L, 2R, 3L, 1R, 4L, 3R, 2L, 4R.

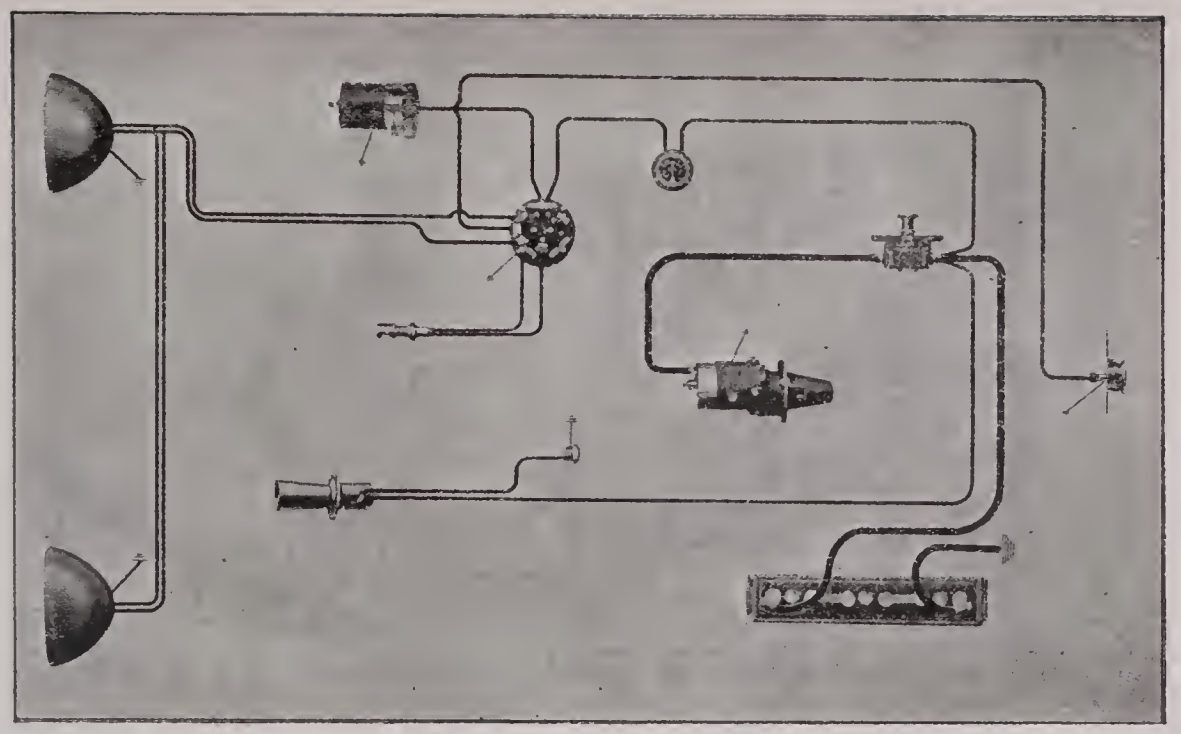
CAUTION: Do not use screwdriver to try contacts, as it will form a short circuit and take temper out of the spring. Every 800 miles remove cover and put a few drops of oil in the hole exposed. Every 1,000 miles other wearing parts of breaker should be lubricated by a small drop of oil applied with a toothpick. Spark gap should be about .020 in.

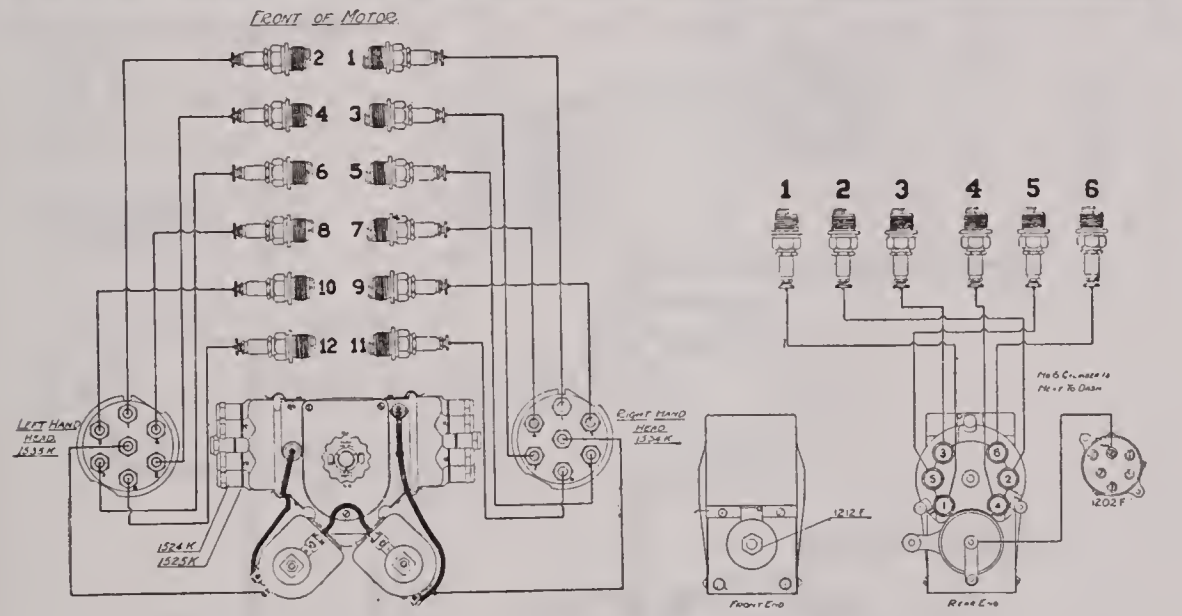
Starter is connected to flywheel by a Bendix gear.

Voltage regulation is by third brush. With no lights burning the generator should charge the battery at a rate of 8 to 13 amperes, with engine running at a high gear car speed of 10 miles per hour. Ammeter indicates rate of charge or discharge. With car running below 10 miles per hour, ammeter should not show a discharge of over 8 amperes. In case the generator fuse, which is located on the dash, is blown, care should be taken to run the engine at only low speeds if lamps are burning, as the excessive voltage may burn out the lamps. Ball bearings of generator are packed with cup grease, but should be oiled every 500 miles, making sure passages are not plugged up, cleaning them with a wire if necessary. Oil starting motor every 1,000 miles. Oil horn motor every 4,000 miles. Oil ignition timer shaft every 500 miles. Between storage battery positive terminal and generator there is a common positive lead to which No. 12, 11, 35, 36, 34, 32, 37, 38 terminals are connected.

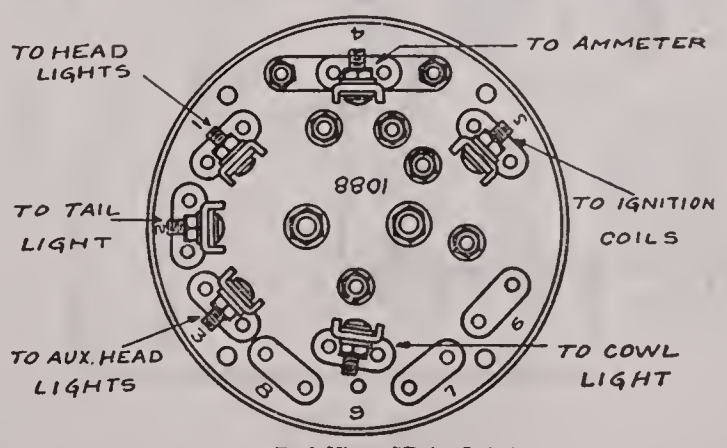
Large head lights are 6-8 volt, 15 cp. Dimmer lights are 6-8 volt, 4 cp. Dash and tail lights are 6-8 volt, 2 cp.







Ignition Wiring Diagrams of Highway Six and Highway Twelve



Back View of Delco Switch

PLATE No. 16

National

WESTINGHOUSE OR BIJUR STARTING AND LIGHTING SYSTEM. DELCO OR DIXIE MAGNETO IGNITION

Series AF—Six cylinder, 3½ in. x 5¼ in. motor. Car No. 2001 to .....
Series AK—Twelve cylinder, 2⅞ in. x 4¾ in. motor. Car No. 25001 to .....

The battery on the Six is 6-volt, 95-ampere-hour. On the Twelve the battery is 6-volt, 100-ampere-hour. The positive terminal is grounded.

Dixie type 60 magneto is used for ignition on the six cylinder and Delco on the twelve cylinder. Westinghouse starting and lighting is used on the six, and Bijur on the twelve.

Whenever distributor head on the six is removed, be careful not to break the edges from the carbon brushes when replacing it. If magneto fails to spark, see if there is a streak of powdered carbon from one contact to the other. If so, clean with gasoline. Contacts should open 1/64 in.; spark plug gap, .025 in. Firing order is 1, 5, 3, 6, 2, 4.

The twelve uses Delco distributor No. 5162 and two ignition coils No. 2152. Combination switch is No. 1088. There are two sets of contacts operated by two cams. There is both automatic and manual advance employed. There are two oil holes on head, which are exposed by turning oil cover. Oil with five or six drops of oil every two weeks. During first season apply a very small amount of vaseline to distributor tracks until button is polished, after which only care needed will be to keep clean.

TIMING: With spark at one-third advance, turn engine until R 1 cylinder is on upper dead center, power stroke. Remove top cover of distributor and loosen screw that holds gear on horizontal shaft. Turn shaft so that with right rotor under No. 1 plug the contacts just open when shaft is rocked forward and close when rocked back as far as slack in gears will allow. The timing adjustment screws should be carefully locked in this position. When one set of contacts is properly adjusted the other is also.

When replacing distributor head be sure that the rotor button springs are in place to allow button to be completely depressed, otherwise excessive wear will result. The plunger in the center of distributor head should have a free movement. Distributor heads should be locked in place and turned so that the locating tongues in the hold-down clips are in the notch provided for them. Contacts should open .018 in. There are two contacts in parallel, operated by each cam. The two contacts operated by one cam should open at exactly the same time. Spark gap is .030 in. Correct connection of distributor to cylinders is shown in diagram.

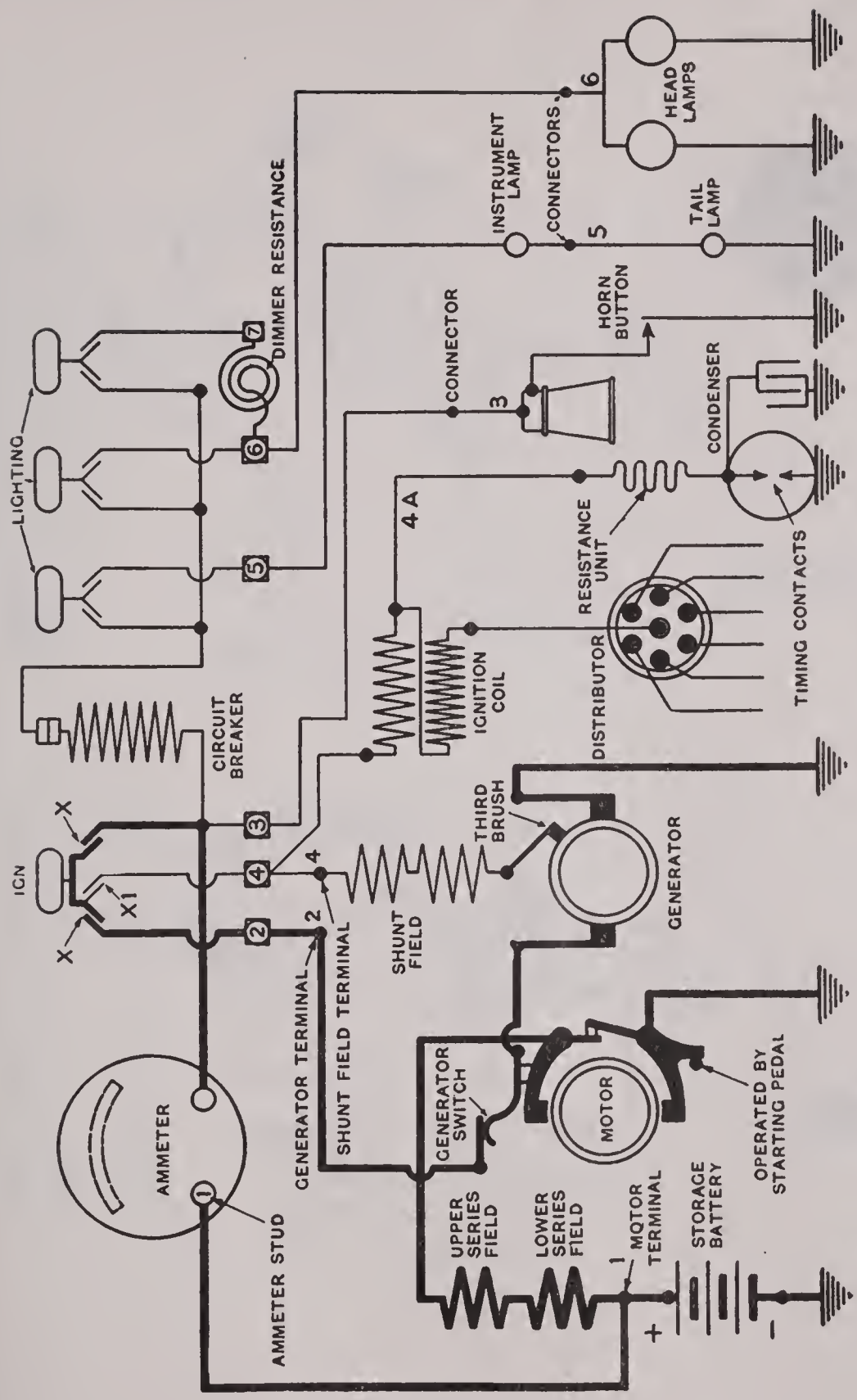
Generator should charge battery at an 11-ampere rate with car running 15 miles per hour and no light burning.

The generator on the twelve runs at 1½ times engine speed. Relay should close at 12 and open at 10 miles per hour. There is a fuse to protect shunt field on front end of generator. Voltage regulation is by third brush.

On both the six and twelve, motor is connected to engine by Bendix gear.

Voltage regulation on the Westinghouse generator used on the six is by third brush. Third brush must be tapered, taking off about 1/3 at end where contact is made with commutator. Relay closes at generator voltage of 6.3 to 6.7, or at a car speed of 10 miles per hour. The main brushes are given a lead.

Every month clean commutator on horn motor and lubricate with small amount of vaseline. Oil oiler with one drop of engine oil.



Circuit Diagram

PLATE NO. 17

Hudson Super Six

DELCO STARTING AND LIGHTING SYSTEM. DELCO IGNITION

Battery is 6 volt, 100 ampere-hour. The negative terminal is grounded.

Ignition is by Delco vertical distributor #5134. Ignition coil is #2127. Combination switch #1017 is used. Firing order is 1, 5, 3, 6, 2, 4. Break should occur when upper dead center mark is just past indicator.

The motor-generator has two separate field windings, one for use when operating as a motor and one for use when operating as a generator. The motor brushes are raised to open motor circuit. They are allowed to come in contact with commutator when starting pedal is depressed. The raising and lowering of the brushes serves as the switch. Motor is connected to the engine by an over-running clutch and non-automatic mechanical shift.

Generator runs slowly as a motor, to facilitate meshing of gears, before motor current is turned on. Just before motor current is turned on generator circuit is opened. Voltage regulation is by third brush. The motor commutator gives but little trouble, but generator commutator must be cleaned quite often, as it is fitted with carbon brushes. Do not run generator with battery disconnected. See that bolts holding generator to base are tight.

At an engine speed equal to a high-gear car speed of 9 miles per hour the battery should charge at 5 amperes and gradually increase to a maximum of about 17 amperes at 24 miles per hour, after which it will gradually decrease to 11 amperes at 42 miles per hour. When engine runs less than 300 R. P. M. the generator will run as a motor, so an over-running clutch is provided which will allow the generator to run free, as it requires very little current when so running. In this way no relay is required. The generator will use 3 or 4 amperes when running this way. To test condenser for short circuit use the 110 or 220 volt circuit in series with a lamp. If no short circuit is indicated when condenser is cold, heat it up to 180° F. and test again. Spark plug gap is .025 in. There is a vibrating circuit breaker to take the place of the fuses. Dash and tail lamps are in series.

Dort

Models 6, 9, 9S, 9T, 19

Westinghouse Two-Unit, 6 Volt, Starting and Lighting System. Connecticut Ignition.

Battery is 6 volt, 80 ampere-hour capacity. The positive terminal of battery is grounded.

Connecticut ignition is used. Contacts should need no adjustment under 10,000 miles. Contacts should open .025 in. to .027 in. Contacts do not need filing, even though they become roughened. If they become irregular enough to cause misfiring they should be replaced. Every 1,000 miles remove the timer cover and put three or four drops of oil around timer shaft. Break should occur with No. 1 piston on upper dead center and spark lever advanced about one inch. Firing order is 1, 3, 4, 2. Ignition coil has a safety gap. There is an automatic device in the combination switch which turns the ignition off if it is accidently left on with engine idle. Spark gap should be .025 in. Plugs are 7/8 in. 18 S. A. E. standard type.

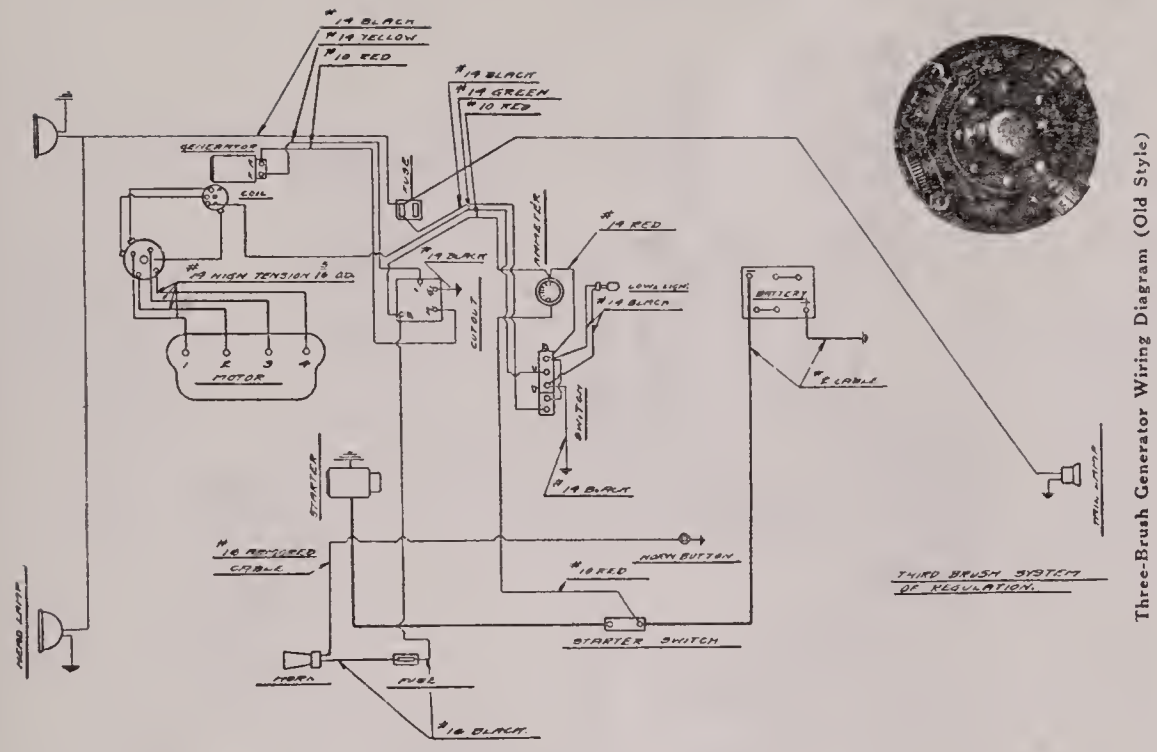
There have been three types of generators used, namely: The two-brush, which required separate voltage regulator, and two models of third brush voltage control generator.

The two-brush generator is carried at the right front side of engine. It is driven from the cam shaft by helical gears running in oil. Relay on this type cuts in at 8 or 9 miles per hour, and generator attains a maximum output at 15 to 18 miles per hour, after which it remains practically constant. Voltage regulation is by vibrating regulator, into which is built the relay.

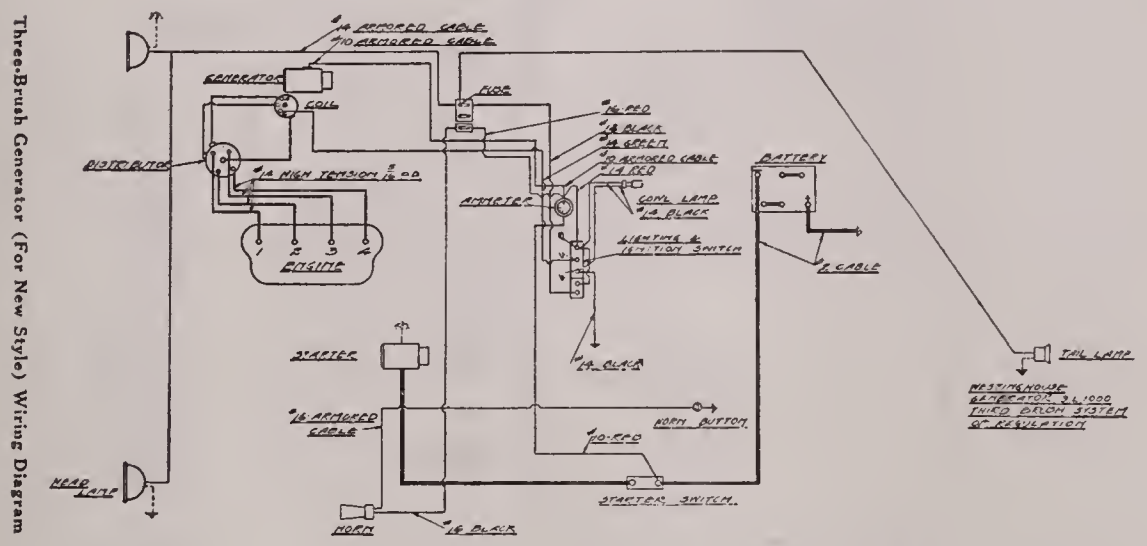
The relay in the third-brush systems closes at 8 to 10 miles per hour. The output increases to a maximum of 12 to 14 amperes at 15 to 18 miles per hour, after which it gradually decreases as speed increases. Field fuses on old style (400 frame) three-brush generators are 5 ampere. Put three or four drops of oil in the oiler on generator every two weeks or 300 miles. Care should be taken in filling timing gear case with oil not to exceed level which is maintained by pet cock on left-hand front side of timing gear case. Brush tension springs should have about 1/2 in. compression.

Starting motor is connected to engine by Bendix gear. Put three or four drops good machine oil in oilers about once a month.

The fuses for both lighting and horn circuits are 10-ampere enclosed fuses.

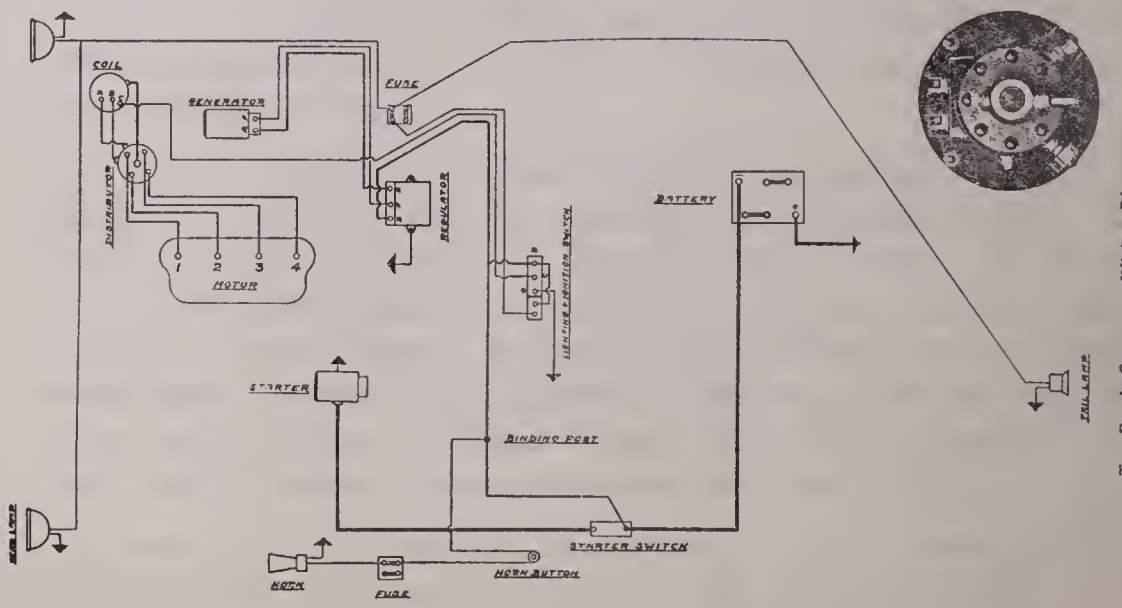


Three-Brush Generator Wiring Diagram (Old Style)

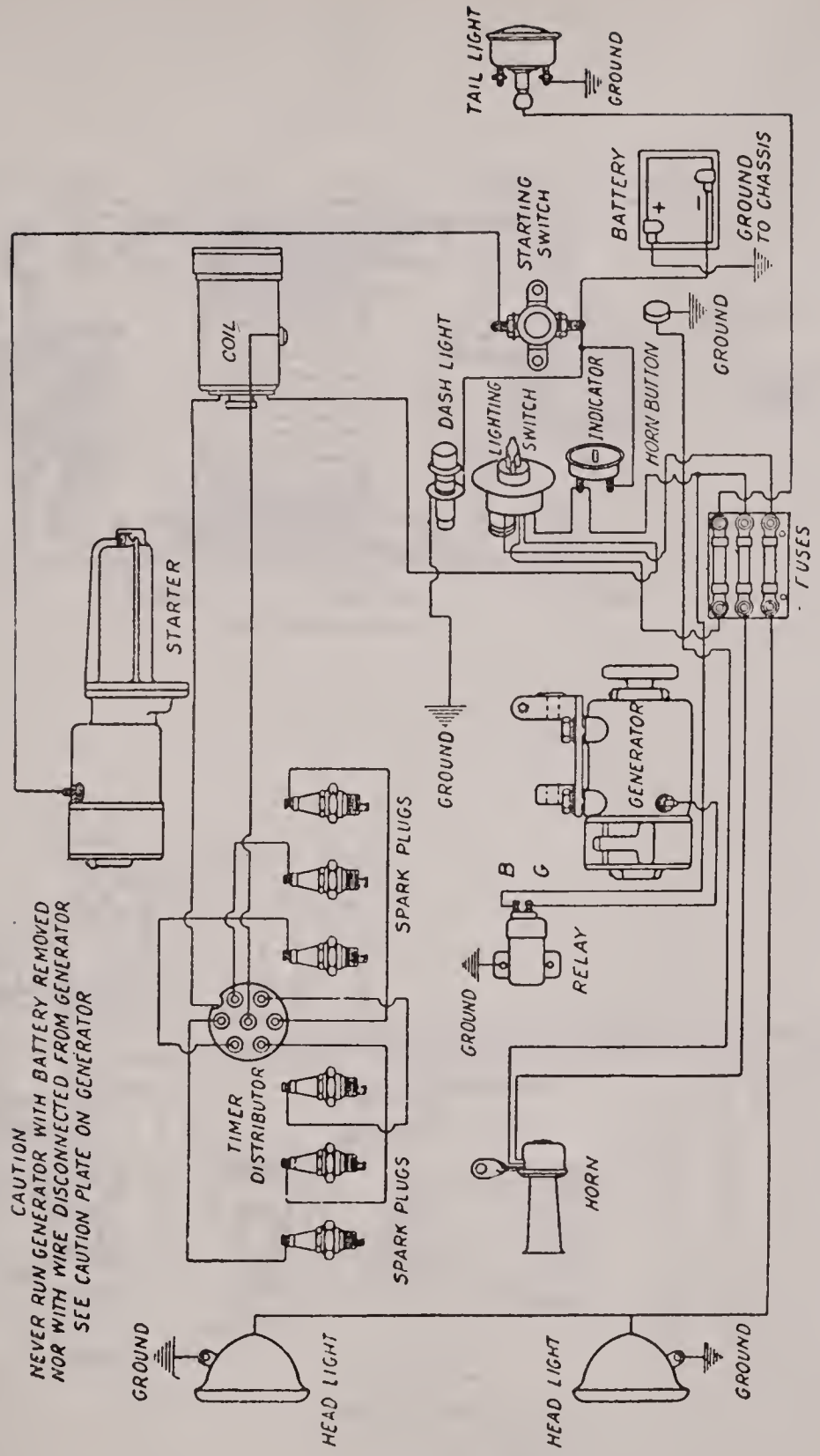


Three-Brush Generator (For New Style) Wiring Diagram

PLATE No. 18



Two-Brush Generator Wiring Diagram



Wiring Diagram

PLATE NO. 19

Saxon Six

MODELS S-3-T, S-4-T, S-4-R, S-4-S

WAGNER TWO-UNIT STARTING AND LIGHTING SYSTEM. REMY IGNITION

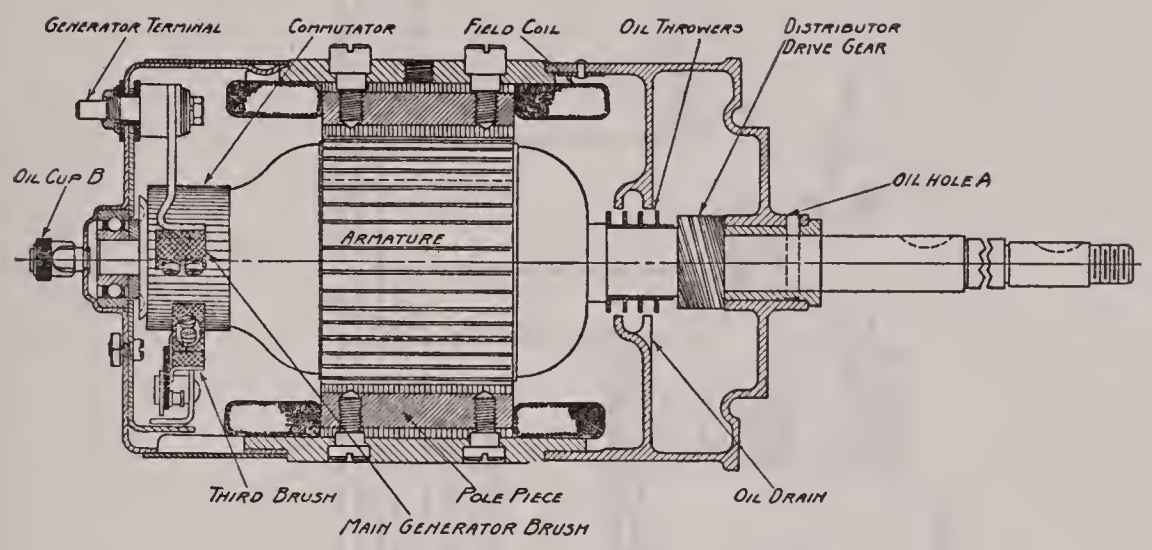
Battery is 6 volt, 80 ampere-hour. Positive terminal of battery is grounded. Contacts should open 1/32 in. Surface with file. Break should occur when mark DC on flywheel is one inch past indicator, spark fully retarded. Firing order is 1, 5, 3, 6, 2, 4. Spark gap is .025 in., or approximately the thickness of a smooth dime. Safety gap should be 3/8 in. Keep grease cup under distributor head filled with soft cup grease and tighten several turns each 500 miles. For opens in coil windings test primary with 110 volts in series with lamp. Test secondary with 220 volts straight. Every 1,500 miles put a small amount of vaseline on cam.

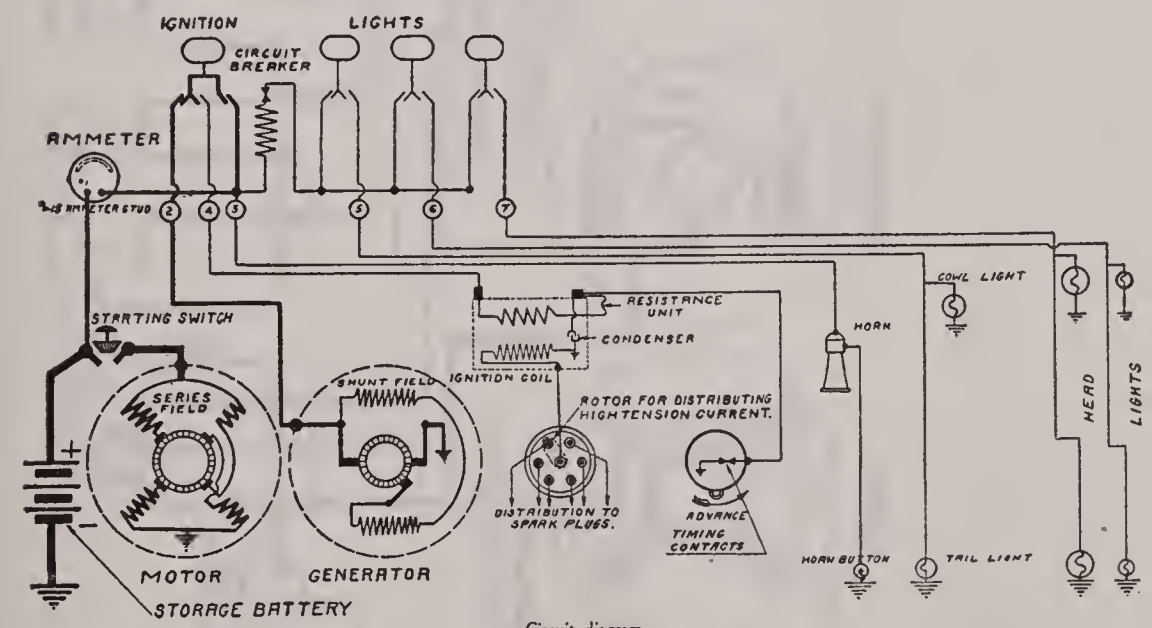
Starter connected to flywheel by Bendix drive and reduction gears. There is a plug where gear housing joins frame. Use grease gun to fill. Keep well filled. "Gredag" is the grease recommended by the manufacturers. Lubricate the bearings at each end of starter well with oil every two weeks. If starter fails, first test battery and wiring. If both are all right, try to crank by hand. If engine will not start then look for ignition, gasoline or carburetor trouble. There may be a stiff bearing if engine turns hard. Bridge starting switch to determine if it makes contact. Keep commutator clean. No lubricant. If starter continues to revolve after switch is released, inspect switch to see if it is sticking. Ordinary moisture will not affect starter or generator, but if it should in any way become thoroughly soaked, as in fording a stream, it should not be used until it has been removed from car and baked in an oven for 24 hours at a temperature of 212° F. Failure to start may be caused by a short circuit in the field or armature.

Generator is chain driven. Voltage regulation by third brush. Third brush is sealed, and guaranty ceases if seal is broken. Relay should close at 10 and open at from 6 to 8 miles per hour.

TESTS FOR SHORT CIRCUITS AND GROUNDS. First ascertain that battery has voltage. Disconnect wires from generator and starter and one terminal of battery. Connect this wire to an ammeter reading at least 0-25 amperes and have a free lead from other ammeter terminal. Open all switches and touch the ammeter lead to terminal of battery. Any current indicates a ground lead to battery. Reconnect generator and touch lead to battery. A circuit very likely indicates that the relay contacts are stuck. Disconnect generator and remove all lamps. Connect meter and turn on switches one at a time. A current in any one indicates a short circuit in that particular circuit.

The indicator on the dash shows whether battery is charging, discharging or off. Focus of head lamps is adjustable by the small machine screw at back of shell.





Circuit diagram.

PLATE No. 20

Stephens Model 70 and 75

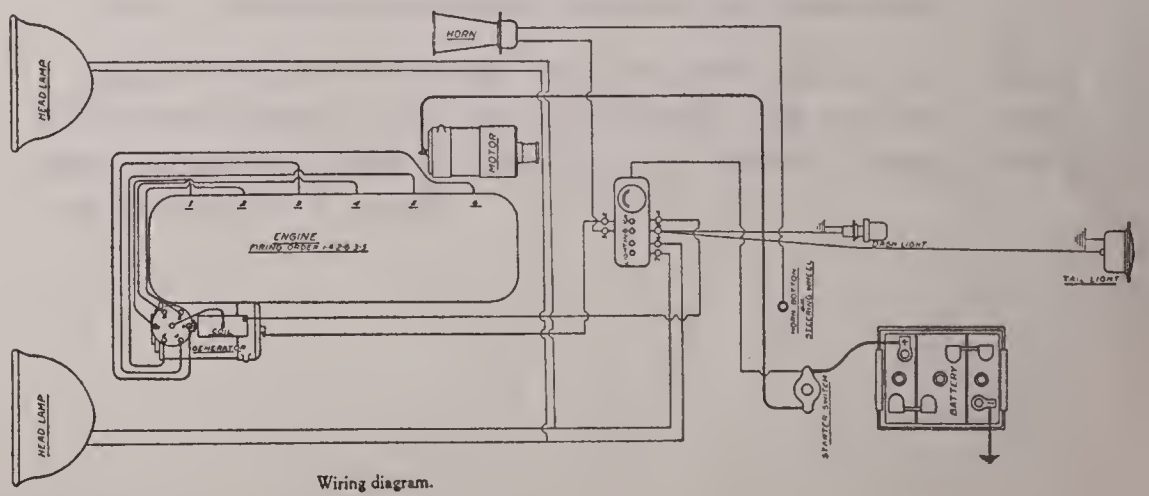
DELCO TWO-UNIT STARTING AND LIGHTING SYSTEM. DELCO IGNITION

Battery is 6 volt, 100 ampere-hour.

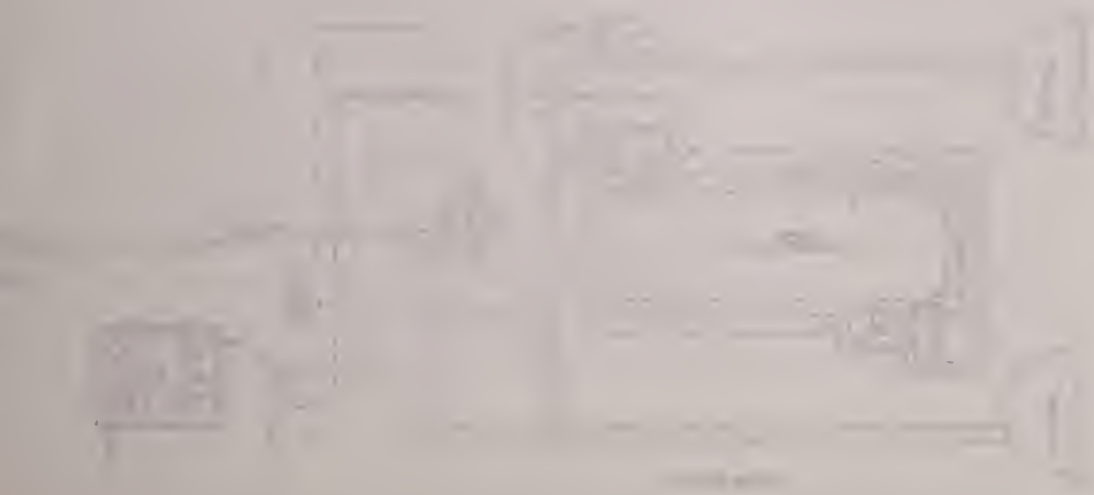
Break should occur when piston is on upper dead center, just entering on power stroke, spark one-third advanced. Firing order is 1, 4, 2, 6, 3, 5. Spark plug gap about .030 in. There is a resistance unit on top of ignition coil. Ammeter indicates rate of charge and discharge. There is no relay. The button marked ignition controls ignition and circuit between generator and battery. There is a vibrating circuit breaker on the back of the switch to take the place of the fuses.

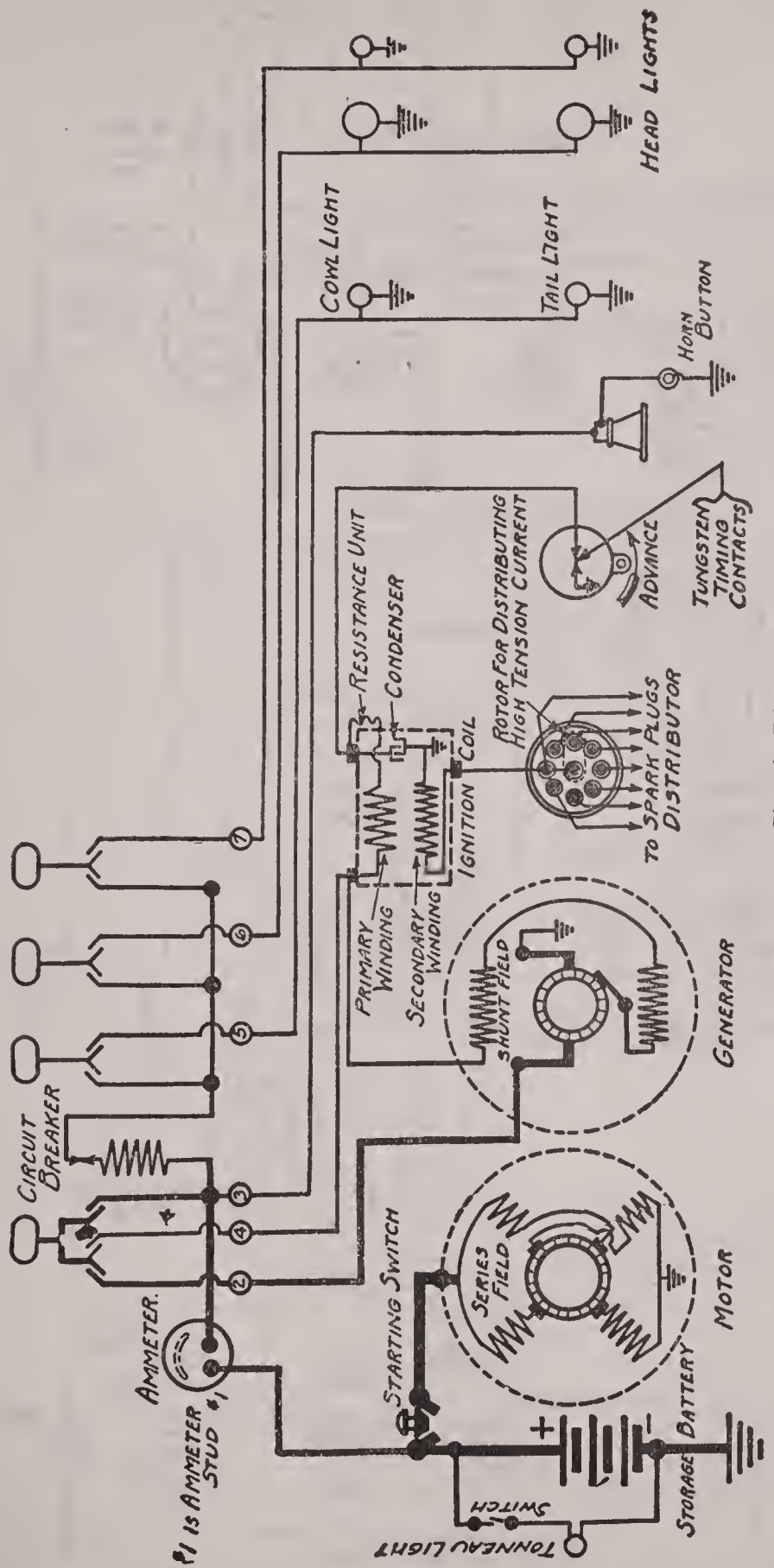
Starting motor is connected to engine by Bendix gear. Motor needs no oil.

Generator is driven at 1½ times crank shaft speed. Voltage control is by Third brush. Put four or five drops of engine oil in the oiler at rear of generator every two weeks. Distributor is carried on front end of generator. Spiral driving gears are oiled from oil compartment on front end of generator. Breaker contacts should open .018 in. They are of tungsten metal. To true tungsten points use a piece of emery cloth wrapped around a thin flat file. The file is only to grip the emery cloth. Put the cloth and file between the points and work back and forth several times, keeping the contacts closed with a slight pressure. The contact screws may also be removed and placed in the chuck of a drill press. With the drill press rotating, bring the contact to bear on a piece of emery cloth laid on the flat surface of the drill press bed. The breaker arm contact should be placed lightly on the flat side of a rotating emery grinder. Both contacts are finished on a hard oilstone.



Wiring diagram.





Circuit Diagram

PLATE No. 21

Cole 8

MODELS 860 AND 880

DELCO TWO-UNIT, 6-VOLT, STARTING AND LIGHTING SYSTEM. DELCO IGNITION

Battery is 6 volt, 120 ampere-hour. The negative terminal is grounded.

Spark control is both manual and automatic. Contacts are tungsten. (See Plate No. 20). They open .018 in. With spark fully retarded, break should occur when piston on power stroke is just over top dead center. Firing order is 1, 8, 2, 7, 4, 5, 3, 6.

Put four or five drops of engine oil in oil hole in side of distributor every week.

Starting motor is connected to engine by Bendix gear. Both motor bearings are of the oilless type.

Voltage regulation is by third brush. Put four or five drops oil in each of generator oilers once a week. Maximum output should not exceed 20 amperes at 20 to 25 miles per hour. Rate decreases at higher speeds.

There is no relay. The ignition button controls both ignition and circuit between generator and battery.

Ammeter indicates rate of charge or discharge. Charging rate, under ordinary driving conditions, should not exceed 15 amperes, all lights out and car running about 20 miles per hour.

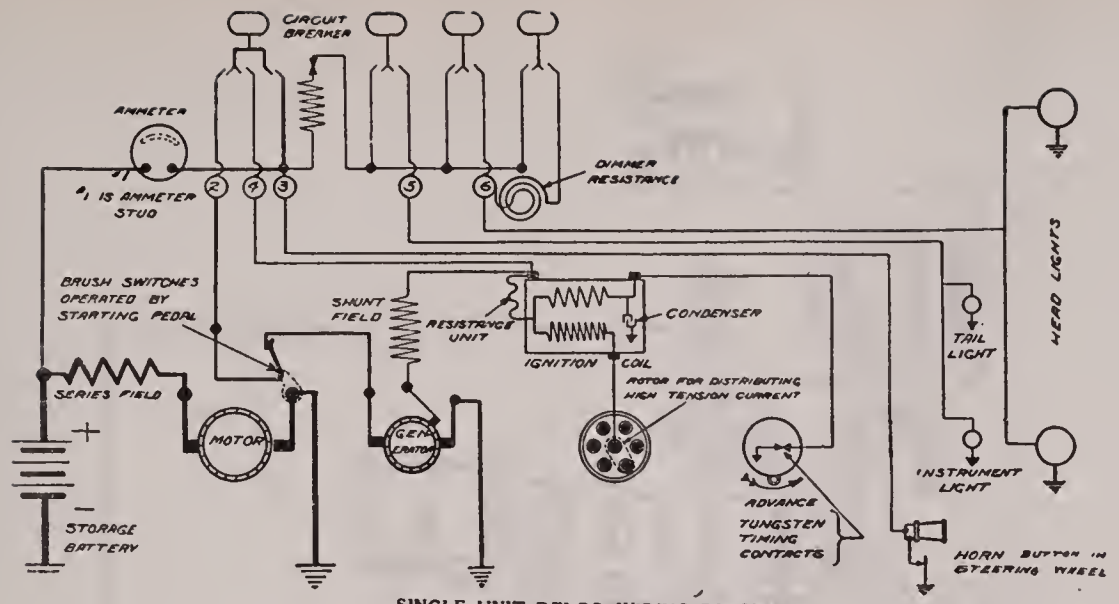
There is a vibrating circuit breaker mounted on the lighting switch.

Diagram for model 880 is shown. On the later 860 models it is also the same. On the early 860 models the tonneau light is not supplied. The dash and tail lamps are in series. The small head lamps are omitted. Instead, a dimming resistance is inserted between No. 6 and No. 7 terminals.

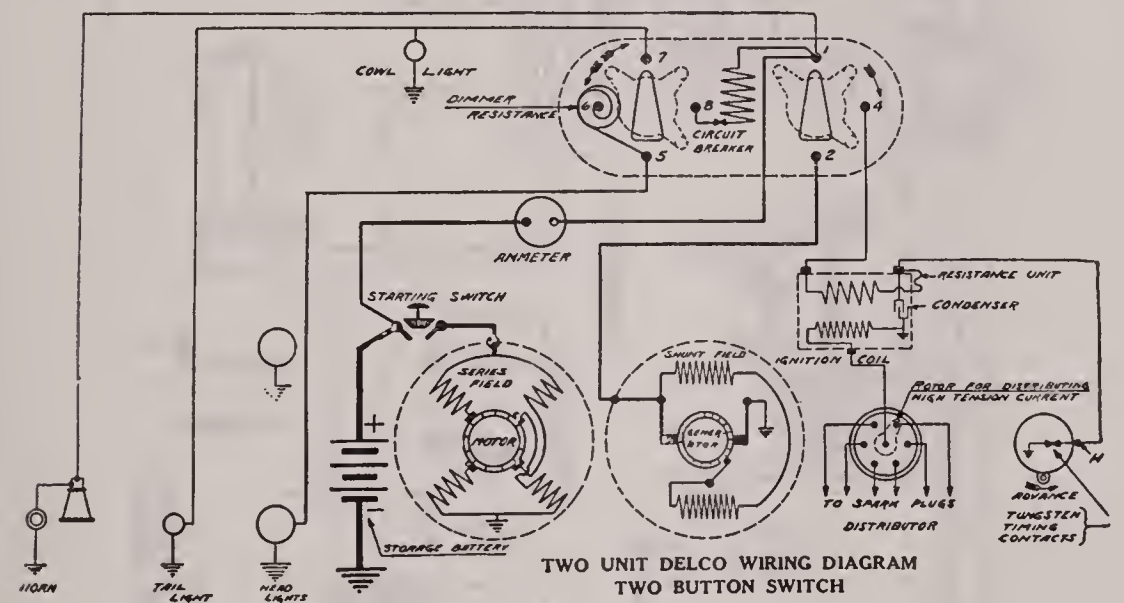
Moon

6-30, 6-43, 6-44, 6-66

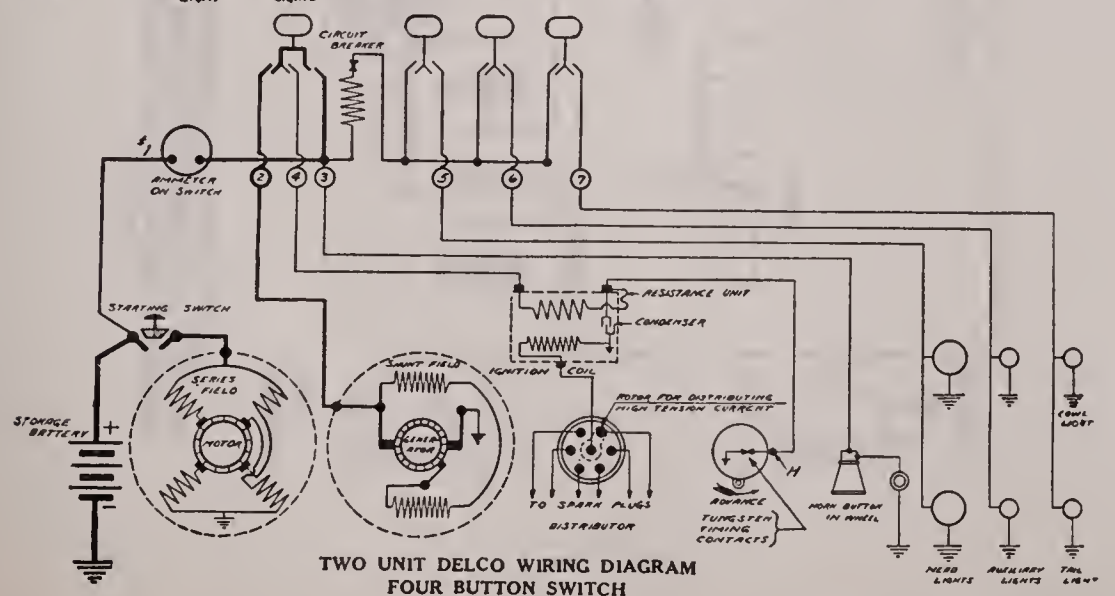
Delco 6-Volt, Double or Two-Unit Starting and Lighting System. Delco Ignition



SINGLE UNIT DELCO WIRING DIAGRAM



TWO UNIT DELCO WIRING DIAGRAM
TWO BUTTON SWITCH



TWO UNIT DELCO WIRING DIAGRAM
FOUR BUTTON SWITCH

PLATE No. 22

Delco 6-Volt, Double or Two-Unit Starting and Lighting System. Delco Ignition

Battery is 6 volt, 100 ampere-hour. The negative terminal is grounded.

The ignition system is provided with both automatic and manual spark control. Breaker is operated by a 6-lobe cam. Contact points are of tungsten metal. (See Plate 20.) They should open .020 in. On models 6-30 and 6-43 the spark gap should be .025 in. On the 6-44 and 6-66 it should be .030 in. Firing order is 1, 5, 3, 6, 2, 4.

Spark should occur when the piston is 1/64 in. past top dead center, spark lever in the fully retarded position.

On models equipped with the double-unit electrical system the upper bearing of the distributor should be lubricated every 500 miles by putting four or five drops motor oil in the hole near base of head. On cars having the two-unit system this bearing is of the oilless type. The distributor cap should be removed and wiped clean with a soft cloth occasionally. To remove the cap pry out the latch spring and give it a slight turn to the left and then lift straight up. If the track on which the rotor button bears has not a glazed surface, lubricate it with a small amount of vaseline.

Models 6-30 and 6-44 are equipped with double-unit starting and lighting system. The motor-generator has two field and armature windings and two commutators. Motor is connected to the engine by non-automatic mechanical shift. When the ignition switch is closed, generator runs slowly as a motor, to facilitate meshing of gears. There is an over-running clutch at the end where generator driving shaft is connected. There is also a clutch between motor and flywheel to prevent motor being driven by gas engine before gears are drawn out of mesh. The clutch is lubricated by the grease cup on the rear of the motor-generator shaft. This cup should be tightened two turns per week. The over-running clutch on the front end receives lubrication from the oil which is in the front end of generator. There should be enough oil put in each week to bring it up to the level of the oiler.

When the starting pedal is depressed the gears are brought into mesh and allows the motor brush to make contact with the commutator, at the same instant opening the generator circuit. If starting switch is left in for any length of time after engine starts, the gears in clutch are apt to heat from the excessive high speed at which they are being driven, burning out the lubricant. Immediately after the motor brush is raised from the commutator by releasing the starting pedal the circuit between generator and battery is completed. Generator starts to charge battery at 7 miles per hour, and the rate increases to maximum at 20 miles per hour and then decreases. The oiler at rear of generator should given four or five drops of oil per week besides what is put in the forward bearing.

The two-unit system is used on Models 6-43 and 6-66. The motor is connected to engine by a Bendix drive. Motor has oilless bearing, so requires no care except an occasional inspection and cleaning of commutator if necessary. Generator is driven from pump shaft. Voltage regulation is by third brush. The rear bearing is ball type. It should receive four or five drops engine oil per week. The forward bearing, the over-running clutch and the gears driving the distributor are all oiled by the same oiler. It should have considerable oil. If too much oil is put in, it will overflow and run out the drain provided. Brushes have graphite in them to lubricate commutator. Relay should close at 6 miles per hour.

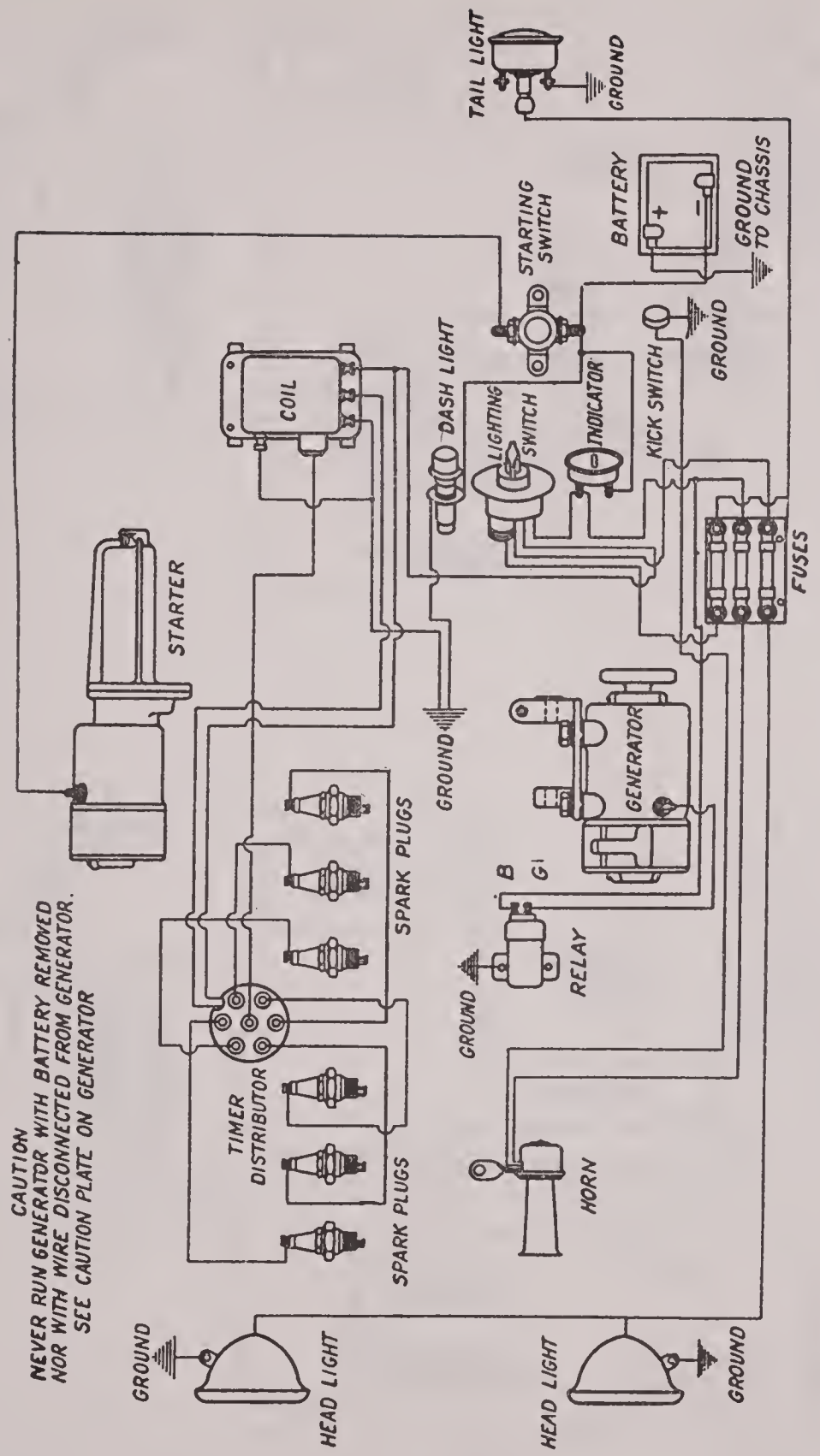


PLATE NO. 23

Saxon

(MODEL S2-1916)

WAGNER OR DETROIT STARTING AND LIGHTING SYSTEM
ATWATER-KENT IGNITION

The early models of Saxon S-2 used Wagner starting and lighting system and the late S-2 models used Detroit starter. Atwater-Kent ignition is used. (See Plate No. 25).

Exide 6 volt, 80 ampere hour battery is used. Positive of battery is grounded.

Break occurs just over dead center, spark fully retarded. Firing order is 1, 5, 3, 6, 2, 4.

Wagner system is two-unit. Starter is connected to engine by Bendix gear. (See Plate No. 25). Voltage regulation is by third brush.

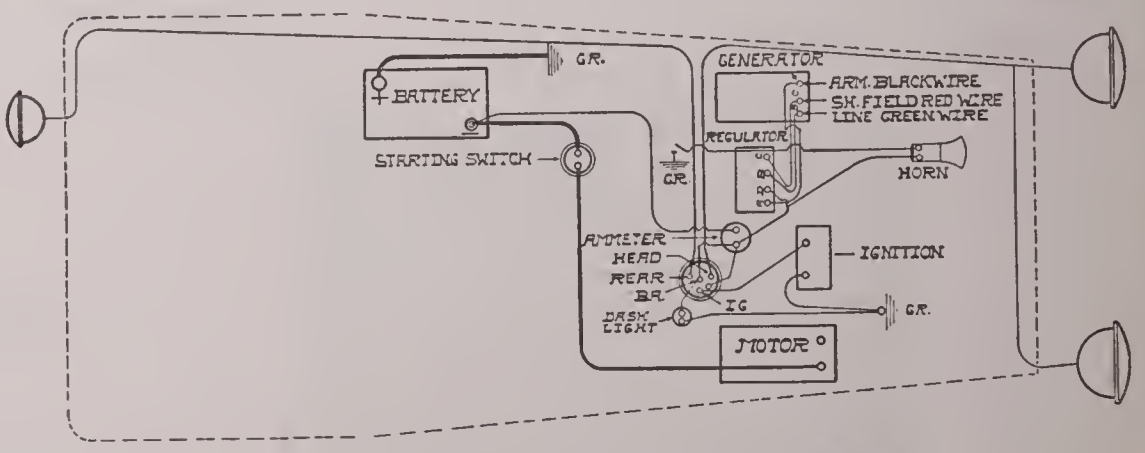
Detroit system uses Ward-Leonard controller. Motor connected to engine by Bendix drive. (See Plate No. 7). Pack grease cup on commutator end of shaft with soft cup grease several times a year. Use cylinder oil in oiler on driving end. This end is provided with a ball bearing.

Generator is driven at twice engine speed by silent chain. Relay should close at 9 to 10 miles per hour. Maximum charging rate should be about 10 amperes at 14 miles per hour. With ordinary use generator requires oil only two or three times a year.

Combined ignition and lighting switch is on dash. Insert key and give it a quarter turn to complete ignition circuit. Head lamps are 7 volt, 15 cp. Tail and dash lamps 7 volt, 2 cp.

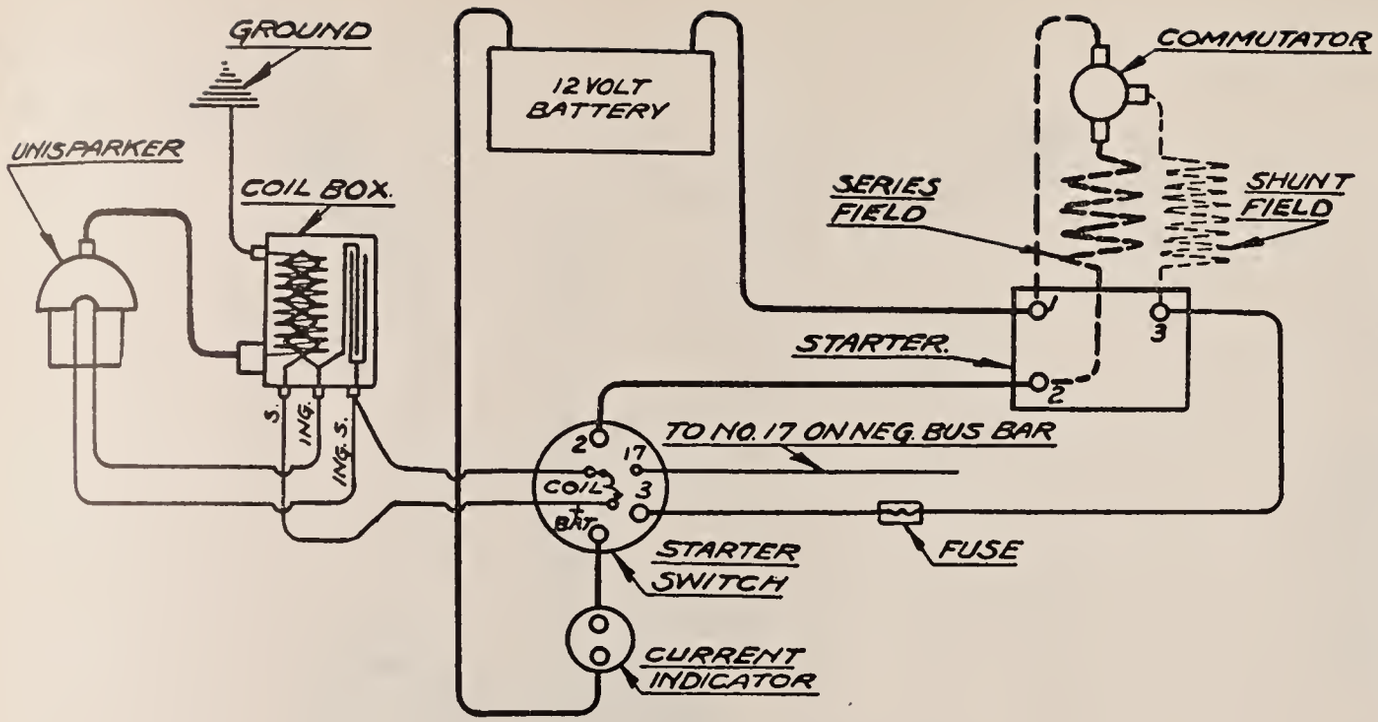
Fuses are 5 ampere.

Do not run generator with battery disconnected.



Detroit Starter Wiring Diagram.

DYNETO 12-VOLT, SINGLE-UNIT STARTING AND LIGHTING SYSTEM
ATWATER-KENT IGNITION



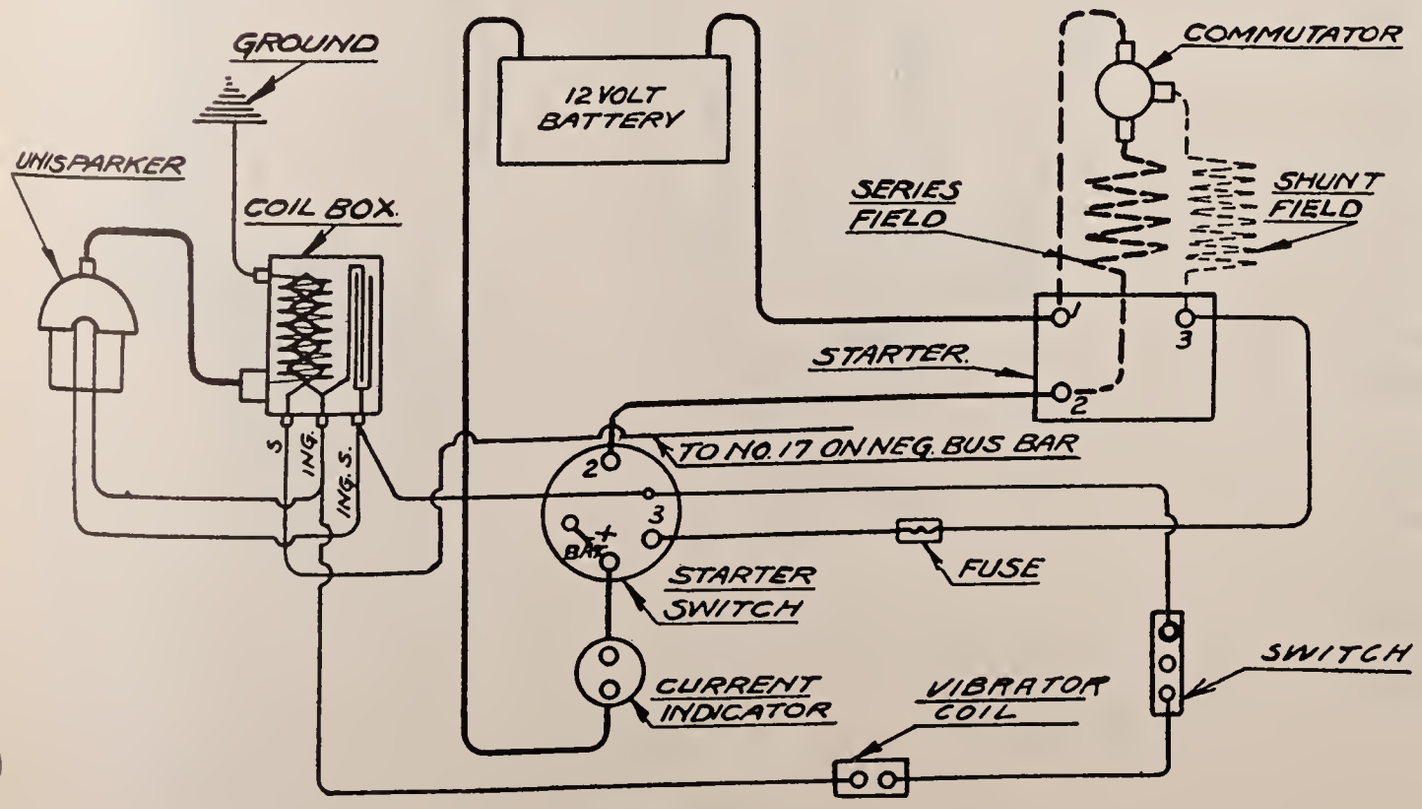


PLATE No. 24

The ignition unit is driven by spiral gears from cam shaft. Contacts are tungsten and should open .010 in. Should be examined every 3,000 miles. To adjust contacts, remove screw and take off one of the thin washers. Break should occur when the mark CL 1-6 on the flywheel is 1½ in. past the center line indicator. Firing order is 1, 4, 2, 6, 3, 5. Every 500 miles put a small amount of vaseline on latch, latch lifter and notched shaft. Every 1,000 miles put one drop light engine oil in opening that leads to governor. Spark should be fully retarded during the timing operation.

The motor-generator is chain connected to crank shaft. It acts as a generator at speeds over 8½ miles per hour and as a motor at lower speeds. The voltage regulation is by bucking series field. Put a few drops of engine oil into the cups on each end bearing every 500 miles. Too much slack in the starter chain will cause a rumbling noise if car is run at low speeds. Chain should have enough slack to permit an upward movement of ⅝ in. The starter out of line will cause noise and undue wear. The starter shaft should have approximately 1/32 in. end play. Correct alignment may easily be obtained by placing shims between starter and tire pump frame. There is a 10-ampere fuse in series with the shunt field. It is on the junction board. If indicator shows discharge at speeds over 9 miles per hour look for blown fuse or loose connections. Brushes should not be used after they are worn down to ⅝ in. length.

If starter fails but generates, see if battery is all right, that brushes move freely when springs are raised, examine field connections, examine series field for open circuit, short circuits or grounds, and see that commutator is clean.

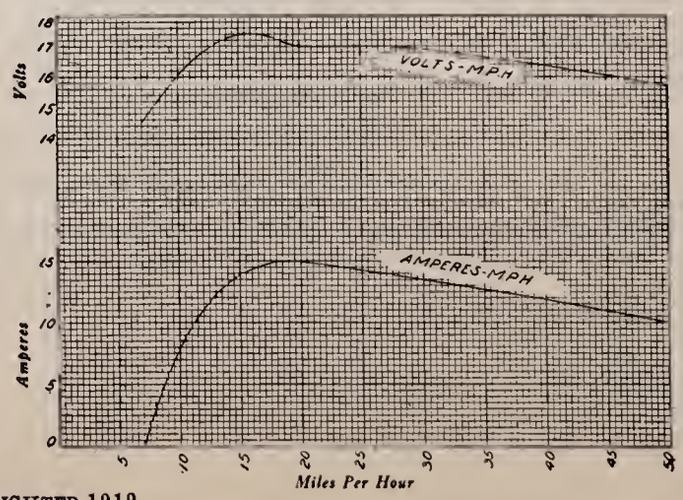
If generator fails, examine fuse, third brush, shunt field and field connections, and clean commutator.

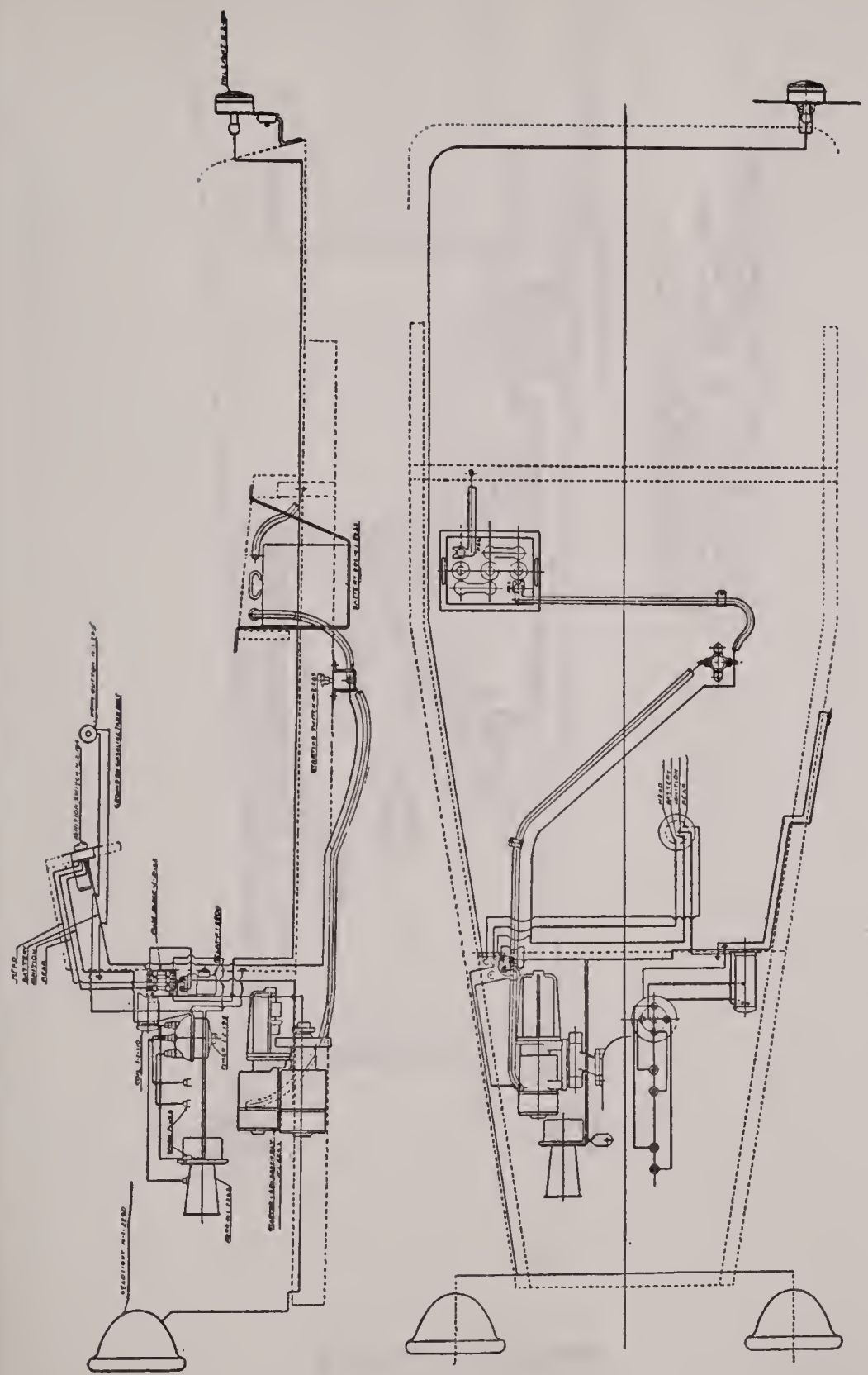
If starter sparks excessively, examine battery and its connections, see that commutator is clean and free from oil, see that brushes do not stick in their sockets and that they have proper tension. If engine is run with battery disconnected, remove shunt field fuse. The battery is Willard 12-volt, 60-ampere-hour. Two-wire system is used complete for starting and lighting. Head lights are in multiple. Speedometer and tail lights are in series. Mazda lamps are used.

If lights burn dim with engine running, examine shunt field and brushes and connections, see that fuse makes good contact with clip, see that shunt field is not oil or water soaked or grounded. Armature winding may be grounded or burnt out. Shunt field may not be connected because starting switch is not making proper contact.

If lights burn excessively bright with engine running, look for dead battery cells, examine connection on indicator, No. 2 terminal on starter and on starting switch, positive battery connection to starter. Look for defective connections where wire is soldered into copper terminals.

Once every 1,000 miles put one drop engine oil in oil cup on horn, and once a year repack bearing at rear of armature shaft with grease.





Wiring Diagram

PLATE No. 25

Saxon Four

MODELS B-5-R, B-6-R

WAGNER TWO-UNIT STARTING AND LIGHTING SYSTEM

ATWATER-KENT IGNITION

Battery is 6 volt, 90 ampere-hour. The positive terminal is grounded.

Atwater-Kent ignition coil No. I-1-110 and timer No. I-2-195 are used. Contacts should open 1/32 in. If pitted or burned use fine flat file to surface. To adjust contacts remove screw and remove one of the thin washers. Break should occur when the mark DC on flywheel is ½ in. past center line, No. 1 cylinder on power stroke. Firing order is 1, 3, 4, 2. Spark plug gap should be .025 in. Put three or four drops of light engine oil in oiler just above timer bracket every 500 miles.

Starter is connected to engine by Bendix gear. For starter troubles see Plate No. 19.

Generator is chain driven from sprocket on flywheel. Bendix of starter meshes with gear on generator shaft and completes connection to engine by generator drive chain. Generator runs on ball bearings. Oil bearings well once a week. Voltage regulation by third brush. Third brush is sealed, and guaranty ceases if this seal is broken. Relay should close at 10 miles per hour. If you have reason to believe that the generator is working improperly, turn all lights out and place an ammeter in the charging circuit. Be sure that meter is properly connected. Speed up engine to a car speed of 10 miles per hour. Relay should close and meter register charge. Then speed up engine until maximum charging rate is reached. Maximum rate should be about 15 amperes at 15 to 20 miles per hour. The terminal voltage for this rate is about 9.2 volts. If voltage is much above this, there is probably a high resistance or a badly sulphated battery in charging circuit. A loose connection will sometimes cause lights to flare up, flicker or go out. If the charging rate is much lower it indicates a sulphated battery or dirty contacts. If, by observation, relay closes but no current flows, see if contacts make connection. If contacts are burned they may be cleaned with No. 00 sandpaper or a very fine file. If burned beyond repair relay must be replaced. If car is used with relay is this condition or with battery disconnected, the terminal of generator should be short circuited. If generator and relay are in working condition and battery will not stay charged, see if lamps are of size furnished with car.

Clean commutator with gasoline. It is not necessary to remove brushes to clean them. Lift them up, and wipe with a cloth moistened with gasoline.

Case 1918

Westinghouse 6-Volt, Two-Unit Starting and Lighting System
Westinghouse Ignition

Battery is 6 volt, 117½ ampere-hour. The positive terminal of battery is grounded.

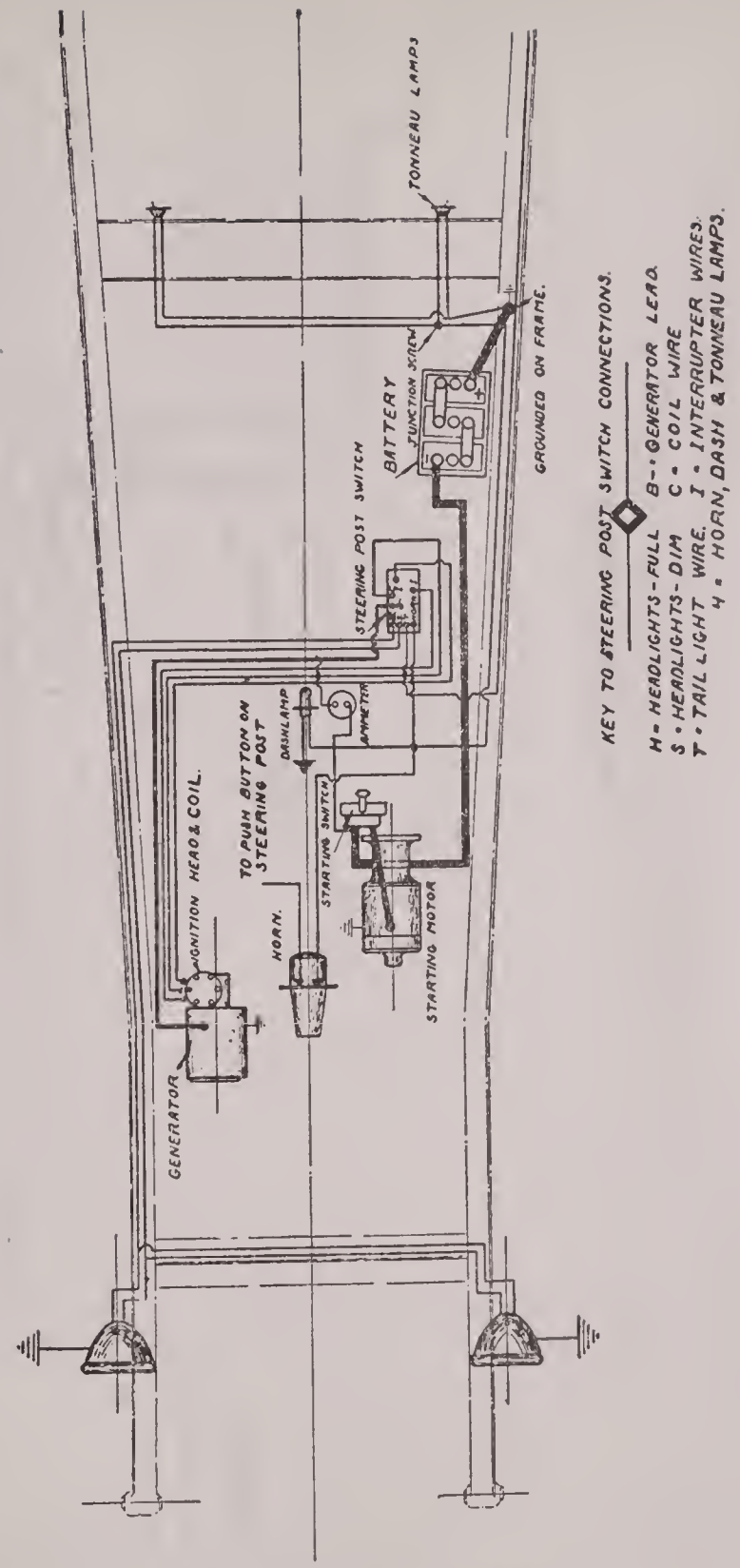
Breaker is operated by 6-lobe cam. Contacts open .010 in. to .012 in. Smooth with fine file. Put three or four drops good machine oil in cup on side of distributor once a month. Distributor can be removed without disturbing timing providing lower bracket is not disturbed. Break should occur on top dead center, spark fully retarded. Firing order is 1, 5, 3, 6, 2, 4.

Starting motor is connected to engine by Bendix gear.

Generator geared to engine. Voltage control by third brush. There is a 5-ampere fuse at commutator end. This must be removed if generator is run with battery disconnected. Relay closes at 8 to 10 miles per hour. Five or six dry cells in series may be used for ignition only, if car must be operated with battery disconnected. If this is done, remove generator fuse. Ground positive of the set of cells and connect negative to negative battery lead. Put three or four drops machine oil in oilers on top of generator and motor bearings at least once a month.

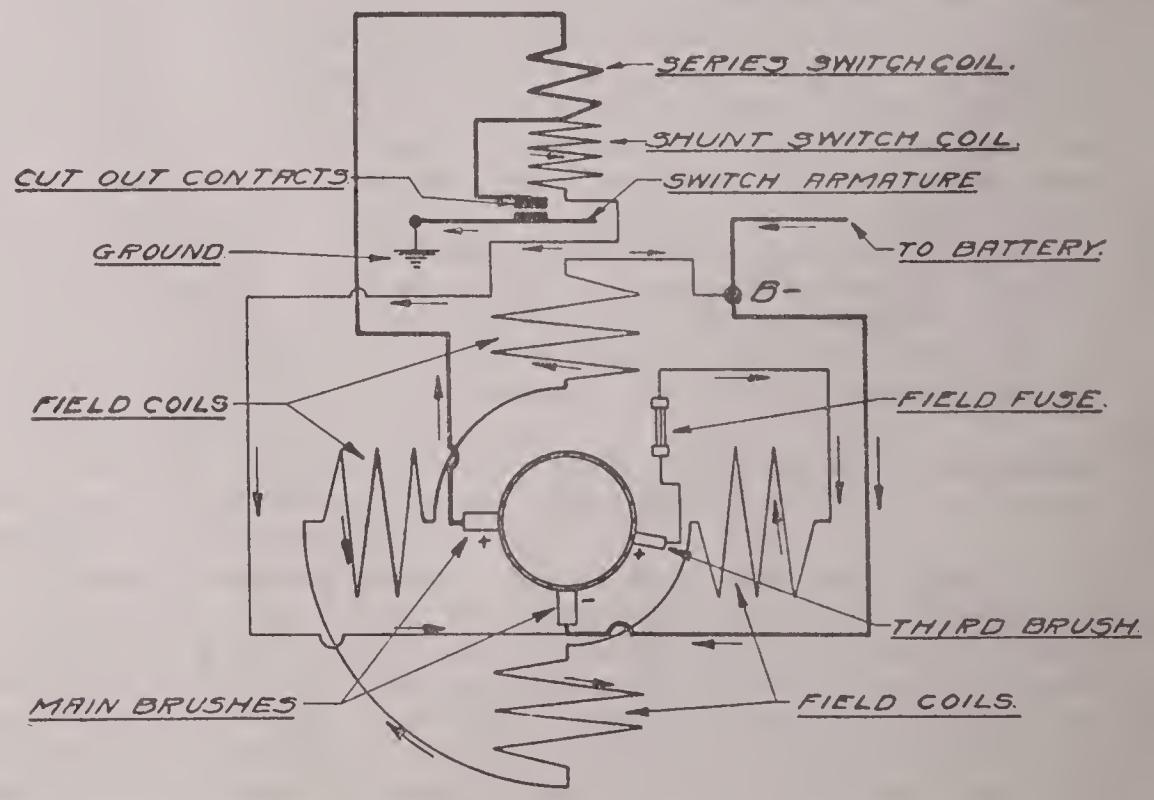
Combined ignition and lighting switch is on the steering column. There is a 15-ampere fuse for the bright head, dim head, and tail lamp circuits. One fuse carries the current for the horn and dash and body light. Fuses are in switch case.

Large head lamps, 18 cp. Small head lamps, 4 cp. Tail lamp, 2 cp. Dash lamp, 2 cp. Tonneau lamp, 2 cp.



WIRING DIAGRAM

Plate No. 26



Internal Wiring Diagram of Generator

Chalmers Six-30

SERIAL NOS. 82001-84000, 94001-111025

WESTINGHOUSE TWO-UNIT STARTING AND LIGHTING SYSTEM. REMY IGNITION

Battery is Willard 6 volt, 80 ampere-hour. The positive terminal is grounded at the motor.

Distributor is driven from rear of generator. Contacts open .015 in. to .018 in. Operated by 6-lobe cam. Smooth with a file or No. 00 sandpaper. With spark at full retard, break should occur when mark U. C. 1 & 6 on flywheel is 15/16 in. past center indicator, No. 1 cylinder on power stroke. On the early motors there is a countersunk hole on the rim of the flywheel to facilitate finding No. 1 and 6 U. C. points. The later motors have this hole 15/16 in. past the U. C. mark, or at the point on flywheel which should be under indicator when spark occurs. Firing order is 1, 4, 2, 6, 3, 5. Spark gap should be .022 in. to .025 in., or thickness of smooth dime.

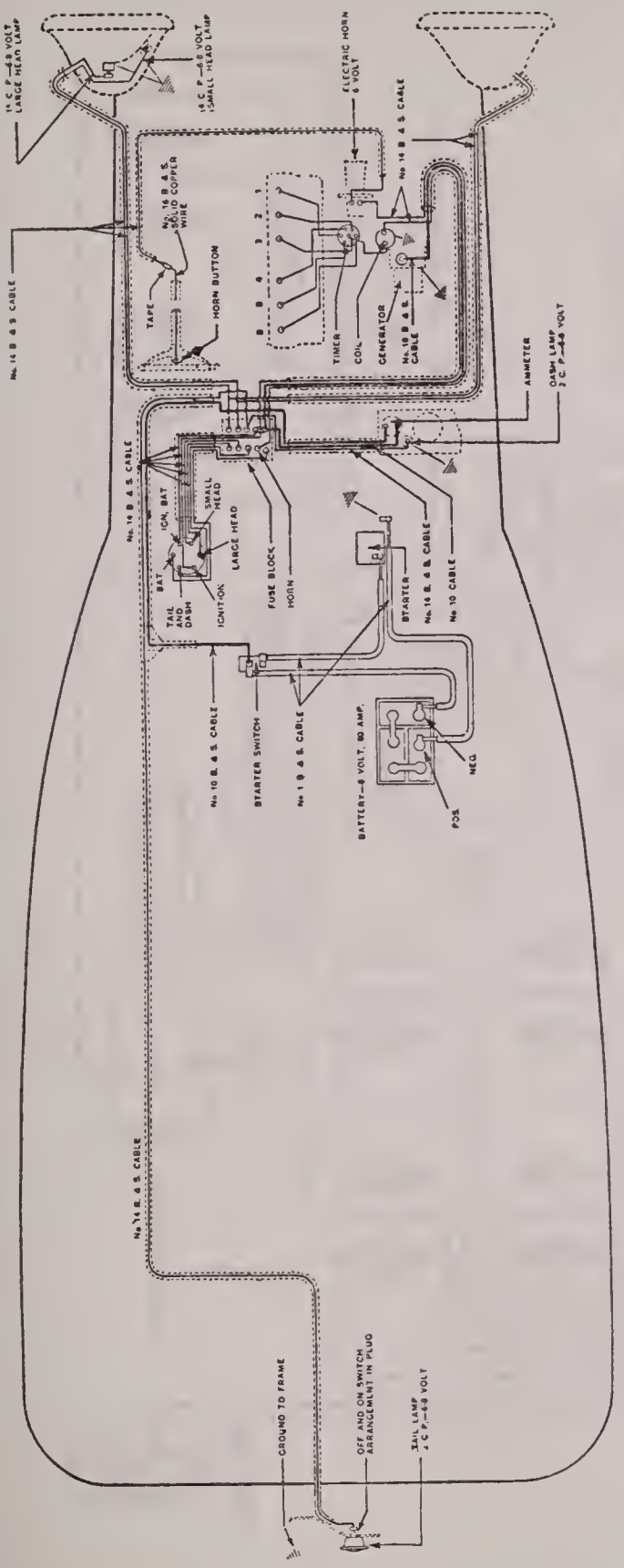
Motor is connected to flywheel by Bendix drive. Oil each of the bearings with four or five drops of machine oil per month.

If motor fails to start when starting switch is closed, place a voltmeter across battery and depress switch. Voltage should not drop below 4¾ volts. Look for loose or high resistance circuits. See that starting switch is working properly. See if brushes are grounded. If motor rotates but pinion does not engage flywheel gear, clean shaft and see if pinion fits properly.

Voltage regulation is by third brush. Relay closes at 8½ to 9 miles per hour. Generator charging rate at 22 miles per hour should be 12 to 16 amperes. Ignition consumes 1.5 amperes. Main head, dash and tail lights consume 5.4 amperes. Main head and tail lights and ignition consume 6.5 amperes. Side and tail lights and ignition consume 3.4 amperes. Side dash and tail lights consume 2.3 amperes. Two large head lamps—7 v., 15 cp. Two small head lamps—7 v., 4 cp. Dash and tail lamps, each—7 v, 2 cp. Main fuse, or No. 1 on panel, is size 5 G2, 25 volt, 3 ampere. The other four fuses are all size No. 3—25 volt, 15 ampere. Shunt field fuse must not be larger than 5 amperes. Relay is mounted inside and at top of rear bracket. Generator output is practically constant above 22 miles per hour. Charging rate of 12 to 15 amperes when generator is cold may drop 2.5 to 3 amperes after generator warms up considerably. If testing this, do not rely on dash ammeter, but use a more reliable instrument. Front bearing of generator is lubricated from oil in chain case. The rear bearing is lubricated by two oil cups. The upper one has a spring cap and the lower one a screw cap. The lower cap should be filled with oil occasionally. The upper one should be given a few drops of oil every two weeks.

If generator fails, examine fuse. If fuse is blown, look for defective connections in charging circuit and see that positive main brush is making good contact with commutator and that relay is working properly.

If battery does not stay charged, car may not be run enough without lights or at high enough speed to recharge battery. One ordinary starting of the engine will require about 15 miles running at 15 miles per hour to restore the current to the battery. Ammeter may be out of order, creating an open circuit when charging rate reaches about 7 amperes on dash ammeter. Check with voltmeter on circuit between generator and ammeter and then on circuit between ammeter and battery. If lights flare badly the third brush may be set too far in the direction of rotation of armature, or there may be loose connections in circuit between battery and ground on fuse block, or fuse loose. Remove fuses and clean clips and metal end of fuse several times a year.



Car Wiring Diagram

PLATE NO. 27

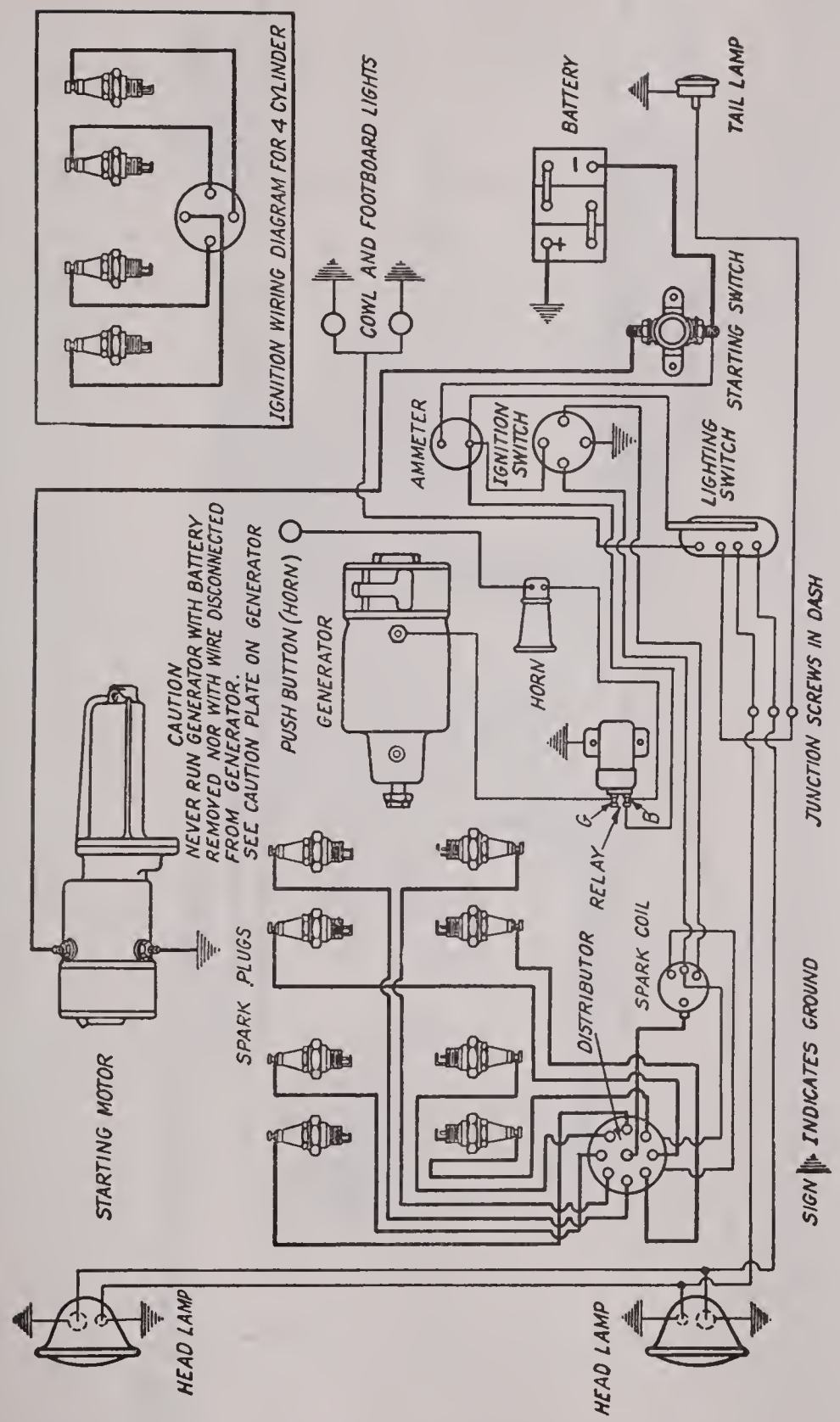


PLATE No. 28

Scripps-Booth

4 AND 8, 1916

WAGNER TWO-UNIT STARTING AND LIGHTING SYSTEM. REMY IGNITION

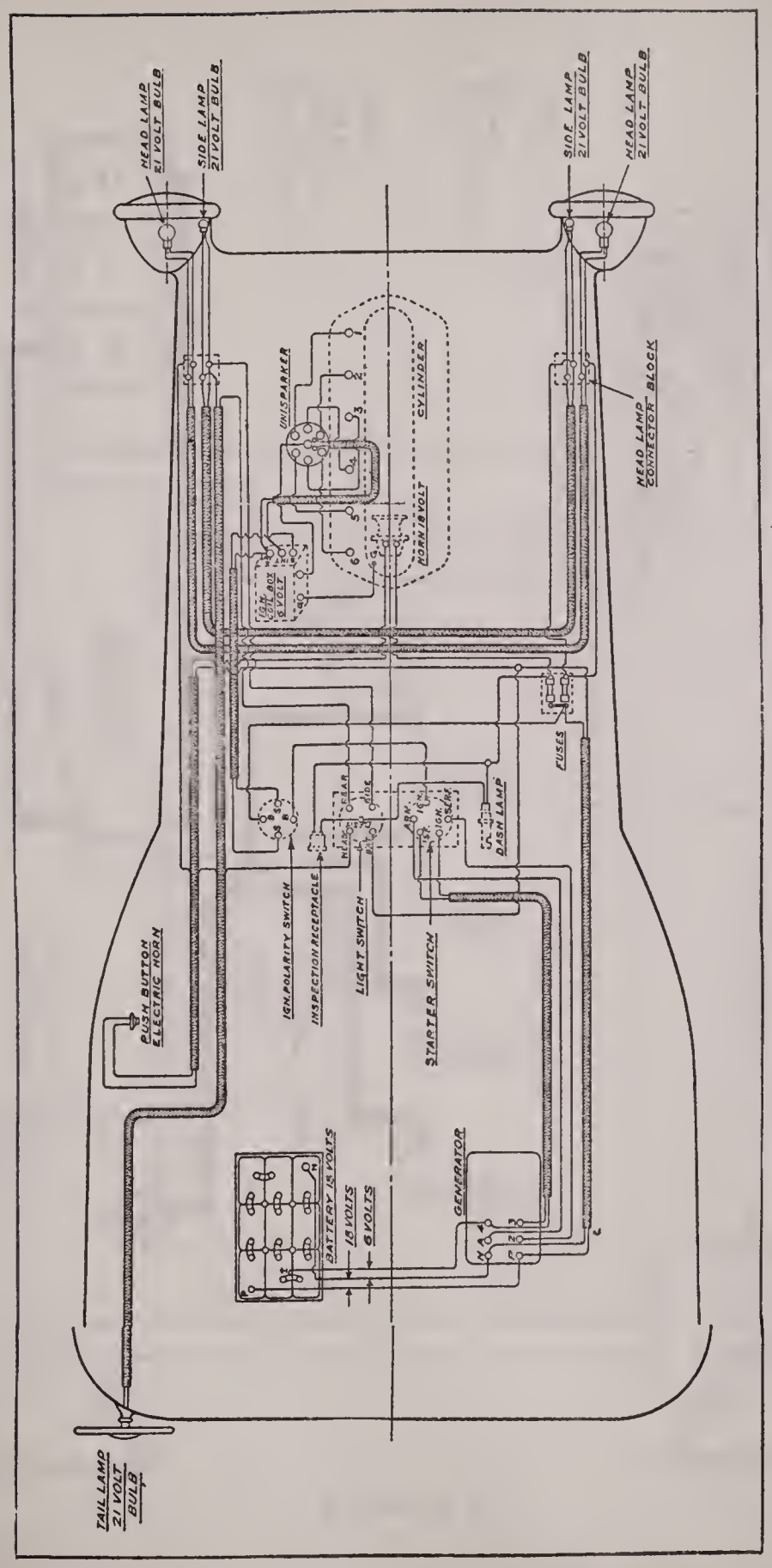
Battery is 6 volt, 80 ampere-hour. The positive terminal of the battery is grounded.

Firing order of the Four is 1, 3, 4, 2; of the Eight is 1R, 1L, 3R, 3L, 4R, 4L, 2R, 2L.

Break should occur on upper dead center, spark fully retarded.

Starter is connected to engine by Bendix gear working with a set of reduction gears. Lubricate the oiler at each end of starter well with good machine oil every 500 miles. Keep the gears well lubricated with grease. Inject grease with a grease gun at the plug in center of starter. The manufacturers recommend "Gredag" as the grease to be used. Do not change the position of brushes, as they are accurately set at factory and will never need moving. (See Plate No. 19.)

On the Four the generator is driven by helical gears from the cam shaft. On the Eight it is driven by a belt from the crankshaft. These generators are equipped with ball bearings. Oil both bearings with about six drops of good machine oil every 1,000 miles. Voltage regulation is by third brush. Third brush is sealed, and guaranty ceases if seal is broken. Relay closes at 10 miles per hour and opens at 5 to 8 miles per hour. For further troubles see Plates 19 and 25.



Chalmers

Model 26

Entz, Single-Unit, Starting and Lighting System
Bosch or Atwater-Kent Ignition

Battery is 18 volt, 50 ampere-hour.

Ignition operates at 6 volts. Care must be taken when connecting battery, as more than three cells in series are apt to burn out the ignition units. Atwater-Kent ignition is used on the light cars and Bosch Magneto on the heavy cars.

On cars where the Atwater-Kent ignition unit is used, breaker contacts should open .006 in. to .008 in. Clean contacts with gasoline. Do not use a file or sandpaper on the contacts unless they are badly corroded. Even though the contacts are very rough they will work satisfactorily. They should be dark gray in color. The magneto contacts should open .018 in. Clean them with gasoline whenever necessary. If contacts are badly burned or pitted they may be resurfaced with a fine, flat, jeweler's file or a piece of worn No. 00 sandpaper. Carefully blow out all dirt or filings after surfacing. Break should occur when the upper dead center mark on the flywheel is 1½ in. past indicator, spark fully retarded. Firing order is 1, 4, 2, 6, 3, 5.

There is no relay, thus the system possesses the non-stalling feature, the motor immediately starting the engine if it is stalled, or helping to propel the car when running below 6 or 8 miles per hour. The non-stalling feature is cut out when switch is in the middle position. The battery is entirely disconnected from the motor-generator when switch is in this position.

Voltage regulation is by reverse series field. The series and the shunt fields work together when the unit is operating as a motor, therefore the unit is a cumulatively compound-wound motor and a differentially compound-wound generator. As a motor it should run at about 100 R. P. M.

If it is desired to stop charging the battery, place the switch in the middle position. Generator begins to supply current at 6-8 miles per hour, or 600 R. P. M. of the generator.

Light fuse is 5 ampere. Horn fuse is 5 ampere. Large head lights are 21 volt, 18 cp. Small head lights are 21 volt, 4 cp. Dash light is 21 volt, 2 cp. Tail light is 21 volt, 2 cp.

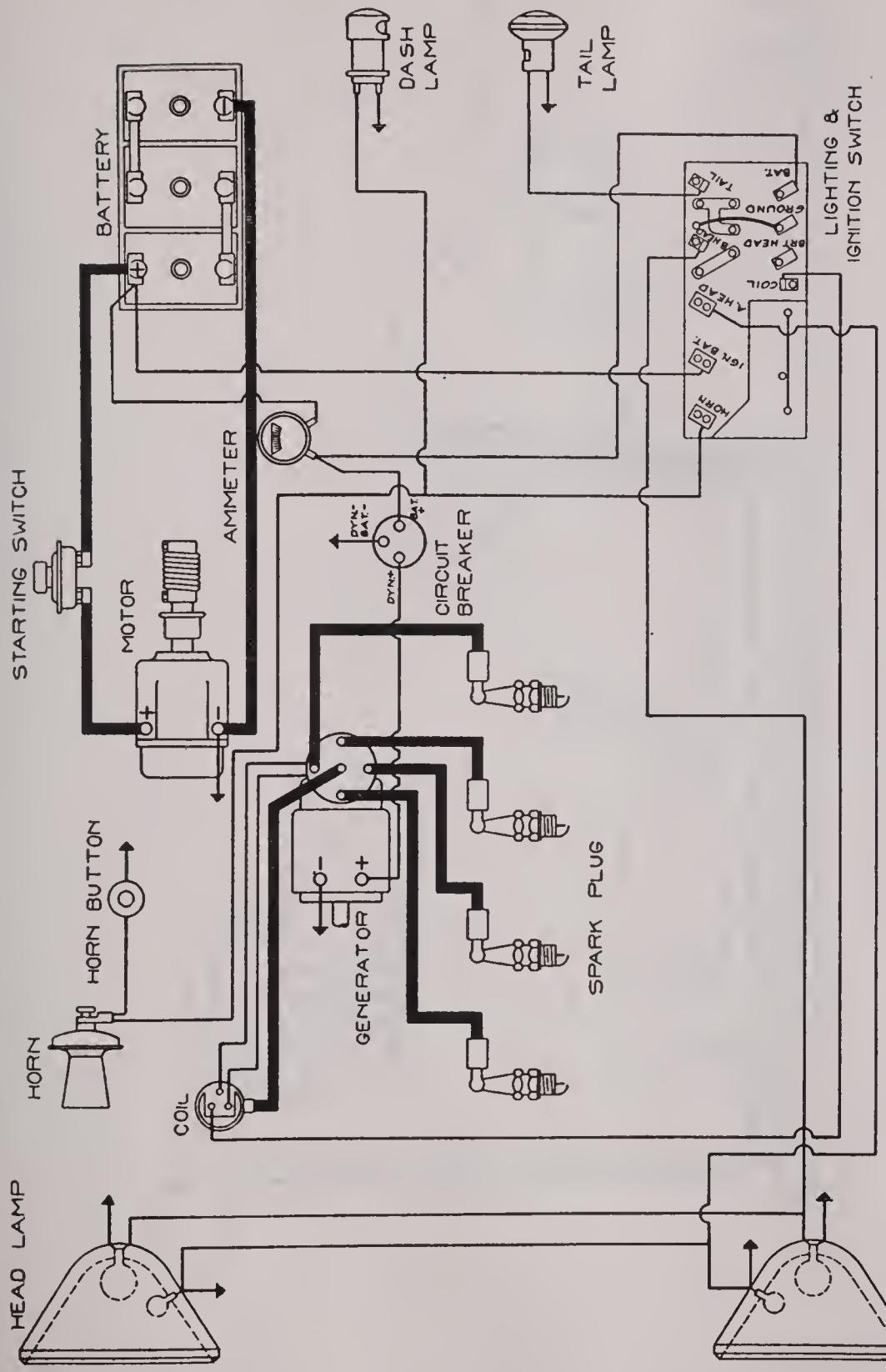


PLATE No. 30

Case

AUTO-LITE STARTING AND LIGHTING SYSTEM. CONNECTICUT IGNITION

Battery is 6 volt, 80 ampere-hour. The negative terminal is grounded at the starting motor.

This car uses the Auto-lite GH generator. Generator is chain driven. Voltage regulation is by third brush. The generator output rises to maximum, then gradually decreases as speed increases.

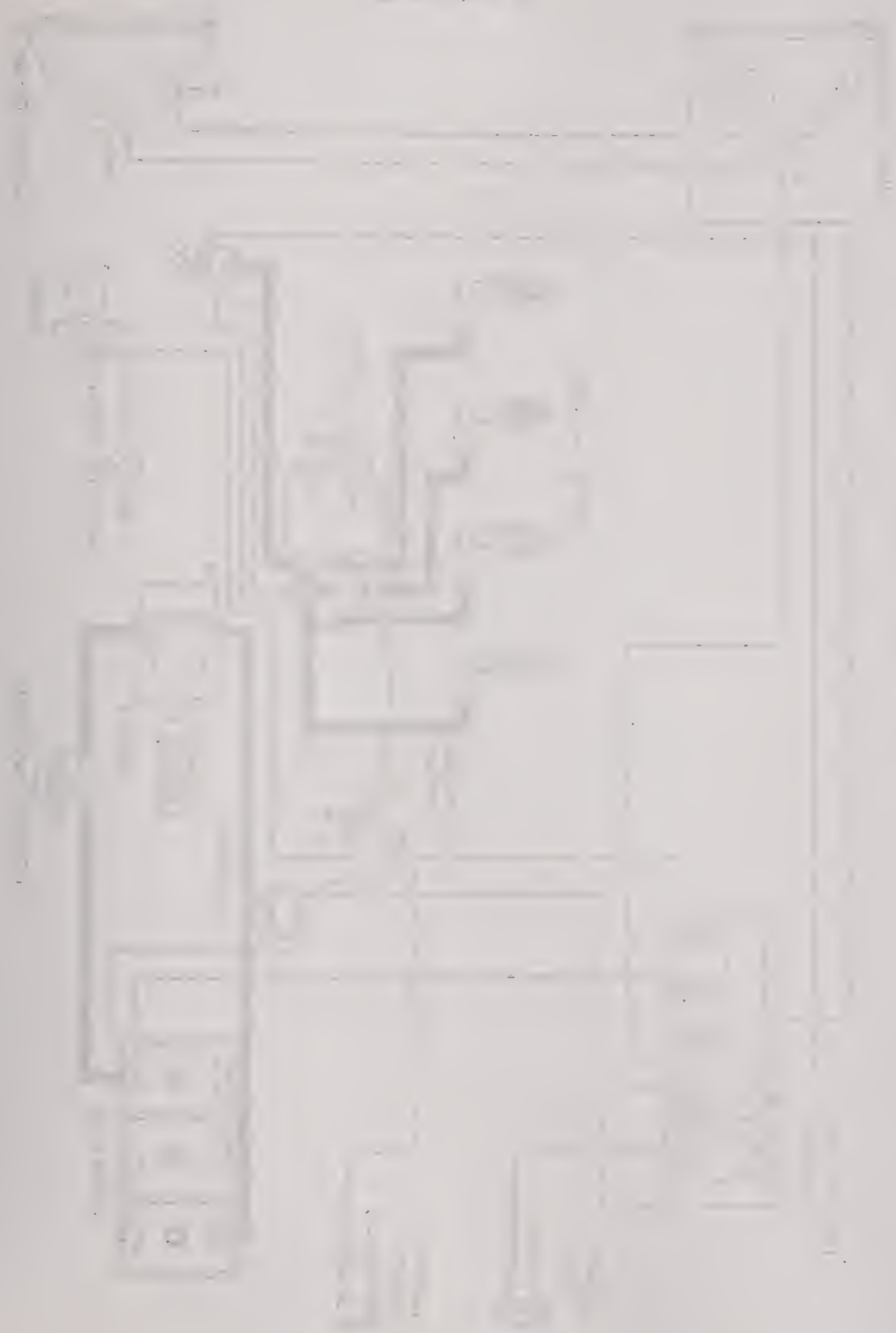
The type MD starting motor is used. It is connected to engine by a Bendix drive. Motor bearings are packed with grease. This grease must be renewed at least once a year.

If motor fails, first test battery, the wiring and starting switch. See that brushes make good contact and that commutator and brushes are free from oil.

To test generator, short terminals with a screwdriver. If you get a hot, snappy spark, the trouble is not in generator. If generator is giving current but does not charge, see that all connections are tight and free from dirt; that relay contacts are clean and that relay is otherwise in good working condition. See that ammeter is working. Try by turning on lights.

If generator does not generate, see that commutator and brushes are clean, that brushes make good contact, that there is the proper spring tension, and that mica is not higher than the copper.

If it is necessary to operate car with storage battery out, short circuit generator terminals and connect three dry cells in series in the place of storage battery. Do not use lights or starter with this arrangement. Be sure that ignition button remains in when pushed in to complete the ignition circuit.



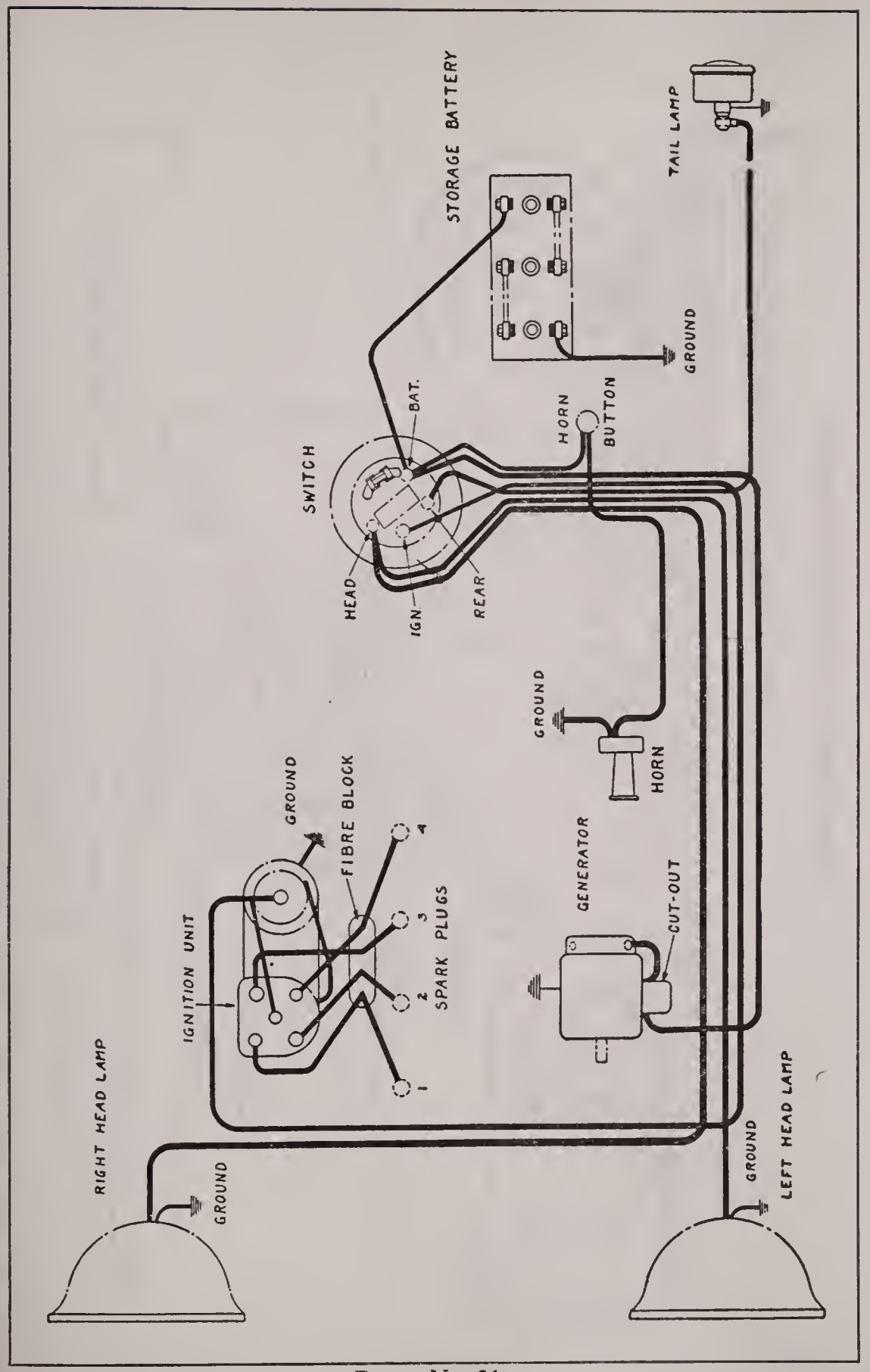


PLATE NO. 31

Maxwell Trucks

AUTO-LITE 6-VOLT GENERATOR. AUTO-LITE IGNITION

Battery is 6 volt, 50 ampere-hour. The positive terminal of the battery is grounded.

Break occurs when dead center mark on flywheel is 1½ in. past indicator, spark fully retarded. Firing order is 1, 3, 4, 2.

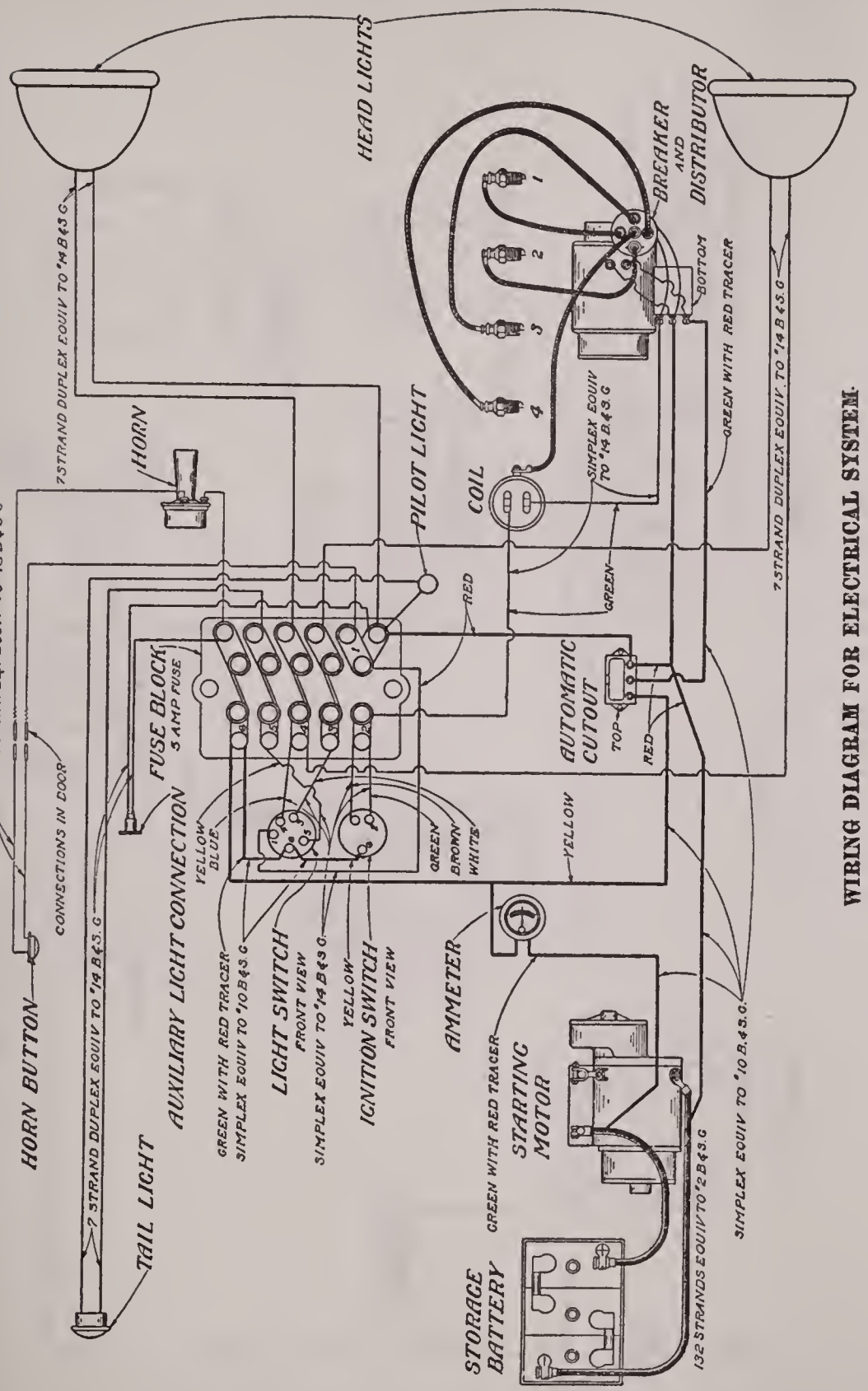
There is no starter.

The type GG generator is used. Voltage regulation is by bucking series field. If battery is disconnected generator terminals must be short circuited. The lights and ignition are not enough load for the generator. If car is to be operated with battery removed, substitute three dry cells and short circuit the generator. Do not substitute the brushes for other makes, as they are of a special composition best suited for this machine. They may be obtained from any Auto-lite or Maxwell dealer or service station. No lubrication on commutator. Put five to eight drops good engine oil in generator oilers each 1,000 miles. Do not use carbon filament lamps or lamps of a higher candlepower than furnished.

To test generator short the terminals with a screwdriver. A hot, snappy spark indicates that generator is working properly.

Fuse is 20 amperes.

The maximum charging rate of 6 amperes is reached at about 350 R. P. M. of the generator.



WIRING DIAGRAM FOR ELECTRICAL SYSTEM.

PLATE NO. 32

Reo 1917

R, S, M, N.

REMY TWO-UNIT, TWO-WIRE STARTING, LIGHTING AND IGNITION SYSTEM

Ignition unit is carried on generator and is driven from generator shaft. Contacts should open .012 in. to .020 in. If generator is removed ignition must be retimed. On the Six, break should occur when the mark UDC 1-6 on the flywheel is just passing dead center. On the Four, the break should occur when the mark UDC 1-4 is 1 in. to 1¾ in. past dead center, No. 1 cylinder being on power stroke and spark at full retard, in each case. Firing order of Six, is 1, 4, 2, 6, 3, 5. Firing order of Four, is 1, 3, 4, 2. Spark gap should be 1/32 in. Safety gap should be ⅜ in. If safety gap is less than 11/32 in. the spark would be apt to jump across it instead of the spark plug gap. Put a very small amount of vaseline on breaker cam every 1,000 miles. The distributor is provided with a grease cup, which should be kept full of soft cup grease and turned two turns to the right every 1,000 miles. Base of ignition coil should be well grounded, as it serves as one terminal. Clean contact points with file or No. 00 sandpaper.

The starter is connected to engine by a set of reduction gears, chain drive and a ratchet engagement to prevent engine turning starter. Do not change position of rocker ring holding brushes. The gears are completely enclosed and the casing packed with grease. A removable plug is provided for replenishing. This should not be required more than once a year. There is a covered oiler at each end of the motor. Inject a few drops of light oil every 1,000 miles under ordinary operation.

Generator is driven from pump shaft. It is provided with ball bearings. Put several drops light oil in the covered oilers at each end of generator every 1,000 miles. Brushes are of a special composition and should not be substituted by others. New brushes can be obtained from any Remy service station.

Voltage regulation is by third brush. Maximum charging rate is 18-20 amperes with generator cold and battery reading 1.280 specific gravity, or 17-18 amperes if battery is reading 1.350. Output gradually reduces at speeds above average. There is also a thermostatic control to prevent the storage battery being overheated by too rapid a charge. It is located on the brush rigging. Great care must be taken not to spring the thermostat blade, as by prying contacts open. To clean, blow out the dust carefully. Should the generator be run with battery disconnected, the thermostat resistance will burn out, thus protecting the generator shunt winding. If battery is reconnected the system may be operated as before, but when the thermostat gets hot enough to open the contacts the output will drop to zero, as the shunt field is opened instead of having a resistance placed in series with it. The resistance must be replaced as soon as it can be obtained from a service station. It is a unit easily installed. The high charging rate of 18 to 20 amperes at the start, when system is cold, is reduced to 13 to 14 amperes when the thermostat is heated enough to open the contacts. If car must be operated without the storage battery, connect the short circuit connector on the bottom terminal at the side of generator across the two lower terminals.

Relay contacts should open .020 in. to .025 in. Clean with No. 00 sandpaper. Ammeter indicates rate of charge or discharge. Head lamps are in series in dim position. Mazda lamps are used. Tail and instrument lights are in series. Head lamps are 6-8 v., 15 cp. Tail and instrument lamps are 3-4 v., 3 cp. The tail lamp is supplied with a switch to allow control at lamp, where ordinances require it.

Fuse block is reached by removing cowl board under dash. All fuses are 5 ampere. Any standard 5-ampere fuse wire may be used in replacing fuses.

On battery test, field of generator draws 5 amperes at 6.4 volts. Generator motoring draws 4.75 amperes at 6.4 volts and runs at 245 R. P. M.

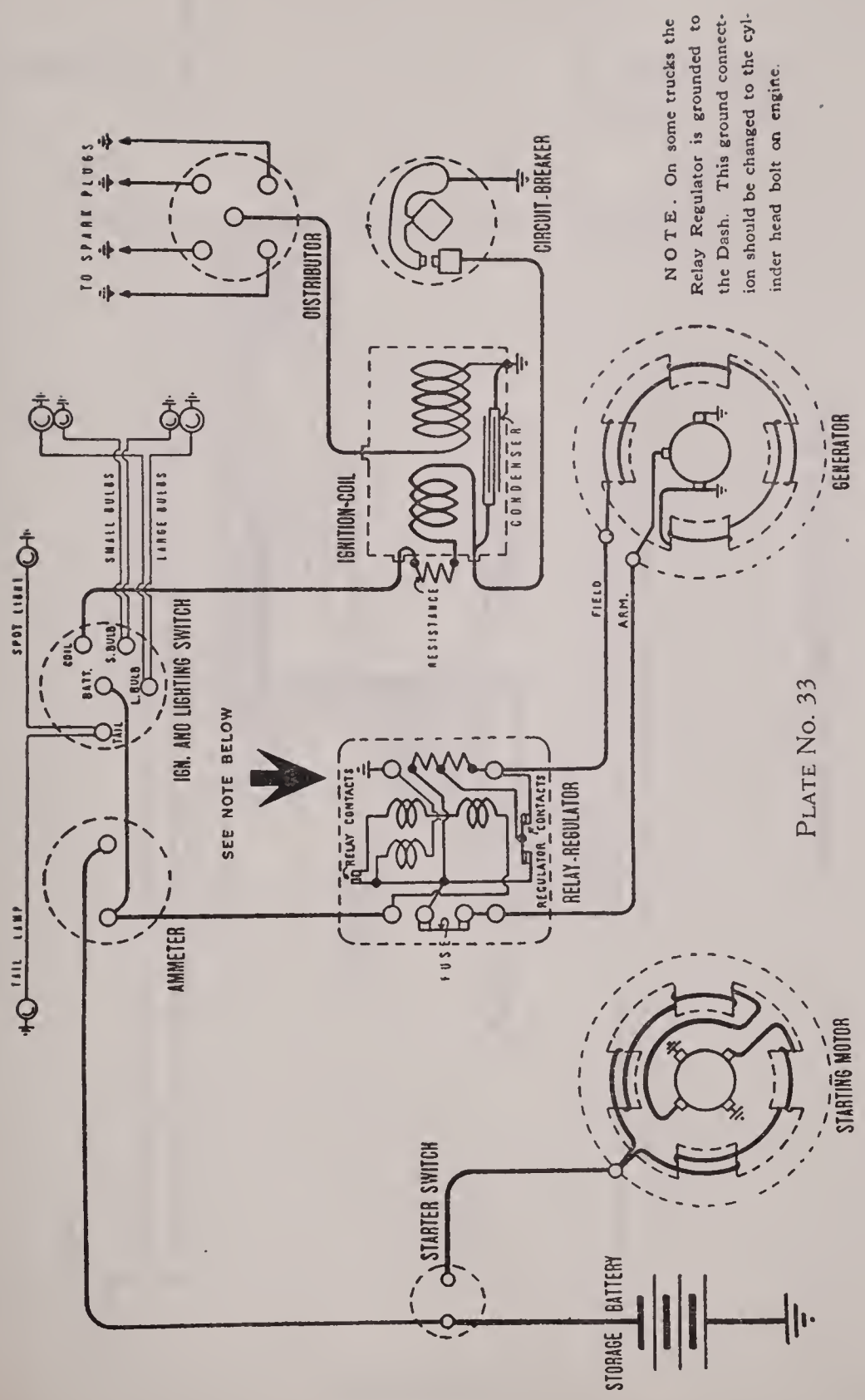


PLATE No. 33

Commerce

MODEL E, 1918

REMY TWO-UNIT, SINGLE-WIRE, STARTING AND LIGHTING SYSTEM

REMY IGNITION

Battery is 6 volt, 80 ampere-hour. The positive terminal is grounded.

Ignition unit is driven from generator shaft. Contacts should open .020 in. to .025 in. Clean with fine flat file or No. 00 sandpaper. Put a very small amount of vaseline on breaker cam every 1,000 miles. Rotor of distributor moves close to but does not touch pins. With spark at full retard, break should occur when dead center mark 1-4 on the flywheel is 1¼ in. past indicator. Firing order is 1, 3, 4, 2. Spark gap is .025 in. The grease cup on distributor should be given two or three turns every 1,000 miles.

Starting motor is connected to engine by Bendix gear. Oil bearing with several drops oil every 5,000 miles. Generator has distributor and coil mounted on it. The two bearings are provided with wick oilers. Fill the oiler wells with good oil every 1,000 miles. There is a 15-ampere fuse on the relay-regulator base to protect generator windings should it be run with battery disconnected. Voltage regulation is by vibrating regulator. Relay should close at 8½ miles per hour. Clean relay contacts with No. 00 sandpaper, taking care not to spring the arm. Contacts should open .020 in. to .025 in.

Inspect the regulator points at least every 1,000 miles. Clean with No. 00 sandpaper when necessary.

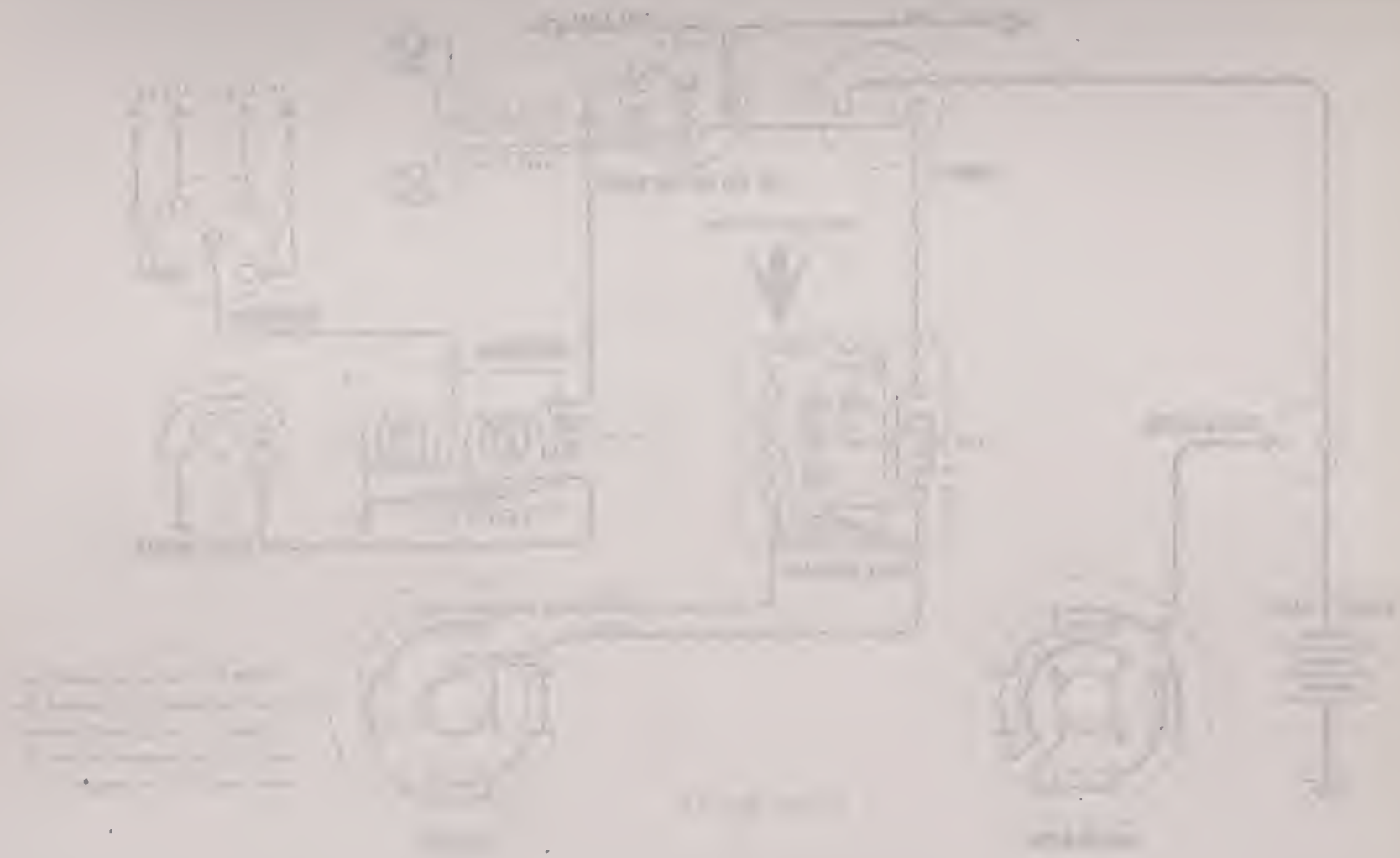
Storage battery will supply current for ignition and the small lights if regulator is removed for repairs. The current must be used with care if generator is not charging, as it will last but a few hours if any but the small lights are used. Do not use the starter with system in this condition. If the battery is too low to start engine, it may be started by connecting three dry cells, in series, to ignition. Ground the negative terminal, and connect the positive terminal to terminal on coil marked "Batt." Then crank engine by hand, spark being at full retard and ignition switch in "off" position. After engine is started the ignition switch may be turned on and the dry cells removed. The starter must not be used, and lights used sparingly, until generator has had a chance to recharge battery.

Charging rate should be 10 amperes at 15 miles per hour. If it is below this, clean the regulator points with No. 00 sandpaper. If this does not correct the trouble, try holding the regulator contacts firmly together. If this raises the charging rate the spring tension is too weak. If this is not the trouble, look for defective connections or a dirty commutator. Generator is apt to be damaged if the output is adjusted to be over 10 to 11 amperes.

Generator draws 4.2 amperes at 6.15 volts when running as a motor. On battery test field draws 2 amperes at 6.04 volts. Generator runs at 240 R. P. M. when motoring.

STARTING MOTOR DATA

Torque (with 6-in. pulley)	R. P. M.	Amperes	Volts
4 lbs.	1400	95-105	5.4-5.5
8 lbs.	1100	140-150	5.2-5.3
16 lbs.	700	220-230	4.8-4.9
33 lbs.	Lock Torque	510-540	3.4-3.6



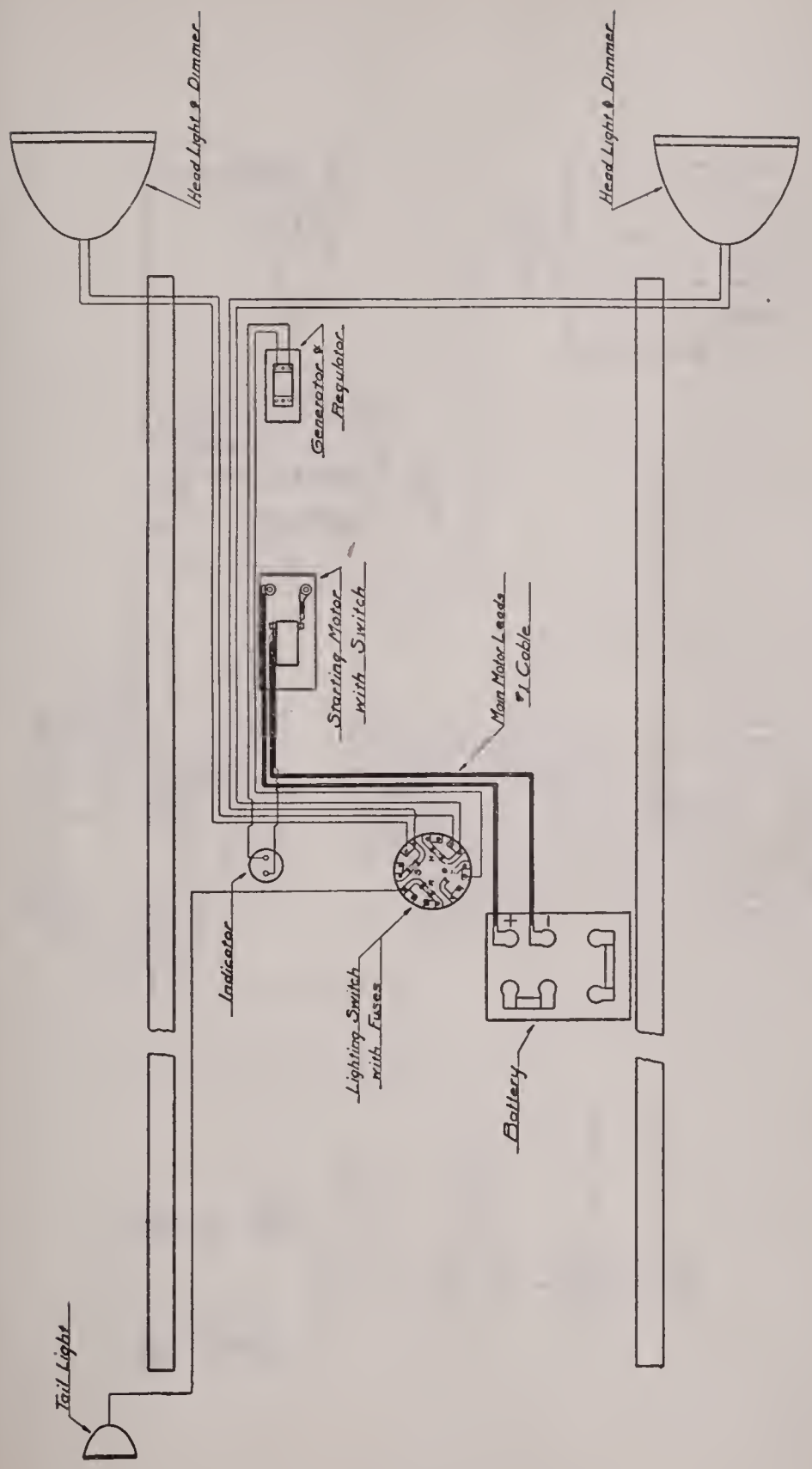


DIAGRAM OF WIRING ON METZ CAR

PLATE NO. 34

Metz

MODEL 25

GRAY AND DAVIS STARTING AND LIGHTING SYSTEM. BOSCH OR DIXIE IGNITION

Battery is 6 volt, 60 ampere-hour.

Magneto armature has ball bearing at each end, while shaft carrying distributor brush has plain bearing. Oil cups are provided at each end. There is one oil hole at driving end and two at distributor end. Oil each hole with three or four drops oil every month or 1,000 miles.

Spark gap should be .024 in. to .026 in. on models using the Bosch magneto, and .030 in. to .034 in. on models using the Dixie magneto.

TO TIME: Turn engine until No. 1 piston is 1/32 in. to 1/16 in. below upper dead center, on compression stroke. Remove one brush holder to expose slip ring. Rotate magneto armature until metal part of ring just begins to appear in groove. Then remove breaker housing. Turn armature until breaker is just about to open, or until the cam is beginning to bear on one of the steel segments. Connect to engine in this position, engine still in position before mentioned. Replace cap and brush holder and connect one of the brushes marked 1 with No. 1 cylinder and the other with No. 4 cylinder. The other brushes must be connected to No. 2 and No. 3 cylinders.

Starter is connected to engine by non-automatic mechanical shift and over-running clutch. There is a spring to prevent pinion accidently engaging flywheel gear. Oil motor regularly every two weeks. Put eight to ten drops best oil in each oiler. Sliding rods must be well lubricated. The gear case should receive one teaspoonful of heavy engine oil every three months.

There is an oil hole, with plug, providing a means of injecting this oil.

If motor rotates but fails to turn engine over, the clutch may be slipping, or the sliding surface of shaft may be dry or injured, preventing pinion meshing with flywheel gear.

Relay and voltage regulator are on top of generator. Relay cuts in at 10 miles per hour. Put eight or ten drops of good light oil in each oiler of generator every 500 miles or two weeks.

Ammeter shows rate of charge or discharge. Fuses for each circuit are in back of lighting switch. Should the small head lamps burn when the switch is turned to bright, turn off current and reverse plug leading into head lights. If current is not turned off when doing this, fuse will blow.

If indicator does not show charge with car running over 10 miles per hour, generator or regulator are not working properly, brushes or commutator are dirty, brushes stuck in holder, or belt loose. If meter indicates discharge with engine at rest and lights off, the needle is bent or there is a ground. If meter does not register when engine is running, the meter is at fault, there is a short or ground in system, or screw between B and L at regulator cutout is loose.

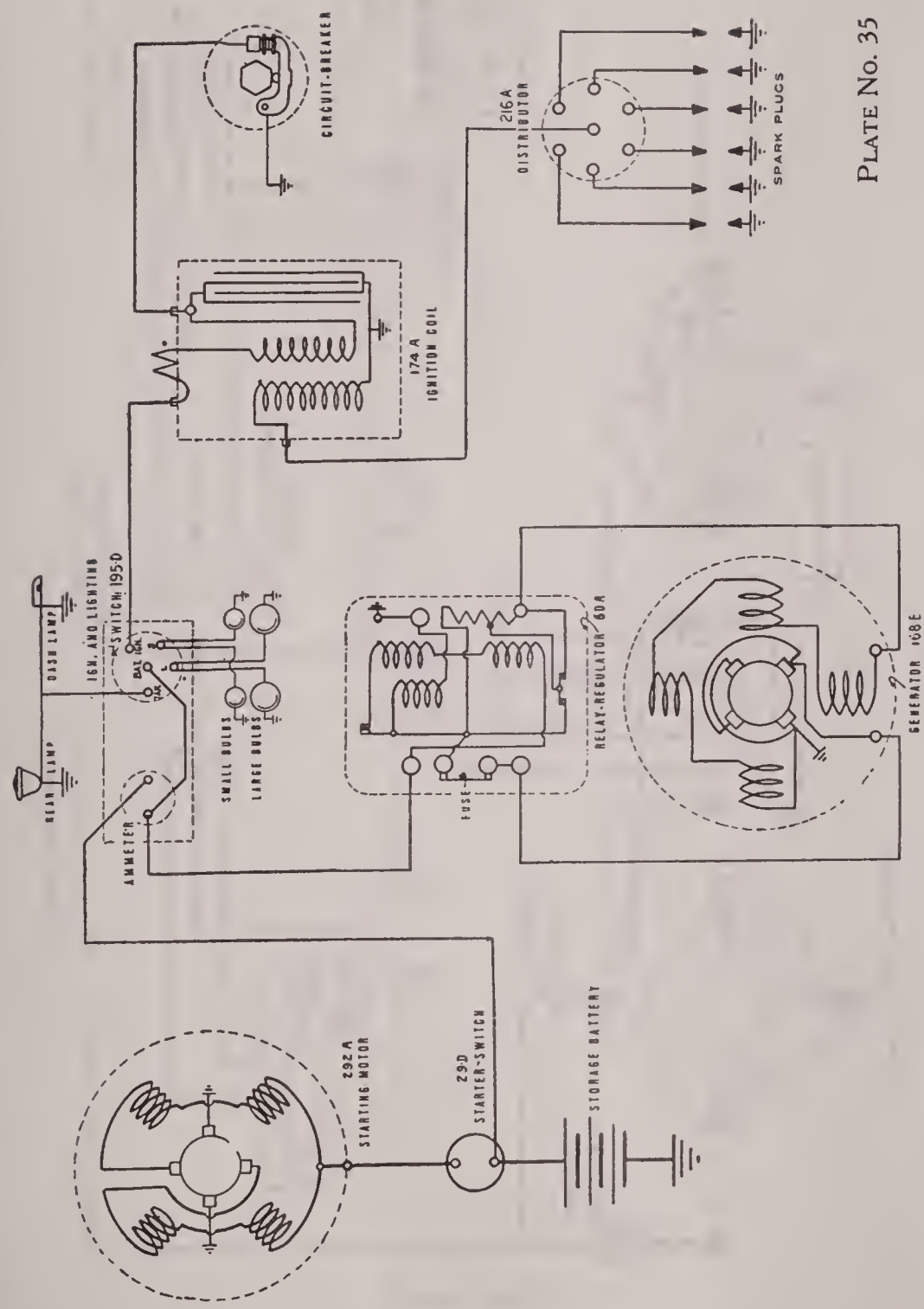


PLATE No. 35

Auburn

MODEL 6-39

REMY 6 VOLT, TWO-UNIT, STARTING AND LIGHTING SYSTEM. REMY IGNITION

Battery is 6 volt, 80 ampere-hour. The negative terminal is grounded.

Ignition unit, coil and relay-regulator are carried on generator. Contacts open .025 in. They should be inspected every 1,500 miles. Clean with file or No. 00 sandpaper. Put a small amount of vaseline on breaker every 1,500 miles. Spark plug gap should be .025 in. Distributor rotor moves close to but does not touch pins. Keep distributor grease cup full of medium cup grease and turn two turns to right every 500 miles. Break should occur when the upper dead center mark on flywheel is 1½ in. past indicator, spark fully retarded. Firing order is 1, 5, 3, 6, 2, 4.

Starting motor is connected to engine by Bendix gear. Voltage regulation of generator is by vibrating regulator. Both pairs of contacts on regulator should operate together. Care should be taken in cleaning not to change the adjustment. If the arms are accidently bent away, the regulator will allow no current to flow. If the spring tension is too great the charging rate will be excessive. Clean relay contacts with No. 00 sandpaper.

Do not change position of brushes. Brushes are of a special copper-carbon composition, and should not be substituted by others. New ones may be obtained from any Remy service station.

To test generator, turn on all lights in a dark place, with engine idling. Speed up generator considerably. If lights brighten considerably generator and relay are working properly.

If all lights go dim the battery is low or there is a ground in wiring. If all lights go out and ignition and starter fail, there is a defective connection at the battery. There is a fuse on base of regulator case to protect generator field windings.

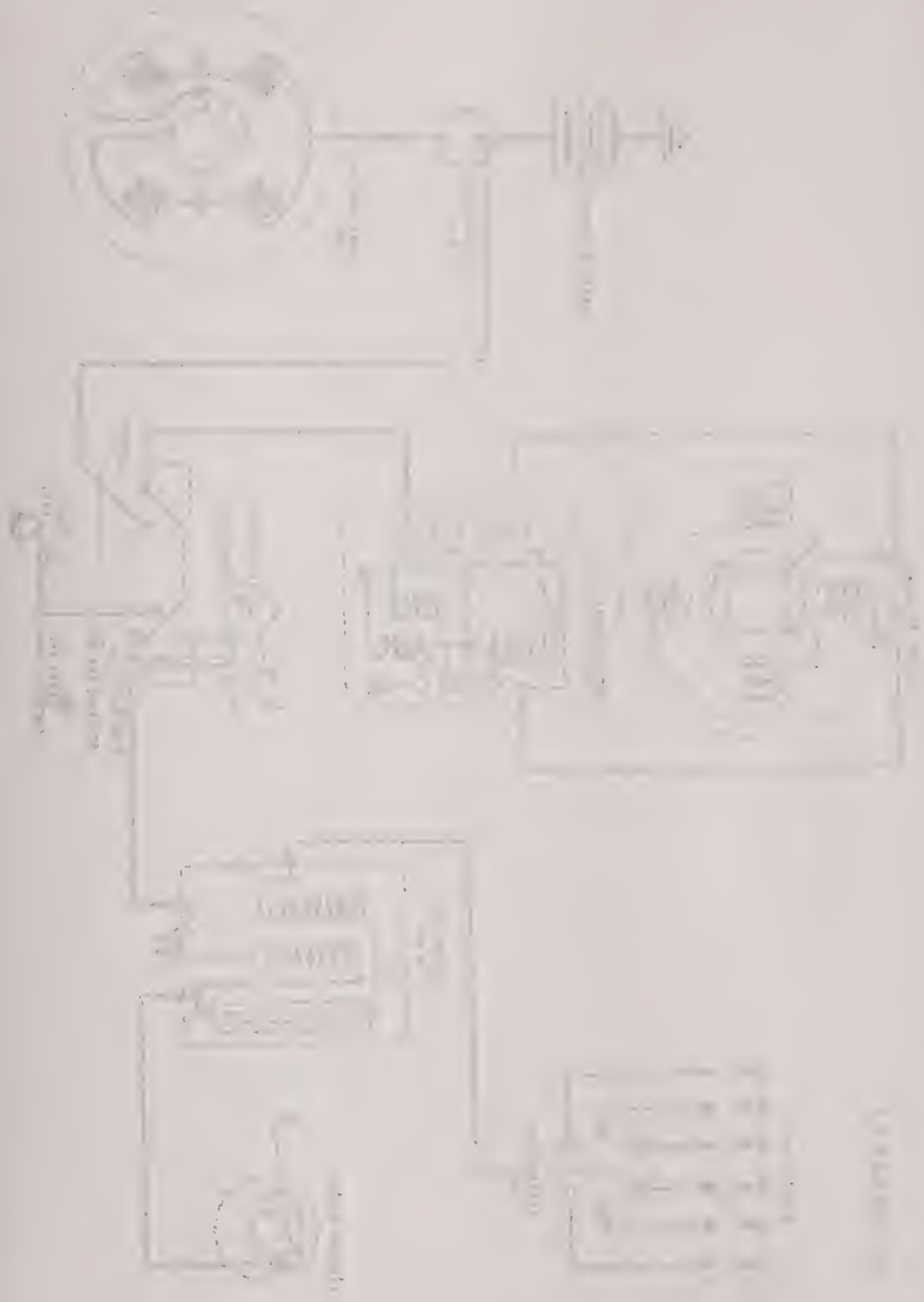
The following data applies to the Model 292A Starting motor used.

Torque (with 6-in. pulley)	R. P. M.	Amperes	Volts
0 lbs.	3300	60	6.0
4 lbs.	2400	110	5.7
16 lbs.	1000	270	4.65
28 lbs.	225	395	3.7
36 lbs.	50	435	3.6
40-44 lbs.	Lock Torque	450	3.6

The following data applies to the Model 168-E Generator used. (Test without ignition):

Amperes	R. P. M.	Volts
0.	500-550	6.0
7.	680-750	6.4
14.5	2400-2900	7.2

On battery test field draws 4 amperes at 5.9 volts. Generator motoring draws 5.5 amperes at 5.85 volts and runs at 400 R. P. M.



Abbot-Detroit

MODEL 6-44 (1916)

REMY 6-VOLT, TWO-UNIT, STARTING AND LIGHTING SYSTEM. REMY IGNITION

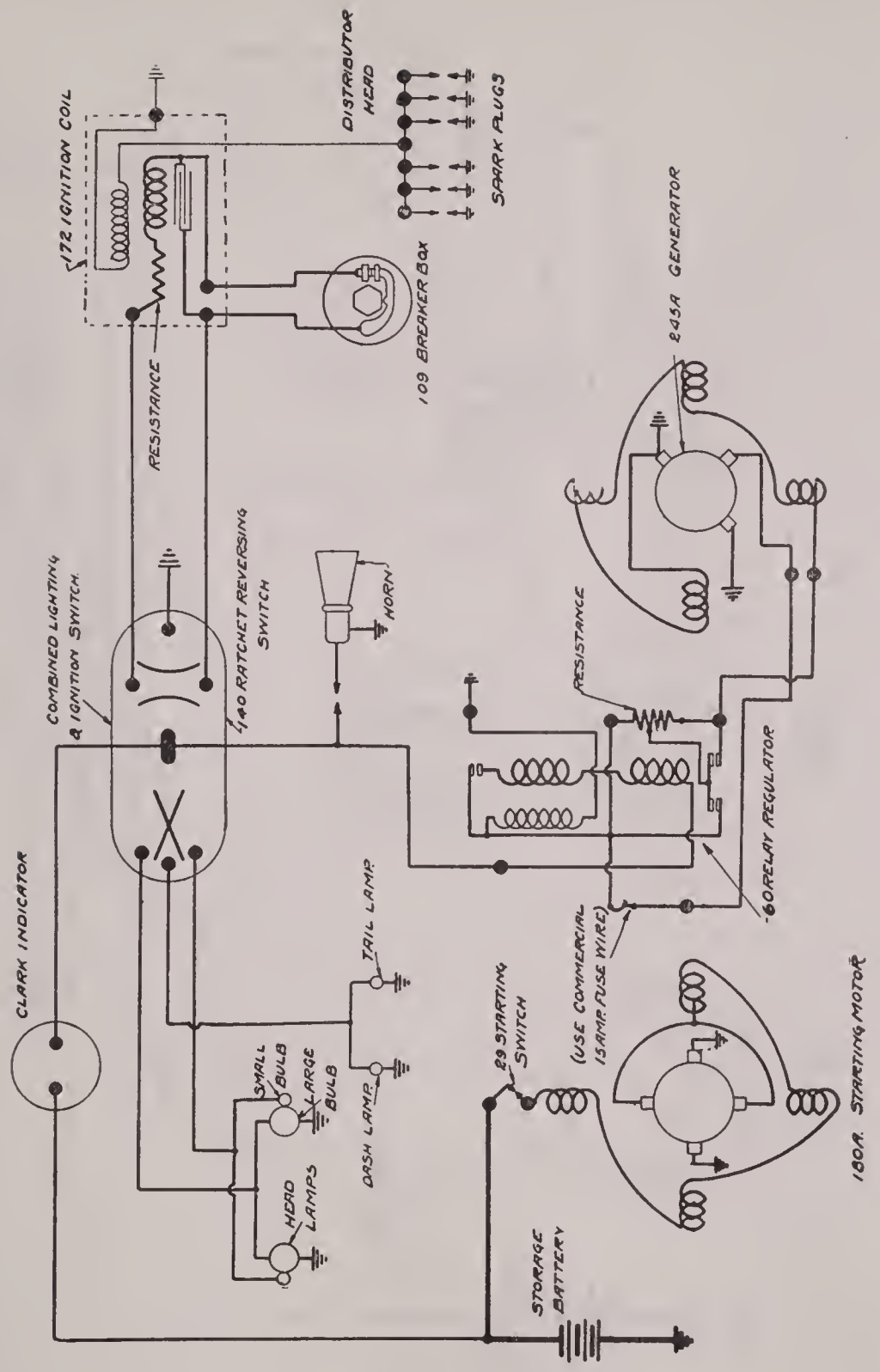


PLATE No. 36

Battery is 6 volt, 80 ampere-hour. The positive terminal is grounded.

The Model 245 ignition generator is used. It is driven at 1½ times engine speed. Contacts should open .020 in. to .025 in. Surface with file or No. 00 sandpaper. The rebound spring should be at least .020 in. from breaker arm when contacts are at their maximum opening. Spark gap is .025 in. to .030 in. Break occurs on top dead center, spark fully retarded. Firing order is 1, 5, 3, 6, 2, 4.

Starter is connected to engine by Bendix gear.

Oil generator oilers with five or six drops oil every 1,000 miles. Brushes are of special copper-carbon composition, and should not be substituted by others. New ones may be obtained from any Remy service station. Voltage regulation is by vibrating regulator. Increasing spring tension will increase charging rate. Be careful not to disturb adjustment when cleaning. Relay is built into regulator. Clean contacts with No. 00 sandpaper or fine, flat, jewelers file. There is a 15-ampere fuse on base of regulator to protect generator windings. Do not change position of the rocker ring holding brushes. Remove fuse if generator is run with battery disconnected. Combined lighting and ignition switch reverses current across contacts every time it is turned on.

All lamp bulbs are Mazda 7 volt. Large head lamps are 16 cp. Small head lamps are 4 cp. Dash and tail lamps are each 2 cp. Battery will discharge if ignition switch is left "On" with engine idle.

If lights, ignition, horn and starter fail, look for defective battery connections. If dash and tail light go out examine wire No. 7 (see diagram) for breaks or grounds. If any lights go out or flicker see that they make good contact with socket and that they are not burned out. If all lamps burn dimly test battery. If battery be O. K., test connections, and look for short circuits.

Starting Motor data:—

Torque (with 6-in. pulley)	R. P. M.	Amperes	Volts
0 lbs.	3600-4000	55-65	6.0
16 lbs.	1200-1450	200-220	4.6
24 lbs.	900-1100	290-310	4.5
40 lbs.	300-450	460-600	3.6
14 ft. Lbs.	Lock Torque	550-600	3.2

Generator data:

Amperes	R. P. M.	Volts
0.	600-650	6.0
7.	700-750	6.5
13-14	1500	6.9
13-14	3000	6.9

On battery test field draws 3.5 to 4 amperes at 5.9 volts. Generator motoring draws 6 to 6.5 amperes at 5.8 volts and runs at 470 R. P. M.

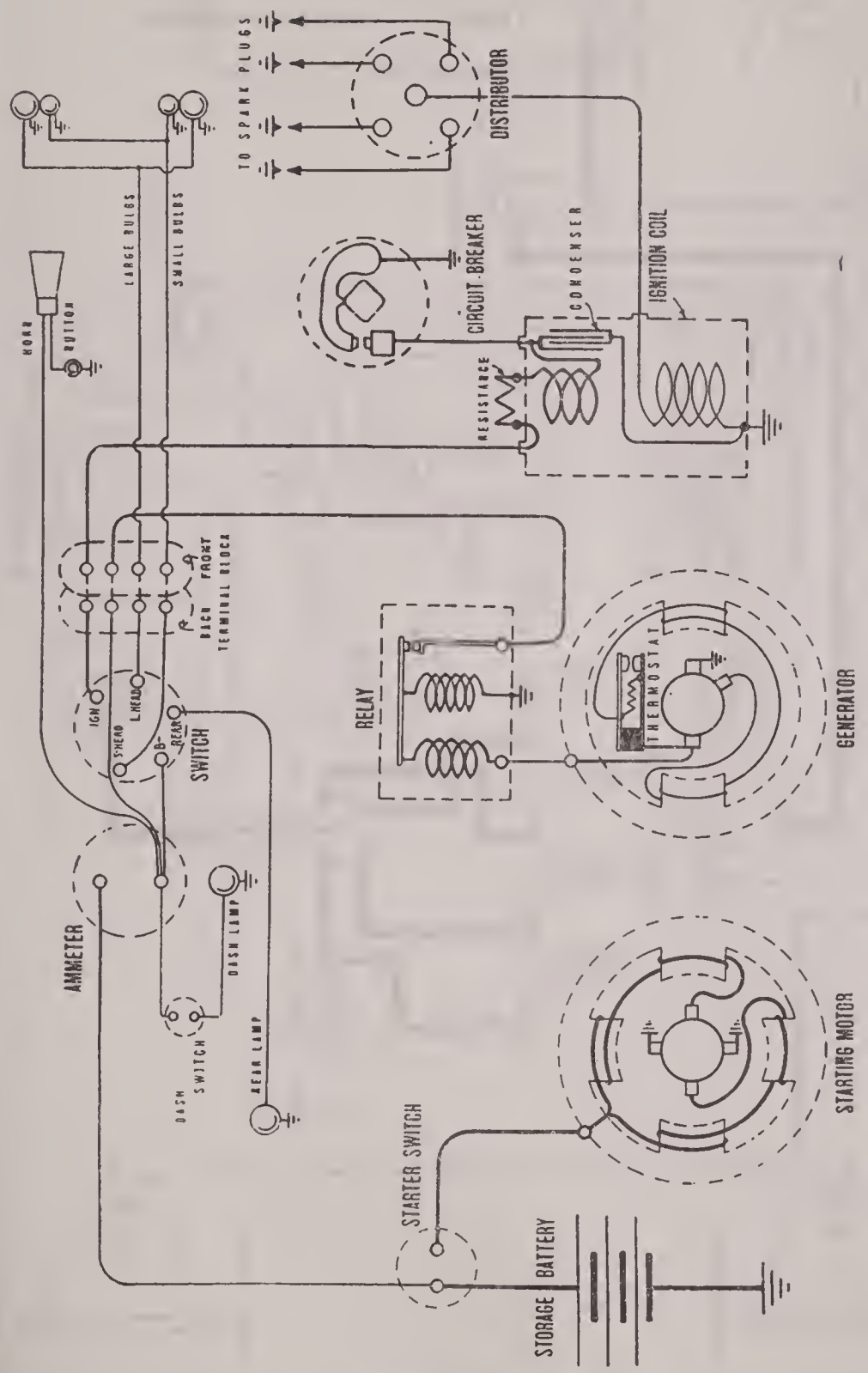


PLATE NO. 37

Scripps-Booth

MODEL G 1917

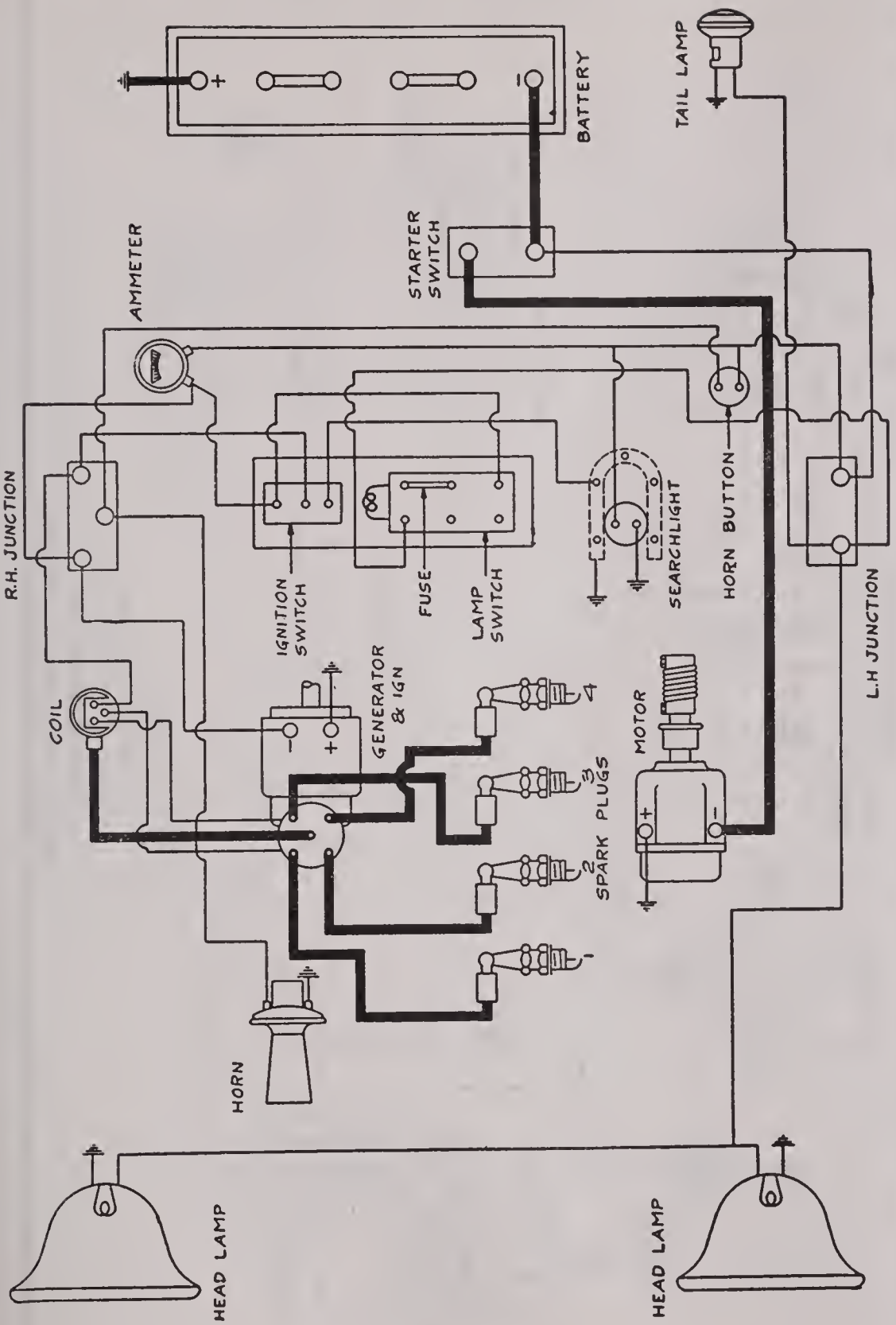
REMY TWO-UNIT, 6-VOLT, STARTING AND LIGHTING SYSTEM. REMY IGNITION

Battery is 6 volt, 140 ampere-hour. The positive terminal is grounded.

Distributor and coil are carried on generator. Contacts open .025 in. Inspect every 1,500 miles. Surface with file or No. 00 sandpaper. Put a small amount of vaseline on cam every 1,500 miles. Break should occur when dead center mark on flywheel is 3/8 in. past dead center, spark lever fully retarded. Firing order is 1, 3, 4, 2, Spark gap is .025 in. to .030 in. Safety gap not under 11/32 in. and not over 3/8 in. The distributor is provided with a grease cup which should be kept full of medium cup grease and tightened two turns every 1,000 miles. There is an automatic spark advance.

Starting motor is connected to flywheel by Bendix gear. Clean commutator at least once per year. Oil bearings with several drops oil every 1,000 miles. Generator is provided with an oil well and wick feed at each bearing. Oil with a few drops light oil every 1,000 miles. Voltage regulation is by third brush. Any adjustment should be made only when thermostat is cold. Thermostat is located on brush rigging. It throws a resistance into the shunt field, at approximately 175° F. When cold the maximum charging rate should be 18-20 amperes with battery reading at 1,280, or 17-18 amperes with battery reading at 1,250. At speeds above that which will produce this rate the third brush gradually decreases the output. There may be a slight decrease due to the warming of the generator windings. The thermostat will reduce the rate to 13 or 14 amperes, after a run at the high charging rate. In case maximum current cannot be made to exceed 15 amperes with generator and thermostat cold, inspect commutator and third brush.

In case the generator is run with battery disconnected, the thermostat resistance will burn out, thus protecting the generator windings. The battery will charge with system in this condition until thermostat is heated enough for contacts to open, then the shunt field will be opened instead of having a resistance put in series with it, thus rendering generator inoperative until it has had time to cool off again. The resistance must be replaced as soon as another can be obtained from the nearest Remy service station, as battery is not being properly charged without it.



Wiring Diagram

PLATE No. 38

Briscoe

MODEL B-4-24

AUTO-LITE 6-VOLT, TWO-UNIT STARTING AND LIGHTING SYSTEM
CONNECTICUT IGNITION

Battery is 6 volt, 80 ampere-hour. The positive terminal is grounded.

The distributor is driven by worm gears from the generator shaft. When contacts are badly burned a new breaker should be installed. The contacts may be surfaced with a file sufficient to run the car several hundred miles if a new breaker is not immediately available. They should open a little less than 1/32 in. Every 1,000 miles the oil cup at side of distributor should be removed and the wick thoroughly saturated with 3-in-1 or similar oil. Wipe out distributor cap with a soft cloth at same time. Use vaseline in the grease cup below distributor head. With spark at full retard the break should occur when mark 1:4 on the flywheel is at indicator, No. 1 piston just entering power stroke. With engine in this position, ammeter should not show discharge with lights and horn off. A slight advance of spark lever should close contacts and cause meter to indicate discharge. Firing order is 1, 3, 4, 2. Spark gap, 1/32 in.

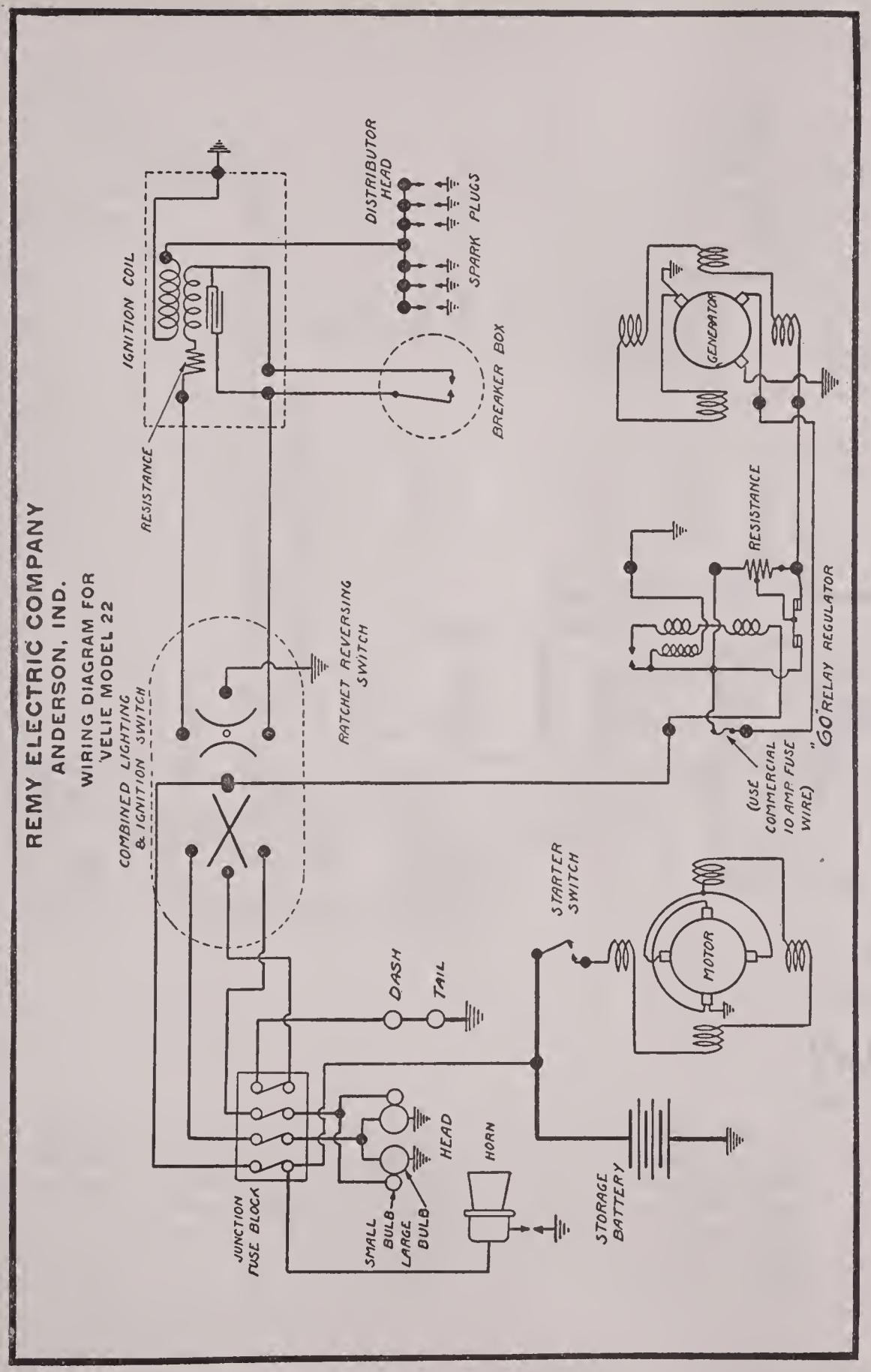
The ignition switch is equipped with an automatic release.

Head lamps are 6 v., 12cp. Tail lamp is 6 v., 2 cp. Dash lamp, 6 v., 2 cp. Ammeter registers rate of charge and discharge. Head and tail lamps burning bright, ignition off, should consume a trifle less than 4 amperes, and with lights dimmed a little less than 3 amperes. With lights off and motor running very slow, the discharge through ignition will be about 4½ amperes. With motor running at a speed equal to a car speed of 15 miles per hour there should be a charge of 7 to 10 amperes with lights off.

Starting motor is connected to engine by Bendix gear. Motor bearings should be repacked with medium cup grease at least once a year.

The type GH generator is used. Voltage regulation is by third brush.

If car is run with battery disconnected from generator the generator terminals must be short circuited. Put 5 to 8 drops light engine oil in the generator oil cups each 1,000 miles. If it is desired to run car with storage battery out, short circuit the generator and put three dry cells, in series, in place of storage battery. Use dry cells for ignition only.



Velie

Model 22 (1915-16)

Remy 6-Volt, Two-Unit Starting and Lighting System. Remy Ignition

Battery is 6 volt, 80 ampere-hour. The positive terminal is grounded.

Breaker, distributor and ignition coil are mounted on generator. Breaker contacts should open .020 in. to .025 in. Break should occur when the dead center mark on the flywheel is 3/8 in. past indicator, engine being turned slowly by hand. Spark advance and retard is by a governor. Firing order is 1, 5, 3, 6, 2, 4. Spark gap should be .025 in. to .030 in. Use medium cup grease in grease cup under distributor. In case a wick is provided, use only pure vaseline instead of cup grease. Surface contacts with a piece of No. 00 sandpaper or a fine, flat jeweler's file.

Motor is connected to engine by a Bendix gear. Pinion should have about 1½ in. lateral travel. Motor is equipped with ball bearings. Several drops of light machine oil should be injected into the bearing every 1,000 miles. The following data applies to the motor:

Torque (with 6-in. pulley)	R. P. M.	Amperes	Volts
0 lbs.	3600-4000	55-65	6.0
16 lbs.	1200-1450	200-220	4.6
24 lbs.	900-1100	290-310	4.5
40 lbs.	300-450	460-600	3.6
14 ft. lbs.	Lock Torque	550-600	3.2

Voltage regulation is by vibrating regulator. Relay is combined with regulator. There is a fuse on relay-regulator base to protect the generator windings in case generator is run with battery disconnected. Use commercial 15-ampere fuse wire. Increasing the spring tension on regulator contact arm will raise the voltage. Clean contacts by drawing a piece of soft paper between them or with a piece of worn No. 00 sandpaper. Do not use sandpaper unless necessary, as too frequent use of it is apt to affect output. Be very careful not to bend the contact arms when cleaning contacts.

The following data applies to generator, test to be made without ignition:

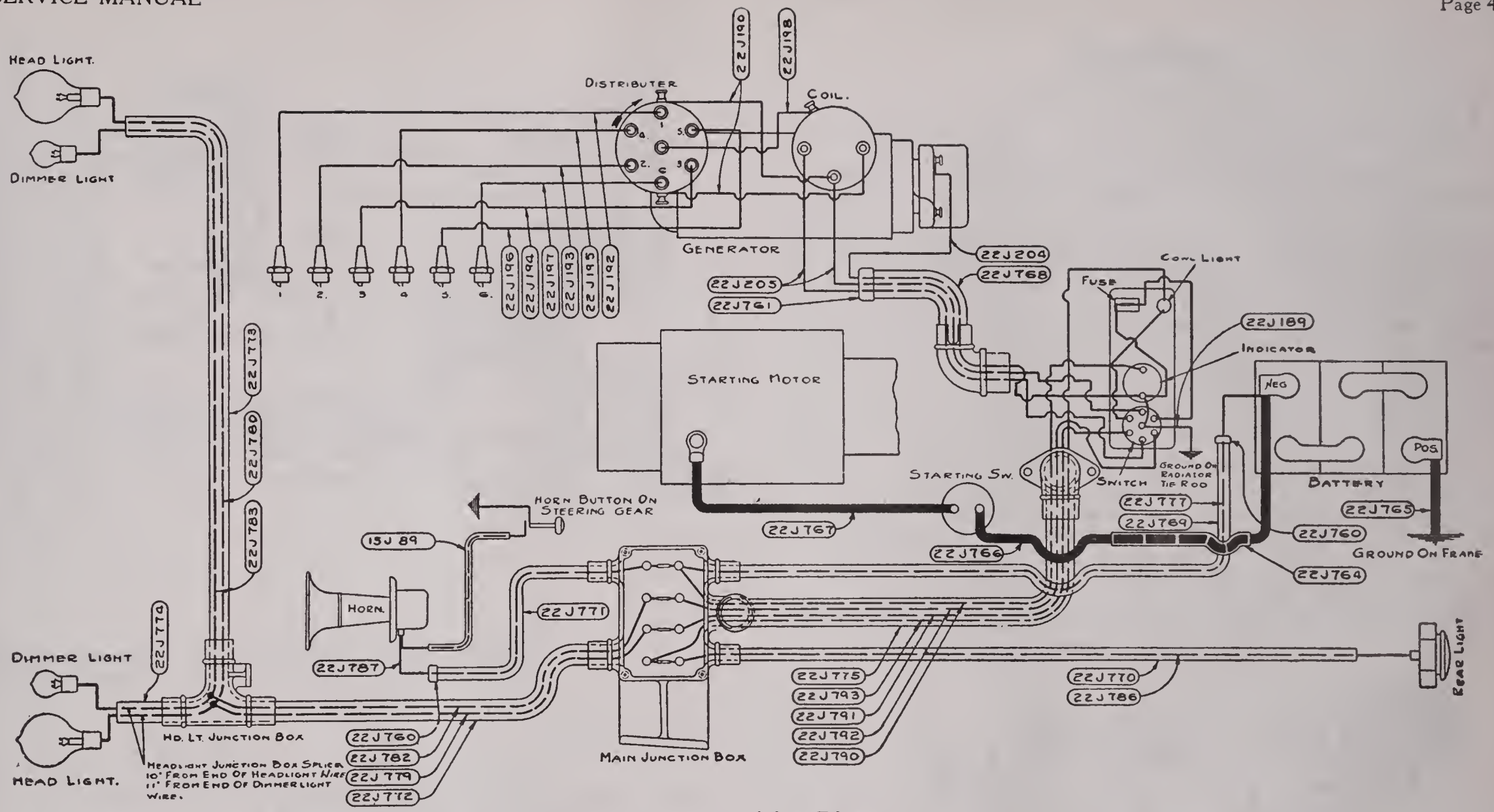
Amperes	R. P. M.	Volts
9.	600-650	6.0
7.	780-850	6.6
14.5	2500-3000	7.2

On battery test, field draws 3.5 to 4 amperes at 5.9 volts. Generator motoring draws 4.5 to 5 amperes at 5.8 volts and runs at 430 R. P. M. Every 1,000 miles put five or six drops of medium weight machine oil in each of the generator oilers.

Mazda lamps are used in all circuits. Dash and tail lights are in series. They are 3.5 volt, 2 cp. Large head lights are 7 volt, 16 cp. Small head lights are 7 volt, 4 cp.

All fuses on fuse panels are 15 amperes. Fuses may be obtained from Remy or Velie service stations or made of commercial 15-ampere fuse wire.

Plate No. 39



Wiring Diagram

PLATE No. 40

Velie

MODEL 28

REMY TWO-UNIT STARTING AND LIGHTING SYSTEM. REMY IGNITION

Distributor is driven from generator shaft. Contacts open .015 in. to .018 in. Clean with fine file or No. 00 sandpaper. Put a small amount vaseline on cam every 1,500 miles. Break should occur when the dead center mark on flywheel is 3/8 in. past indicator, spark full retard. Firing order is 1, 5, 3, 6, 2, 4. Spark gap is .025 to .030 in. Safety gap 11/32 in. to 3/8 in. Distributor segment moves close to but does not touch pins. Use medium cup grease in distributor grease cup. Turn two turns to right every 1,000 miles. Starting motor is connected to engine by Bendix drive. Oil motor bearings with a few drops light oil every 1,000 miles.

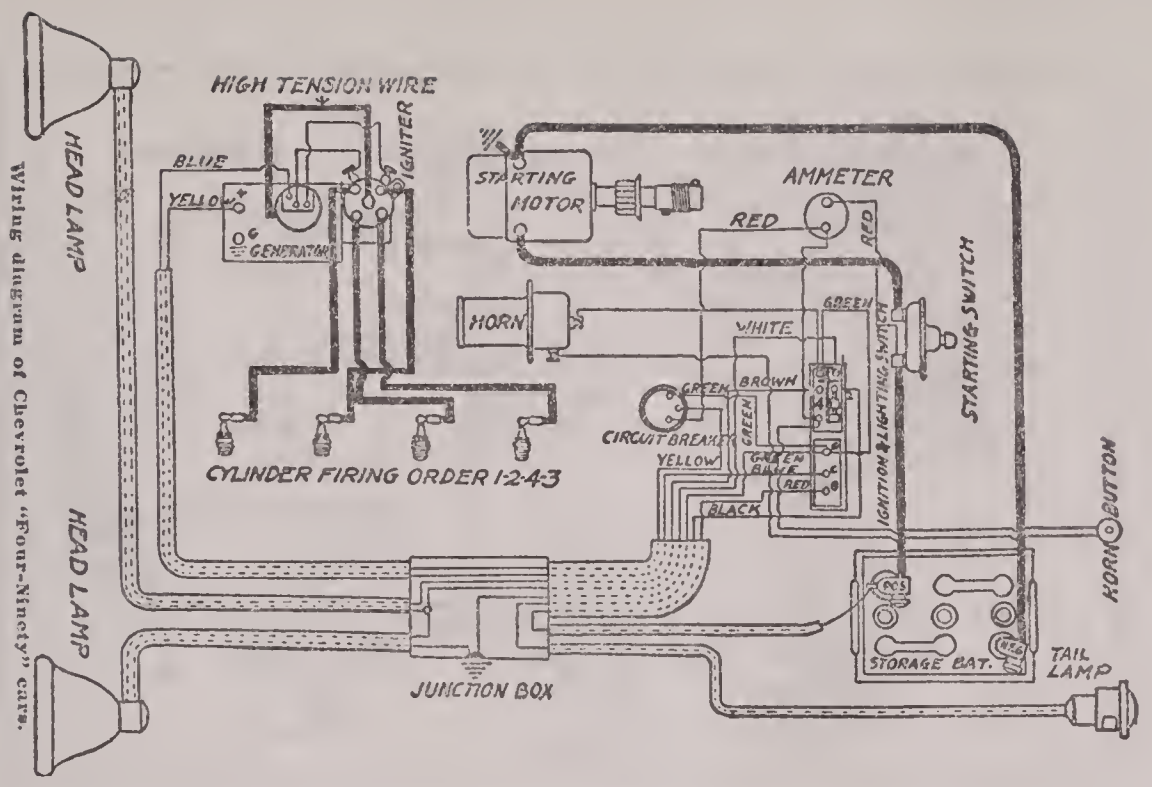
Oil generator oilers with five or six drops oil every 1,000 miles. Voltage regulation by vibrating regulator. There is a 15-ampere fuse on regulator base. In case generator is run with battery disconnected this fuse will blow, protecting the generator windings. Use commercial 15-ampere fuse wire.

The followng data applies to the generator, tests to be made without ignition:

Amperes	R. P. M.	Volts
0.	600-650	6.0
7.	780-850	6.6
14.5	2500-3000	7.2

On battery test field draws 3.5 to 4 amperes at 5.9 volts. Generator motoring draws 4.5 to 5 amperes at 5.8 volts and runs at 430 R. P. M.

Relay should close at about 7 miles per hour and open at about 6 miles per hour.



Wiring diagram of Chevrolet "Four-Ninety" cars.

Chevrolet

Models D-F, 4-90, 1916-17

Auto-Lite Starting and Lighting System. Connecticut Ignition

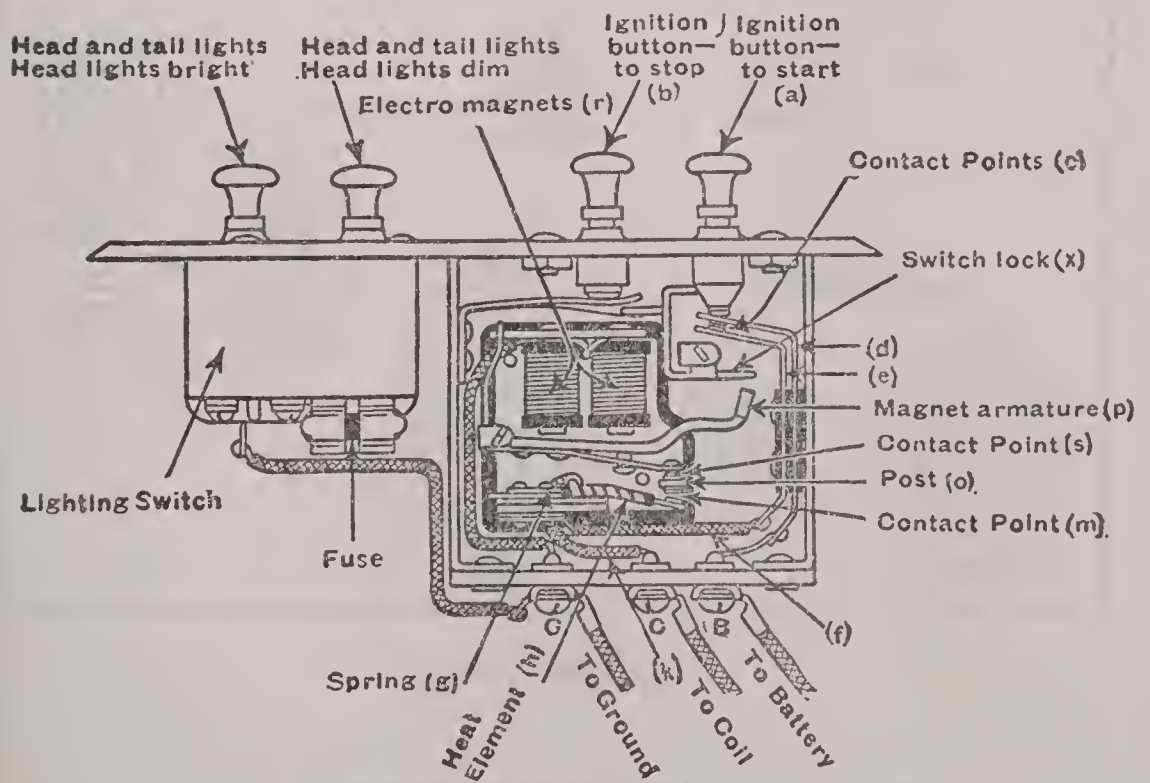
Battery is 6 volt, 80 ampere-hour. The negative terminal is grounded.

Break should occur on top dead center, spark fully retarded. The firing order is 1, 2, 4, 3.

There is a circuit breaker in the switch box to open the ignition circuit if it is accidently left on with engine idle. If it fails to operate loosen the screws holding it to the instrument board and pull it out. To locate the trouble disconnect the wire from the middle connection (C). Connect a long wire to the negative terminal of the storage battery. Hold in the ignition button and touch the free end to spring (e) and make and break the circuit. If a spark is given off, the contacts (c) are in good condition. If not, make necessary repairs. If they are in good condition test the heat element (h) by bringing the free end of the test wire from battery to terminal (C) and make and break the circuit. Failure to secure a spark at this point is due to the following: The heat element (h) may have burned out, the wire (h) may have become unsoldered or the heat element from the spring (g). The last two troubles may be easily repaired, but if the heat element is burned out a new one may be installed. It may be obtained from the nearest service station. A temporary repair may be made by soldering a short piece of wire from the terminal (C) to the spring (e), but with this arrangement the automatic cut-out feature is destroyed until the heat element is renewed. There is a fuse in the main line leading to the light circuit.

Starter is connected to engine by Bendix gear.

Two types of generators were used. Type GG, two-brush generator, with reverse series field voltage control was used on part of the 4-90 models. The type GH generator with third brush regulation is used on the other 4-90 models and the D and F. Oil generator oilers with five to eight drops of light oil every 1,000 miles.



Lighting and Ignition Switch (cover removed).

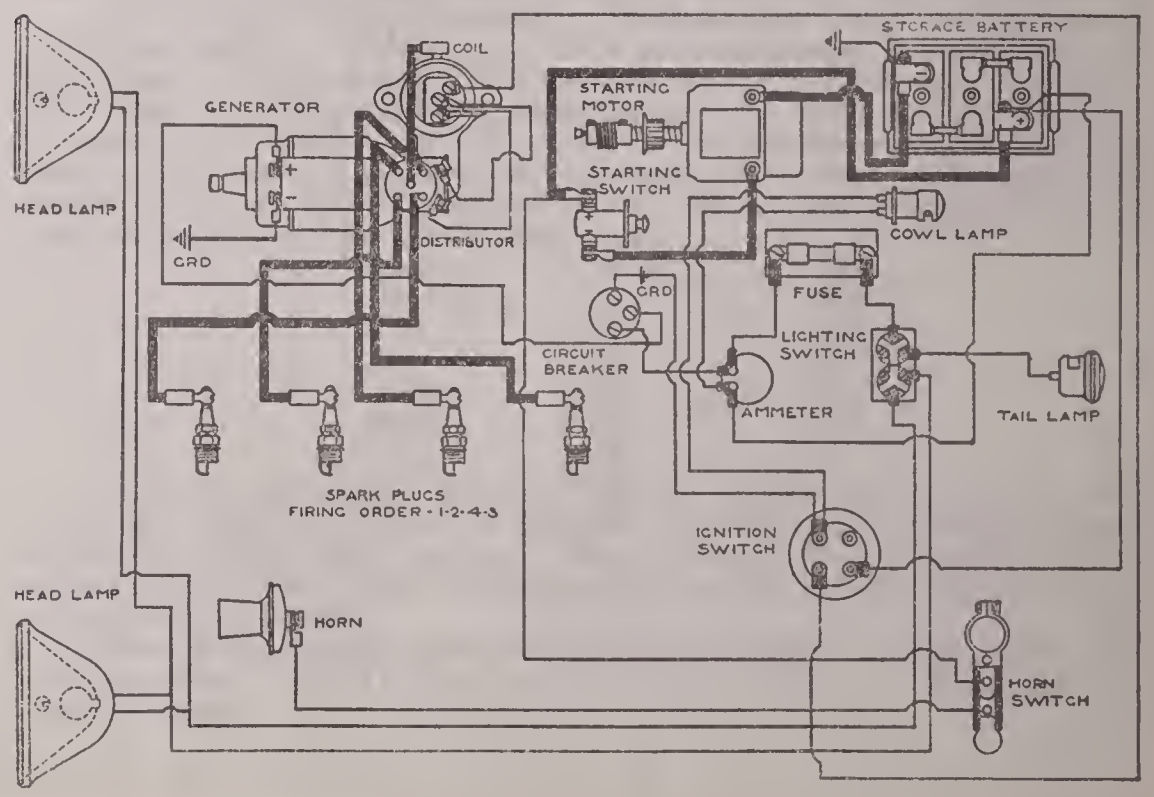
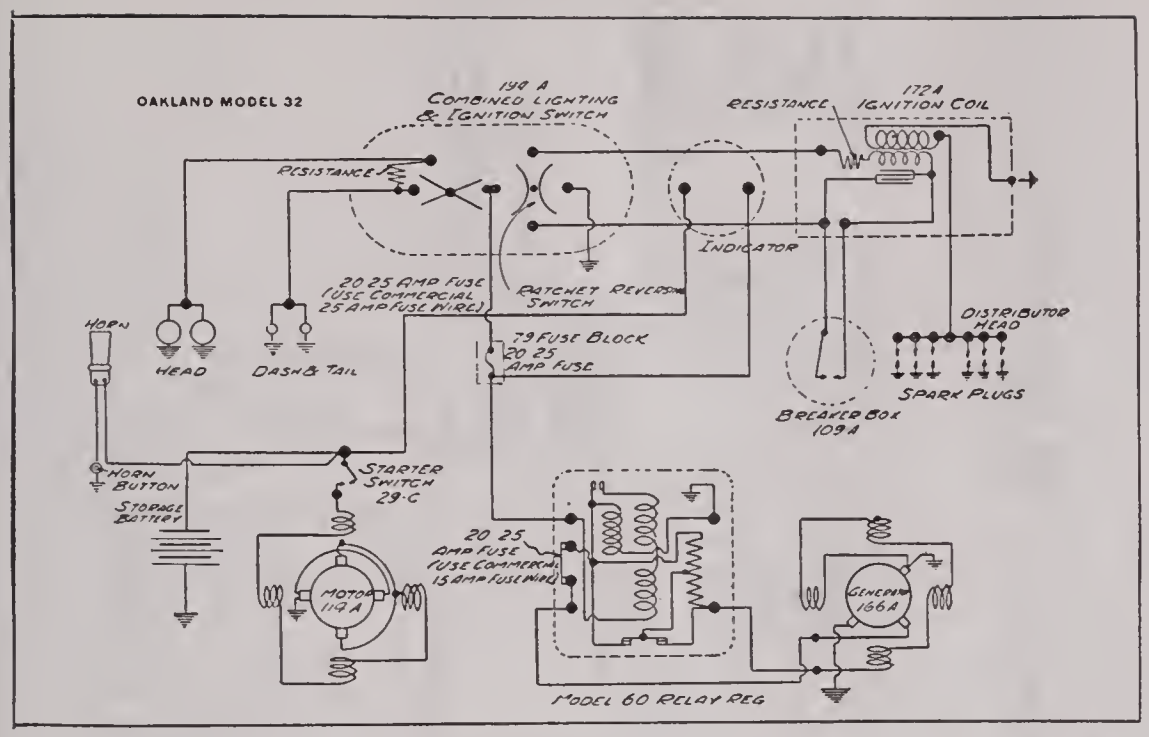


Plate No. 41



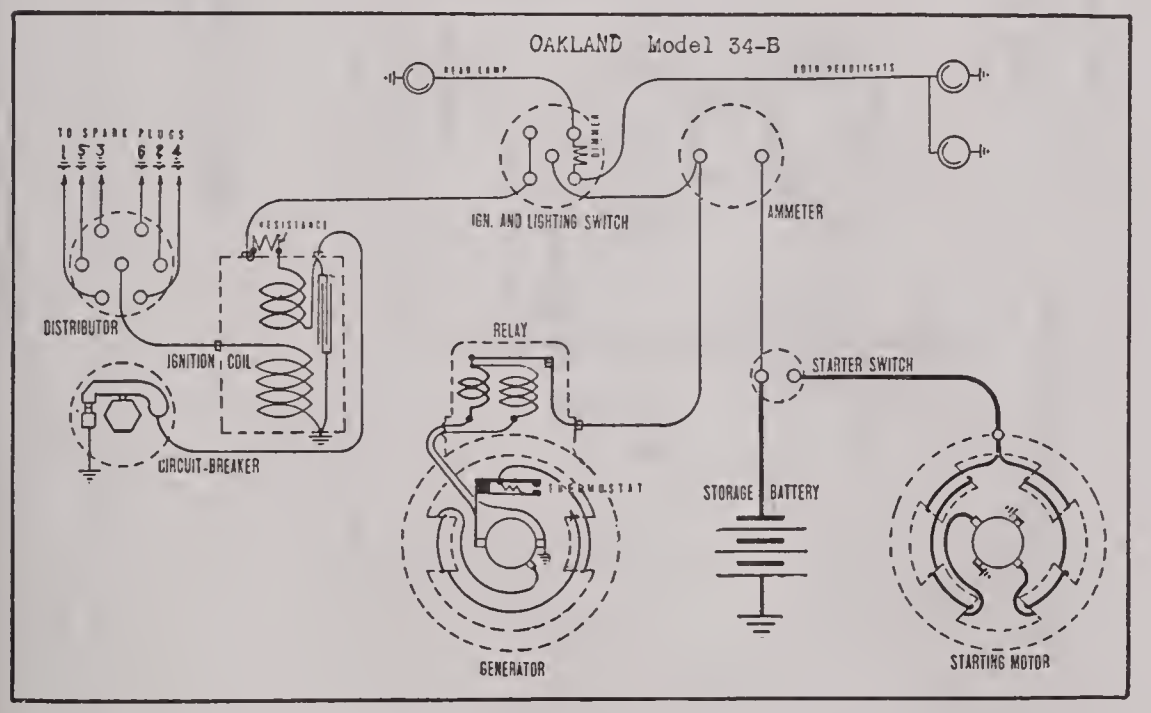


PLATE No. 42

Oakland

MODELS 32 AND 34-B (1916-18)

REMY TWO-UNIT STARTING AND LIGHTING SYSTEM. REMY IGNITION

Battery is 6 volt, 80 ampere-hour. The negative terminal is grounded.

Breaker contacts should open .020 in. to .025 in. Break should occur when mark UDC 1-6 on flywheel is at indicator, spark retarded. Firing order is 1, 5, 3, 6, 2, 4.

Starting motor is connected to engine by a Bendix gear. The following data applies to the No. 114-A starting motor used on the Model 32 car:

Torque (with 6-in. pulley)	R. P. M.	Amperes
00 lbs.	3500-6000	36-50
16 lbs.	1100-1450	190-220
24 lbs.	850-1050	280-300
40 lbs.	200-350	420-475
14 ft. lbs.	Lock Torque	520-600

Breaker is driven from the generator on the Model 32 car. The following data applies to this generator. (Test without ignition.)

Amperes	R. P. M.	Volts
0.	600-650	6.
7.	780-850	6.4
14.5	2500-3000	7.2

On battery test, generator field draws 4 amperes at 6 volts. Generator motoring draws 5.5 amperes at 5.8 volts and runs at 740 R. P. M. Voltage regulation is by a vibrating regulator. There is a fuse on the relay-regulator base. This fuse is in the shunt field circuit and will blow if generator is run with high resistance in the battery circuit. Use commercial 15-ampere fuse wire. There is also a 20-25 ampere fuse in line leading to lighting and ignition switch.

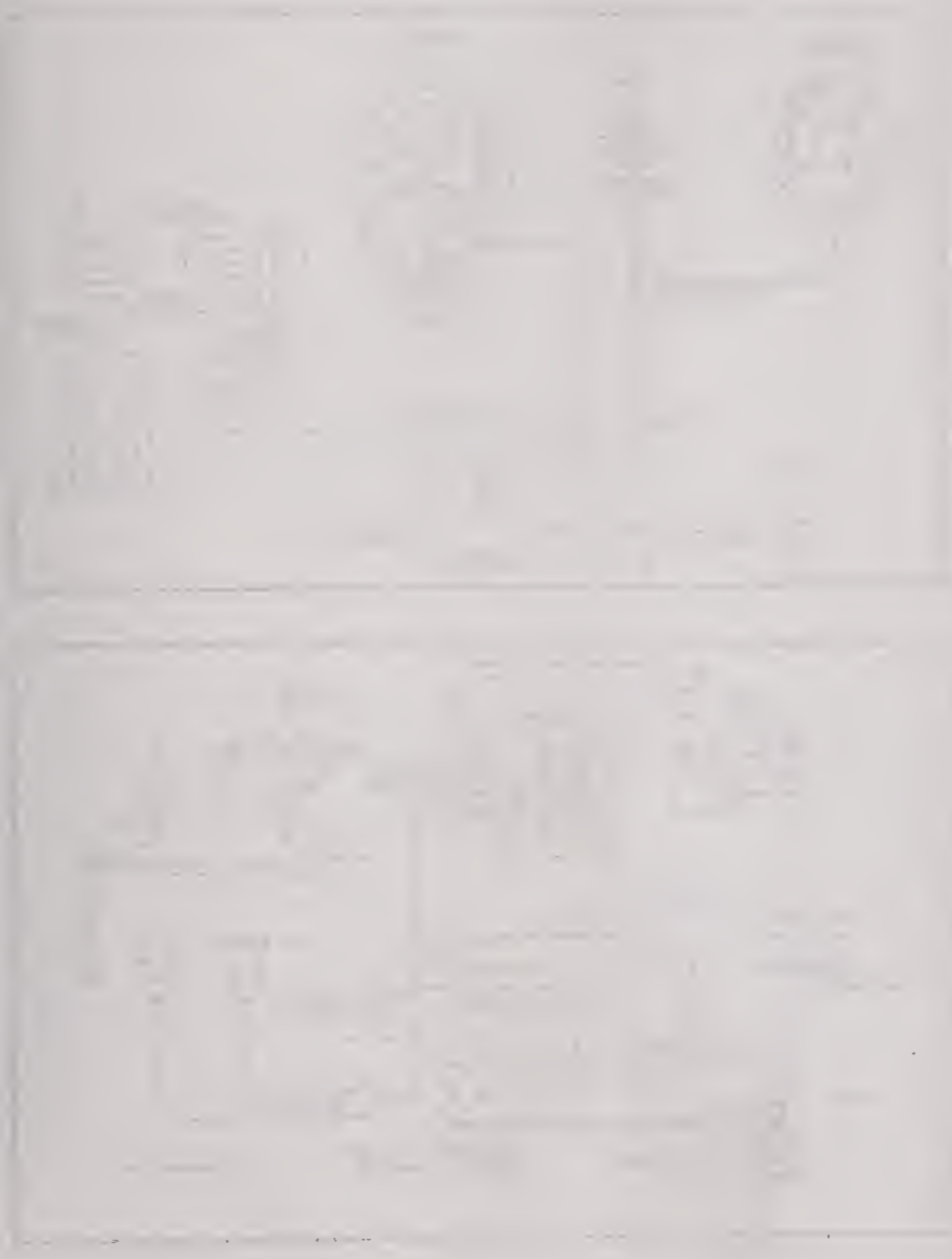
Put five or six drops of oil in motor and generator oilers every 1,000 miles. Use pure vaseline in grease cup under distributor head. Tighten two or three turns occasionally.

On the Model 34-B car the model No. 234-A generator is used. On this generator the voltage regulation is by third brush. There is also a thermostat to protect the battery from injury due to overheating. The maximum charging rate with thermostat cold is 18-20 amperes. The thermostat will reduce this rate to 13-14 amperes. The thermostat is mounted on the brush rigging. The thermostat resistance acts as a fuse in the shunt field. It will burn out if generator is run with battery disconnected. This resistance is a unit easily replaced. The following data applies to the generator. All tests to be made with relay in circuit and thermostat contacts closed:

Amperes	R. P. M.	Volts
0.	525	6.4
7.	780	7.1-7.2
14.	1100	7.8
19.5-20.5	1680	8.6
19-20	2000	8.6
13-15	3000	8.

Tension on main brushes should be 17-20 oz. Tension on third brush should be 13-17 oz. Field draws 5 amperes at 6.4 volts. The front bearing of generator is lubricated by the oil in the timing gear case. The rear generator bearing is provided with an oil well with wick feed. Every 1,000 miles, fill this oil well with good, light machine oil, to the level of the oil inlet.

Motor bearings should receive several drops of machine oil every 1,000 miles. Head lamps are 7 volt, 15 cp. Dash and tail lights are 7 volt, 2 cp. Mazda lamps are used in all circuits.



Oakland

32 B and 34 (1917)

DELCO IGNITION, 6-VOLT, TWO-UNIT STARTING AND LIGHTING SYSTEM

Battery is 6 volt, 80 ampere-hour. The negative terminal is grounded.

Breaker contacts open .018 in. to .020 in. Break occurs when mark U. D. C. 1-6 on fly wheel is at indicator, spark at full retard. For testing ignition units see Plate 69. Firing order is 1, 5, 3, 6, 2, 4. Contacts are made of tungsten metal. For care see Plate No. 20.

Voltage regulation is by third brush. For adjustment see Plate No. 77.

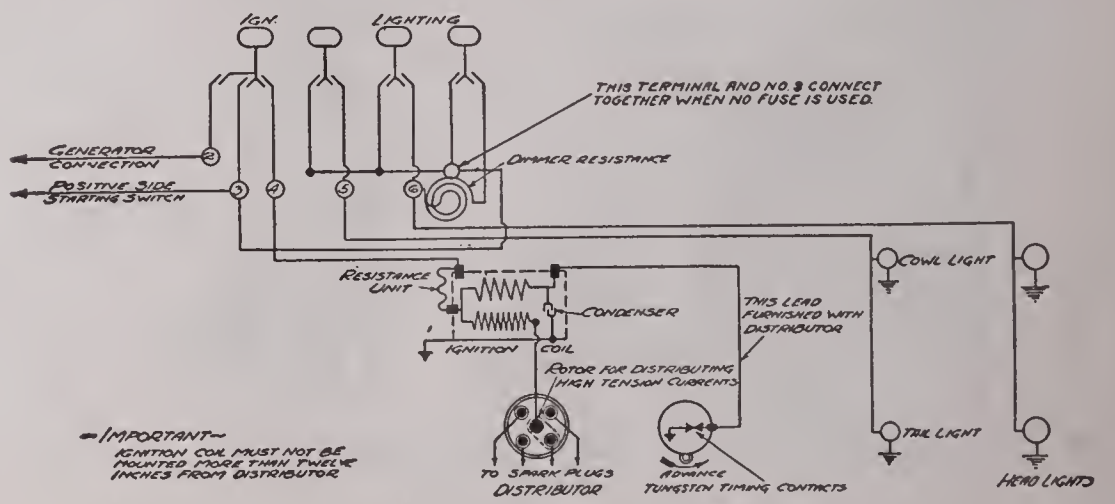
There is no relay. Circuit between generator and battery is controlled by ignition switch. On model 32-B the ammeter shows rate of charge or discharge. Model 34 has an indicator connected in place of ammeter used on model 32-B. A circuit breaker on back of the combination switch takes the place of fuses in lighting circuit.

On model 34 the dash light is connected to No. 8 terminal on switch instead of No. 7. On this model dash light is grounded to oil indicator.

Tail and head lights are both controlled by same switch, both sets being connected to same line. When dimmer resistance is thrown into circuit both head and tail lights are dimmed.

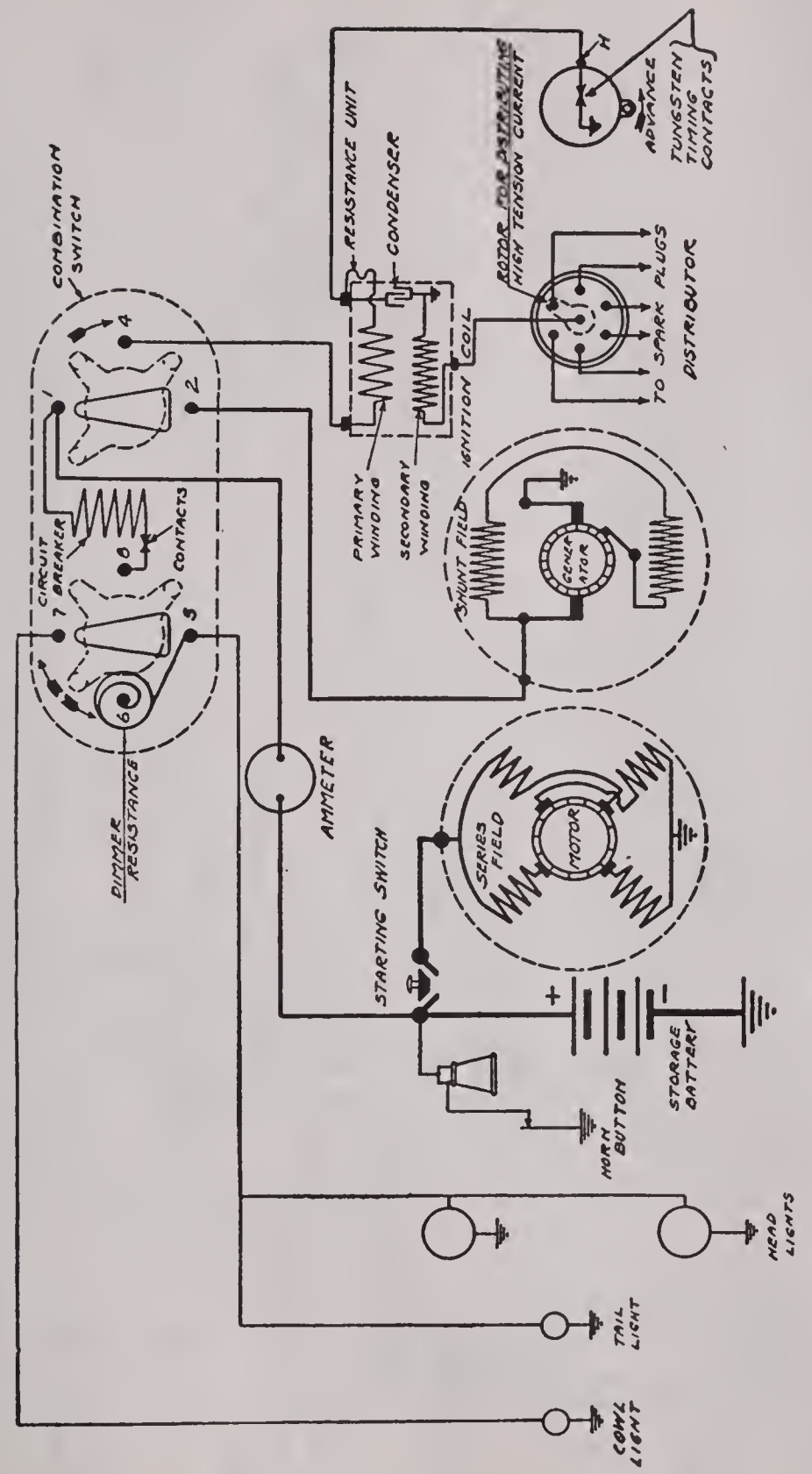
Head lamps are 7 volt, 15 cp. Tail lamp is 7 volt, 2 cp. Dash lamp is 7 volt, 2 cp.

Maximum charging rate of 16-18 amperes is reached at 18-20 miles per hour. It decreases to 10-15 amperes at higher speeds. Charging rate should never exceed 25 amperes. See Plate No. 73 for care and adjustment.



5160 Distributor 2118 Ignition Coil 1089 Combination Switch

OAKLAND, MODEL 32



99 Generator 100 Motor
1078 Combination Switch 1965 Motor Switch
2137 Ignition Coil

OAKLAND, MODEL 32

Oakland

Models 43, 48, 62 (1914)

Delco, 1914 Large, Single-Coil, Single-Unit Starting and Lighting System
Delco Ignition

Battery is 6 volt, 120 ampere-hour. The negative terminal is grounded.

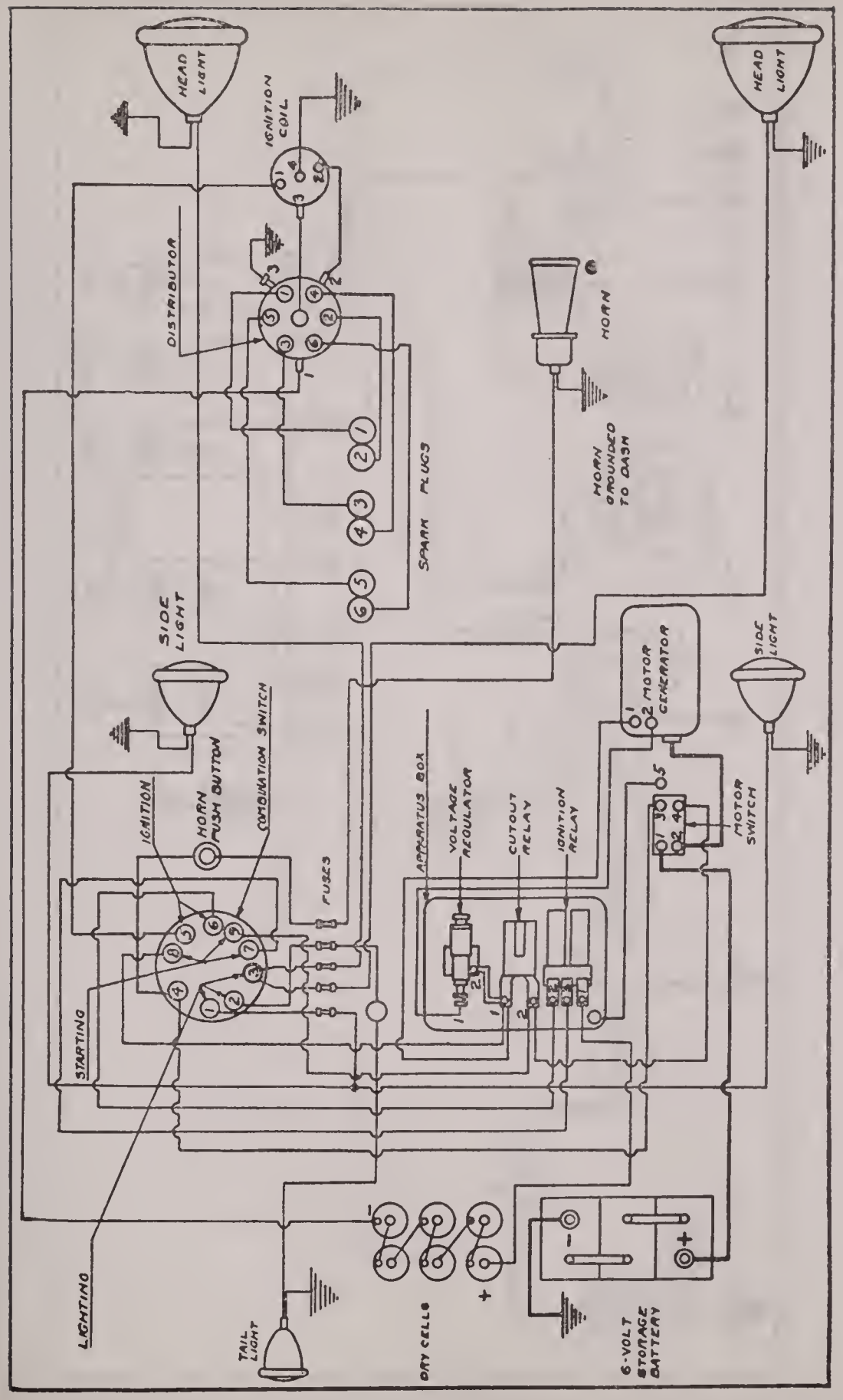
Breaker contacts should open .020 in. Break should occur just over top dead center, spark retarded. The firing order is 1, 5, 3, 6, 2, 4. There is an ignition relay and a set of dry cells to send a shower of sparks across the spark gap when starting. For a description of, and directions for the care of this relay see Plate No. 68. Spark gap should be .030 in.

For care of the motor-generator see Plates No. 65 and 65A.

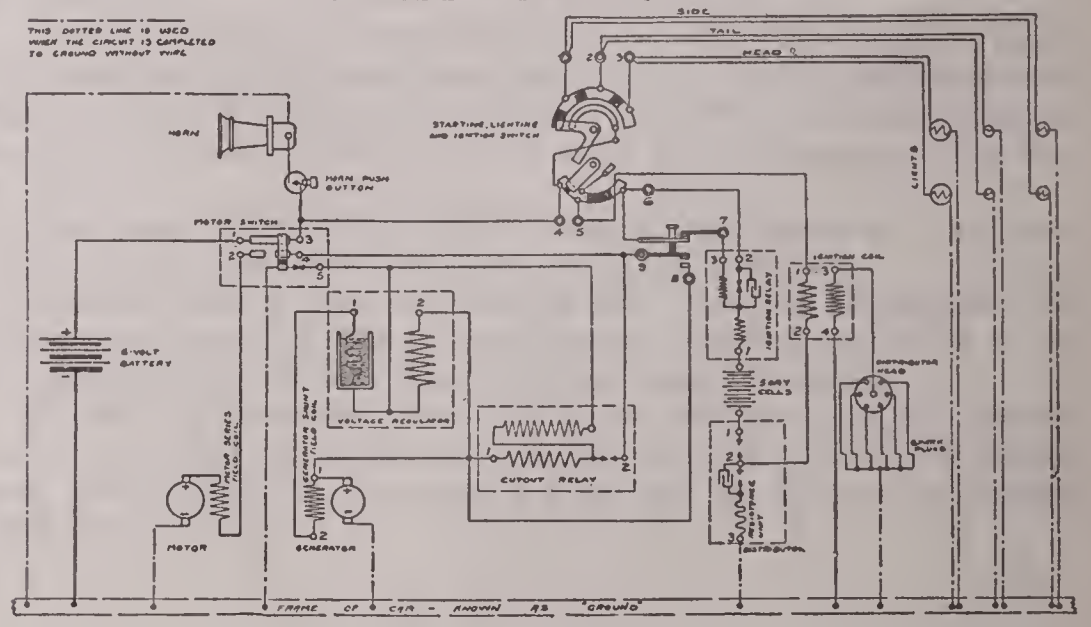
Head lamps are 7 volt, 15 cp. Side lamps are 7 volt, 15 cp. Tail lamp is 7 volt, 2 cp.

Fuses are 10 ampere.

Figure 1 shows the wiring as it is on the car. Figure 2 is a technical wiring diagram, showing the internal connections.



OAKLAND 1914 MODELS 48-62-43



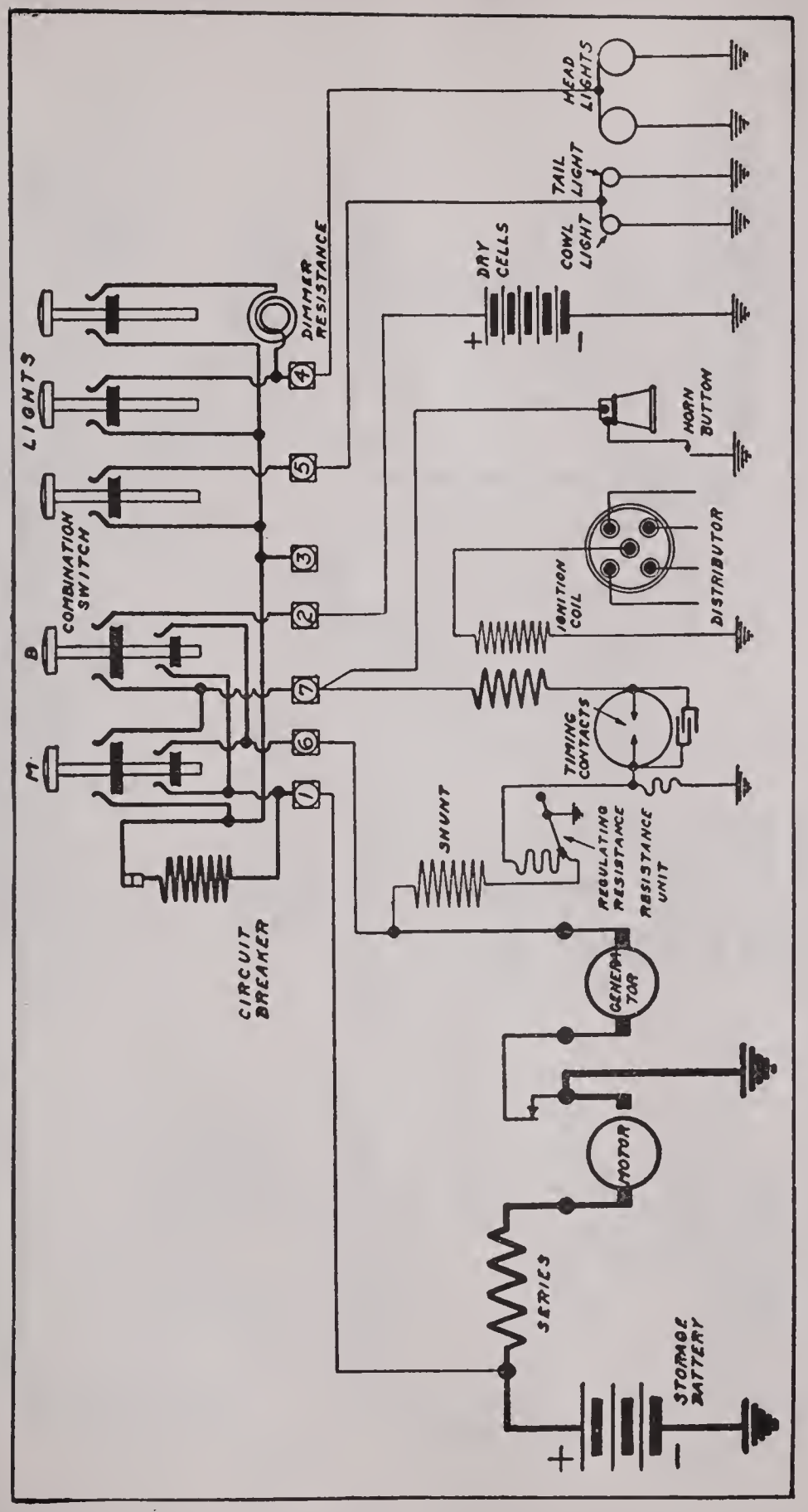


PLATE No. 45

Oakland

MODELS 37, 49 (1915)

DELCO DOUBLE-UNIT STARTING AND LIGHTING SYSTEM. DELCO IGNITION

Battery is 6-volt, 100 ampere-hour. The negative terminal is grounded.

Breaker contacts open .018 in. to .020 in. Break occurs when mark UDC 1-6 (on model 49) and when mark UDC 1-4 (on model 37) is at indicator, spark retarded. Firing order of model 49 is 1, 5, 3, 6, 2, 4. Firing order of model 37 is 1, 3, 4, 2. For testing of ignition units see Plate No. 77.

A set of five dry cells, connected in series is supplied for ignition purposes. Contacts are of tungsten metal. For care see Plate No. 20. Spark gap should be about .030 in.

There is no relay. Circuit between generator and battery is controlled by ignition switch. There is a circuit breaker to take the place of fuses. It requires 25 amperes to start circuit breaker vibrating, but a current of 5 amperes will keep it vibrating.

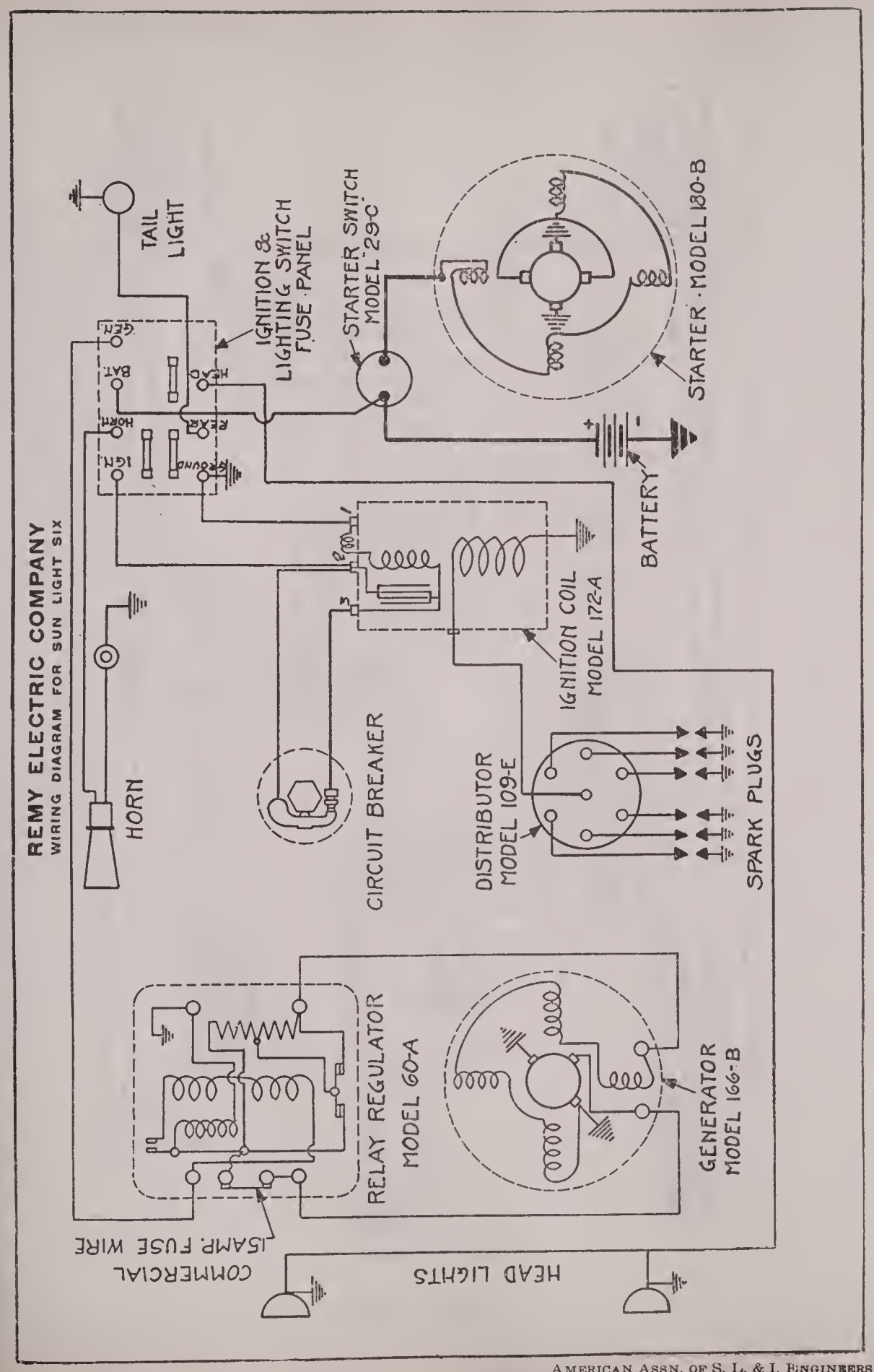
The starting motor circuit is opened by raising one of the motor brushes. Motor end of dynamo is connected to engine by non-automatic mechanical shift. When ignition switch is closed generator operates as a motor to facilitate meshing of gears. When starting pedal is depressed gears are drawn into mesh, generator circuit is opened and motor brush is allowed to come in contact with the commutator, thus applying full battery pressure to motor, cranking engine. There is a clutch to allow generator to run as a motor during starting operation or when it is not being driven fast enough to produce a pressure equal to that of the battery.

Voltage regulation is by a regulating resistance in series with shunt field. This is a coil of special resistance wire wound on a form. There is a sliding contact operated by the automatic spark advancer, which slides along the coil and cuts more resistance into the shunt field as the speed increases and cuts it out as the speed decreases. (See Plate No. 73.)

Head lamps are dimmed by placing a resistance in series with them. Head lamps are 7 volt, 15 cp. Dash light is 7 volt, 2 cp. Tail light is 7 volt, 2 cp.

Generator begins to charge at 7 miles per hour. Maximum charging rate of 16 to 20 amperes is reached at 18 to 20 miles per hour. Rate decreases to 10 to 15 amperes at higher speeds. Generator output should never exceed 25 amperes.

Put four or five drops light machine oil in the two oilers, one at each end of dynamo, every week. At least once a year remove name-plate and pack the spiral gears with cup grease. Do not put in an excess amount, as it will work out and get on the regulating resistance if it is too full.



Sun

Light Six

Remy Two-Unit, Starting and Lighting System. Remy Ignition

Battery is 6 volt, 100 ampere-hour. The negative terminal is grounded.

Breaker contacts should open .020 in. to .025 in. Spark gap is .025 in. to .030 in. Firing order is 1, 5, 3, 6, 2, 4. Break should occur on upper dead center, spark retarded.

Voltage regulation is by vibrating regulator. There is a 15 ampere fuse on relay regulator base to protect the generator windings should it be run with the battery disconnected. Use commercial 15 ampere fuse wire. Ammeter shows rate of charge or discharge.

Starting motor is connected to flywheel by a Bendix gear. It is equipped with ball bearings, which should be kept well oiled. Several drops of light oil every 1,000 miles should be sufficient. The following data applies to the No. 180-B starting motor used:

Torque (with 6-in. pulley)	R. P. M.	Amperes	Volts
0 lbs.	3600-4000	55-65	6.0
16 lbs.	1200-1450	200-220	4.6
24 lbs.	900-1100	290-310	4.5
40 lbs.	300-450	460-600	3.6
14 ft. lbs.	Lock Torque	550-600	3.2

Ignition coil and distributor are carried on generator. The following data applies to the generator: (Test to be made without ignition.)

Amperes	R. P. M.	Volts
0.	600-650	6.0
7.	780-850	6.4
14.5	2500-3000	7.2

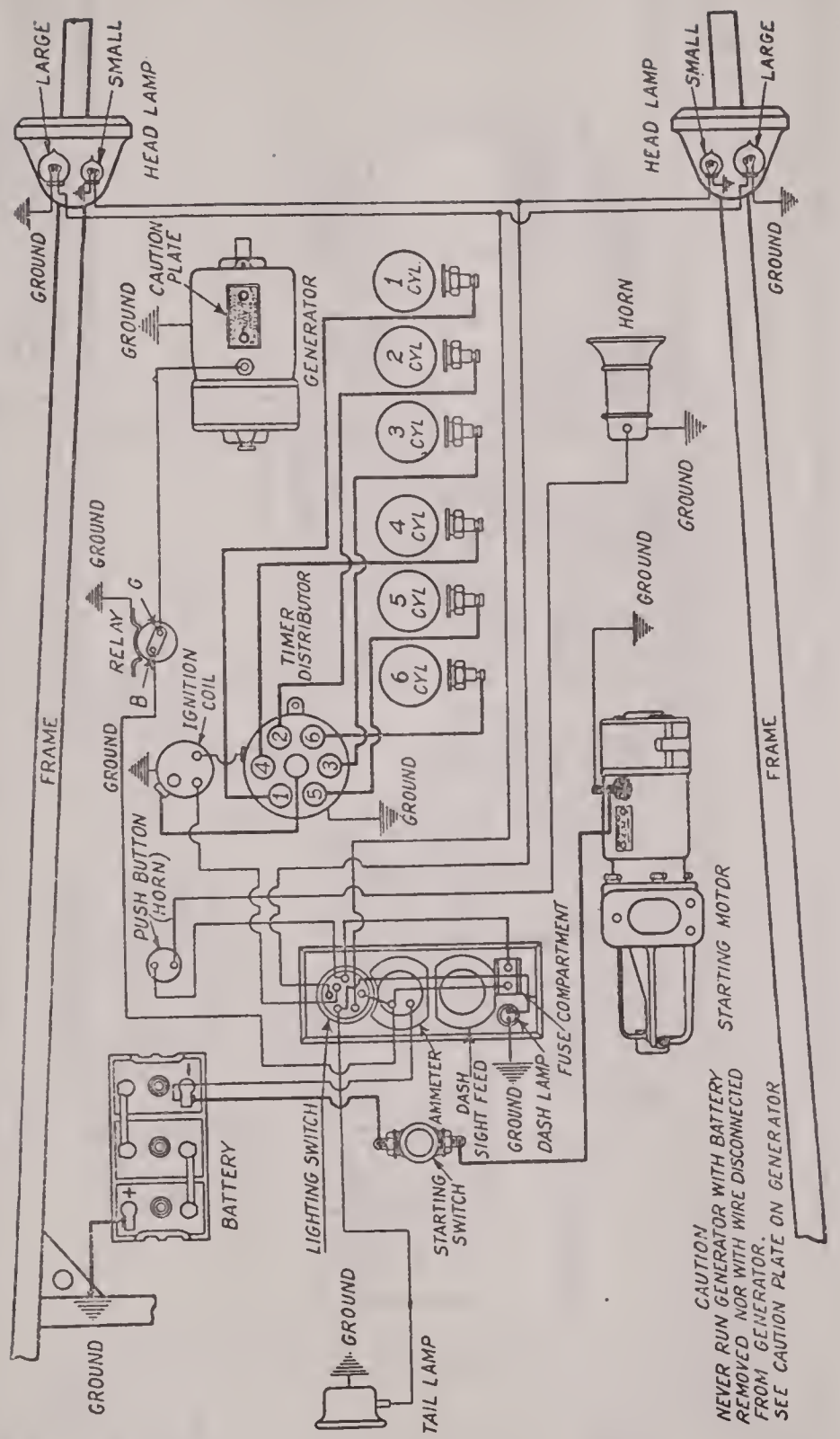
On battery test field draws 4 amperes at 6 volts. Generator motoring uses 5.5 amperes at 5.8 volts and runs at 470 R. P. M.

Put five or six drops of oil in generator oilers every 1,000 miles. The grease cup under distributor head should be tightened two or three turns occasionally. Use pure vaseline in this grease cup. The positive brush is insulated from the rocker ring. The negative and third brushes are grounded to the rocker ring. Should all lights, ignition, horn and starter fail, battery connections are defective, ground is defective or connection between starting switch and the positive terminal of the battery is defective.

Should starter operate and lights, horn and ignition fail, there is an open circuit or defective connection between the starting switch and the dash panel switch marked "Bat."

Should ignition fail, see that the side terminal of the coil is connected to the center distributor terminal. Momentarily short circuit terminal 1 and 2 on top of the ignition coil, ignition key in. No current indicates loose connections at the ignition switch terminals marked "Ign." or "Ground" or a poor connection between the terminal marked "Ground" and the stove bolt on the tubing which carries the high tension wires, or short circuits or poor connections between the ignition coil and the distributor.

The head lamps are 6-8 volt, 15 cp. The tail light is 6-8 volt, 2-4 cp. Fuses are 20 ampere.



Wiring Diagram.

PLATE No. 47

Grant Six

WAGNER TWO-UNIT STARTING AND LIGHTING SYSTEM. REMY IGNITION

Battery is 6 volt, 80 ampere-hour. The positive terminal is grounded.

Breaker contacts open .020 in. to .025 in. Clean contacts with No. 00 sandpaper or flat file. Put a small amount of vaseline on cam every 1,500 miles. Use medium cup grease in grease cup under breaker head. Tighten cup two turns every 500 miles. Spark gap is .025 in. Break should occur when mark 1-6 DC on flywheel is at dead center, spark at full retard. Firing order is 1, 5, 3, 6, 2, 4. There is an automatic spark advance in breaker box.

Starter connected to engine by Bendix gear. Lubricate motor bearings well every two weeks.

Generator is equipped with ball bearings. Oil once per week. Voltage regulation is by third brush. Third brush is sealed, and if the seal is broken by unauthorized persons the guarantee is forfeited. Relay closes at 10 miles per hour and opens at 5 to 8 miles per hour. Ammeter shows rate of charge or discharge.

Short circuit generator if it is run with battery disconnected. Maximum charging rate of 15 amperes is reached at 15 to 20 miles per hour. Maximum voltage is 8.7.

Large head lights 6.5 volts, 16 cp. Small head lights 6-8 volt, 7 cp. Tail light is 6-8 volt, 2-4 cp. Dash light is 6-8 volt, 2-4 cp.

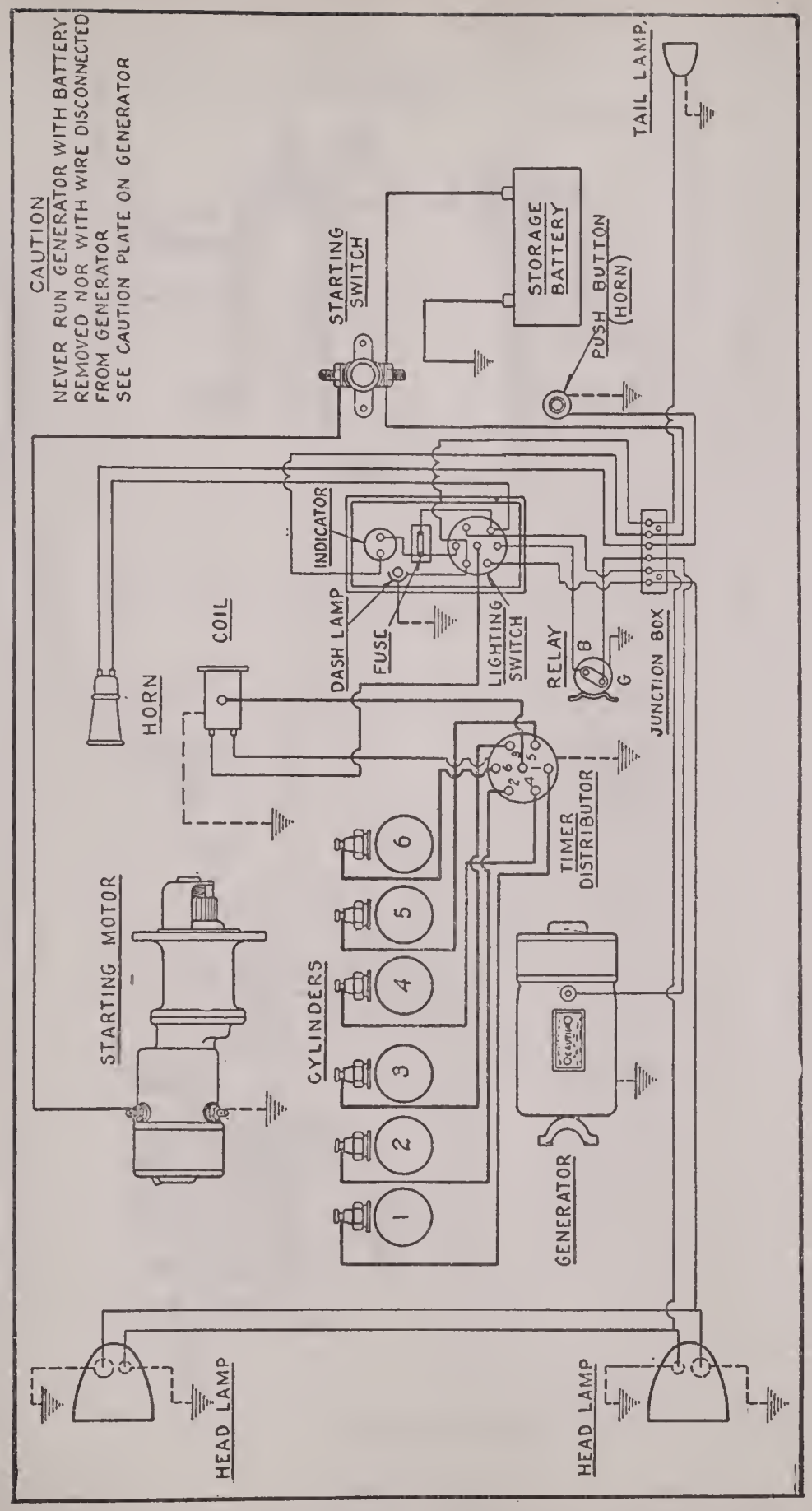


PLATE NO. 48

Elgin 6

WAGNER TWO-UNIT, STARTING AND LIGHTING SYSTEM. REMY IGNITION

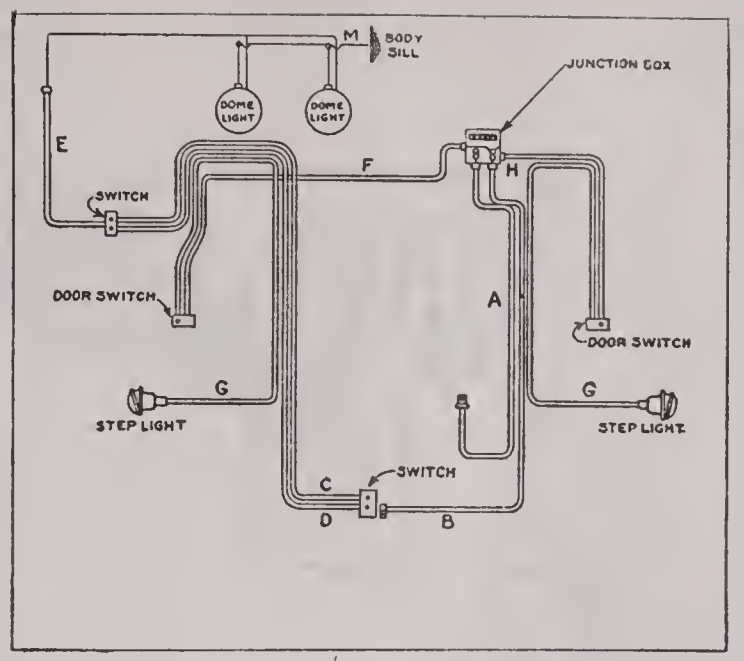
Battery is 6 volt, 100 ampere-hour.

Breaker contacts open .020 in. to .025 in. Spark occurs when the dead center mark is just past indicator, spark at full retard. Firing order is 1, 5, 3, 6, 2, 4. Put a small amount of vaseline on cam every 1,000 miles. Use vaseline or soft cup grease in breaker grease cup. Tighten grease cup two turns every 500 miles if vaseline is used.

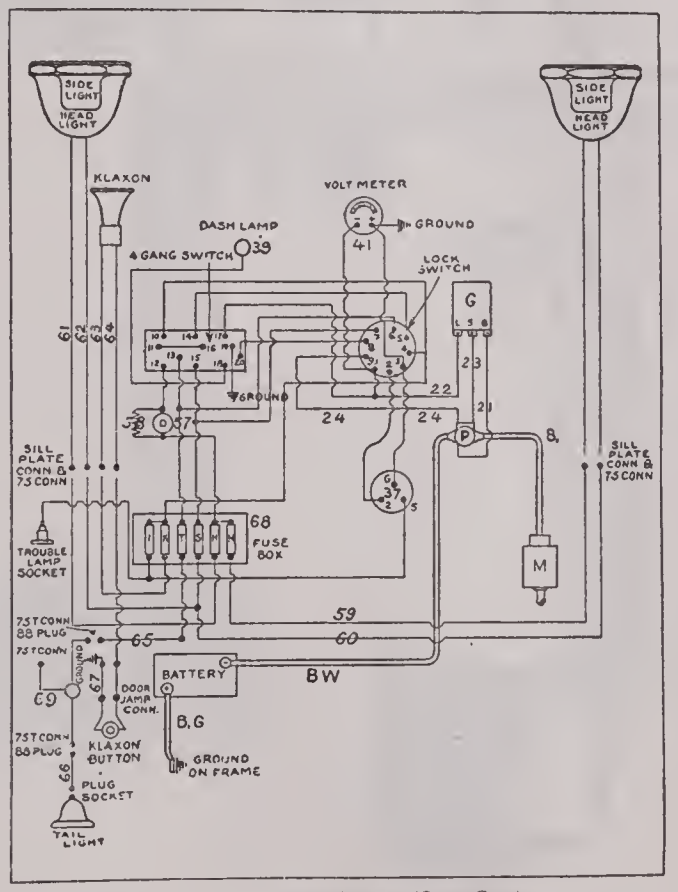
Starter is connected to engine by Bendix gear. Lubricate motor bearings well every two weeks.

Generator is equipped with ball bearings which should be well lubricated once a week. Voltage regulation is by third brush. Third brush is sealed. The guaranty ceases if this seal is broken by an unauthorized person. Relay should close at 10 and open at 5 to 8 miles per hour. Indicator indicates charge, discharge or off. The maximum charging current should not exceed 15 amperes at 8.7 volts, reached at a speed of 15 to 20 miles per hour. If generator is to be operated with battery disconnected or relay removed, its terminals should be short circuited.

Large head lights are 6.5 volt, 16 cp. Small head lights are 6.5 volt, 7 cp. Tail light is 7 volt, 2 cp. Large head lights take about 3 amperes. Small head lights take about 1¼ ampere. Tail light takes about ½ ampere. Dash light is 7 volt, 2 cp. It takes ½ ampere.



Wiring Diagram on Closed Cars



Wiring Diagram (Open Cars)

PLATE No. 49

Locomobile

SERIES TWO, MODELS 38 AND 48 (1917)

WESTINGHOUSE TWO-UNIT, 6-VOLT STARTING AND LIGHTING SYSTEM

BOSCH DUAL IGNITION

Battery is 6 volt, 120 ampere-hour. The positive terminal is grounded.

Ignition is by Bosch ZR-6 two-spark magneto. When operating on the battery only the two plugs over the inlet valves are in operation. There is a distributor for each set of plugs; however, if one plug is short circuited the other is not affected. On the "48" the magneto is set so that the spark occurs when piston is ¼ in. from top of dead center, and on "38" when cylinder is 3/16 in. from top dead center, spark fully advanced. The battery breaker is set to give spark a little later than the magneto, so that when spark is at full retard the spark occurs just after piston has started its downward stroke. Firing order is 1, 5, 3, 6, 2, 4. Spark gap on inlet side is .022 in. to .023 in. Magneto breaker should open .35 mm.

Starting motor is connected to engine by magnetic pinion shift. This shift consists of a solenoid which pulls in a soft iron core which in turn draws the pinion into mesh. There is a short-circuited winding around the motor fields which prevents the motor turning rapidly before the gears are meshed, after which it rapidly picks up speed and cranks the engine. When the engine commences to run on its own power the current consumed by motor decreases, due to back pressure of motor increasing. This cuts down the energizing current in solenoid (as it and motor are in series), thus reducing its pull and allowing the pinion to be drawn out of mesh by a spring acting against the magnet.

The motor is so connected that it will not have voltage applied to it if starting switch is closed when engine is running over 300 R. P. M. As the engine attains this speed the generator voltage builds up and the cut-out switch closes, grounding the positive side of the generator. When this occurs wires 23 and 24 on generator, being thereby grounded on both ends, cease to carry current to the primary relay switch magnet, which allows switch to open, thus opening motor circuit.

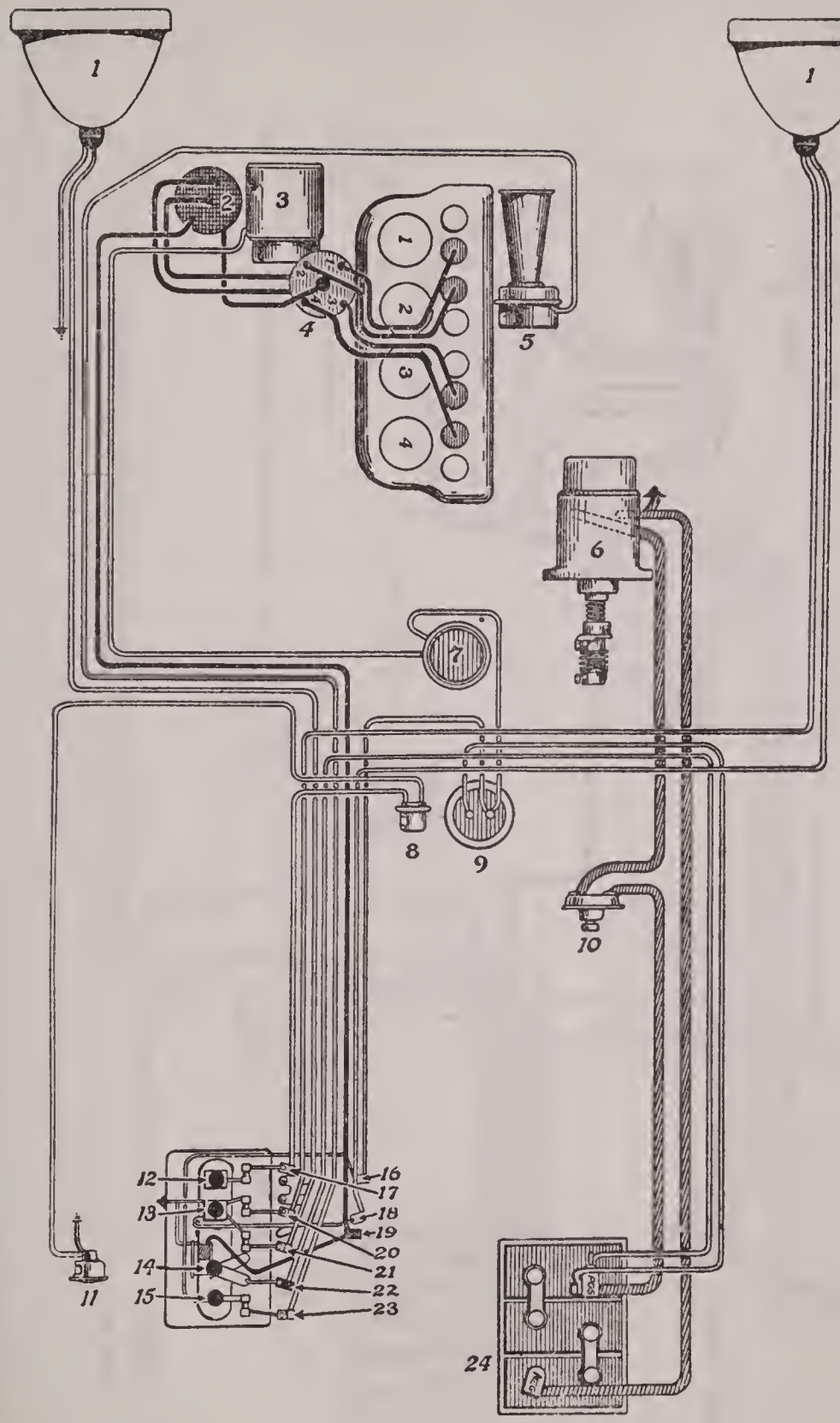
Voltage regulation of generator is by bucking field. The field winding is made of special wire, so that as the generator gets warm the resistance increases and cuts down the output.

Fuses are, from left to right: 1, ignition; 2, horn; 3, tail and body lights; 4, side lights; 5, left head, and, 6, right head lights. Fuses are all 10 ampere.

Lamp sizes are:

Headlights . . .	G-16½	Bulb, 21 cp.,	6-8 v.
Signal lights . .	G-10	Bulb, 6 cp.,	6-8 v.
Tail light . . .	G- 8	Bulb, 4 cp.,	6-8 v.
Dome light . . .	G- 6	Bulb, 2 cp.,	6-8 v.
Cowl light . . .	G- 6	Bulb, 2 cp.,	6-8 v.
Trouble light . .	G- 8	Bulb, 6 cp.,	6-8 v.
Tonneau light . .	G- 6	Bulb, 2 cp.,	6-8 v.
Step lights . . .	G- 6	Bulb, 2 cp.,	6-8 v.

Interior of dome light may be reached by turning catch on edge of lamp and then swinging the globe downward on its hinges.



Wiring System

PLATE NO. 50

Overland Light Four and Country Club

AUTO-LITE STARTING AND LIGHTING SYSTEM. CONNECTICUT IGNITION

Battery is 6-volt, 75 ampere-hour. It will supply current to lights for 18 hours when they are bright, and from 30 to 35 hours when head lights are dim.

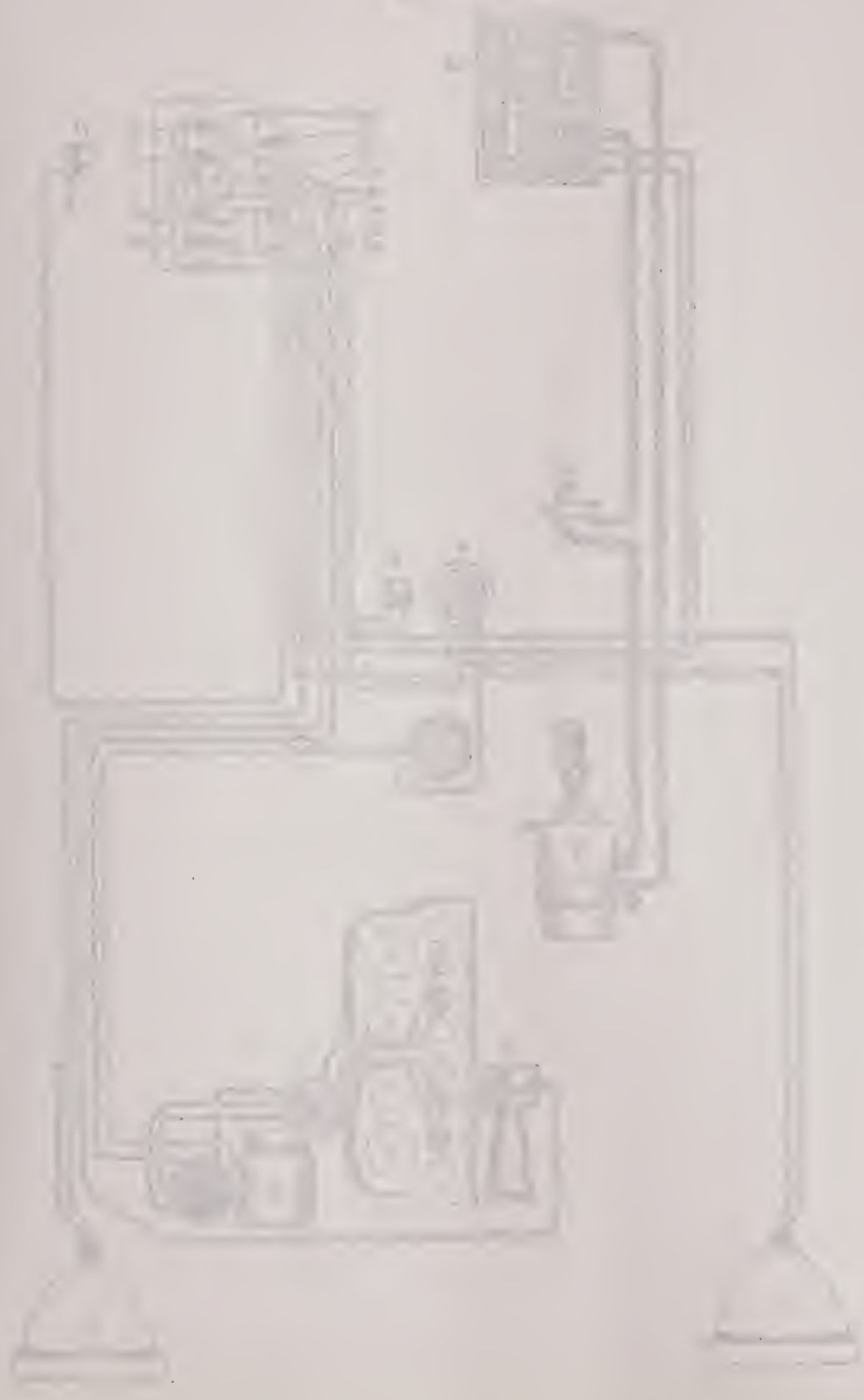
If breaker contacts become so worn as to impair the proper operation of the engine the breaker must be renewed. To do this remove the wire which leads to breaker from coil terminal marked C. Unclasp and remove distributor head, leaving wires on. Lift off distributor rotor. Unscrew the two ring retaining screws which hold the breaker in the case. Then remove the breaker by pulling upward. Then remove the primary wire and keep it to be placed on the new breaker. To install th new breaker reverse the oprations given above. Do not file contacts. Break should occur when mark 1-4 U-P is at indicator, spark at full retard. Firing order is 1, 3, 4, 2. Lubricate driving gears well.

Combination ignition and lighting switch is on steering column. There is an automatic release in the box, to open ignition circuit if it has been left on with engine idle.

Starter is connected to flywheel by Bendix gear.

Generator is driven from crank shaft. Oil generator with few drops of oil every 500 miles. Voltage regulation is by third brush. Generator must be shorted if it is to be run with battery disconnected. Relay closes at 7½ miles per hour. Maximum charging rate of 14 amperes is reached at about 20 miles per hour.

Ammeter shows rate of charge or discharge. All fuses are 20 ampere.



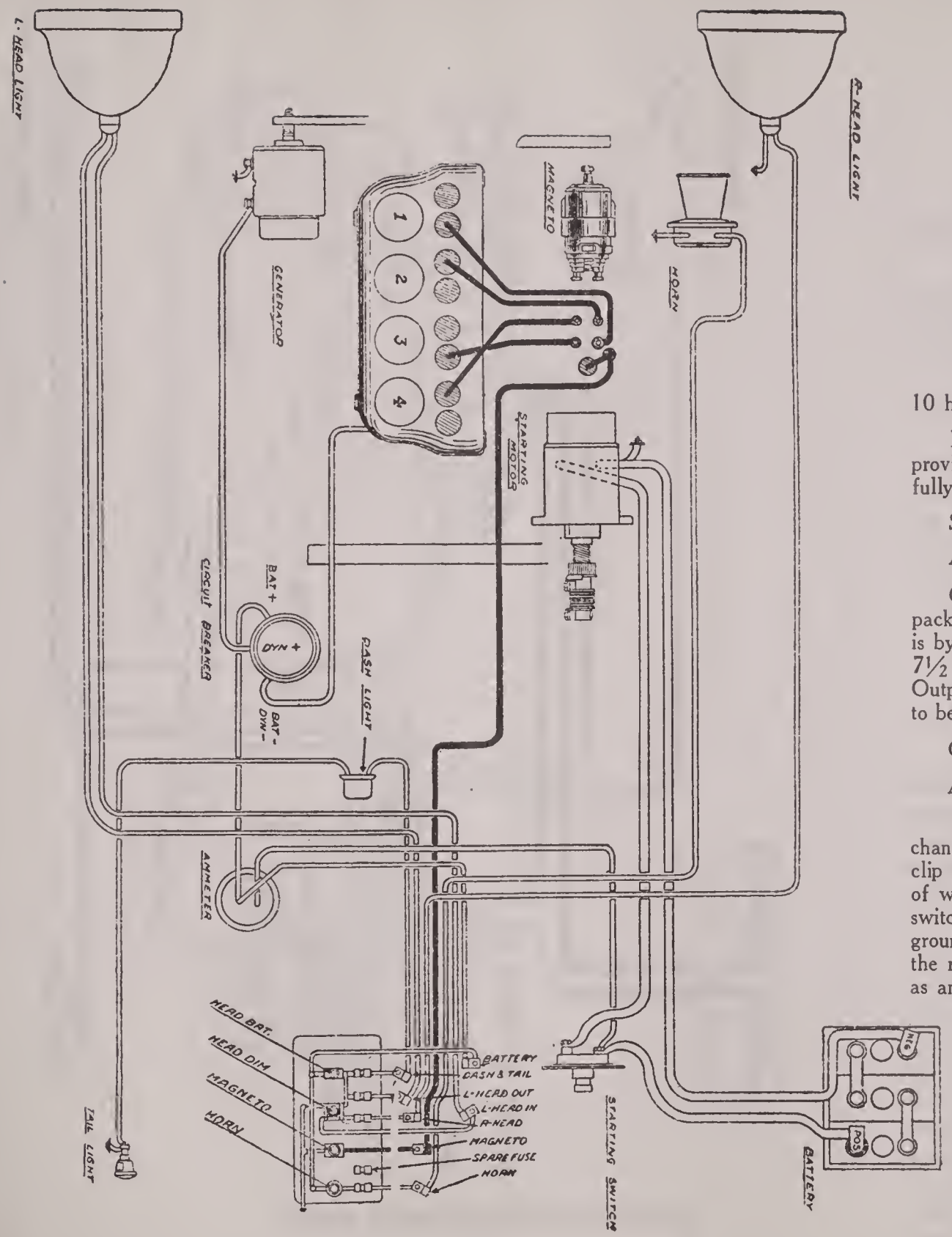


PLATE NO. 51

Overland 75

AUTO-LITE TWO-UNIT STARTING AND LIGHTING SYSTEM

DIXIE MAGNETO IGNITION

Storage battery is 6 volt, 75 ampere-hour. It will supply all the lights bright for 10 hours or all lights, head dim, for 30 hours.

Lubricate magneto every 1,000 miles by putting 1 or 2 drops light oil in holes provided. Break occurs when mark 1-4 UP on flywheel is 1¼ in. past indicator, spark fully retarded. Firing order is 1, 4, 3, 2.

Starter is connected to engine by Bendix gear.

Ammeter shows rate of charge or discharge.

Generator chain driven from crank shaft. Ball bearings are provided. They are packed with grease. Oil with 1 or 2 drops of oil every 1,000 miles. Voltage regulation is by reverse series field. Both brushes must be insulated from frame. Relay closes at 7½ miles per hour. Maximum output of 14 amperes is reached at 20 miles per hour. Output at 15 miles per hour is 10 amperes. Generator must be short circuited if it is to be run with battery disconnected.

Combined ignition and lighting switch is on steering column. (See Plate No. 7.)

All fuses are 20 amperes.

Should the car be hard to start on the magneto, a very small amount of labor will change the magneto to a dual type. To make this change, remove the brass grounding clip which connects the coil winding to the frame of the magneto. Then solder a piece of wire to the upper terminal and run this wire to the negative terminal of the starting switch, taking care to insulate it from the magneto frame and the frame of the car. A ground in this circuit will cause the magneto to fail. When the starting switch is closed the magneto will operate as a dual type, and when the switch is opened it will operate as an independent type, as before the change was made.

Overland

All Models

Auto-Lite Two-Unit, 6-Volt Starting and Lighting System

Connecticut Battery or Dixie Magneto Ignition

Battery is 6 volt, 80 to 120 ampere-hour. The negative terminal is grounded through the starting motor frame.

The spark gap should be about 1/50 in. The firing order of the Four is 1, 3, 4, 2. Contacts open .020 in. Surface with a fine file. The breaker lever should be lubricated with a drop of light oil every 1,000 miles. The bearings of the magneto are provided with oil cups. Lubricate with a few drops light oil every 1,000 miles. Break should occur when the mark $\frac{1 \& 4}{\text{U. P.}}$ is 1¼ in. past indicator.

Lighting and ignition switch is mounted on steering column. Two types have been used. On the new type the circuit is controlled by buttons. (See Plates No. 50, 51 and 7.) On the older type the ignition and lighting circuits are controlled by levers. The lower lever controls the ignition and the upper one the lighting circuit. Horn button is on top of switch box.

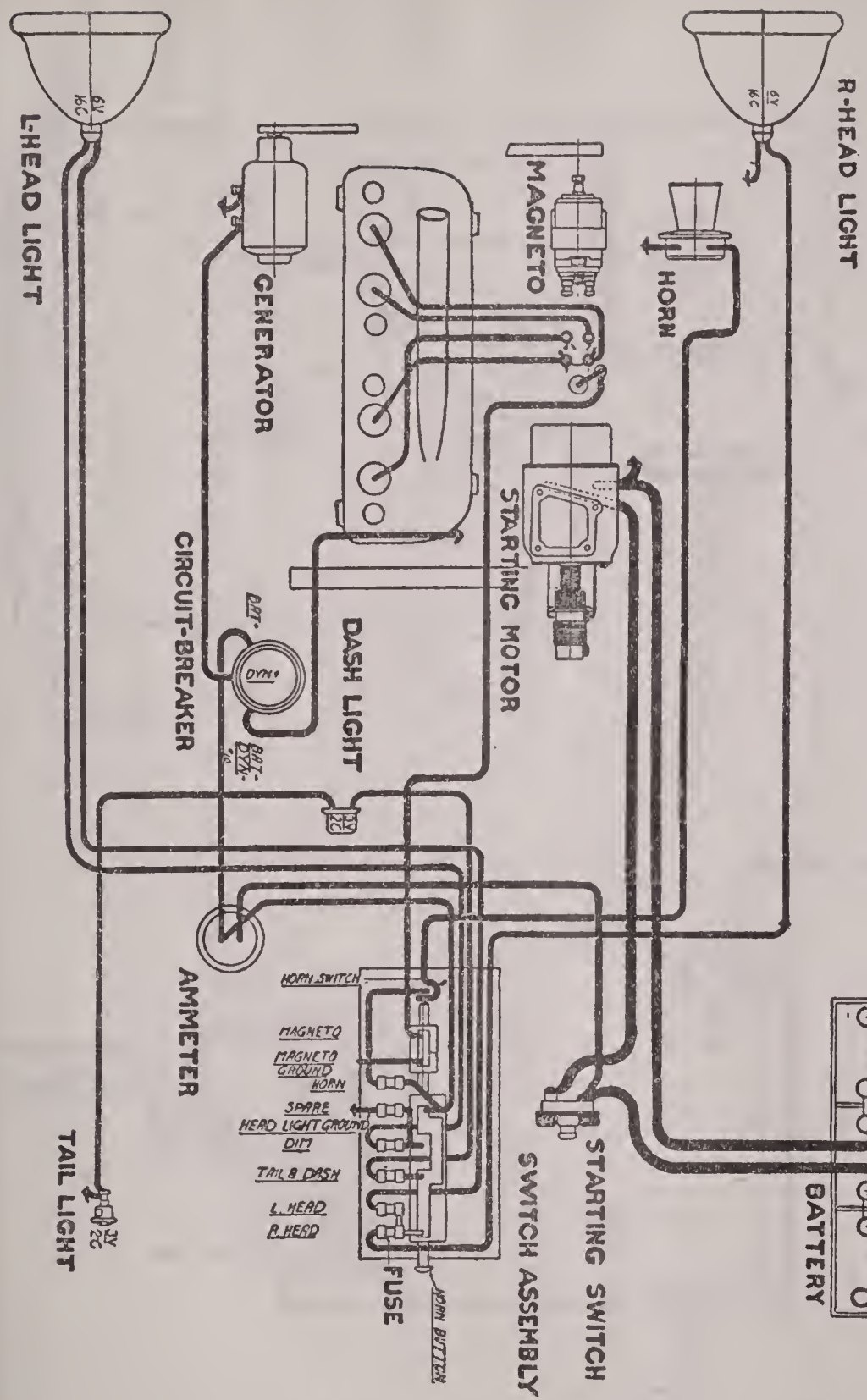
All fuses in light, horn and ignition circuits are 10 ampere.

Ammeter shows rate of charge or discharge.

Starting motor is connected to engine by Bendix drive. Ball bearing on commutator end is packed with cup grease. Use only the special brushes furnished by manufacturer.

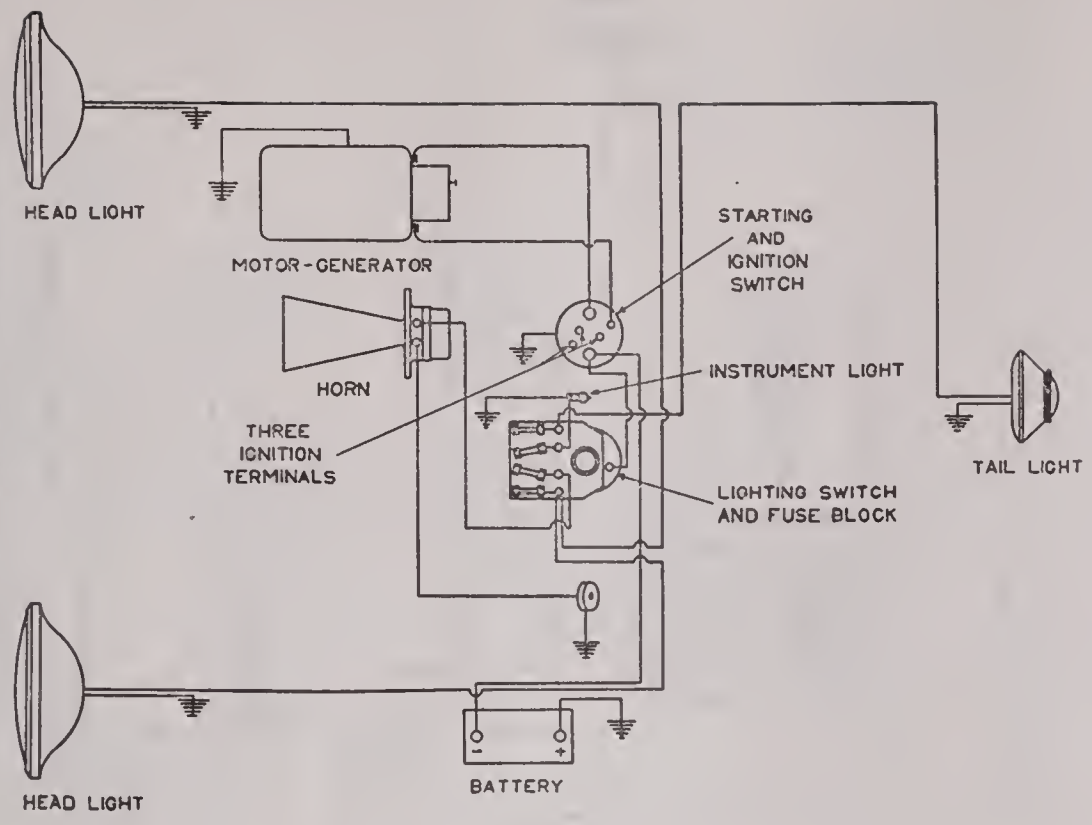
Voltage regulation by reverse series winding on older models. Some of the new models have third brush control. Relay closes at 7½ miles per hour. Maximum of 14 amperes is reached at 20 miles per hour. The output at 15 miles per hour is about 10 amperes. If the maximum charging current falls below 10 amperes, increase the spring pressure on the brushes by moving spring to next notch. This procedure is easily understood when machine is seen.

Generator is provided with ball bearings. They are packed with grease. Put in one drop oil every two weeks or 1,000 miles travel, to keep grease soft. Driving chain should be well lubricated with a good grade of lubricating oil. After oil has penetrated to innermost bearings of chain, wipe surplus oil from outside of chain to prevent collection of dust. The chain may need adjustment after the first 1,000 miles travel and every 10,000 miles after that. If it is required more often, see that sprockets are properly lined up and that chain is kept well lubricated and free from dirt. It should have just enough slack that there is no strain on links with engine idle. The chain may be tightened by loosening bolts holding generator and moving generator by adjusting screw on engine side. Both brush holders are entirely insulated from the frame. If generator is to be run with battery disconnected, the generator terminals must be short circuited. Lamp sizes are: Head lamp 6 v., 16 cp.; tail lamp 3 v., 2 cp; dash lamp 3 v., 2 cp. Dash and tail lamps are in series.



Wiring diagram of Overland cars

Plate No. 52



Wiring diagram for horn, starting and lighting system.

Hupmobile

Model K 1915

Westinghouse 12 Volt, Single-Unit Starting and Lighting System
Atwater-Kent Ignition

Storage battery is 12 volt, 50 ampere-hour. The positive terminal is grounded.

Distributor is driven from cam shaft by spiral gears. To adjust contacts, take out contact screw, remove one of the thin washers and replace screw. Break should occur when mark 1-4CL is 2 in. past indicator, spark fully retarded. Firing order is 1, 2, 4, 3. Spark control is automatic on some and manual on other models.

When the starting switch is closed the ignition circuit is also completed, by same switch. There is no relay, hence the motor-generator helps to propel the car at speeds under 9 miles per hour. The unit acts as a cumulatively compound-wound motor and as a differentially compound-wound generator.

Fuse block is just back of lighting switch. Fuse sizes are: Head lamp, 15 ampere; tail lamp, 3 ampere; extra circuit, 15 ampere; horn, 15 ampere. Lamp sizes are: Head, 15 cp., 14 v.; tail, 4 cp., 14 v.; instrument, 2 cp., 14 v.

Put several drops cylinder oil in the two oil cups on motor generator every 1,000 miles. Do not over oil.

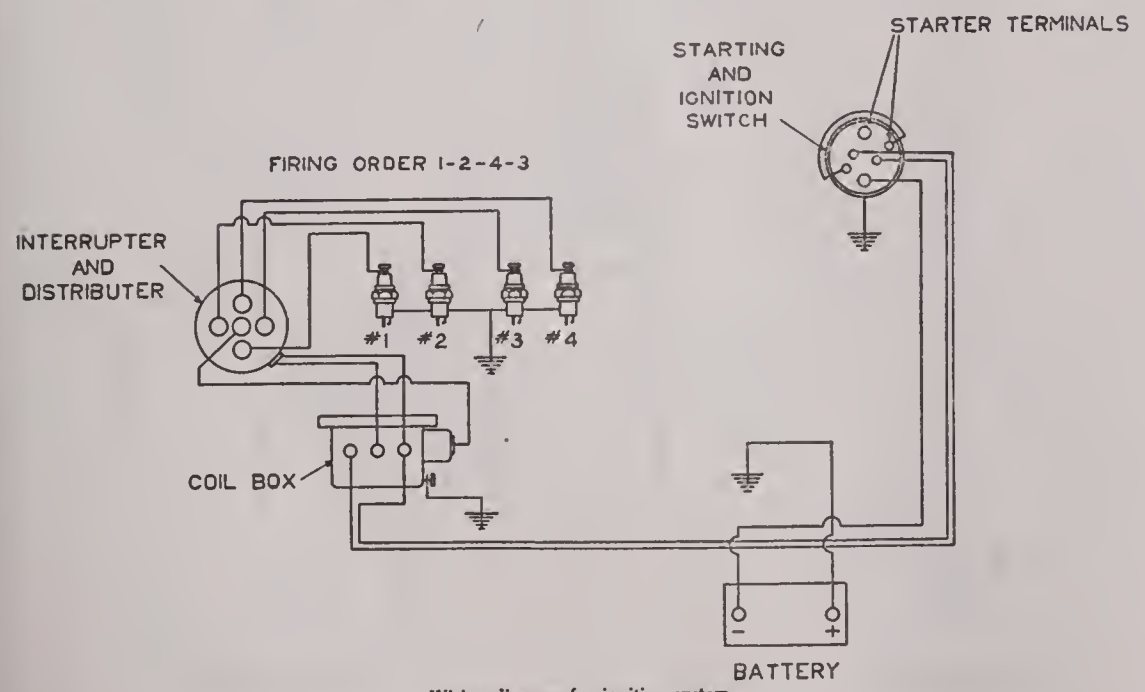
If motor fails to crank engine, see that switch is entirely closed and completes ignition and starter circuits when in this position. Test battery and inspect wiring, brushes and commutator.

If lights become dim when engine stops battery is run down. If battery does not stay charged car is not run enough without lights, is run at too low speeds, or starter is used excessively. It may also be due to the solution in the battery being too low or a ground in the circuit.

Failure of one lamp may be due to blown fuse, open circuit or burned-out lamp. The order in which fuses are arranged are, left to right, head lamp, horn, instrument lamp and tail lamp.

If all of the lamps fail, the battery connections may be at fault, battery very low, battery poorly grounded or open circuit between battery and switch.

If the voltage drops to 10 or 11 volts with head lights burning and engine not running, the battery is practically discharged.



Wiring diagram for ignition system

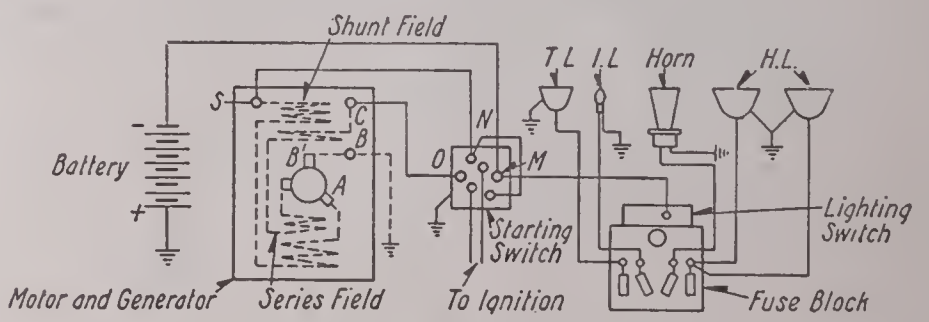
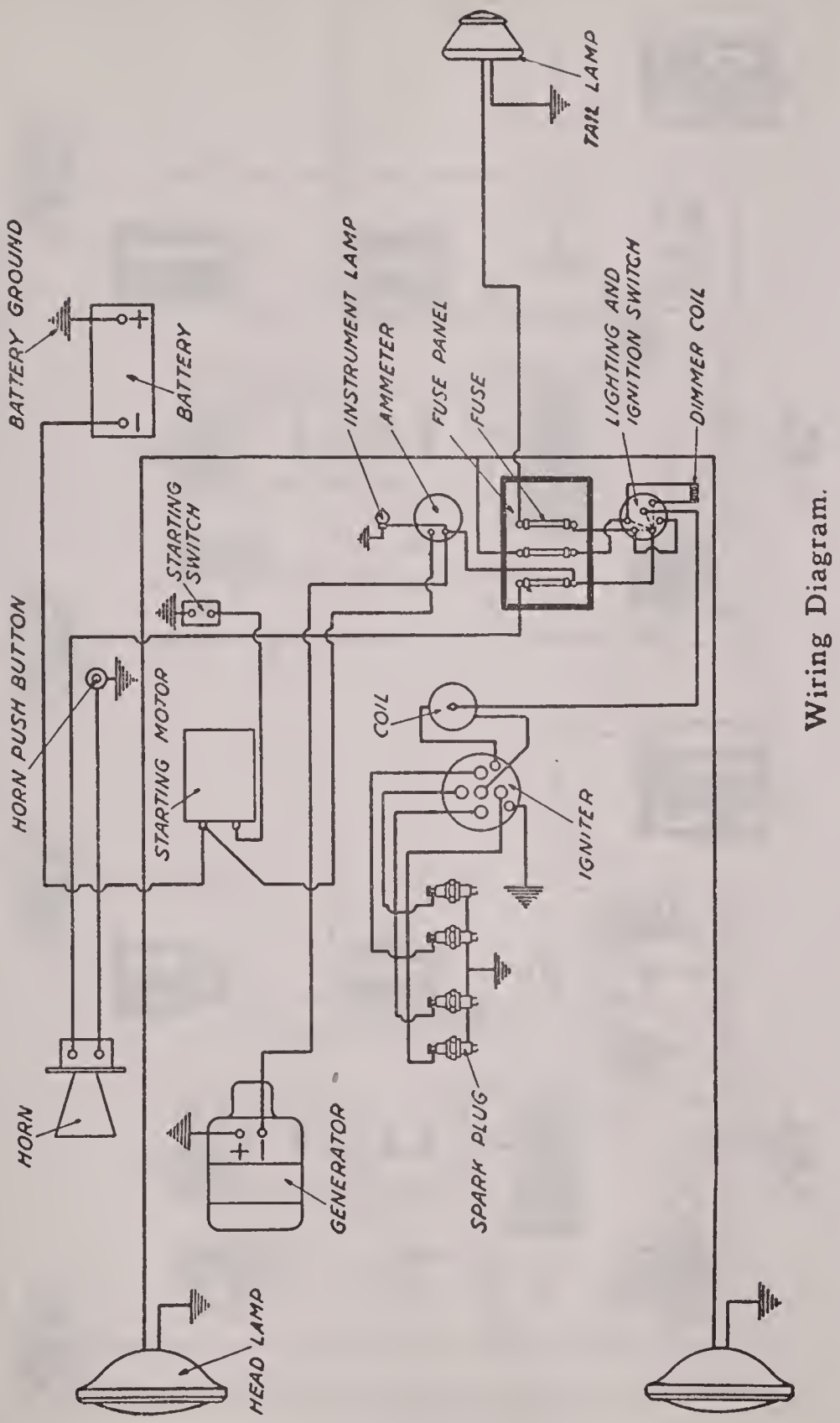


Diagram of Connections
Westinghouse Motor-and-Generator System on the Hupmobile

Plate No. 54



Wiring Diagram.

PLATE NO. 55

Hupmobile

"SERIES R" 1917-18

WESTINGHOUSE TWO-UNIT STARTING AND LIGHTING. ATWATER-KENT IGNITION

Battery is 6 volt, 60 ampere-hour. The positive terminal is grounded.

For ignition see Plate 54. Firing order is 1, 2, 4, 3. Break should occur when the upper dead center mark on the flywheel is two inches past the indicator, spark fully retarded.

Starter is connected to engine by Bendix gear. There is a light spiral spring to prevent the pinion accidently engaging the flywheel gear from vibration.

Generator is chain driven from crank shaft. Relay closes at 10 miles per hour. Relay is built into the generator. There is a 12-ampere fuse, to protect generator windings in small round cap on generator head. Voltage regulation is by third brush.

Fuse panel is on instrument board, at the right of switch. All fuses are 10 ampere.

Lamp sizes are: Head, 15 cp., 7 v.; tail light, 2 cp., 8 v,; instrument light, 2 cp., 8 v.

For lamp troubles see Plate No. 54.

Ammeter indicates rate of charge or discharge.

If generator is to be run with battery disconnected, remove field fuse.

Hupmobile

(Series N) 1916-1917

Westinghouse or Bijur Starting and Lighting System
Atwater-Kent Ignition

Battery is 6 volt, 60 ampere-hour.

For care of Atwater-Kent ignition, see Plate No. 54.

Break occurs when dead center mark is 2 in. past indicator, spark fully retarded. Firing order is 1, 2, 4, 3.

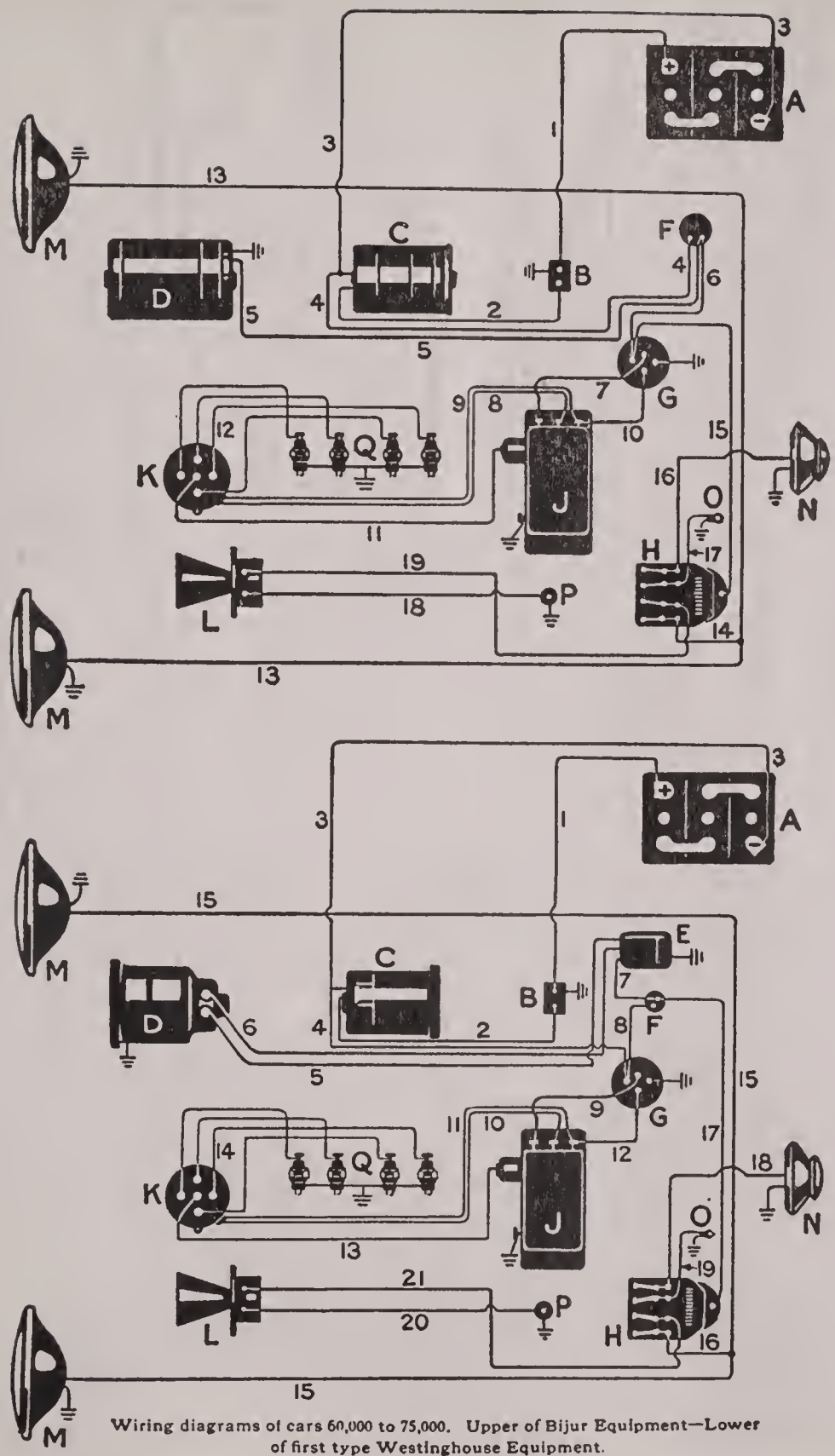
Cars 60,000 to 75,000 use Bijur starting and lighting system. On this system relay closes at 7 miles per hour. At a speed of 14 miles per hour the maximum output of 10 to 12 amperes is reached. At no time should it reach more than 18 amperes. If it does, the relay or third brush will require adjustment. Voltage regulation is by third brush. There is a 5-ampere fuse to protect the generator windings, on the generator head.

Ammeter shows rate of charge and discharge.

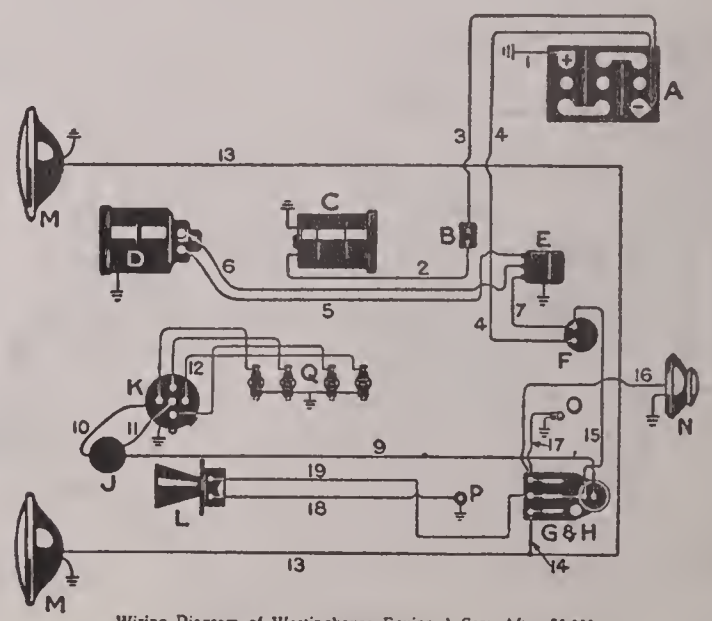
On cars above 75,000 Westinghouse starting and lighting system is used. Voltage regulation is by vibrating regulator. (See Plate No. 6.) Relay is combined with regulator. The output is practically the same as for cars using the Bijur system.

Dimmer resistance and fuse panel is back of lighting switch. All fuses are 10 amperes. Extra fuses are carried in clips on the inside of left front door post, just under cowl. They are easily reached by unsnapping and turning back the leather cover.

Lamp sizes are: Head lamp, 15 cp., 7 v.; side lights, 2 cp., 8 v.; tail lights, 2 cp., 8 v.; instrument light, 2 cp., 8 v.



Wiring diagrams of cars 60,000 to 75,000. Upper of Bijur Equipment—Lower of first type Westinghouse Equipment.



Wiring Diagram of Westinghouse Equipped Cars After 75,000

Plate No. 56

Haynes

Light Twelve

Leece-Neville Starting and Lighting System. Remy Ignition

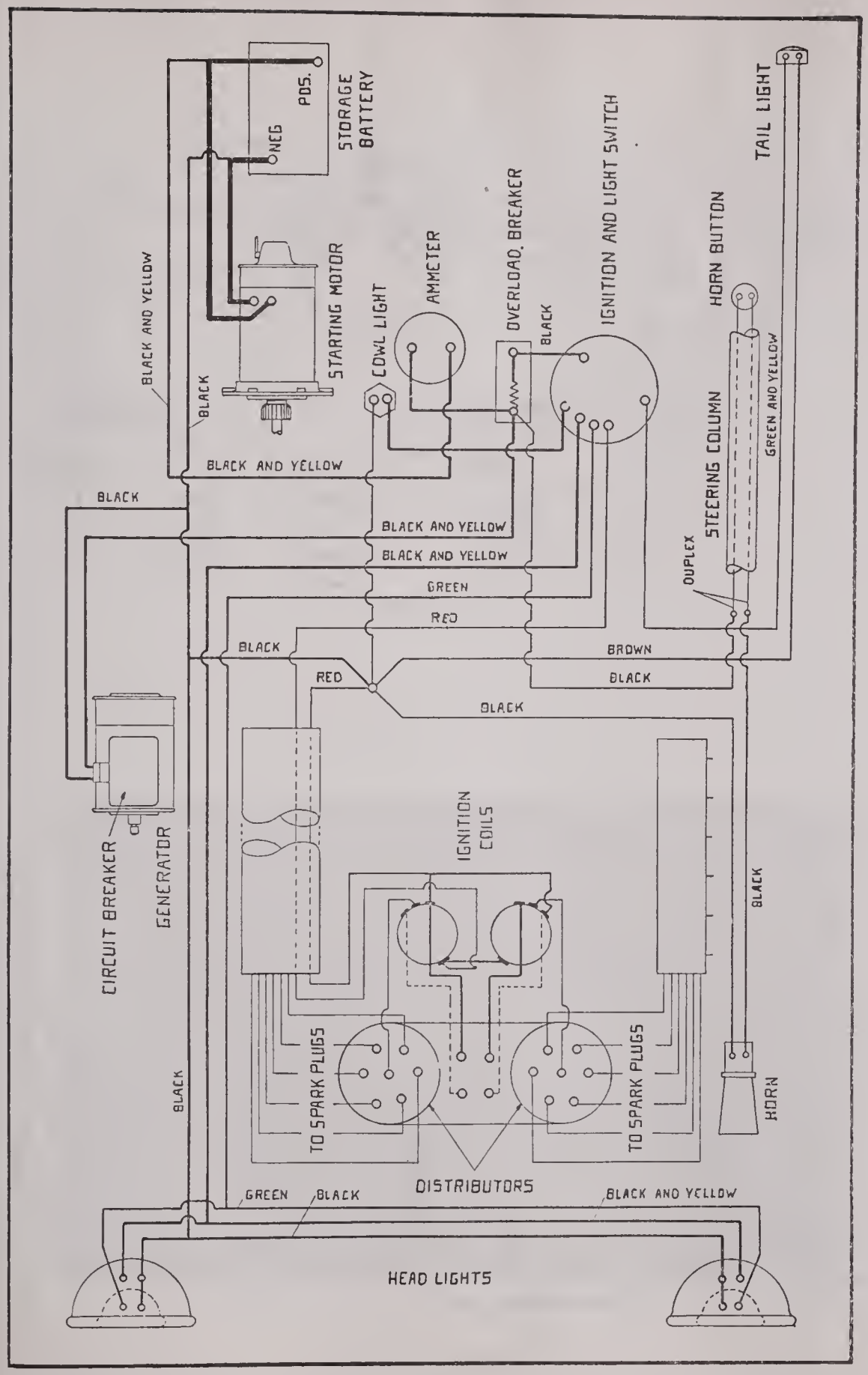
Battery is 6 volt, 100 ampere-hour. The two-wire system is used.

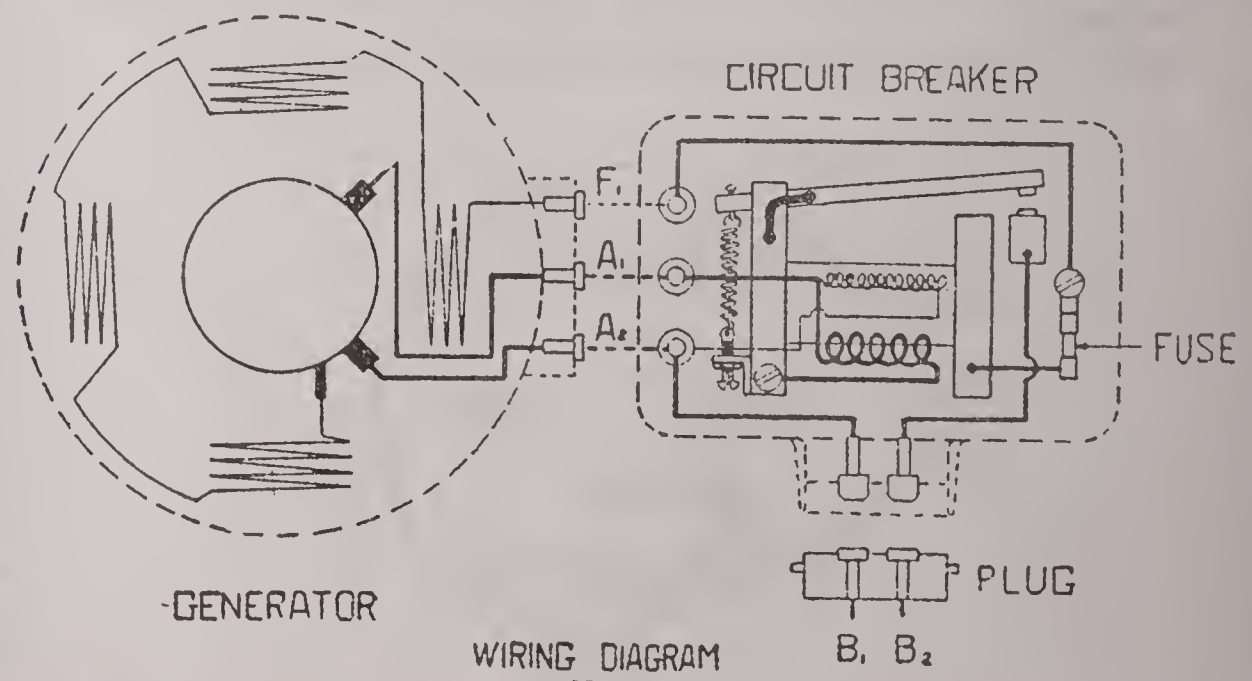
Breaker contacts should open .018 in. Break should occur when the top dead center mark on the flywheel is ½ in. past the indicator, spark lever fully retarded. The firing order is 1R, 6L, 4R, 3L, 2R, 5L, 6R, 1L, 3R, 4L, 5R, 2L. Spark gap should be .025 in. to .030 in.

Motor is connected to the flywheel by a Bendix gear. The starting motor should crank the engine at 125 to 150 R. P. M. Every 1,000 miles put two or three drops of light oil in each of the motor oilers. The normal cranking current is about 200 amperes, but may reach a momentary value of 550 amperes when breaking the motor loose.

Voltage regulation is by third brush. Relay should close at 6-8 miles per hour and open at about 5 miles per hour. The maximum charging rate should be about 16 amperes at 18-20 miles per hour. The third brush is adjusted by turning the thumbnut on the commutator end of the generator. There is a 5-ampere fuse in the relay case. This fuse is in the shunt field circuit. The fuse will blow if the generator is run with high resistance in the charging circuit or should a short circuit occur in the field coils. To test for a short circuit in the field windings, remove the third brush from its holder and connect it to the negative terminal of a 6-volt storage battery. Then, connect the positive terminal of the ammeter, at the screw terminal at the end of the fuse on the relay, to the terminal of the battery. Not more than 4 amperes will flow if there are no short circuits in the fields. Every 1,000 miles put three or four drops of light oil in each of the generator oilers.

There is a lockout type of circuit breaker on the dash, to take the place of fuses in the lighting circuits. Large head lamps are 6-8 volt, 18 cp. Small head lamps are 6-8 volt, 12 cp. All other lamps are 6-8 volt, 2 cp.





WIRING DIAGRAM OF GENERATOR & CIRCUIT BREAKER CIRCUITS

Plate No. 57

Westcott

SERIES 18

DELCO TWO-UNIT, 6-VOLT, STARTING AND LIGHTING SYSTEM. DELCO IGNITION

Storage battery is Willard 6-volt, 120 ampere-hour. The negative terminal of battery is grounded.

Distributor is mounted on forward end of generator. Breaker is operated by 6-lobed cam driven at one-half crank shaft speed. Spark advance is both manual and automatic. Contacts open .018 in. Contacts are tungsten. (See Plate No. 20.)

TIMING: Set cam so that when distributor is rocked forward as far as slack in gears will allow the contacts will open and close again when distributor is rocked back, upper dead center mark at indicator, spark at full retard. Firing order is 1, 5, 3, 6, 2, 4.

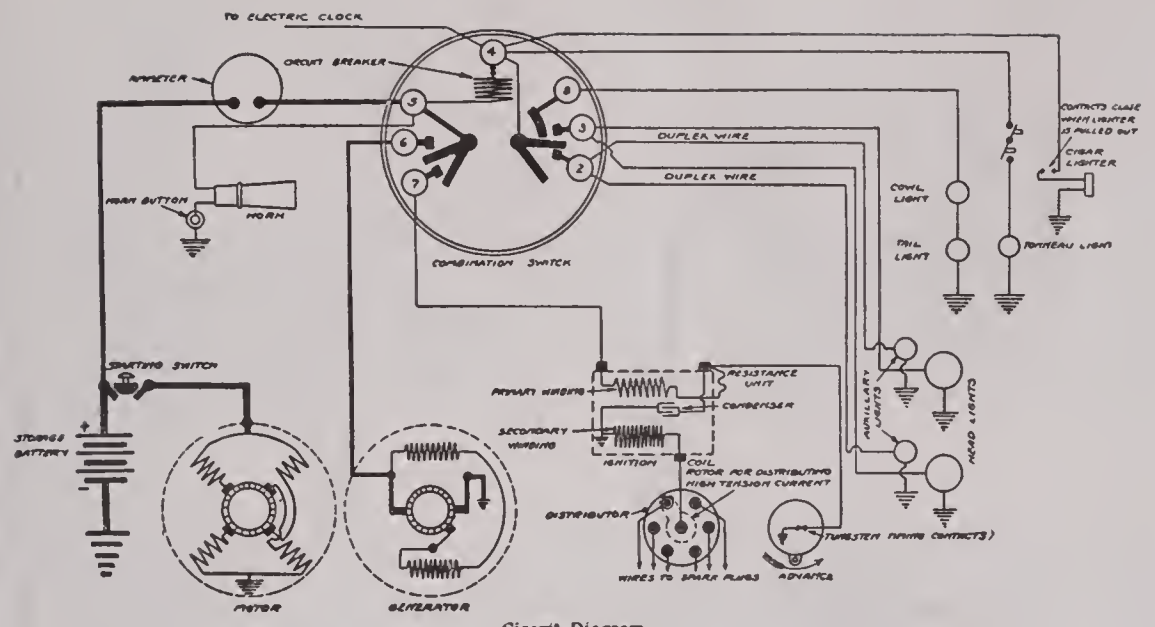
If distributor rotor track is not yet polished from use, a very small amount of vaseline should be applied. Spark gap is .030 in.

Starter is connected to engine by Bendix gear. Both rotor bearings are of oilless type.

Generator is driven from water circulator shaft. There is no relay, so an over-running clutch is provided at driving end to allow generator to run freely as a motor, thus preventing a heavy discharge through the generator when ignition switch is on with engine idle, as ignition switch controls circuit between generator and battery. Put four or five drops of oil in rear generator bearing each week. Oiler on side lubricates distributor shaft bearing. Oil with four or five drops of oil every week. The oiler at front of generator lubricates front bearing, clutch and driving gears. There is a drain to prevent any excess oil reaching commutator or brushes. Lubricate well.

Voltage regulation is by third brush. Maximum output is about 16 amperes at 20 to 24 miles per hour. Output rate decreases as speed increases, after it reaches maximum.

There is a vibrating circuit breaker back of lighting switch to take the place of fuses.



Circuit Diagram.

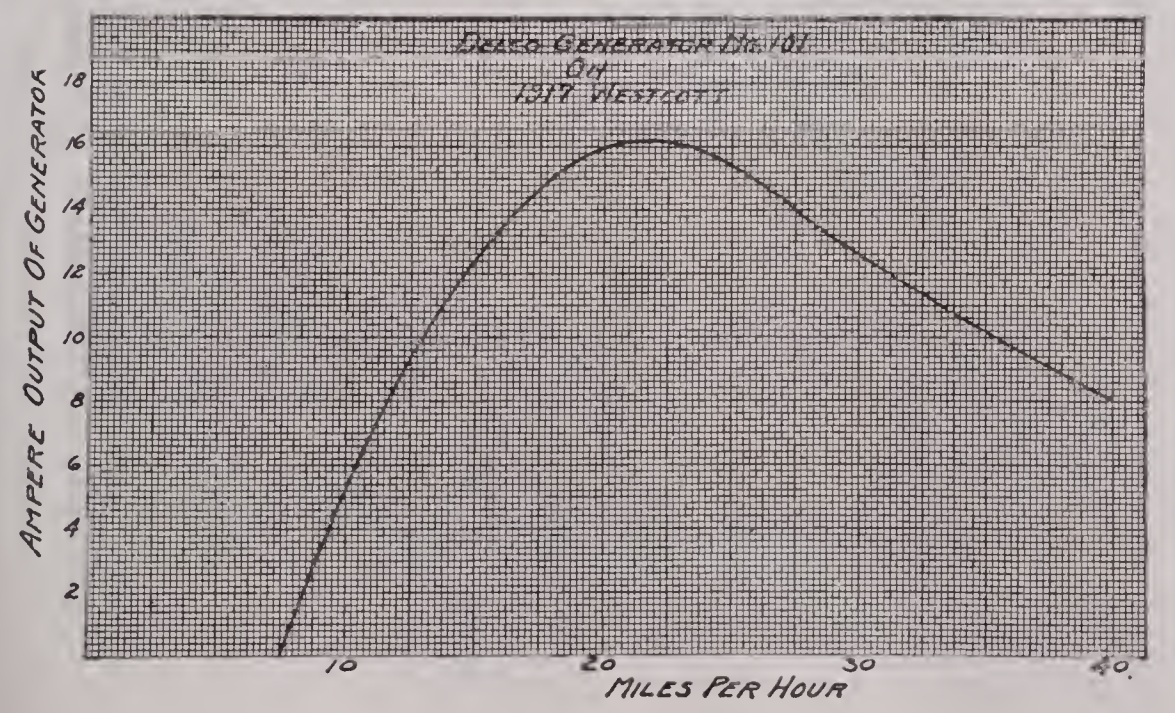
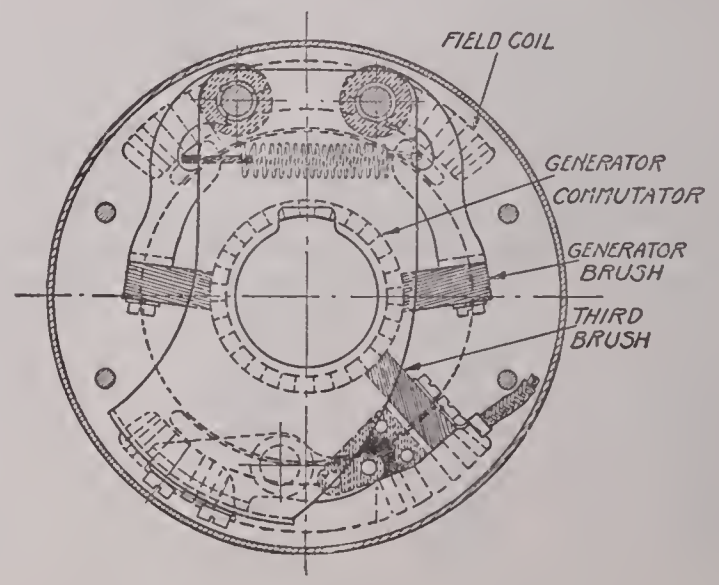


PLATE NO. 58



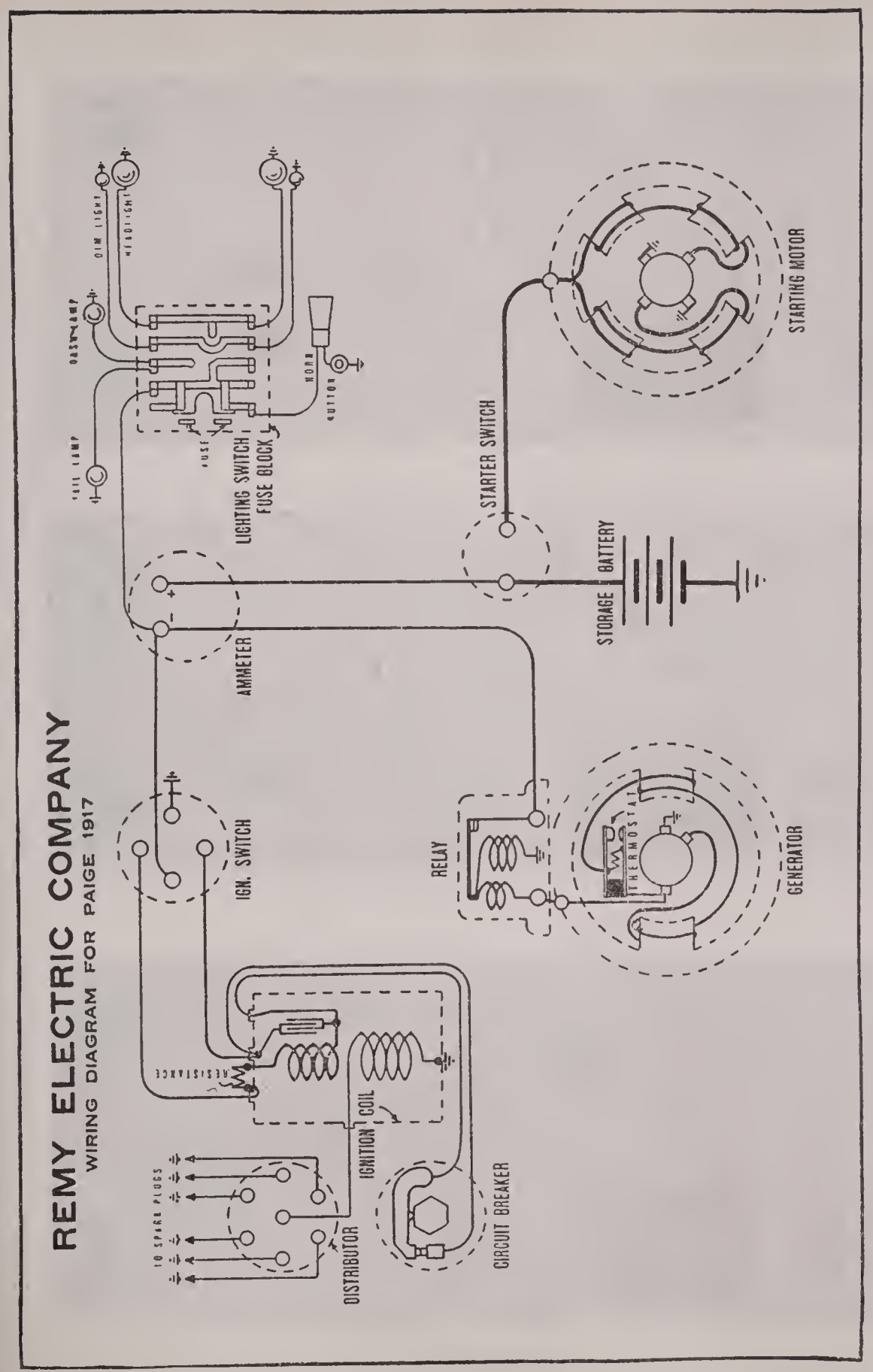


PLATE NO. 59

Paige-Detroit

MODEL 6-51 (1917)

REMY TWO-UNIT, 6 VOLT, STARTING AND LIGHTING SYSTEM. REMY IGNITION

Battery is 6 volt, 90 ampere-hour. The negative terminal is grounded.

Breaker contacts open .020 in. to .025 in. Surface with file or No. 00 sand paper. Put a small amount of vaseline on cam every 1,000 miles. Break occurs when mark DC 1-6 on flywheel is 1¼ in. past indicator, spark fully retarded. Firing order is 1, 5, 3, 6, 2, 4. Spark gap is 1/32 in. Safety gap is 9/32 in. to 3/8 in. Use medium cup grease in breaker grease cup. Tighten two turns every 1,000 miles.

Voltage regulation is by third brush. There is also a Thermostat to cut down charging rate when battery tends to become overheated from charging. Thermostat is on brush rigging. See Plate No. 32. Maximum charging rate at a cold start should be 18 to 20 amperes. The Thermostat will reduce this rate to 13-14 amperes after it is heated. If the maximum current does not reach 15 amperes with thermostat cold, clean commutator and brushes, inspect wiring and connections and battery, then if necessary adjust the third brush.

Relay is mounted on generator. It should close at about 8 miles per hour.

Large head lights are 6-8 volt, 16 cp. Small head lights are 6-8 volt, 4 cp. Dash light is 6-8 volt, 2-4 cp. Tail light is 6-8 volt, 2-4 cp. Large head lights take 3 amperes. Small head lights take about 1 ampere. Dash and tail lights each ½ to 1 ampere.

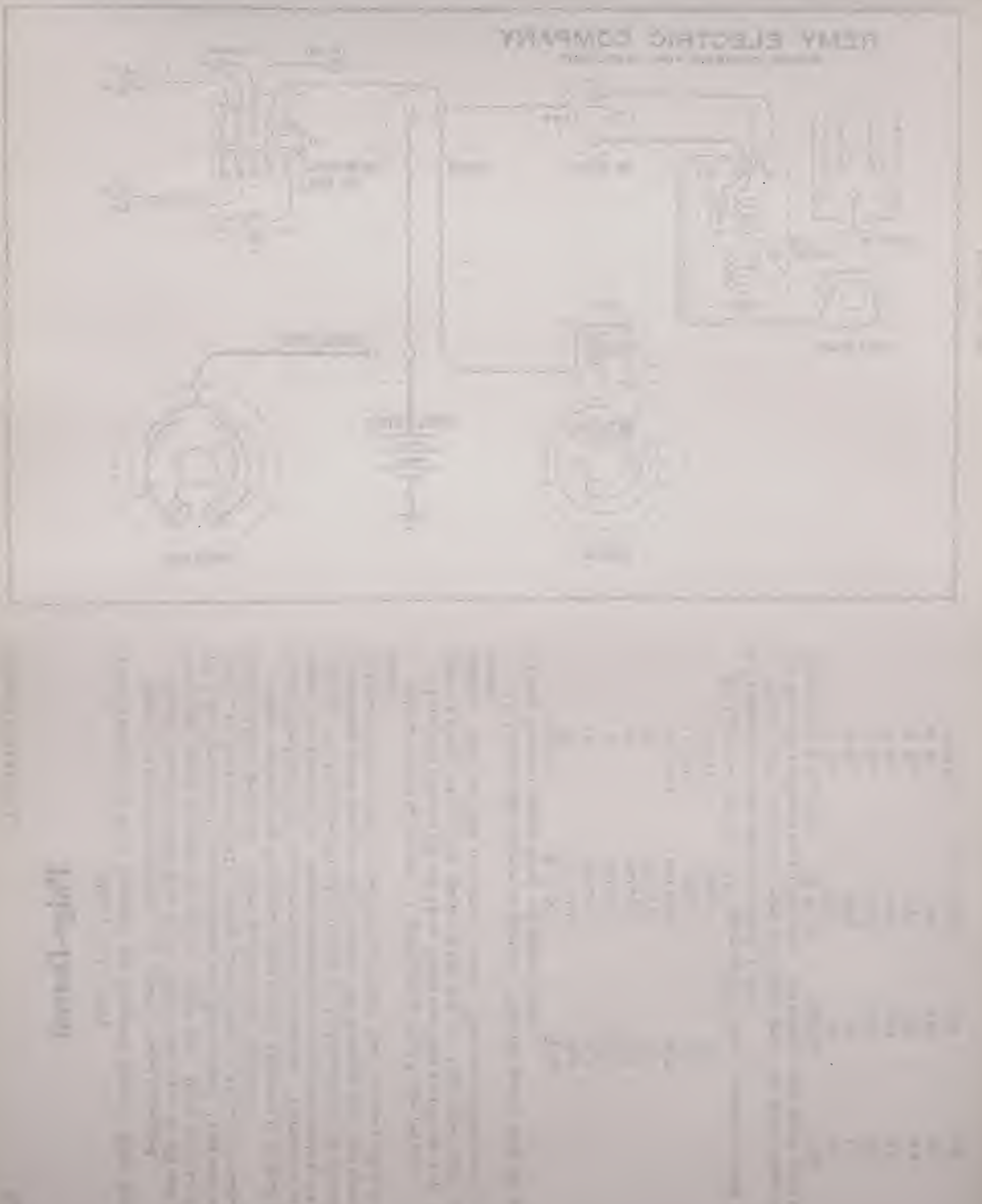
The following data applies to the generator. These tests must be made with generator cold, thermostat contacts closed and without ignition.

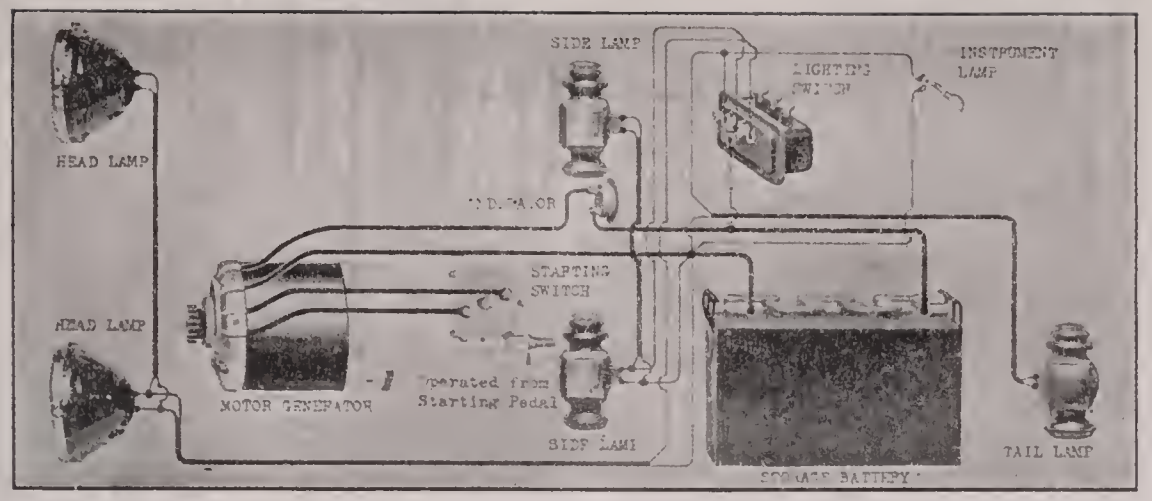
Amperes	R. P. M.	Volts
0.	375-410	6.4
11.	405-415	6.8
5.	420-570	7.2
10.	650-720	7.6
16.	850-870	8.1
19.5-20.5	1200-1500	8.25
16.2-19.2	2000	8.2
9.3-11.7	3000	7.7

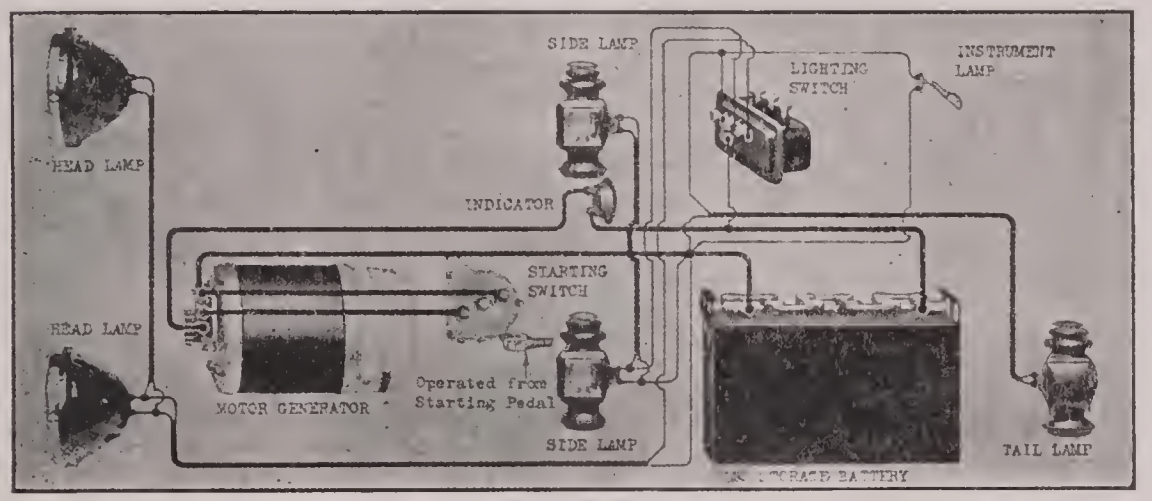
On battery test field draws 3.5 amperes at 6.85 volts. Generator motoring draws 4.5 amperes at 5.9 volts and runs at 250 R. P. M.

Starting motor is connected to engine by a Bendix gear. Oil motor bearings with a few drops light machine oil every 1,000 miles. The following data applies to the motor.

Torque (with 6 in. pulley)	R. P. M.	Amperes	Volts
0 lbs.	3850	45	6.
4 lbs.	1800	95	5.7
16 lbs.	1070	195	5.0
28 lbs.	660	290	4.6
36 lbs.	475	350	4.4
48 lbs.	250	425	3.9
60-68 lbs.	Lock Torque	500	3.6







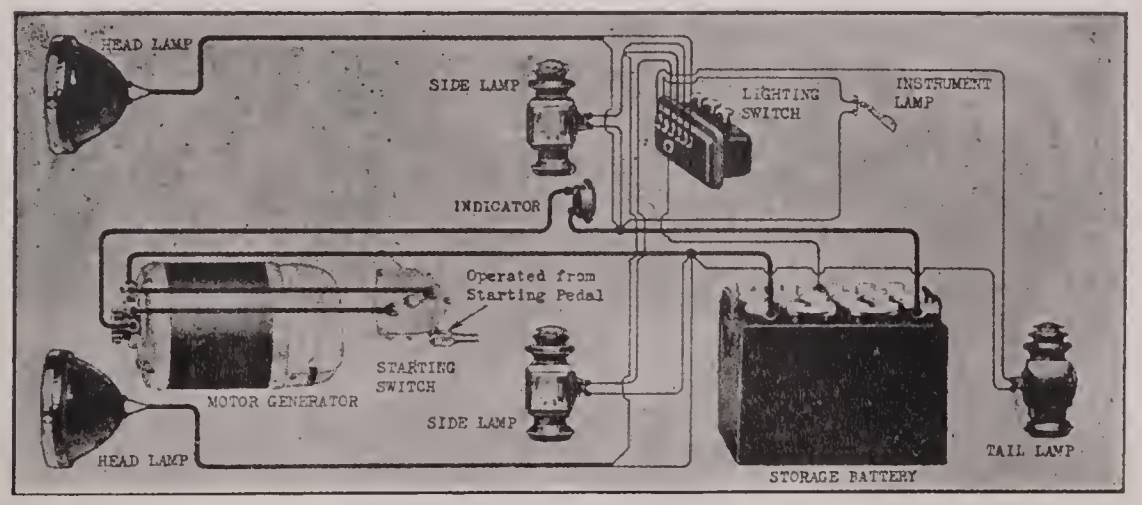


PLATE No. 60

North East for Ford

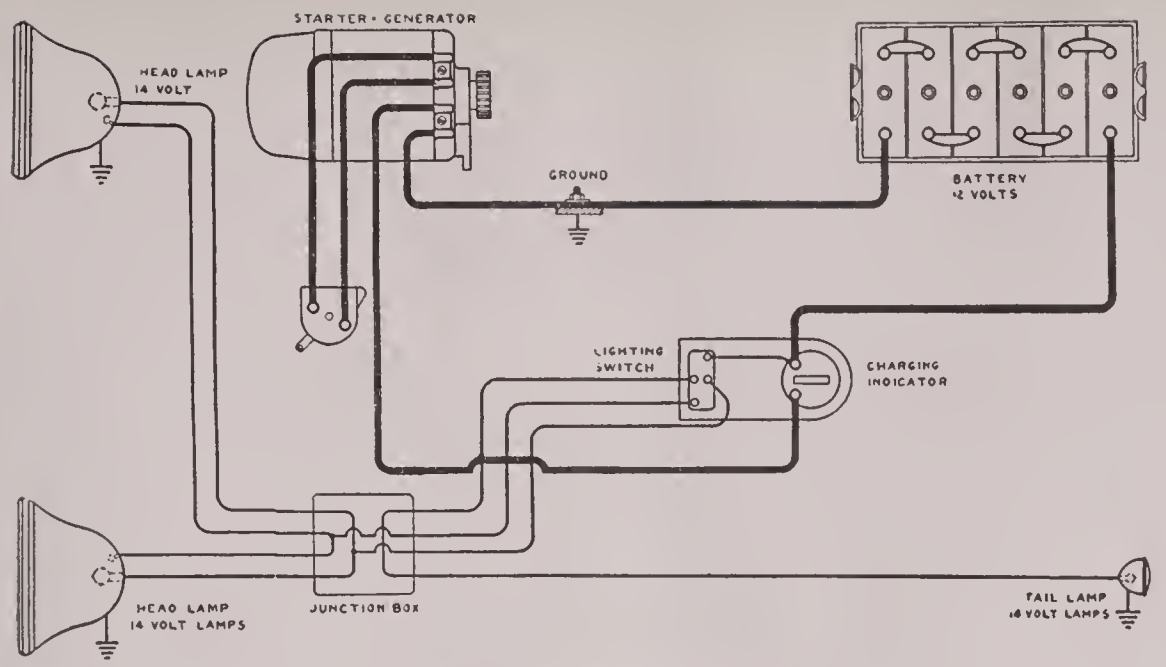
12-VOLT, SINGLE-WIRE, SINGLE-UNIT SYSTEM

Battery is 12 volt, 60 ampere-hour.

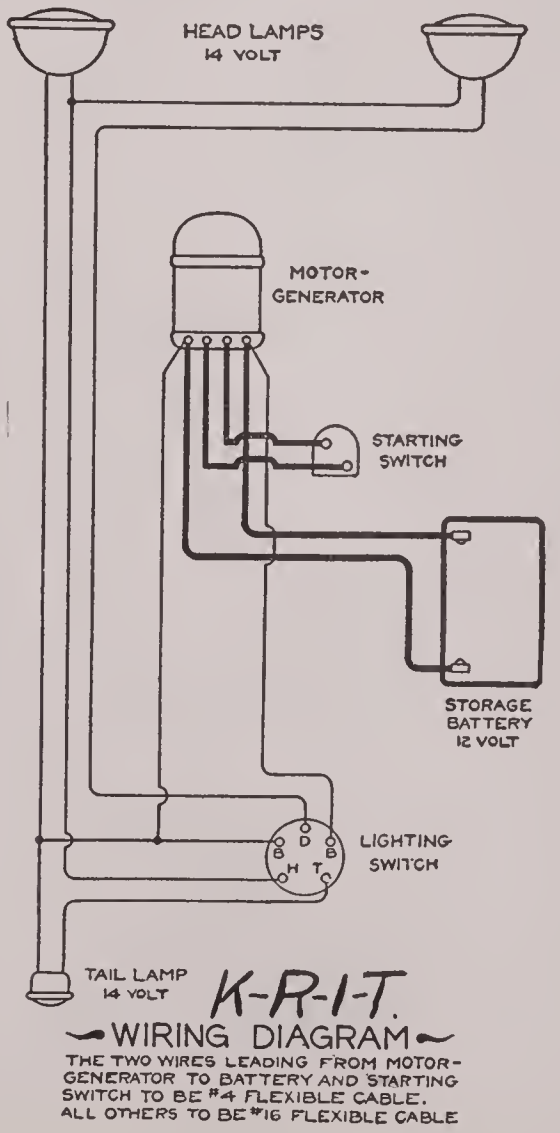
Starter-generator is chain connected to crankshaft of engine. The bearings are packed with a special lubricating compound and no lubrication is needed. There is a 10-ampere fuse located over brushes, under cover. Remove it if generator is to be run without battery. Keep chains and sprockets clean and well oiled. Oil once a week. To adjust vertical chain release nut on clamp stud and screw down adjusting screw. Do not forget to lock this screw after adjusting. If horizontal chain then also needs adjustment, loosen clasp holding starter-generator and turn generator in a counter clockwise direction until proper tension is obtained, after which tighten clamp again.

Use dry cells or magneto for ignition and horn, unless they are made for 12 volts. Connecting ignition or other apparatus across three cells of battery is apt to cause serious battery trouble.

Wash lamp reflectors with a small stream of cold water and allow to dry in air only. Do not rub. Lamp sizes are:—Head 14 volts, 18 cp., size G-16 1/2; side and rear 14 volt, 4 cp., size G-8.



Model D Starting and Lighting System on the International Motor Truck



International Motor Truck and Krit Car

North East 12-Volt, Single-Unit, Starting and Lighting System

On the Krit car the spark should occur when the piston is .125 in. before top dead center, spark lever fully advanced. The firing order is 1, 3, 4, 2.

On the International Motor Truck the spark should occur when the piston is 1/64 in. past top dead center, spark fully retarded.

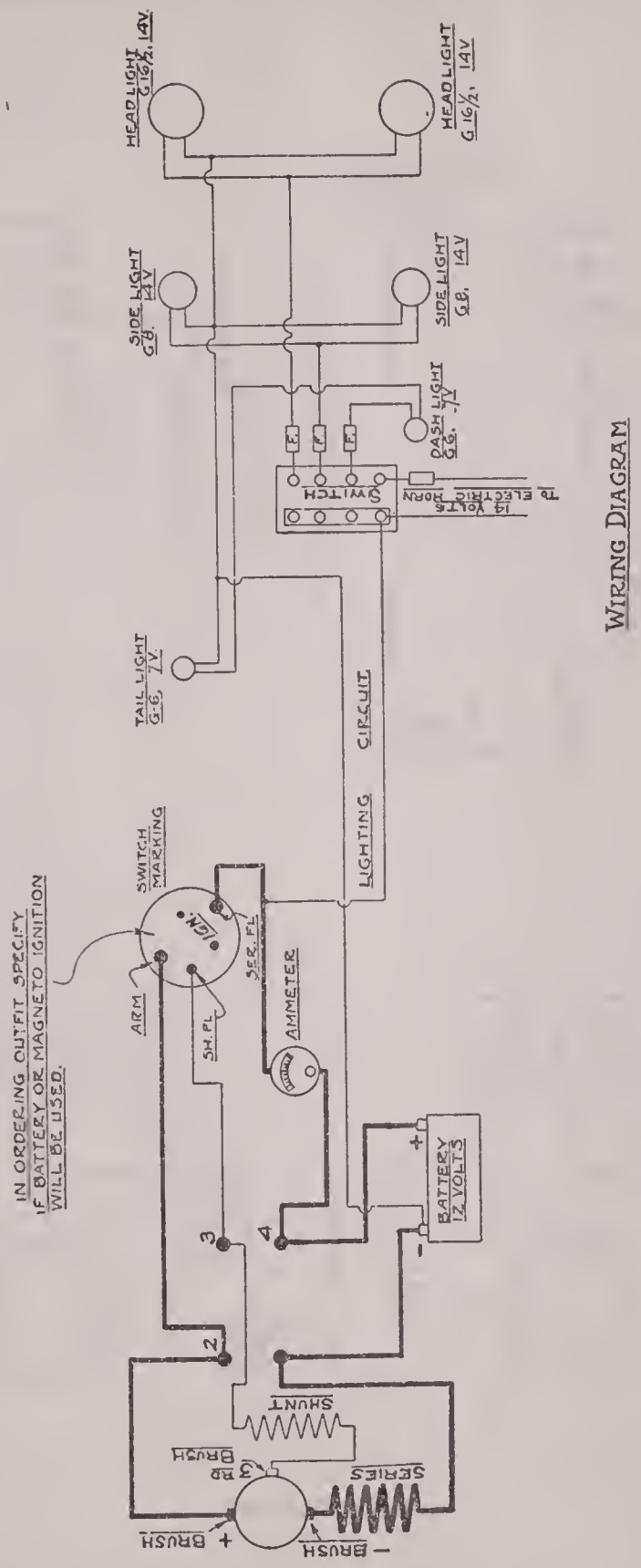
The North East Model D starter-generator is used. This unit has but one commutator, field and armature winding. It operates as a cumulatively compound-wound motor and as a differentially compound-wound generator. There is also a regulator acting with the differential winding of generator to regulate voltage.

The relay and regulator are combined. Both ends of starter-generator are supplied with ball bearings which are packed with a special grease which ordinarily lasts for the life of the machine, but should it ever become necessary to lubricate the bearings, a few drops of oil may be applied to the shaft where it leaves the bearing housing. Keep driving chain well oiled and free from dirt.

There is a 10-ampere fuse located in the brush compartment. This should be removed if generator is to be run with battery disconnected.

Relay should close when engine is running 1050 R. P. M. and open at 900 to 1,000 R. P. M. Driving chain should have ½ in. up-and-down play. To adjust: Release the turnbuckle locknuts and apply a wrench to the hexagon portion of the turnbuckle and screw to the left until proper tension is on the chain, then tighten locknuts, to hold turnbuckle in this position.

To adjust chain on Krit car: Remove the six screws and revolving sprocket carrier, after which procedure is plainly visible. Other care, same as for International trucks described above.



WIRING DIAGRAM

PLATE NO. 62

Dyneto

SINGLE-UNIT SYSTEM
MODEL A AND B.

Battery is 12 volt, 60 ampere-hour.

Both the A and B type, Dyneto motor-generators are 12 volt. The model A is the smaller. It is usually driven by a silent chain from crankshaft when practical. The gear ratio should be 2 1/2 or 3 to 1.

Starting switch must be closed and left closed as it is the only control of circuit between generator and battery. Generator begins to charge battery at 7 to 8 miles per hour. Voltage regulation is by third brush. Both bearings are of the ball type. Each is provided with an oiler.

Size A will begin to charge battery at 1,000 R. P. M. It will charge at a 5 ampere rate at 1,200 R. P. M. and at a 10 ampere rate at 1,600 R. P. M.

Type B will begin to charge at 900 R. P. M. Charging rate will increase to 5 amperes at 1,150 R. P. M. and 10 amperes at 1,400 R. P. M.

Motor consumes about 200 amperes when starting. The wire in the main circuit must be of such size that the voltage drop, with this current will not be over 1/2 volt. The exact size may be calculated as follows:—

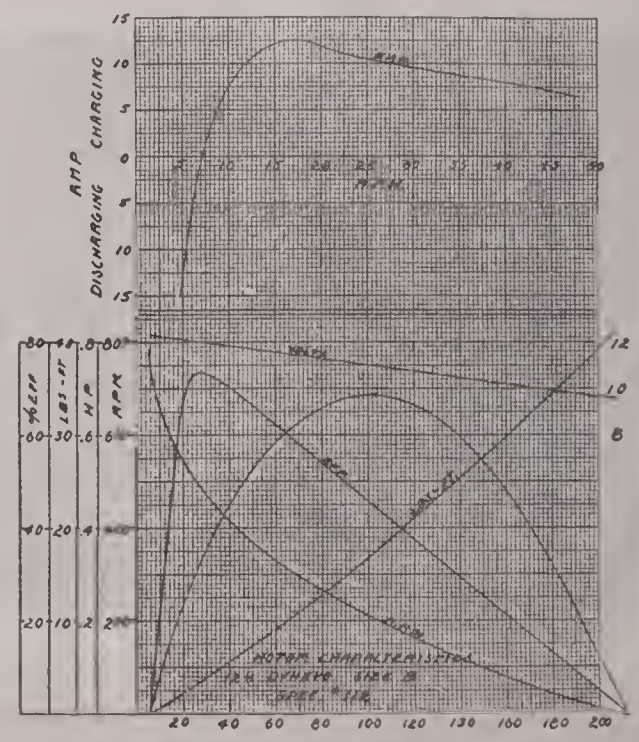
$$\frac{200 \times 10.7 \times \text{number of feet of wire used}}{.5} = \text{the cross section area of wire in}$$

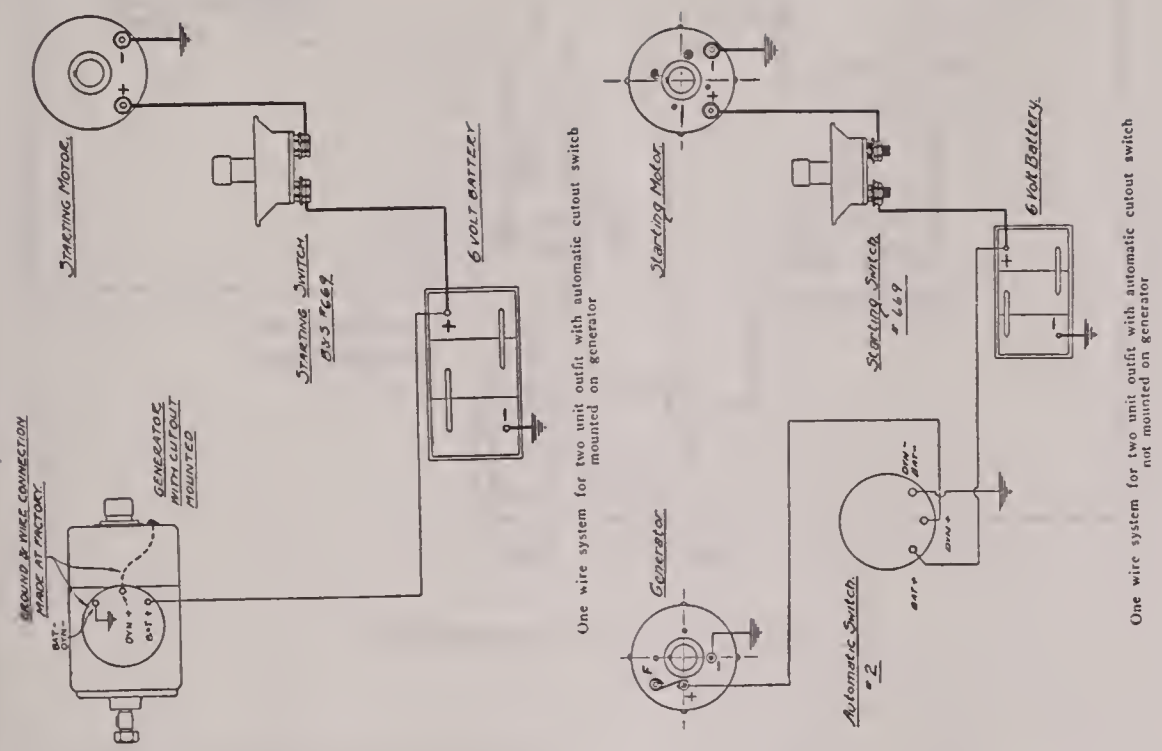
circular mils. The guage number may then be obtained by consulting a wire table, choosing size of wire with cross section area nearest that obtained by above formulæ. If the size next under the required is very much smaller a size larger must be used. If not over 25 ft. is used No. 0 will be the correct size to use. For all other circuits No. 12 B & S may be used. Flexible, stranded wire with a water and oil proof insulation of good thickness should be used. All joints should be soldered. It is also recommended that all wiring be further protected by being placed in flexible metal conduit. Fuses should be placed in all but the main (starting and charging) circuits.

A 12 volt, 60 ampere hour battery is used.

Lamp sizes are:—Head lamps 14 volt, 15 to 24 cp., size G-16 1/2; side or dimmer lamps 14 volt, 4 to 6 cp., size G-8; tail lamp 7 volt, 4 to 6 cp., size G-6; dash same size as tail lamp. Tail and dash lamps are in series.

Starting switch has three positions, marked: "Off", "Neutral" or "Touring" and "Start". In "Off" position ignition is also off. The "Neutral" or "Touring" position is for long drives with a fully charged battery.





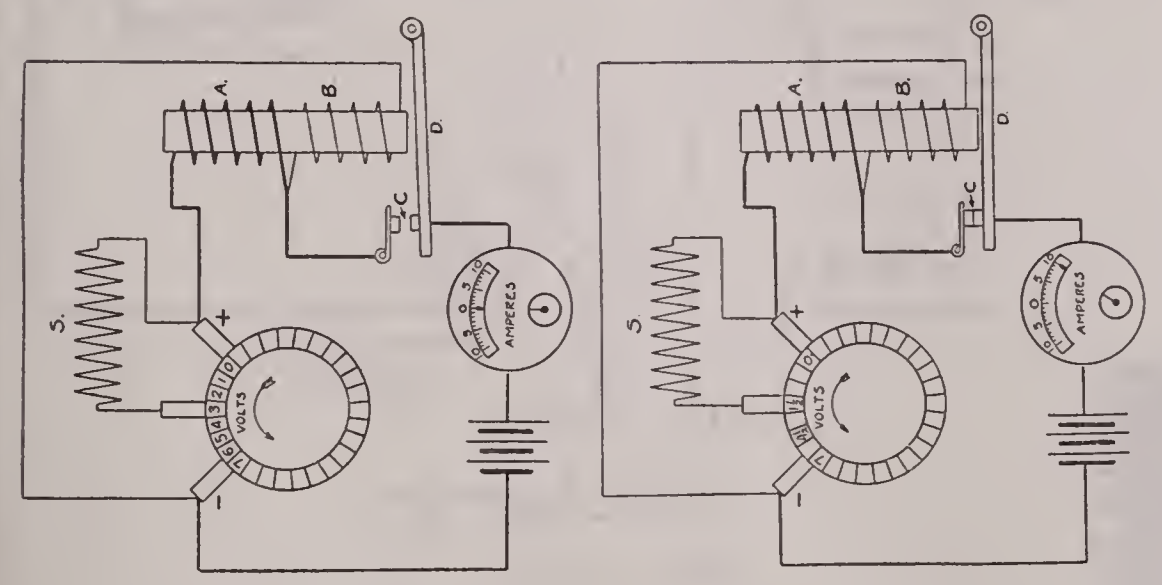


PLATE No. 63

Dyneto

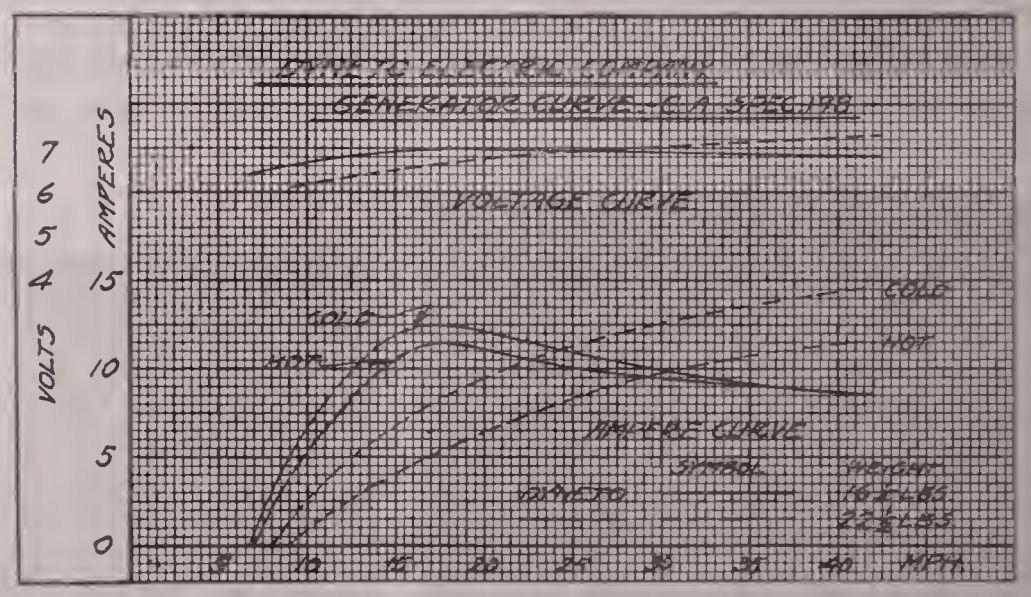
TWO-UNIT STARTING, LIGHTING AND IGNITION SYSTEM
TYPE C A GENERATOR AND D A STARTING MOTOR

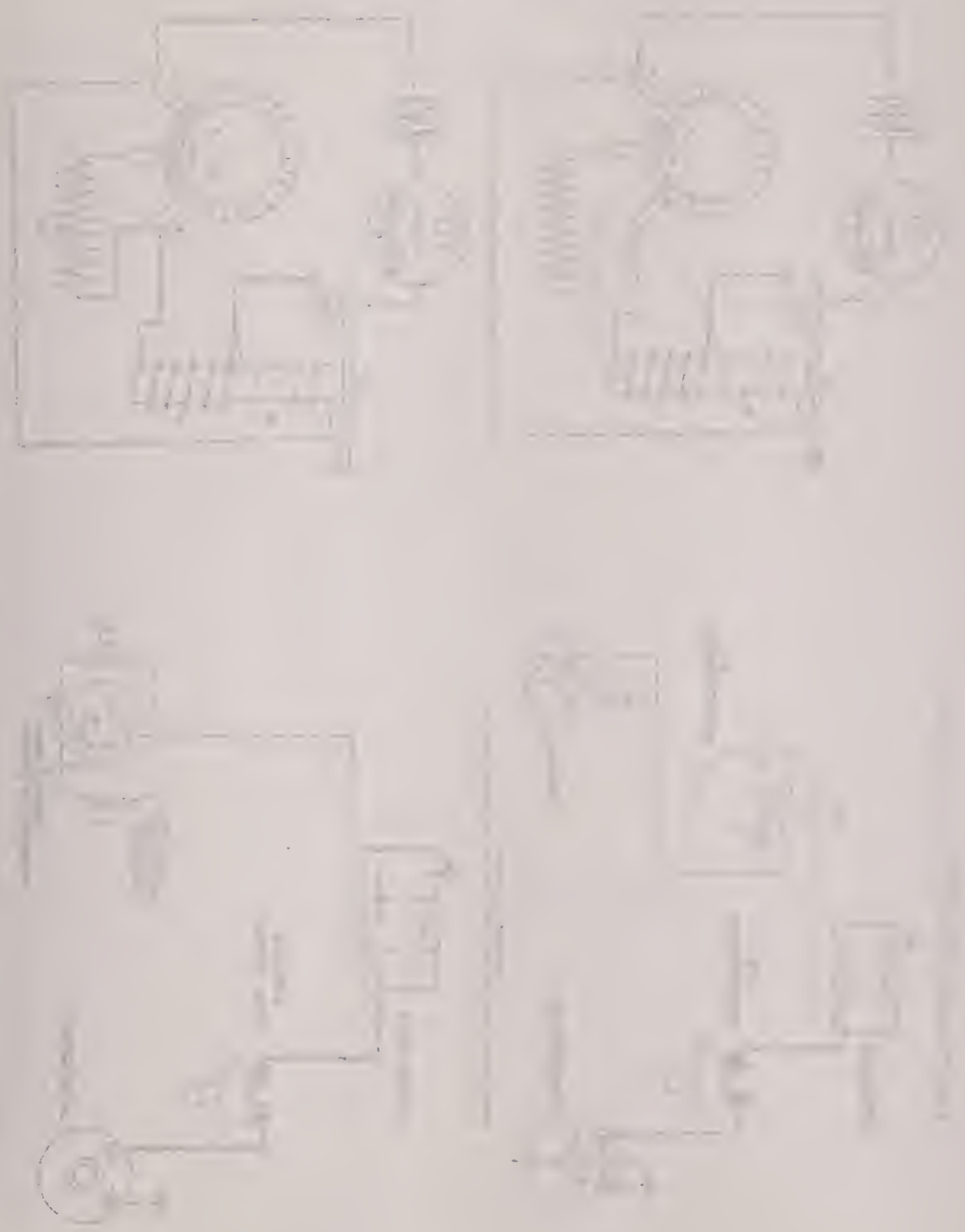
The Dyneto two-unit system is 6-volt, single-wire. Distributor is driven from generator shaft. Generator has ball bearings. Front bearing is adjustable. Any standard ignition distributor may be attached with very slight change in generator. Voltage regulation is by third brush.

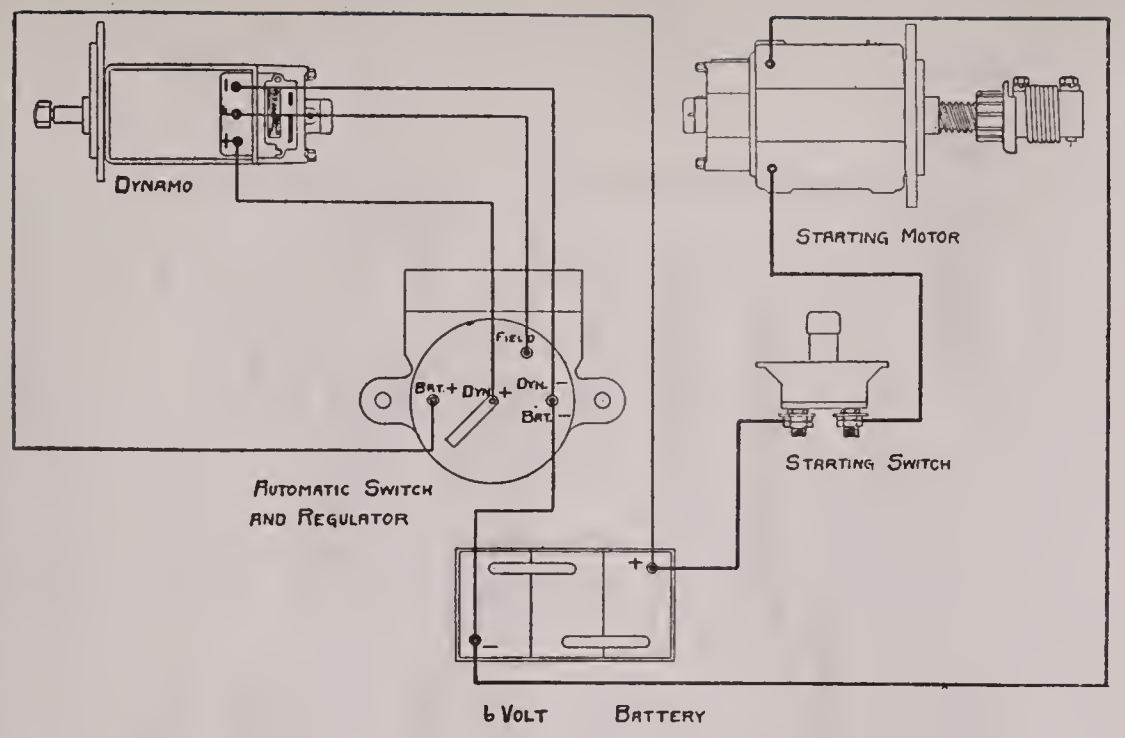
Maximum output is generated at from 15 to 20 miles per hour. When generator is hot output is reduced about one ampere. Voltage is about 7 volts, not varying to any great extent after proper speed to produce this amount is reached. Output and voltage curves are shown. Generator must be short circuited if it is to be run with battery disconnected.

Motor is connected to engine by Bendix gear. Plain bearings are used. Driving end of generator is provided with an oil cup. Commutator end is oiled through the lid of the screw cap adjustment. When equipped with an ignition distributor lubrication at this end is through a plug in ignition housing which provides lubrication for bearing and gears. Lubricate once every 1,000 miles.

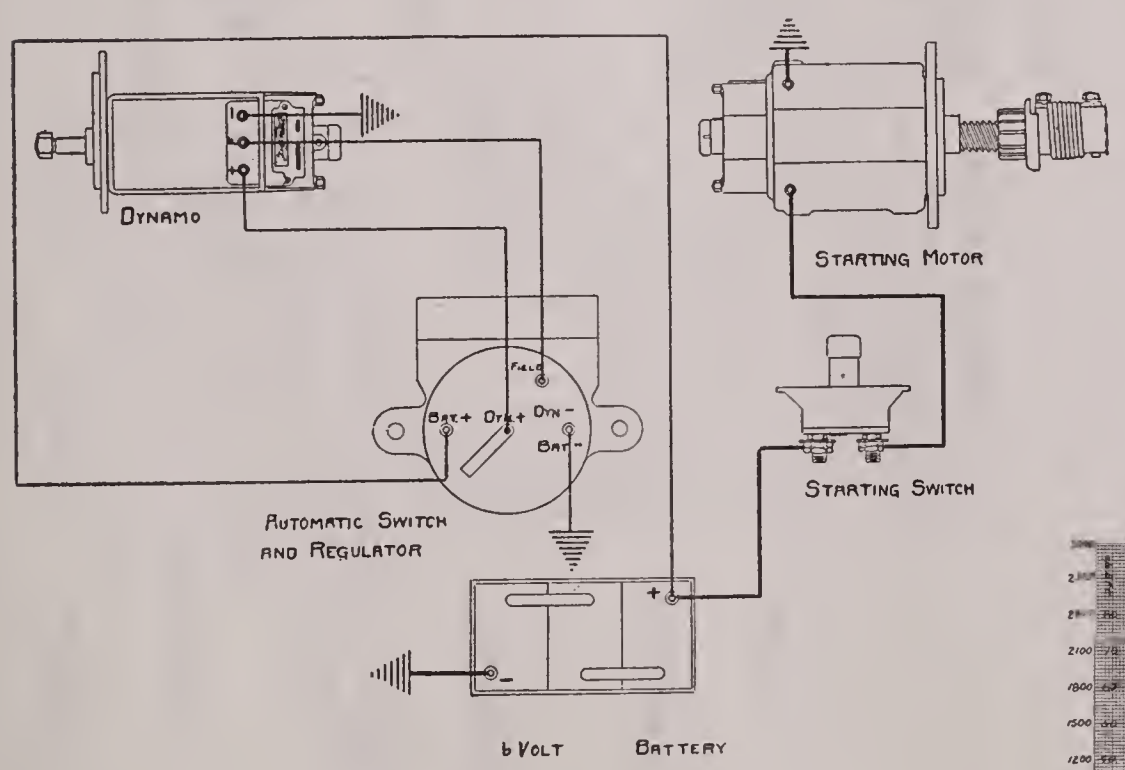
For lamp sizes and wiring see Plate No. 62.







Wiring Diagram for Two Wire System



Wiring Diagram for One Wire System

PLATE No. 64

Dyneto

TWO-UNIT STARTING AND LIGHTING SYSTEM

TYPES UA STARTING MOTOR AND VA GENERATOR

This two-unit, 6-volt, Dyneto starting and lighting system consists of a type VA generator and a type UA starting motor.

Motor is connected to engine by Bendix drive.

All bearings are of the "Bronze-Graphite," oilless type, but on the commutator end a felt washer is supplied. This washer should be kept sufficiently oiled, but not over-oiled. The drive end is provided with a long oil hole which contains a felt plug, the inner end of which touches the shaft. Do not over-oil this plug. Every 1,000 miles should be sufficient.

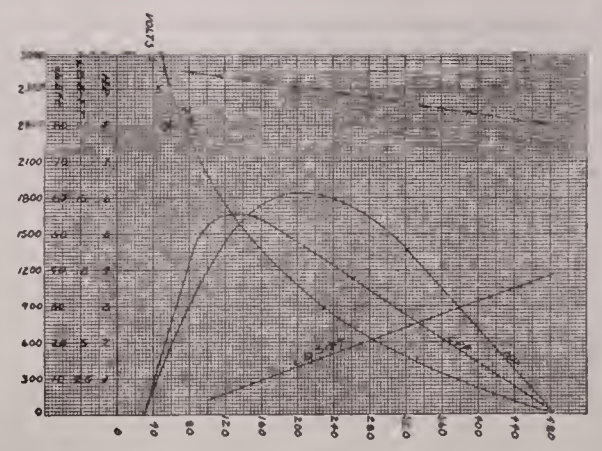
Both motor and generator is of the two brush type. To inspect brushes remove nameplate. To renew brushes, remove the housing. The position of brushes should not be changed.

Voltage regulation is by vibrating regulator. This regulator has no effect whatever until an output of 10 or 12 amperes is reached. Above this rate regulator operates, and keeps output practically constant. Maximum output is reached at 15 miles per hour. A 6-volt, 126-ampere hour battery is used. Curves showing motor characterictics were taken with a battery of this size.

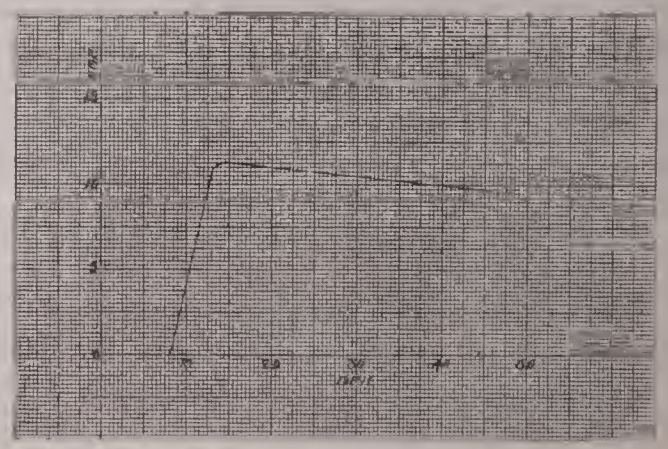
For cranking and charging circuits the size wire to be used is determined by the following formula: $\frac{400 \times 10.7 \times \text{No. ft. of wire used.}}{.25}$ = cross section area of wire in circular mils. The size B & S guage can then be found by consulting a table, using the size next largest if the size required is over half way between the sizes made. Normal cranking current is 400 amperes. In all other circuits No. 12 B & S guage is used.

Head lamps are 7 volt, 15-24 cp. Size G-16 1/2 bulbs. For side lights 7 volt, 4-6 cp. Size G-6 bulbs. Tail and dash lamps are 7 volt, 4-6 cp. Size G-6 bulbs.

Do not run generator with battery disconnected unless terminals are short circuited.



Dyneto Type "UA" Starting Motor Characteristics



Dyneto Type "VA" Generator Curve

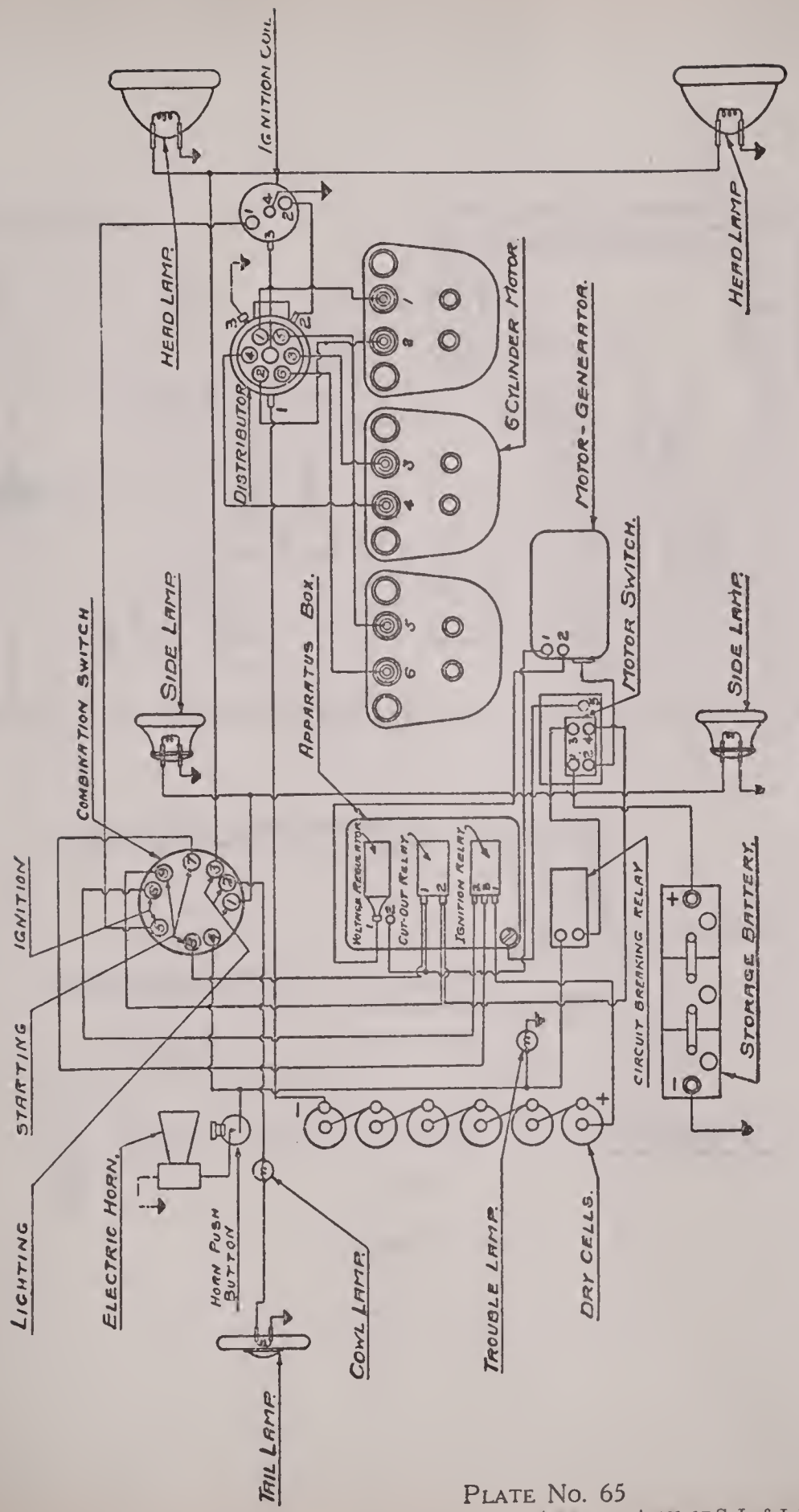


Fig. 1

Delco

1914 Large, Single Coil, Double Unit System

This Delco system is used on the following cars:

1914 Buick, Model B-55	1914 Oakland, Model 43
1914 Cole, Series 9	1914 Oakland, Model 6-48
1915 Cole, Series 10	1914 Oakland, Model 6-60
1914 Moon, Model 42	1914 Oldsmobile, Model 54
1914 Moon, Model 6-50	1915 Oldsmobile, Model 55

The motor generator is two pole and has one armature on which are two commutators and two windings. All four brushes are in constant contact with commutators with the exception of the Model 54 used on the Oldsmobile 55. It has a motor brush lifting device instead of the switch. Since the models were put out, many of the generators have been rebuilt so as to do away with the mercury regulator originally installed. A reverse series winding is used instead. There is a phospher-bronze contact on the motor which opens the generator circuit when motor circuit is closed. On the Buick B-55 the distributor is mounted on motor-generator.

Particular care must be taken to keep the starting switch contact blocks free from oil. If block or contact burns the temper will be taken out of the spring and whole cradle should be replaced.

Apparatus box contains the mercury regulator, cut out relay and ignition relay.

Connections after machine has been rebuilt is shown in Fig. 3.

Once a year the motor-generator should be overhauled. The old grease should be cleaned out and new put in, the mica undercut, commutator trued up if necessary and brushes reseated.

On the Oldsmobile 55 the ammeter shows charging rate. On other cars only a part of the charging current is indicated as there are two circuits. The total current given out on these cars may be determined by placing an ammeter in series with the large generator terminal and left hand terminal of cutout relay.

Motor-generator is provided with oil holes by which both of the bearings can be lubricated with a few drops of oil every week. Clutch and shaft are both lubricated by grease cup on shaft. Keep over-running clutch well lubricated. The distributor gear housing is packed with grease, which lubricates the driving gears and lower bearings of distributor shaft. The upper bearing of the distributor must have a few drops of oil occasionally.

(*Continued on Plate* 65-A)

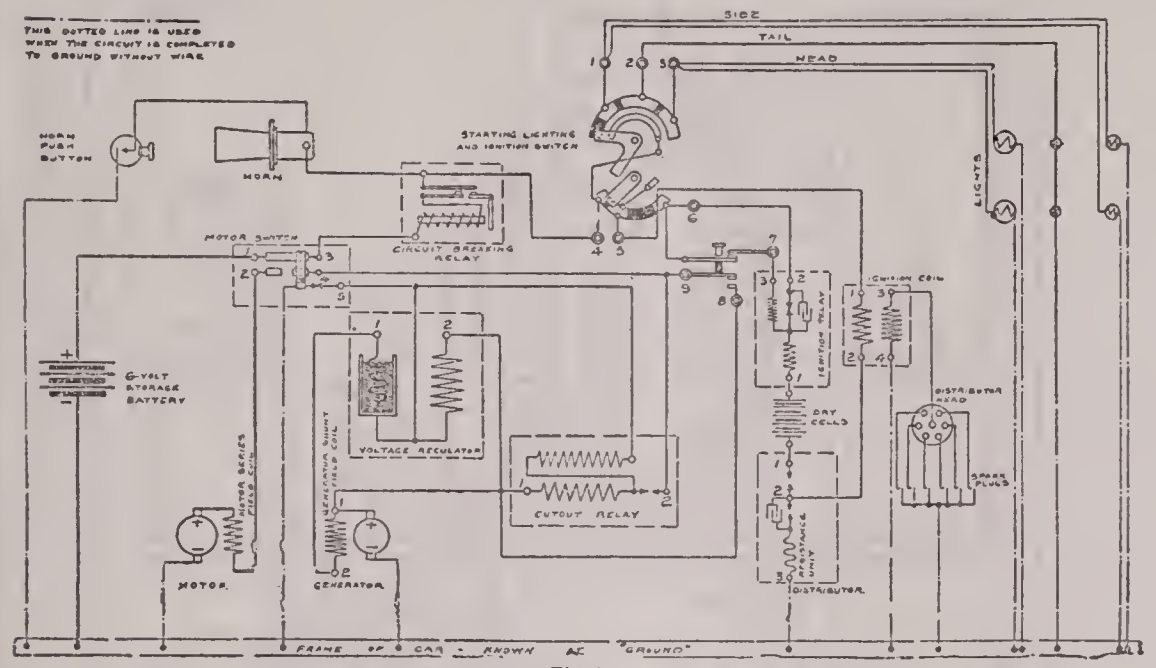


Fig. 2

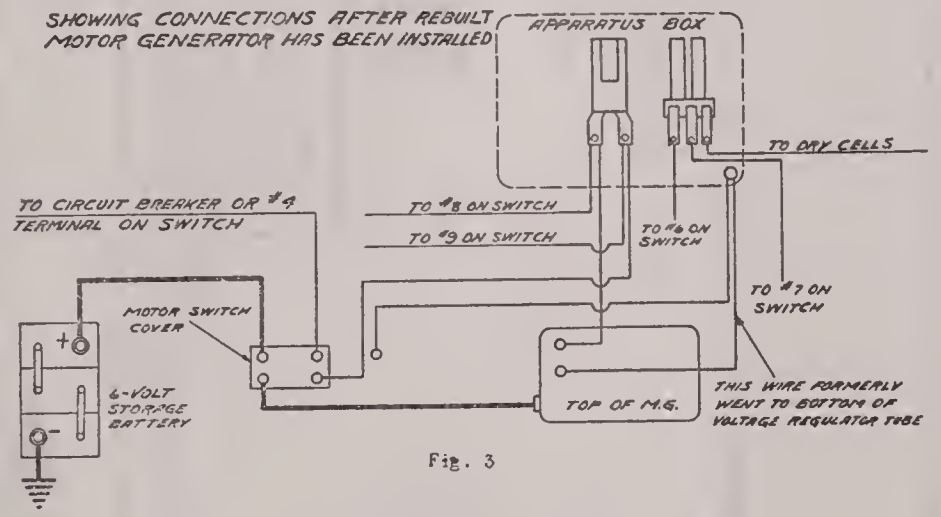


Fig. 3

PLATE No. 65A

Delco

1914 LARGE SINGLE COIL, DOUBLE UNIT SYSTEM

(*Continued from Plate No.* 65)

An increase in temperature will cause the voltage to rise. The indicator should be turned in a clockwise direction when viewed from the top, to increase the charging rate and in the opposite to reduce it. If the generator is run with battery disconnected or a high resistance connection in circuit the regulator, the relay and the generator may be burned out. If for any reason, the regulator develops an open circuit the generator will not charge the battery. If battery is not charging it can be determined if regulator is open circuited by temporarily bridging across the red fiber gasket at bottom of tube with a piece of metal. If under these conditions the generator will charge, the trouble will be found in the mercury tube. Another way to determine if there is an open circuit in regulator or shunt field is by pressing starter button on the lighting and ignition switch. If there is an open circuit the armature will revolve in a counter clockwise instead of a clockwise direction when viewed from the front.

A set of dry cells is provided to supply ignition current when starting. To start turn ignition switch to battery position. This connects dry cells to ignition and will give a single spark type of ignition. If the "Start" button is pressed it opens circuit between terminals No. 6 and 7 on switch, thus permitting ignition relay to vibrate, sending a shower of sparks across gap. Depressing of starting button also completes circuit between terminals 8 and 9, allowing current to flow around relay and running generator as a motor, making it possible to mesh starter gears when starting pedal is depressed. There is a clutch to prevent engine driving motor.

Figure 3 shows changes in connections when series field is substituted for mercury regulator on ordinary type generator. Figure 4 shows changes in connections on motor generator on Oldsmobile. For ignition relay see Plate No. 68.

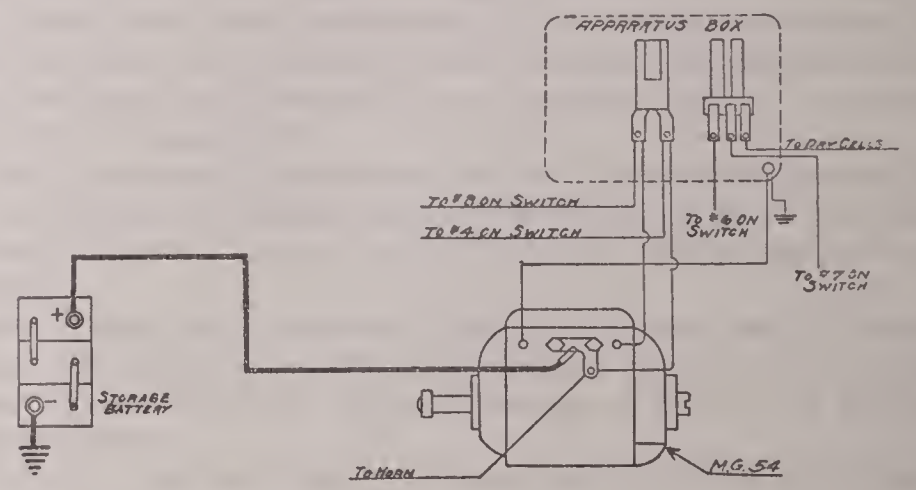


Fig. 4

Delco

1914 Junior Double-Unit System

The 1914 Delco Junior 6 volt, single wire system is used on:

1914 Cartercar, Model 7	1914 Buick, Models B-24-25, B-36-37
1914 Hudson, Model 6-40	1914 Oldsmobile, Model 42
1914 Keeton, Model 4-35	1914 Paterson, Models 32-33
1914 Oakland, Model 36	1914 Wescott, Model O-A

The motor-generator has a single armature, but is electrically a double unit system, as it has a single armature with two windings and two commutators. There is one field coil with two separate windings. Both commutators are mounted on the front end of armature. Negative terminal of battery is grounded.

Distributor is carried on front end of generator. A set of five dry cells is provided for starting. A ground in dry cell ignition may cause "Mag" ignition to fail entirely, yet not seriously affect the battery ignition.

Two types of ignition switches are used, one for ignition only and one for both lights and ignition.

When starting pedal is depressed part way the brush shifting rod will close cut out relay by means of the catch. This starts generator to turning as a motor, which allows the gears to be meshed when lever is further depressed. When starting gears are fully meshed generator brush is automatically raised and motor brush allowed to come in contact with commutator, thus opening generator circuit and completing motor circuit. There is a clutch to prevent engine driving motor before gears are drawn out of mesh by releasing starting lever. When lever is released the motor brush is raised and generator brush allowed to bear on commutator. There is an overrunning clutch at driving end to allow generator to turn as a motor.

The brush lifting rod must be so adjusted that relay is closed before gears begin to mesh. If the little catch is not put on properly, that is, so that the long end with the hook on it bears against the extension on generator brush holder and raises the brush before motor brush comes in contact with commutator the motor will only operate at 30% of its rating.

Cut out relay closes when generator voltage is 7 to 7½ volts. If it is desired to install an ammeter in the circuit, cut the brass strip connecting the two terminals and connect one terminal to each of the two terminals and connect the other ammeter terminal to switch and storage battery respectively, but left precisely as before. This arrangement will indicate the charging current.

At least once per year the motor-generator should be overhauled, removing the old grease from clutches and bearings, bearings examined and replaced if badly worn, the clutch packed with grease and mica undercut, commutator trued up and brushes reseated if necessary.

To test charging rate on generators not having an ammeter supplied, disconnect the lead going from field to the top carbon brush and connect one lead of an ammeter to brush and the other to the lead. Maximum charging rate should be 14 to 20 amperes with generator warm.

With spark at full retard, break should occur when dead center mark on flywheel is approximately 2 in. past indicator.

Voltage regulation is by reverse series winding.

(*Continued on Plate No. 67*)

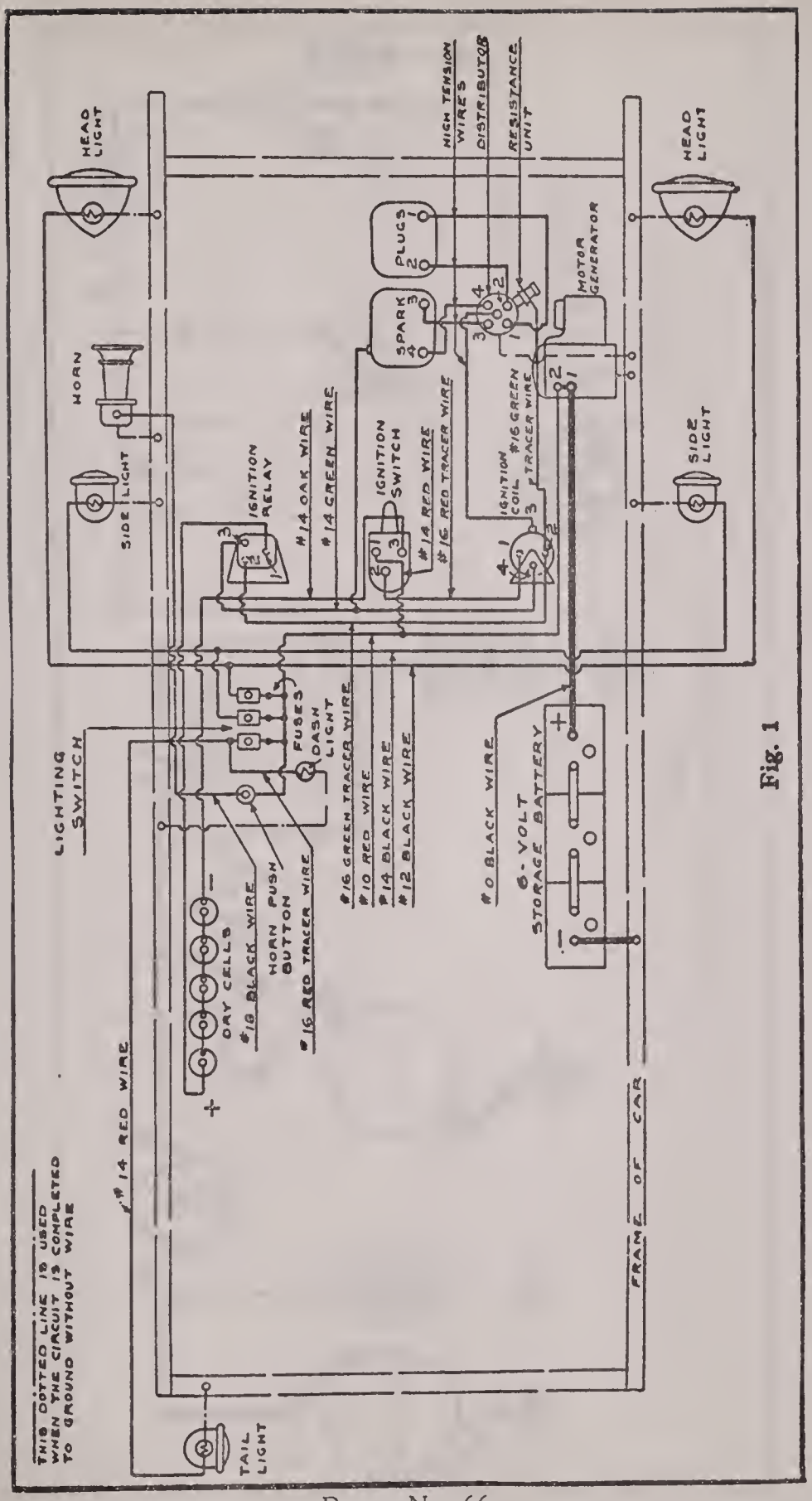


Fig. 1

Plate No. 66

Delco

1914 Junior Double-Unit System

(*Continued from Plate No.* 66)

Connecting Ammeters:

It is impractical to connect an ammeter in the 6-24 volt systems to show the charging and discharging.

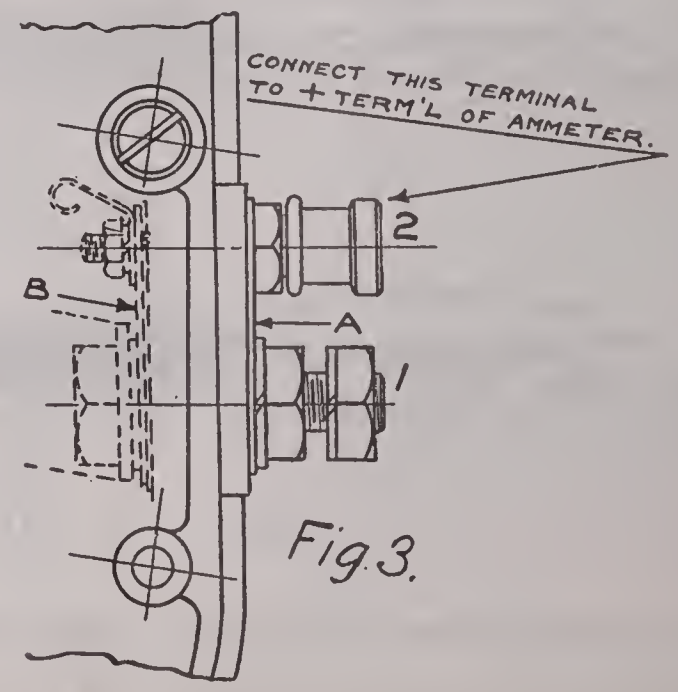
On the 1914 Junior Systems, which include the following: Buick B-24-25-36-37; Cartercar, Model 7; Hudson 1914-15, Model 6-40; Oakland 1914, Model 36; Paterson 1914, Models 32-33, the connections should be made as follows, referring to the illustration: The strap connecting terminals (1) and (2) must be cut or removed.

On some of these machines this strap is on the inside of the frame, as shown at "B", in which case it becomes necessary to remove the motor-generator from the car and disassemble it in order to cut this strap. On the others it is on the outside, as at "A", and can be cut with a hack-saw without removing the motor-generator from the car. After this strap is cut a tap is made on the wire from No. (2) terminal to the positive side of ammeter, and a wire run from the other terminal of the ammeter to No. (1) terminal. On the following 1914 Systems the ammeter should be connected in the line from the right side of the cut-out relay to one of the spring terminals on the motor switch block.

This will show the full output of the generator. It is impractical to connect the meter in these systems so as to show the discharge to the lamps. These systems are: Buick Models B-54-55; Cole, Series 9; Moon, Models 42-6-50; Oakland, Models 43-48-62; Olds, Model 54.

On the 1915 systems using either the switch No. 1048 or No. 1050 the ammeter should be connected in the line which connects the No. 1 terminal on the combination switch with the positive terminal of the meter connected to the No. 1 terminal of the switch.

For testing of motor-generator see Plates No. 70-71.



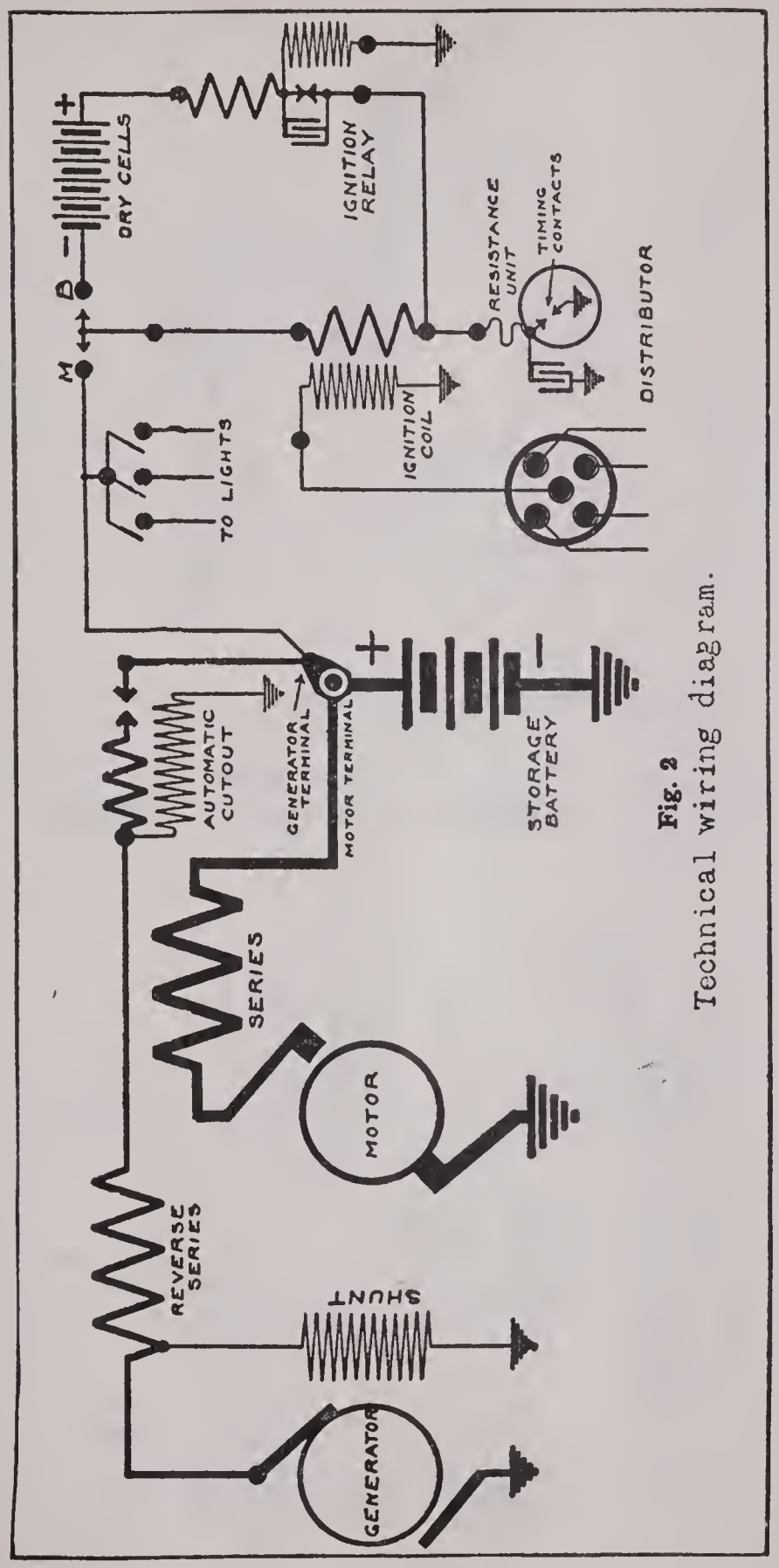


Fig. 2 Technical wiring diagram.

PLATE No. 67

Delco Ignition Relay

The ignition relay is in the dry cell circuit. It acts as a vibrator interrupting the current and sends a shower of sparks across the gap when the breaker contacts of magneto or distributor are open.

This relay consists of a set of contacts operated by an electro magnet having two windings. One of coarse wire, in series with the contacts and a holding coil of very fine wire to hold the contacts open after circuit in large winding is broken.

The operation of this relay varies with the external connections. If connected as shown in Fig. 1 a series of sparks will be thrown across the gap as long as the circuit between Nos. 6 and 7 terminals (holding coil) is held open, by holding down button on switch, timing contacts being closed. If the button is released, completing holding coil circuit, a single spark just as a magneto or breaker system gives, is obtained.

Fig. 2 shows the method of connecting the ignition relay to the 1914 Delco Junior system. The ignition switch completes the primary circuit and holding coil circuit is completed by timer contacts. In this way a vibrating spark will be obtained all the time the timer contacts are open. This provides a late spark.

The following points should be borne in mind while adjusting the relay:—When armature is pressed down to open contacts "C" there should be absolutely no motion of the lower spring "G". Contacts open .005 in.

Increasing the air gap between armature and core of upper coil decreases the tension of the Spring A on contacts. If it is impossible to get a strong enough spark by adjusting the air gap slightly, it may be necessary to increase the tension of the spring. This may be done by holding the spring loosely in a pair of duck-bill pliers, pressing down slightly and at the same time twisting to the right as shown in Fig. 3. When properly adjusted it should have a bowlike shape, Fig. 4, free from the waves shown in Fig. 3. Care should also be taken to see that the armature makes a right angle (90°) and that it is free to move on its pin.

When properly adjusted the ignition relay should take .6 amperes when furnishing a vibrating spark, motor at rest, the deflection of an ammeter should be about 1.5 amperes when ignition switch is on.

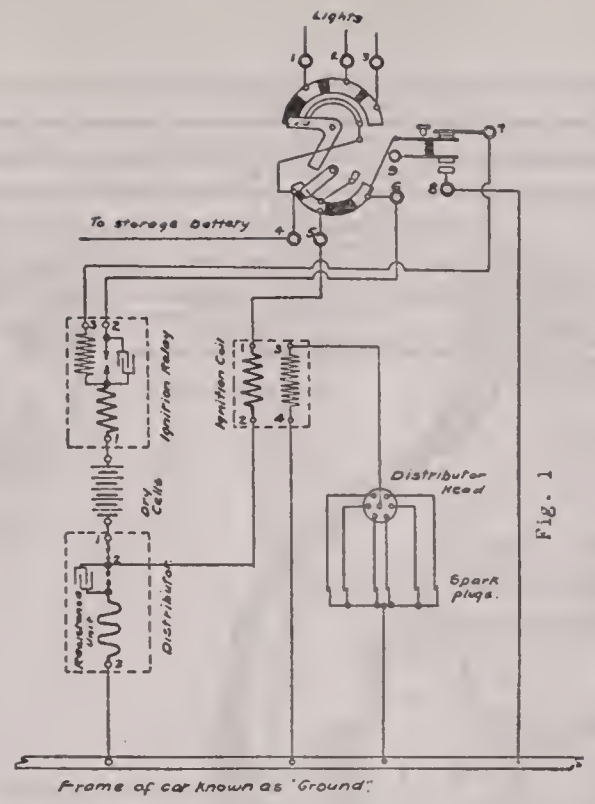


Fig. 1

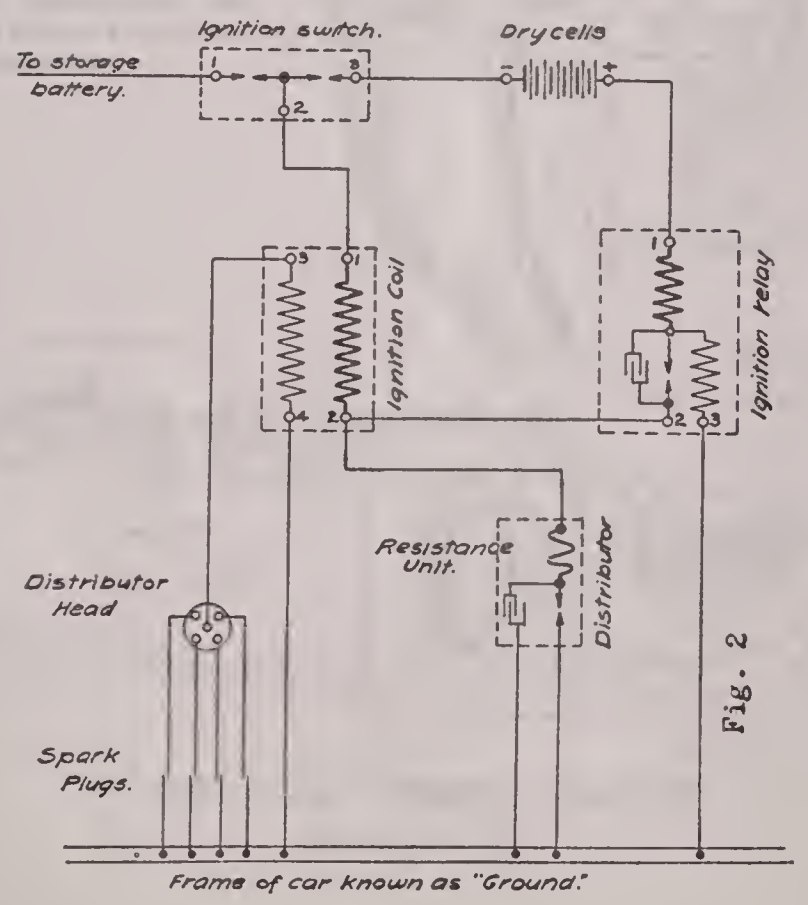


Fig. 2

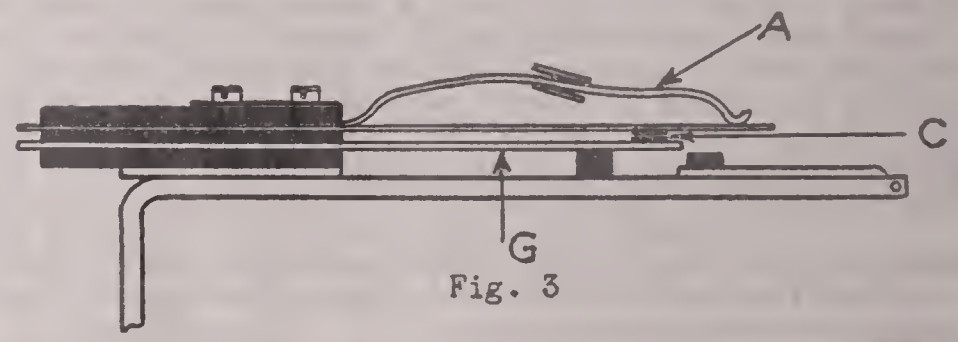


Fig. 3

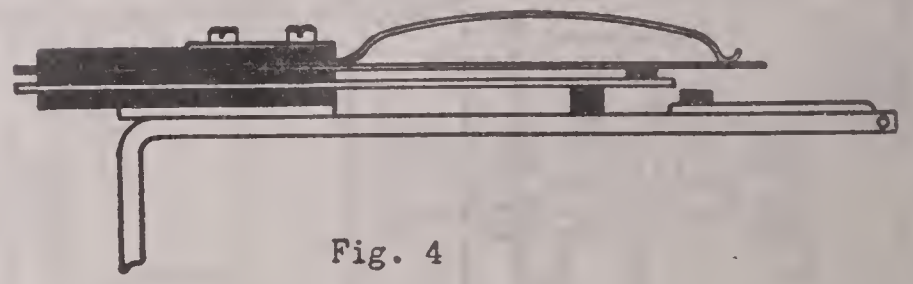


Fig. 4

Diagram showing how springs should look when properly "crowned"

PLATE No. 68

MODEL 6-54 (1914-15)

DELCO DOUBLE-UNIT, 6-VOLT STARTING AND LIGHTING SYSTEM

DELCO IGNITION

Battery is 6 volt, 80 ampere-hour. The negative terminal is grounded.

The 1914 large single coil Delco motor-generator is used. See Plate No. 65.

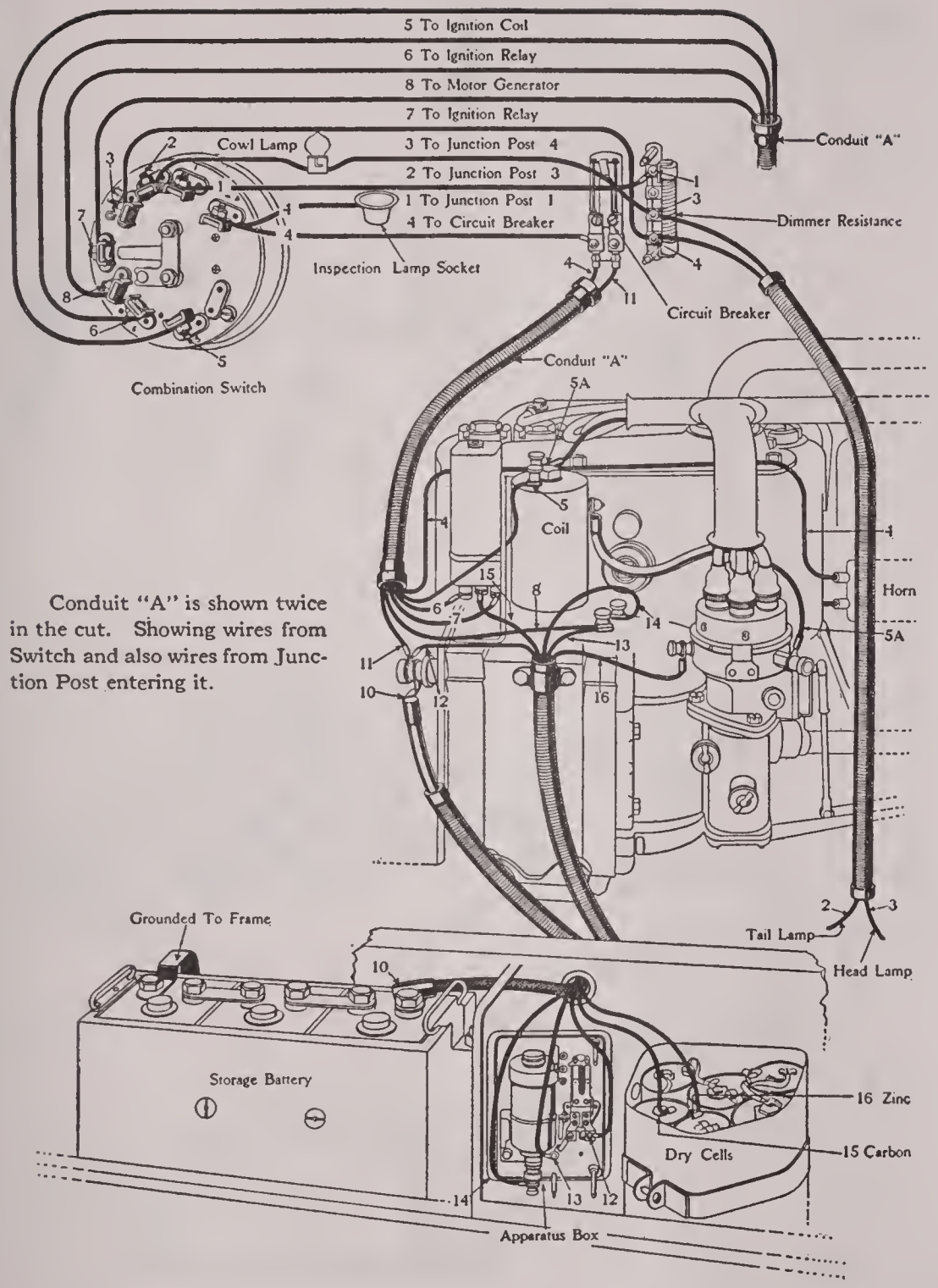
Contacts open .018 in. Firing order is 1, 5, 3, 6, 2, 4. Break occurs just over top dead center, spark fully retarded.

TESTING IGNITION UNITS: Source of current, 6-volt storage battery. When in good condition primary of coil will allow 10 amperes to flow. A much larger current, say 15 to 20 amperes, through it indicates a short circuit. No current indicates an open circuit. In 1913-14-15 coils, a voltmeter connected in series with the battery, to one top and and the bottom terminal or to one top and the side terminal of coil should not indicate. If it does it indicates a connection between primary and secondary windings. In 1916 coil, if voltmeter is connected between one top and the bottom terminal of coil, a deflection of needle indicates a ground. If connected between side and bottom terminals, any deflection indicates secondary is grounded. On the 1913-14-15 coils, if voltmeter is placed in series with the side and bottom terminals of coil the deflection of needle will indicate three volts if secondary is intact. A greater pressure indicates that part of the winding is short circuited. No deflection indicates an open circuit. On the 1916 coils, an open circuit will be indicated by the needle not deflecting when the two test terminals are applied to the left top and the side terminal. If secondary is intact deflection will be three volts. If there is a greater deflection part of the winding is short circuited. The above test must be made with all car wiring removed from coil.

After all these tests have been made and no fault has been found with the coil a further test may be made by removing the distributor head and rotor and connecting the positive of the battery to one top terminal and the negative side of battery, in series with breaker, to other top terminal. Condenser should be connected in shunt with the breaker. Connect a wire to lower terminal of coil and hold 3/16 in. to 1/4 in. from side terminal. On opening and closing the contacts with the finger a spark should jump. Oil or dirt on contacts will cause them to arc badly. Clean as directed on Plate No. 20. If arcing still continues after contacts are cleaned remove condenser and see if the sparking is more violent. If it is several times as great condenser is at fault. If not, condenser is all right. Another method of testing condenser is by the 110 or 220 volt D. C. circuit. Connect a lamp in series with the condenser. If lamp lights condenser is short circuited. Connect a short piece of wire to each side of condenser, leaving it in series with light as before, and then make and break the circuit as before. If a sharp spark (like that when a storage battery is shorted, but much less in volume) results, the condenser is all right. It would be well to compare spark thus obtained, with that obtained if circuit is made and broken so as to light the lamp with condenser removed. It should be much different.

For troubles with other apparatus see Plates No. 70 and 71.

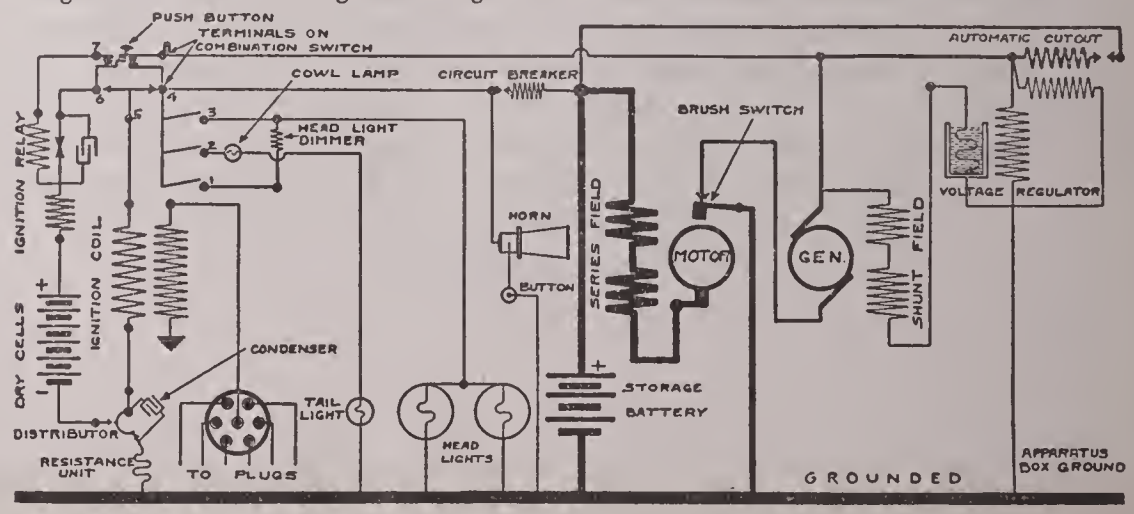
Voltage regulation is by mercury regulator on early models and by rebuilt generator using reverse series winding for voltage control on late models. See Plate No. 65.

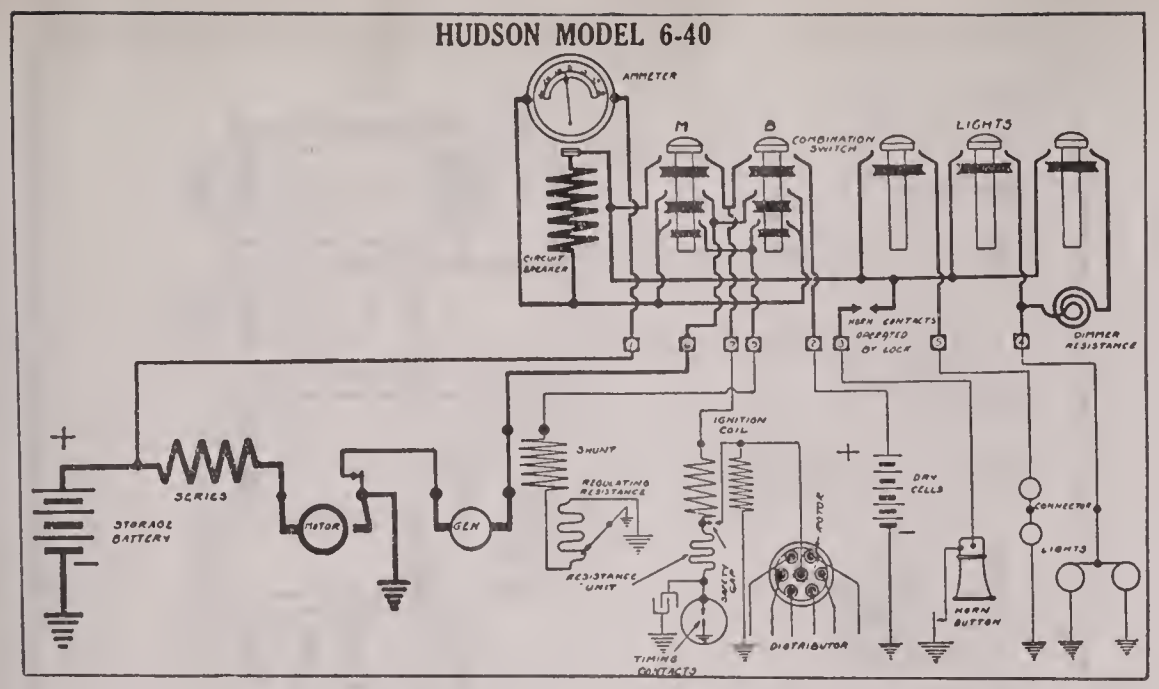


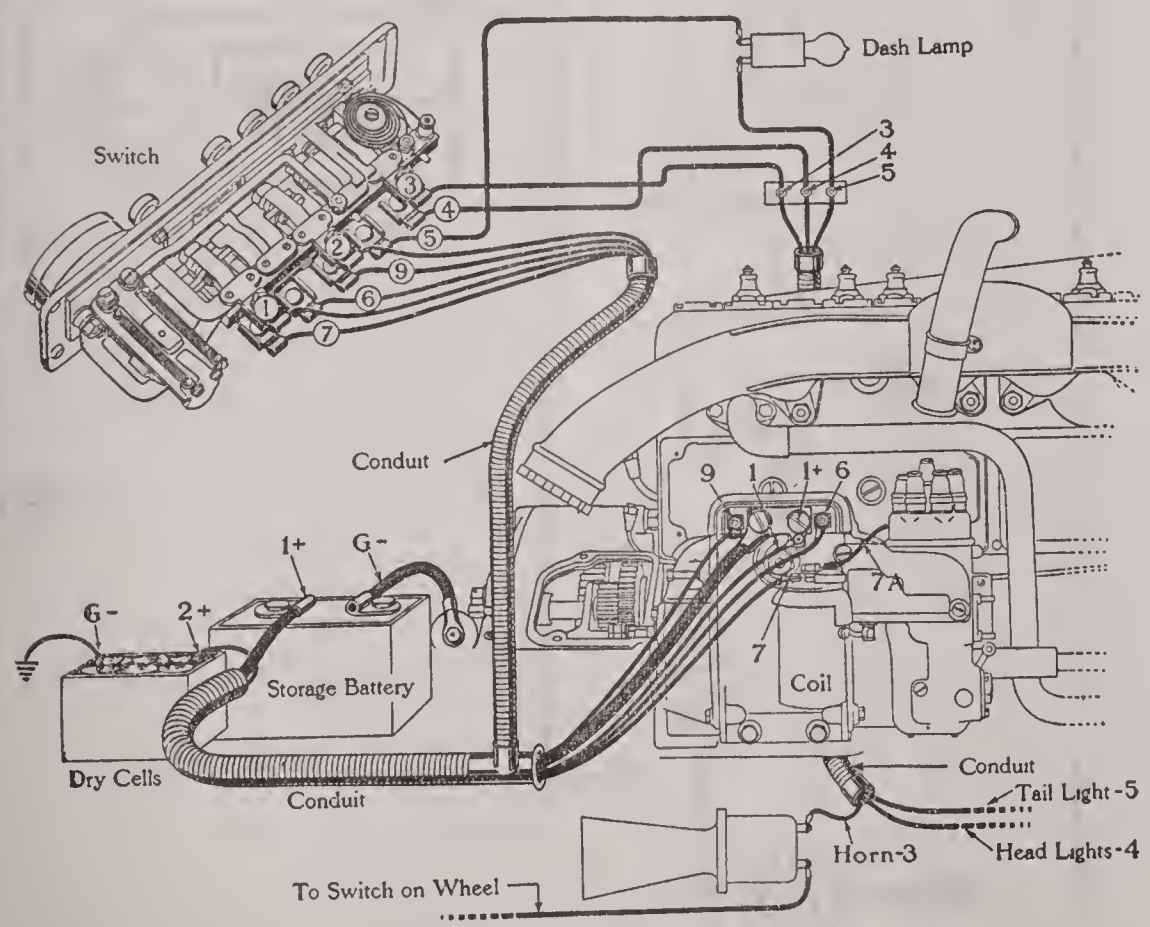
Conduit "A" is shown twice in the cut. Showing wires from Switch and also wires from Junction Post entering it.

1914-15—"6-54" WIRING DIAGRAM

PLATE NO. 69







1916—"40" WIRING DIAGRAM

PLATE No. 70

Hudson

MODELS 16-40 (1916)

DELCO DOUBLE-UNIT STARTING AND LIGHTING SYSTEM. DELCO IGNITION

Battery is 6 volt, 80 ampere-hour. The negative terminal is grounded.

Break should occur when dead center mark on flywheel is just past indicator, spark retarded. Firing order is 1, 5, 3, 6, 2, 4. For testing of ignition see Plate No. 69.

A system similar to the 1914 Junior Delco motor-generator is used. See Plates No. 66 and 67.

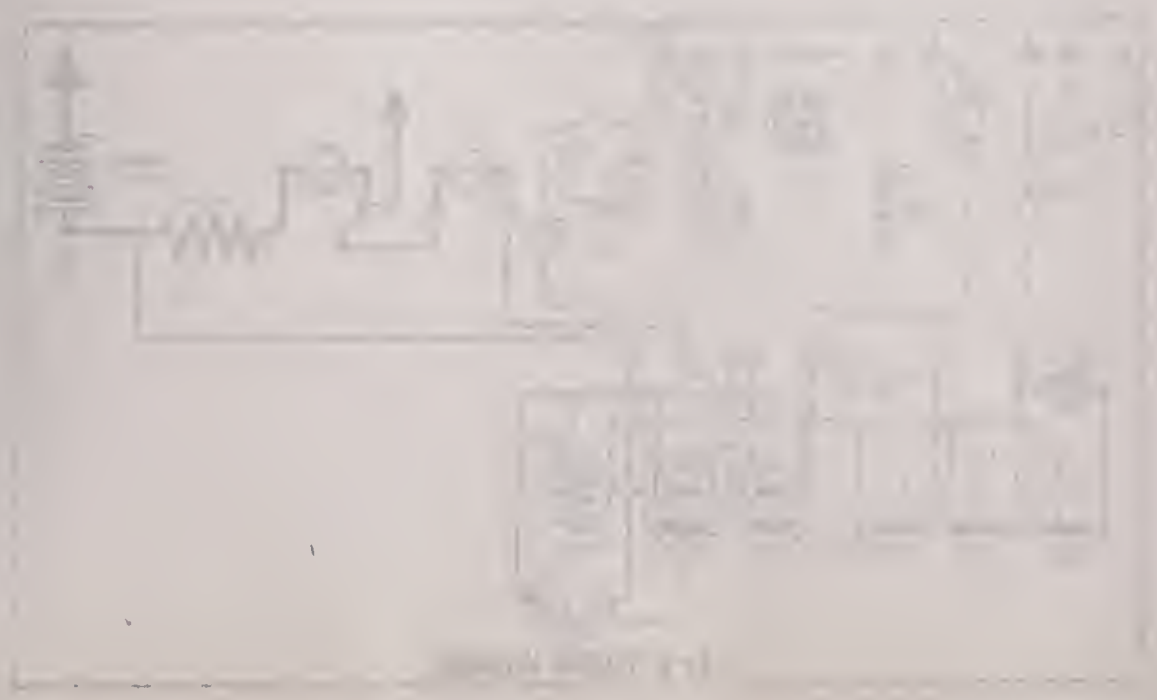
If motor fails, first inspect battery and connections. Connect positive terminal of voltmeter to motor terminal and ground negative side of voltmeter. Reading should be the same as when meter is placed across battery.

When starting switch is depressed meter reading should drop approximately one volt while cranking at normal speed. Do not hold the starter pedal down any longer than is necessary to obtain reading. Connect voltmeter as described above. No indication or a drop to zero, after depressing starter pedal, would indicate loose connections or loose battery or wire terminals. Inspection should locate same. With positive lead from voltmeter connected to motor terminal, the negative lead may be connected to the motor field, brush holder, commutator and opposite brush holder in turn. No reading will be obtained until the open circuit has been passed over. As soon as meter indicates a normal voltage the open circuit has been located as being between the point where the reading was zero and normal.

Starting pedal must be engaged while making the above test. Connect positive side of voltmeter to motor terminal and the negative of voltmeter to ground. When starting pedal is depressed, a drop of one or more volts or slow cranking indicates either a short circuit or a ground, or the generator brushes are not raising from commutator or connections not being broken at switch. Normal current at average cranking speed is 125 amperes. A current of 150 amperes or more indicates a ground or short circuit in armature or field coil. Remove all wiring and intentional grounds from motor, insulate brushes from commutator. Connect a 6-volt battery and voltmeter, in series, using wire from positive terminal of meter for exploring terminal. Connect meter lead to generator frame. Battery lead may then be connected in turn to motor terminal or field and brush connections. A circuit indicates that field or brush holder is grounded. Connect battery lead to commutator. A circuit would indicate ground in armature. Connect battery lead to motor terminal and meter lead to generator terminal. A circuit indicates short between field windings. Connect battery lead to motor commutator and meter lead to generator commutator. A circuit indicates short between two windings.

Voltage regulation is by reverse series field. (See Plate No. 66.)

(*Continued on Plate No.* 71)



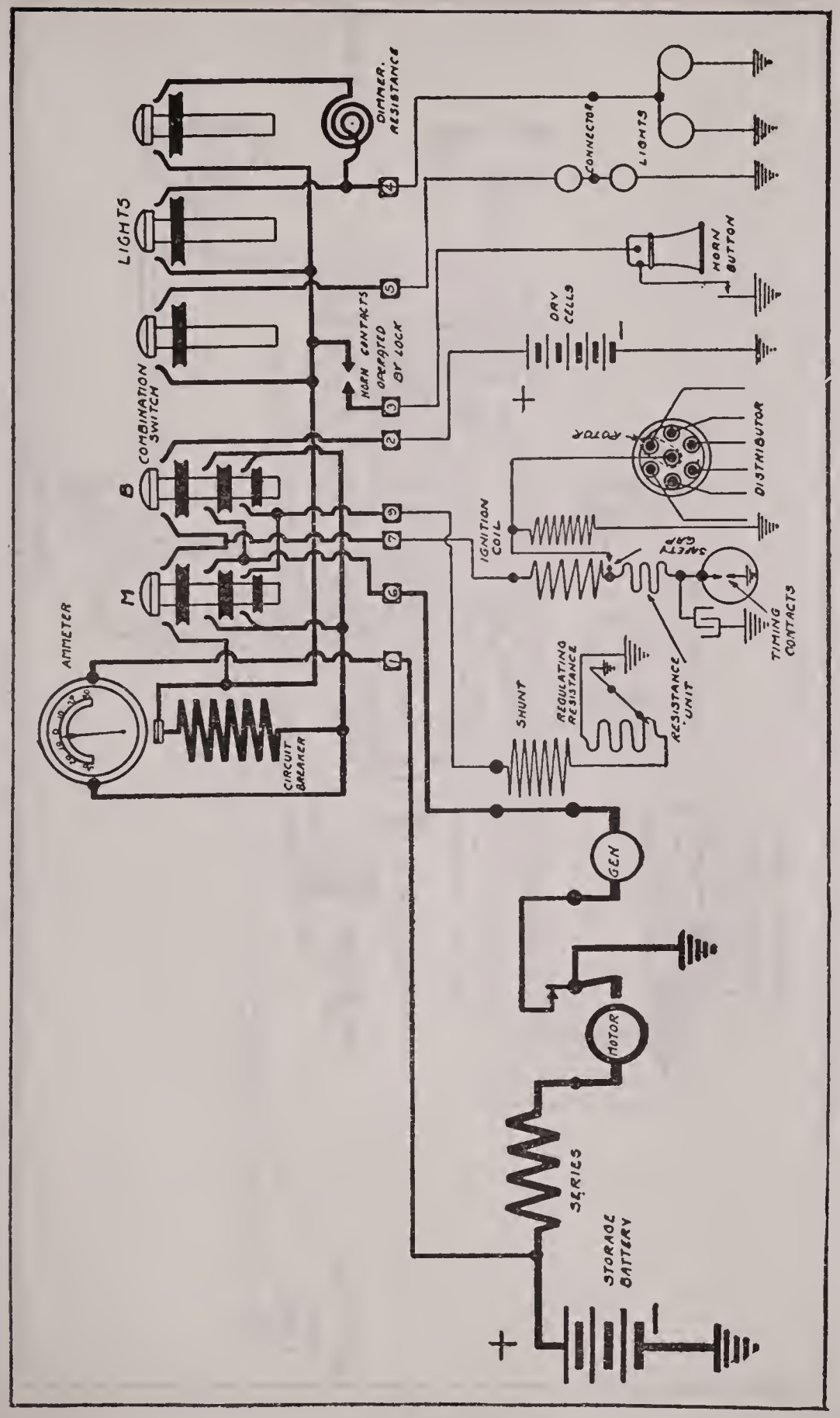


PLATE NO. 71

Hudson

6-40 (1916)

DELCO 1914 JUNIOR, DOUBLE-UNIT STARTING AND LIGHTING SYSTEM
DELCO IGNITION

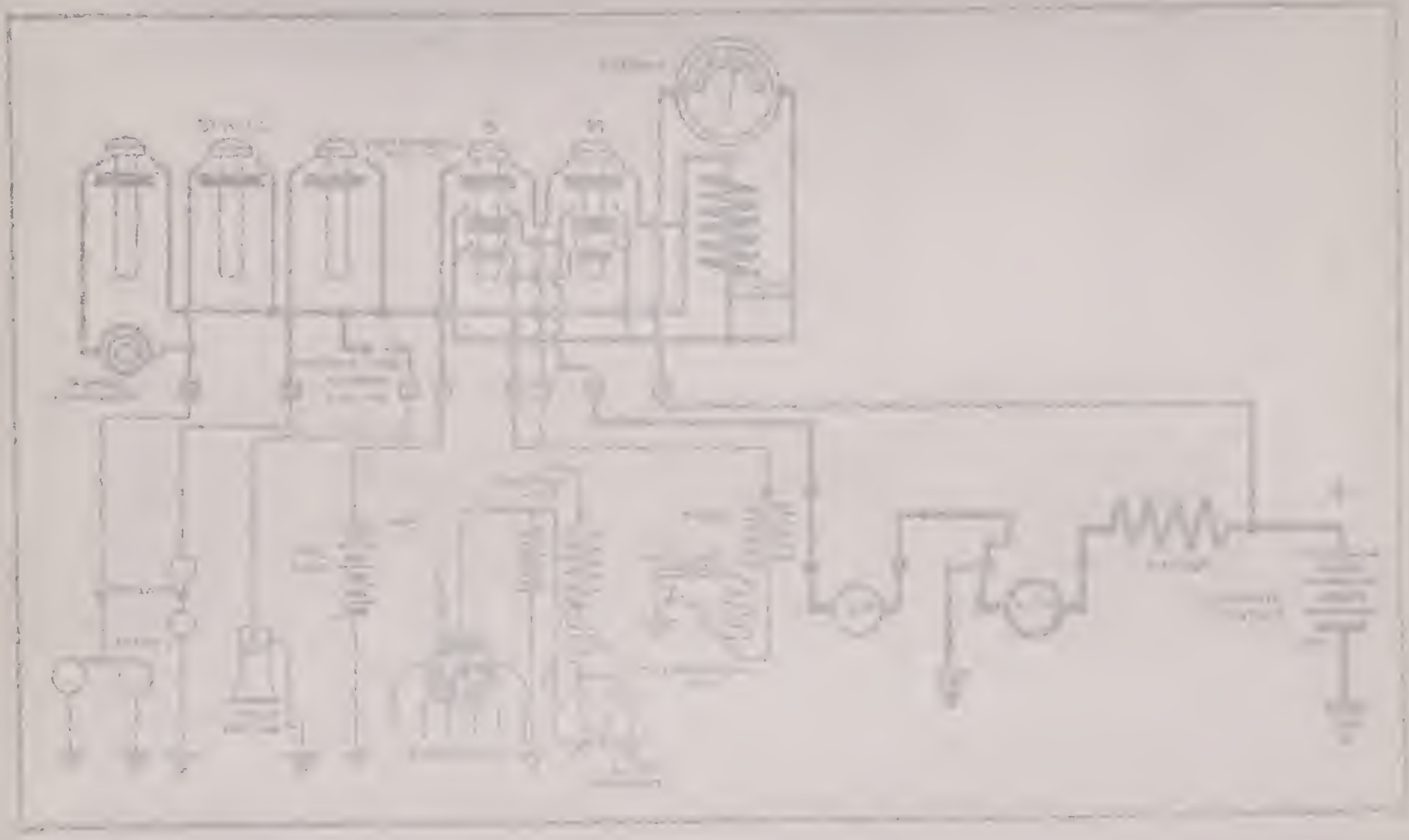
Battery is Exide, 6 volt, 80 ampere-hour. The negative terminal of the battery is grounded.

Break occurs when the upper dead center mark on flywheel is just past the indicator, spark fully retarded. Firing order is 1, 5, 3, 6, 2, 4.

For description of motor and generator see Plate No. 66.

Generator may not deliver current due to high mica, brushes not bearing on commutator properly, dirty commutator, loose connections at terminals of generator or battery, open circuits in fields or armature or short circuit in fields or armature. Inspection should locate any of the first four causes.

Open circuits may be detected by connecting a lead to the positive side of a 6-volt battery, specific gravity of latter reading 1.250 or over, and another lead from negative of battery to the negative of a 30-volt voltmeter. Connect a lead to the positive terminal of meter and use the two free ends thus obtained for test points. With all electrical connections and intentional grounds to motor-generator removed, connect the two exploring leads to generator field terminals. A trifle less than full pressure indicated when leads are connected together will be indicated if coils are intact. Field coils should allow 1½ amperes to flow under pressure of 6 volts. A much larger current indicates that part of the winding is short circuited. Short circuits and grounds may be tested as directed for motors on Plate No. 70. In testing armature a smaller current should be used than when testing fields.



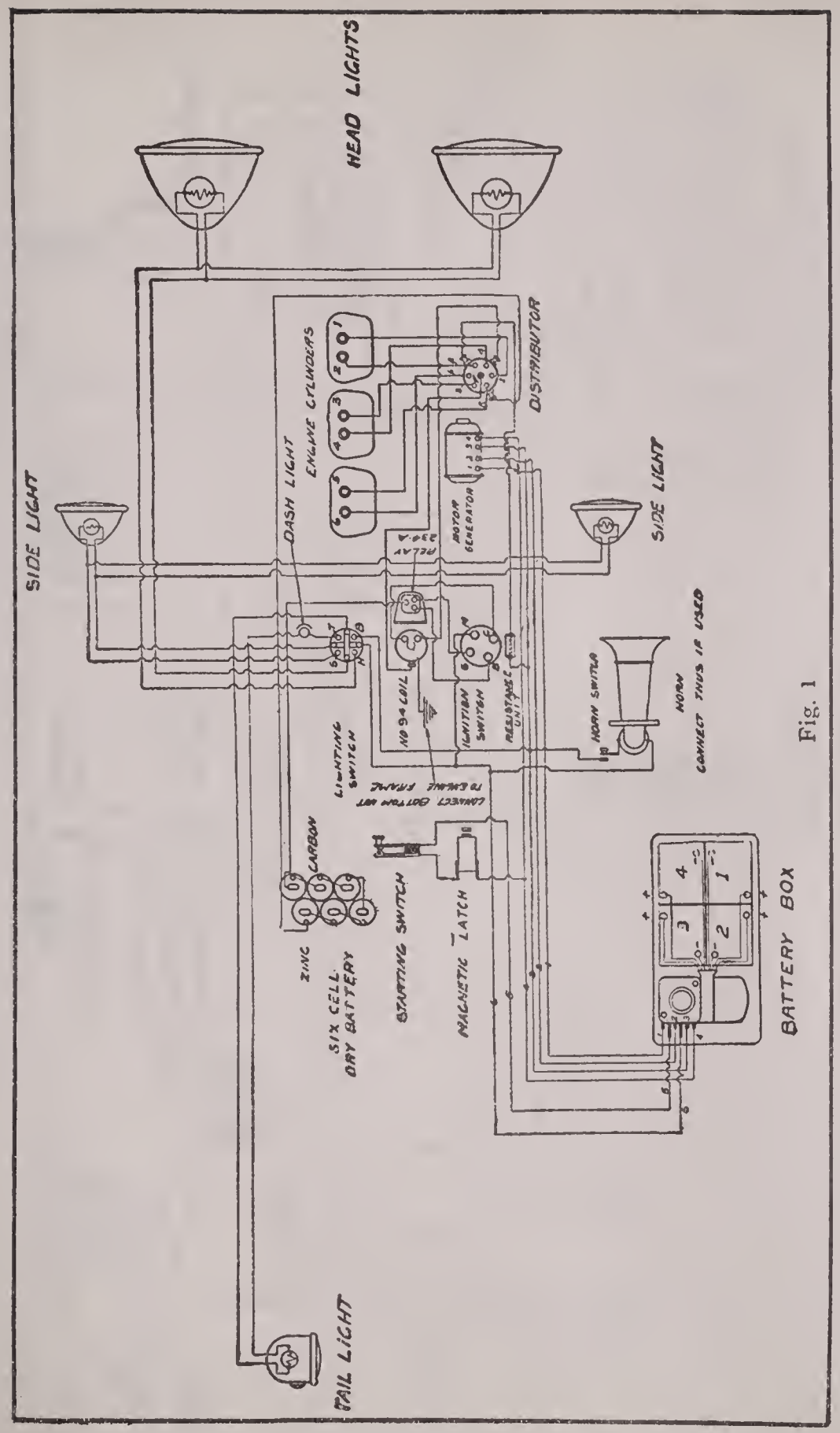


Fig. 1

Hudson

MODELS 37 AND 54 (1913)

Cole

MODELS 4-40, 4-50, 6-60 (1913)

DELCO, 6-24 VOLT, SINGLE UNIT, STARTING AND LIGHTING SYSTEM.
DELCO IGNITION

Battery is 24 volt, 35 ampere-hour. The two-wire system is used. There is a set of six dry cells, connected in series, to supply ignition current if the storage battery is out, and when starting. Six volt, lamps and ignition units, are used.

Break occurs on upper dead center, spark 1/3 advanced. Firing order of the Model 37 is 1, 3, 4, 2. Firing order of the 54 is 1, 5, 3, 6, 2, 4. For testing ignition apparatus see Plate No. 69.

Adjustment of timing is accomplished by raising distributor and, when replacing, turning driving gear one or more teeth forward or back, as required.

There is a controller to change battery connections so as to supply 24 volts for starting and 6 volts for ignition and lights.

When starting switch, on dash, is closed, ignition and circuit around the relay and through the magnetic latch coil is completed. This applies 6 volts to motor, turning it slowly. When clutch pedal is depressed gears are meshed and controller moved to position to put the 24 volts pressure on motor, cranking engine at a speed of 30 to 40 R. P. M. There is an overrunning clutch to prevent engine driving motor. There is another clutch at generator driving end to allow armature to turn freely. Oil motor-generator bearing with a few drops machine oil every two weeks. A grease cup is provided to lubricate clutch and shaft on which gears slide. Keep driving clutch packed with soft cup grease. Oil bottom and top bearings of distributor with a few drops of machine oil every two weeks. Lubricate distributor driving gears well. Overhaul motor-generator at least once a year.

(*Continued on Plate No.* 72A)

PLATE NO. 72

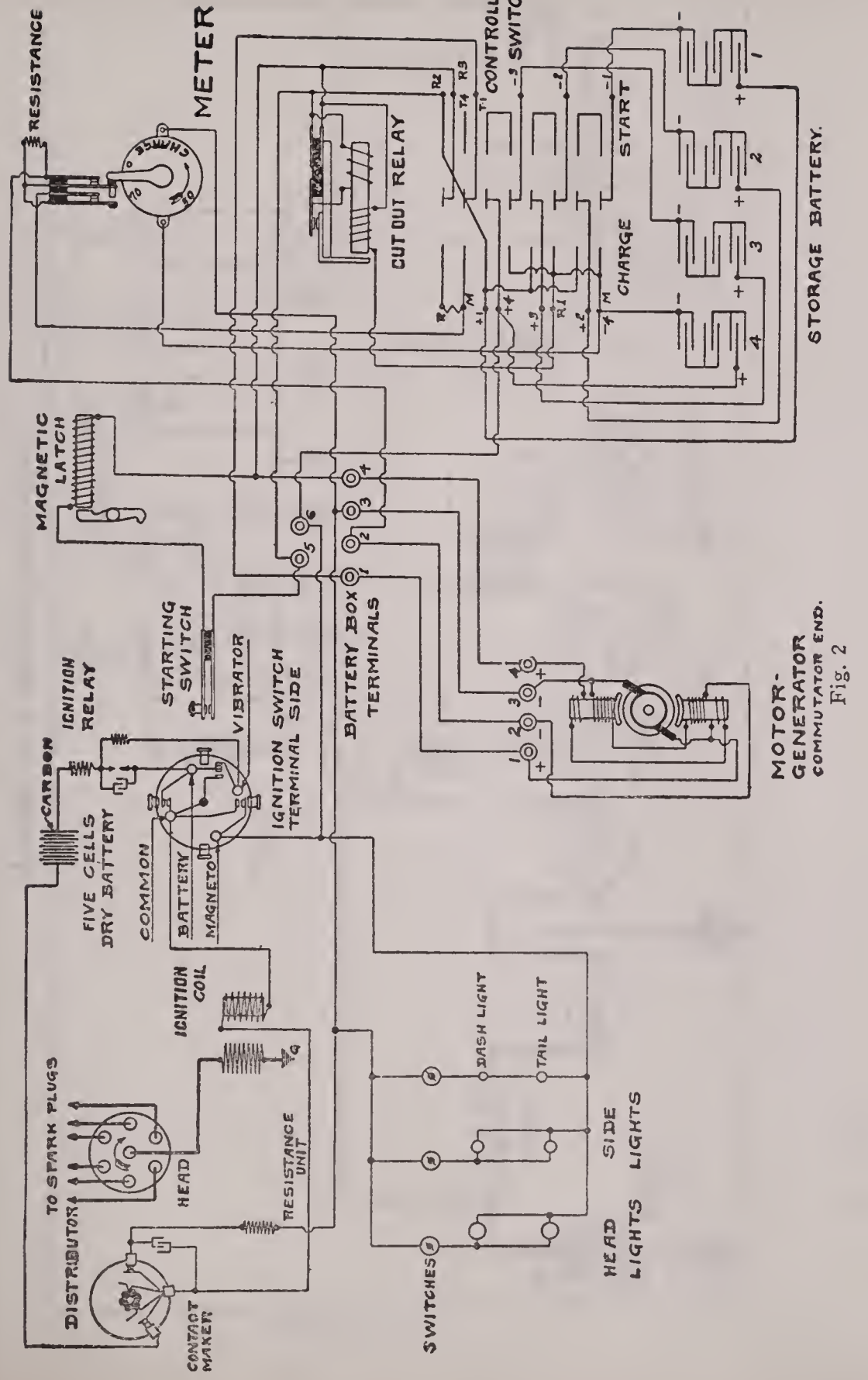


Fig. 2

Hudson

MODELS 37 AND 54 (1913)

Cole

MODELS 4-40, 4-50, 6-60 (1913)

DELCO, 6-24 VOLT, SINGLE UNIT, STARTING AND LIGHTING SYSTEM.

DELCO IGNITION

(*Continued from Plate No. 72*)

Ampere-hour meter is of the mercury motor type. It consists of a copper disk floating in a well of mercury and mounted in a magnetic field formed by two permanent magnets. The resistance of the mercury is about 40 times that of the copper disk, hence most of the current will pass through the disk, approximately in a straight, diametrical line. The reaction formed by magnetic field produced by this current and field of the permanent magnets causes the disk to rotate at a speed roughly proportional to the current.

Charging rate of these motor-generators is varied by changing the resistance of the shunt field circuit. Two sizes of shunt resistance are supplied, single and double strand. For fast driving the single strand shunt is recommended, and for slow driving the double strand is recommended. Do not substitute resistance with copper wire as it will raise voltage too high. The resistance burning out frequently indicates a high terminal voltage caused by loose connections in reverse series field circuit. All connections must be put in order. When it is desired to measure the charging rate insert an ammeter in line between generator and relay. Maximum charging rate should be 22 amperes, although a slight variation either way is permissible if driving conditions require it.

The large hand on the ampere hour meter is so designed that it either opens or throws more resistance into the shunt field when battery is highly charged. All the adjustment or care necessary is to see that the contacts are kept clean and in order. If they are burned or damaged beyond repair the contacts may be connected by a piece of large size copper wire. This will cut the meter contacts out of the circuit entirely. If this is done the large meter hand should be shortened or removed to prevent grounds.

Oil controller blades slightly with light cylinder oil.

Firing order of Cole 6 cylinder cars is 1, 5, 3, 6, 2, 4. Firing order of the Cole 4 cylinder cars is 1, 3, 4, 2. Break should occur on upper dead center, spark retarded.

Moon

4-38 and 6-40 (1915)

Delco, 1914 Large, Single-Coil, Double-Unit 6-Volt Starting and Lighting System. Delco Ignition

Battery is 6 volt, 100 ampere-hour. The negative terminal is grounded.

The timer contacts open .010 in. Break occurs just after dead center is passed, spark retarded. Firing order is 1, 5, 3, 6, 2, 4. For testing ignition apparatus see Plate No. 69.

For description and care of the motor-generator see Plates No. 65 and 65A. On the rebuilt generators using the reverse series field, charging rate is adjusted as follows:

There are six different sizes of Nichrome wire (this is a special resistance wire and must not be replaced by wire of different material), which are as follows:

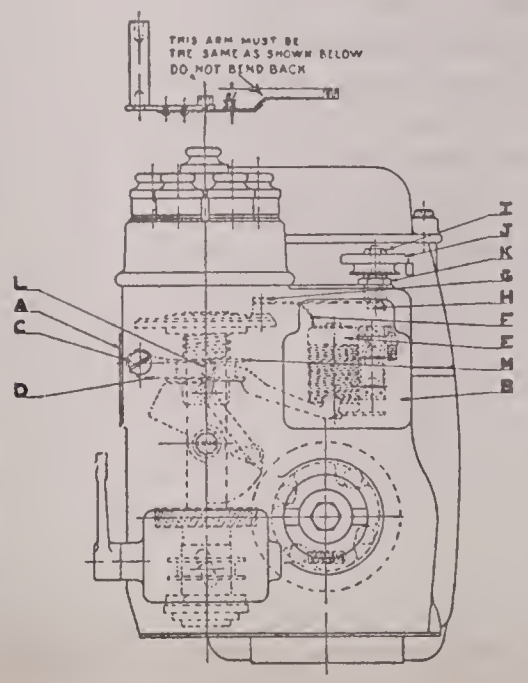
Piece No.	Size B. & S. Gauge	Diameter of Wire
633	21	.028 in.
703	22	.025 in.
702	23	.022 in.
701	24	.020 in.
817	25	.017 in.
955	26	.015 in.

The above lot of spools, together with the different length brass caps on the ends of the same, are the adjustments for the output of the generator.

On leaving the factory each generator is fitted with a spool which gives the proper output. The necessity for this is caused by the difference in the manufacturing and the different windings of the armature to compensate for the different speed at which they are driven.

On the generators which are driven at, or near, once engine speed, spool No. 702 is most often used, 701 and 703 being sometimes used. On the generators Nos. 52 and 58, which are driven at 1½ times engine speed, spools Nos. 817 and 955 are used. The generators commence charging at approximately 7 miles per hour, and reach their maximum charging rate at a car speed of 18 to 25 miles per hour. The maximum charging rate is from 16 to 20 amperes on all generators (excepting No. 52, which is from 16 to 22 amperes). At higher speeds the current decreases to 10 to 15 amperes.

By installing a spool of larger size wire the maximum charging rate is increased, and a higher rate is secured above the maximum point. By installing the spool with the wide cap at the bottom the maximum charging rate is increased with a corresponding increase at higher speeds.



The contact "D" should have a tension of not less than six ounces on the spool "E", but it should not be enough to cause the arm to stick up when raised with the fingers.

NOTE: A poor contact between the arm and spool causes the generator to run at a higher speed when the ignition button is pulled out and results in excessive clicking of the driving clutch when the engine is operated at low speeds.

The holding spring "F" should be sprung down so as to have sufficient tension to hold the spool firmly.

After making any adjustments always check the charging rate by connecting a reliable ammeter in the line to the forward terminal on the generator.

Serious damage will be caused by allowing the charging rate to exceed 25 amperes, as this is above the capacity of the generator.

A circuit breaker takes the place of fuses in lighting and ignition circuit. Head lamps are 6-8 volt, 14-16 cp. Dash and tail lamps are 6-8 volt, 2-4 cp.

MOON 1915 MODEL 4-38—6-40

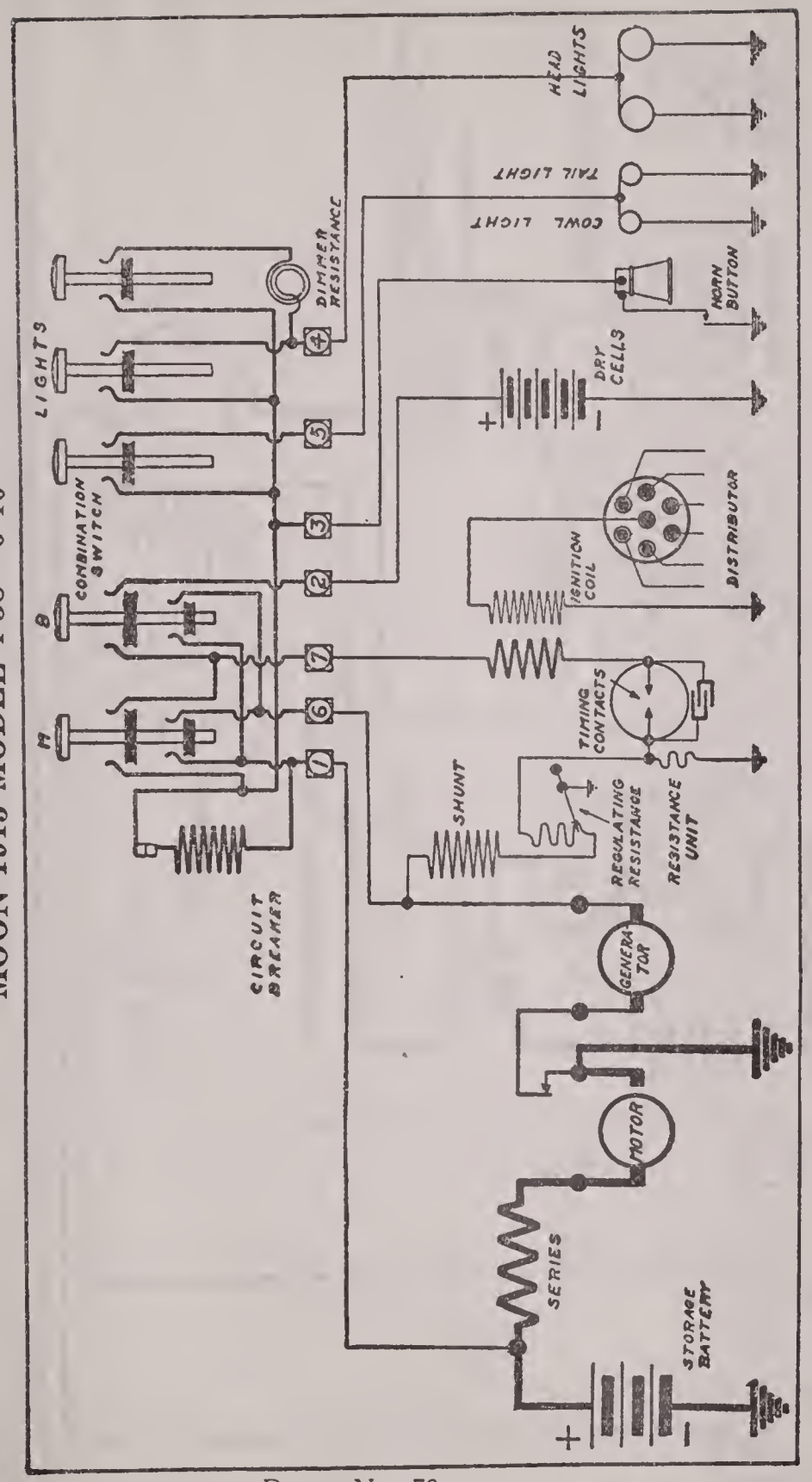
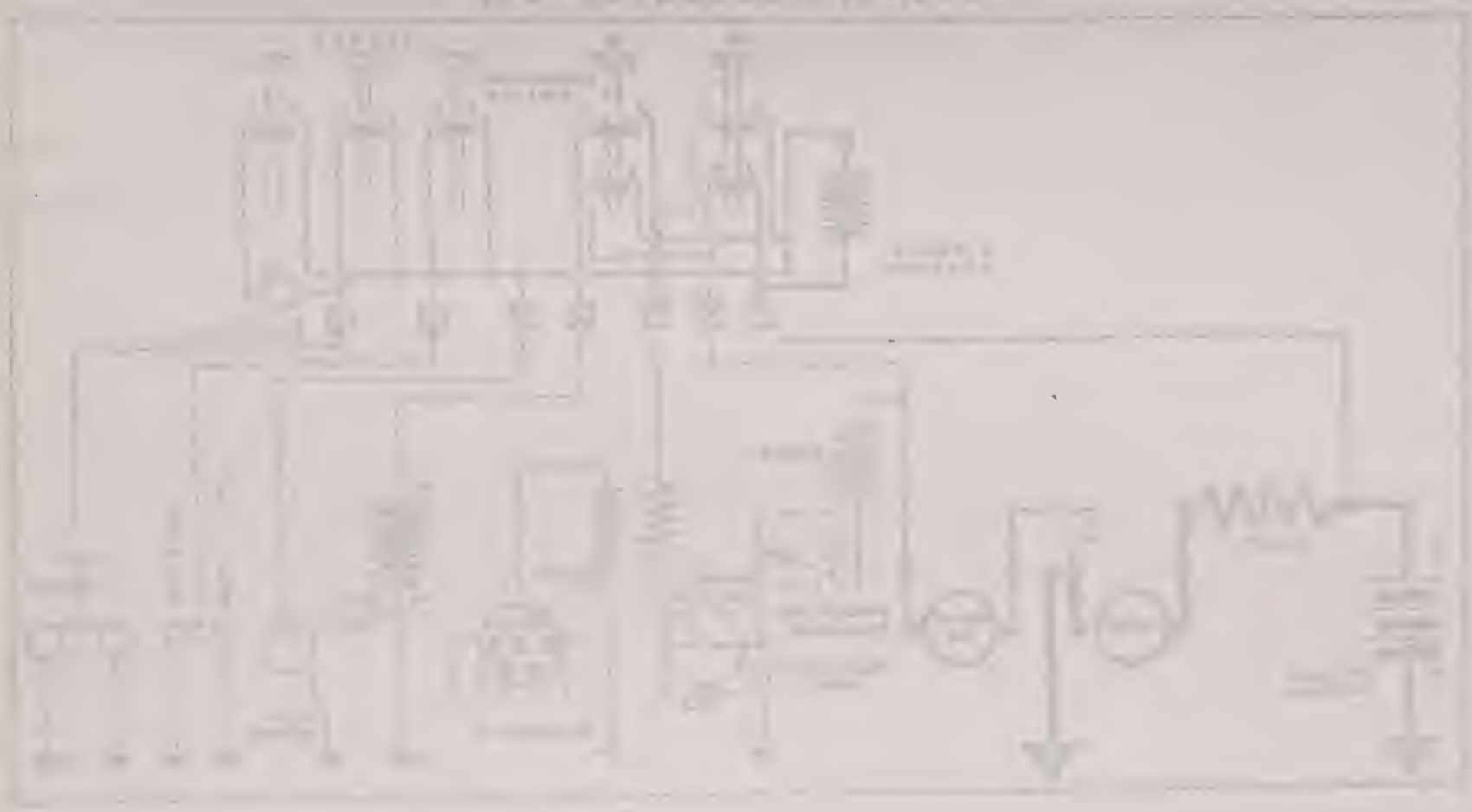


PLATE NO. 73



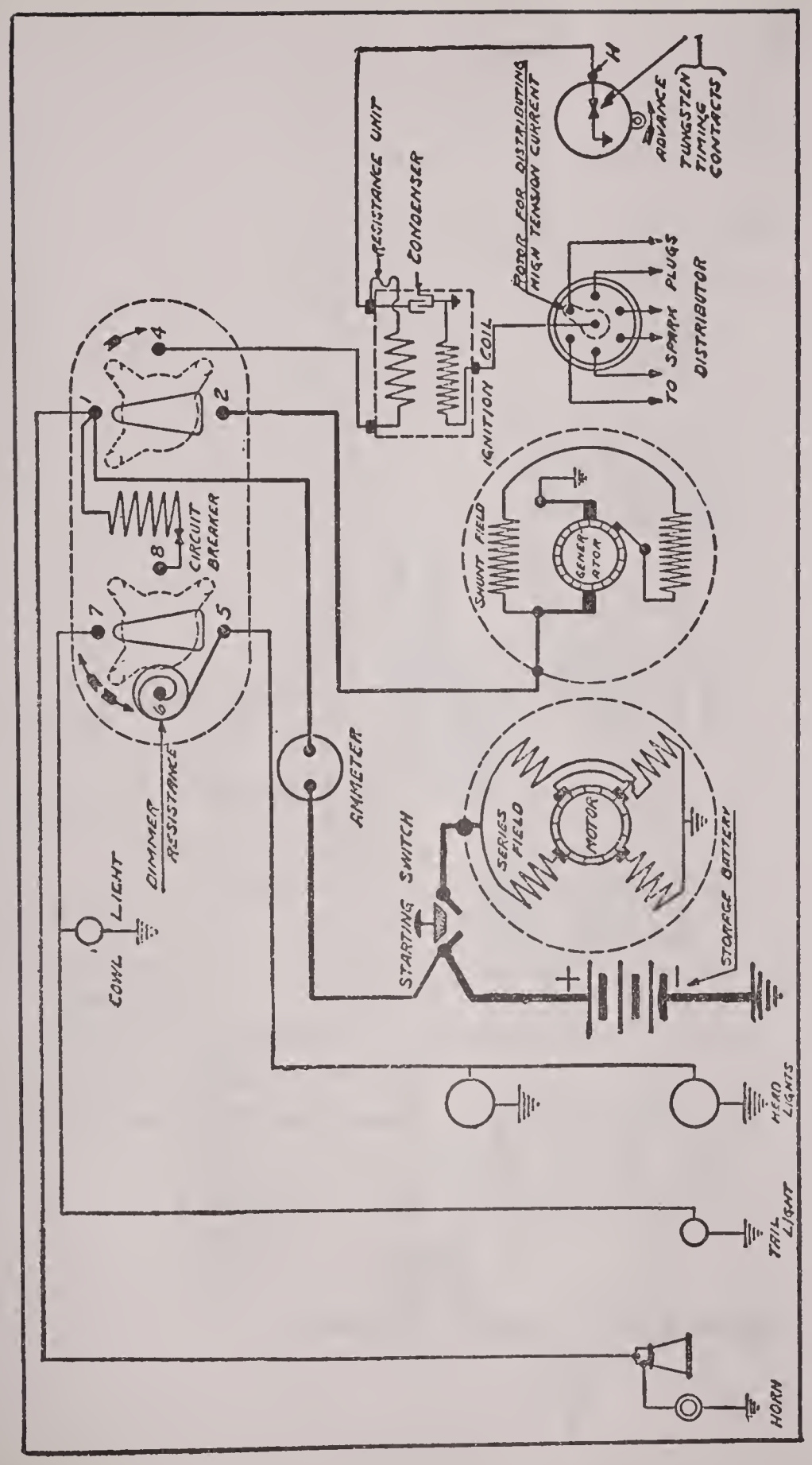


PLATE NO. 75

Moon

MODEL 6-43 (1917)

DELCO TWO-UNIT STARTING AND LIGHTING SYSTEM. DELCO IGNITION

Battery is 6 volt, 100 ampere-hour. The negative terminal is grounded.

Breaker contacts should open .018 in. to .020 in. They are made of tungsten metal. For care of these contacts see Plate No. 20. For testing of ignition units see Plate No. 69. Contacts should just begin to open when the piston receiving the spark is on top dead center, control lever in the fully retarded position. The firing order is 1, 5, 3, 6, 2, 4. The spark gap should be .028 in. to .030 in.

The starting motor is connected to the flywheel by a Bendix gear. The motor should develop at least 15 lbs. lock torque. When running free it should not consume more than 40 amperes. Put four or five drops of light engine oil in each of the motor oilers once every month, or 1,000 miles.

Voltage regulation of the generator is by third brush system. The generator should reach the neutral point—that is, the speed at which it neither delivers current to nor receives current from the battery—at about 500 R. P. M. At 900 R. P. M., the output should be 10-12 amperes at 1400 R. P. M., 14-16 amperes, and at 2000 R. P. M., 11-13 amperes. The above tests are to be made with the generator hot. Once every week the oiler at the driving end should be filled with oil until it overflows through the drain provided. Once every two weeks, or 500 miles, put four or five drops of oil in the rear generator oiler at the driving end should be filled with oil until it overflows through the drain provided. the generator and the battery is controlled by the ignition switch. There is an overrunning clutch to allow the generator to run as a motor when the pressure produced by it is below that of the battery, ignition switch closed.

Head lamps are 6-8 volt, 16 cp. Tail light is 6-8 volt, 2 cp. Dash light is 6-8 volt, 2-4 cp. There is a vibrating circuit breaker on the switch to take the place of fuses in the lighting circuits. This device is explained on Plate No. 12.

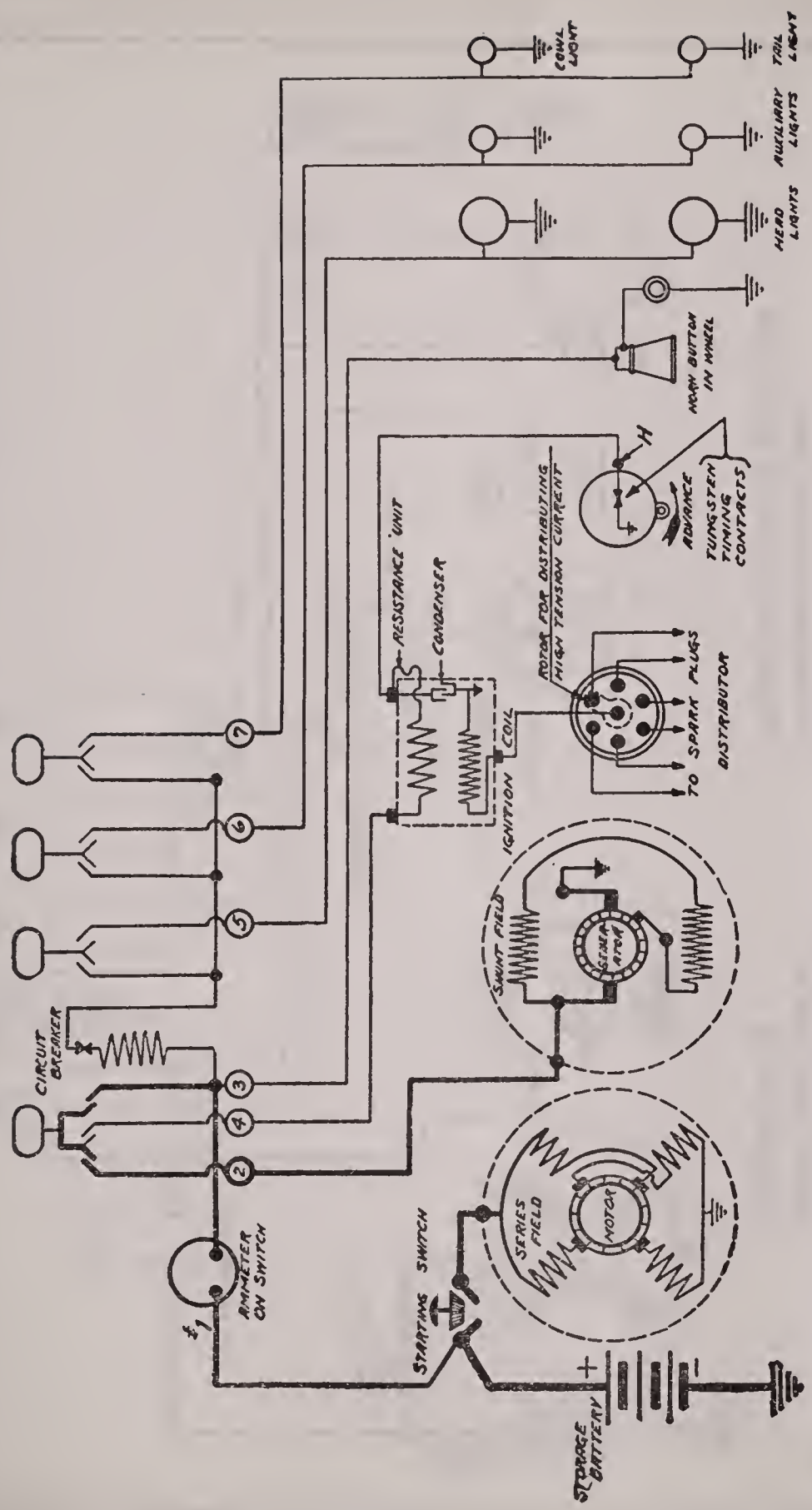


PLATE NO. 76.

Moon

MODEL 6-60 (1917)

DELCO TWO-UNIT STARTING AND LIGHTING SYSTEM. DELCO IGNITION

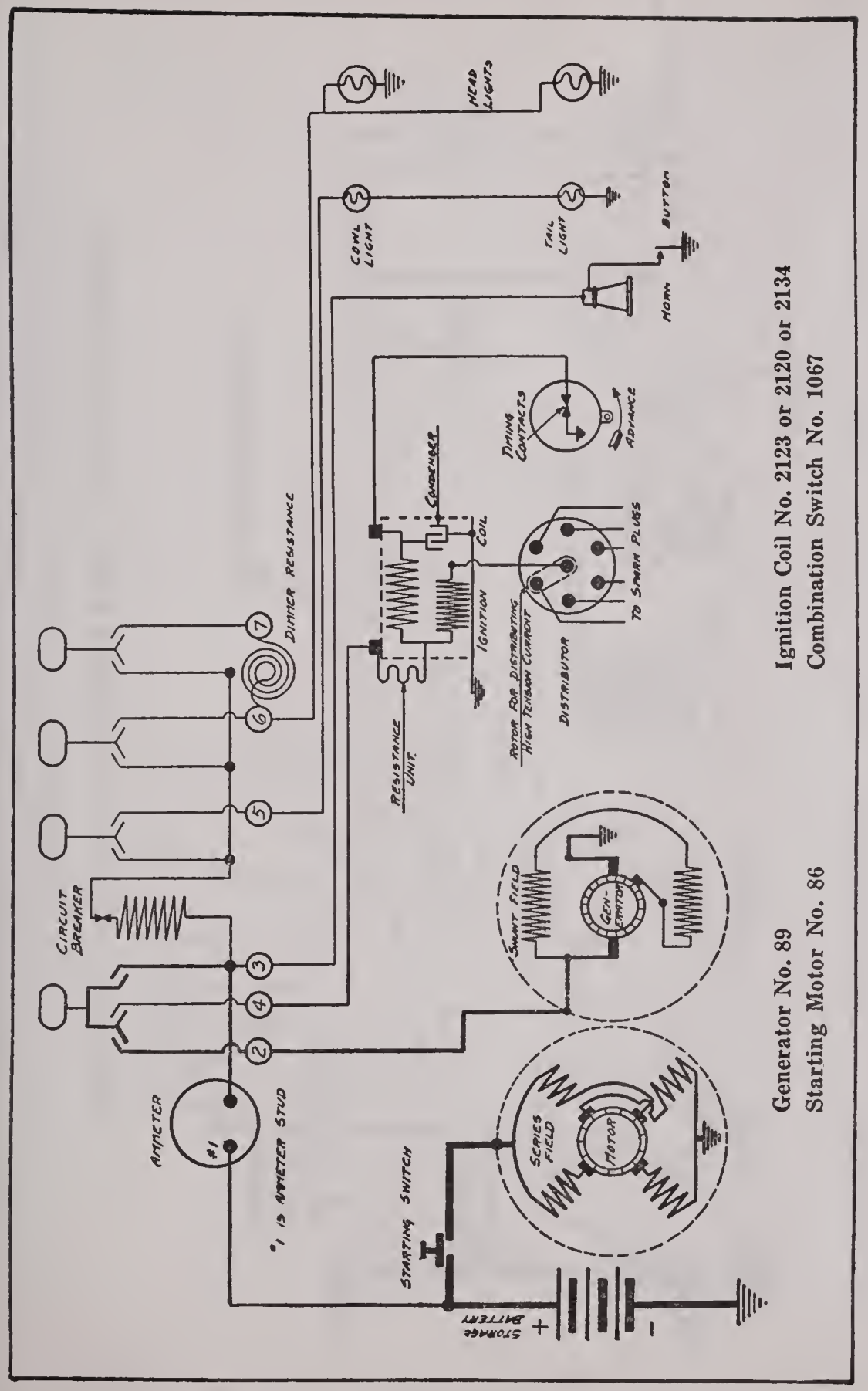
Battery is 6 volt, 100 ampere-hour. The negative terminal is grounded.

Breaker contacts should open .018 in. to .020 in. They are made of tungsten metal. For care of these contacts see Plate No. 20. Contacts should just begin to open when the piston entering power stroke is on top dead center, spark lever in the fully retarded position. The firing order is 1, 5, 3, 6, 2, 4.

The driving power of the starter is transmitted to the flywheel by a Bendix drive. When running free the motor should take 40 amperes or less. It should deliver at least 16 lbs. torque when stalled.

Voltage regulation of the generator is by third brush. The generator should not deliver to or receive current from the battery at about 500 R. P. M. It should start to charge at a speed slightly above this. At 900 R. P. M. the charging rate should be 10-12 amperes, at 1400 R. P. M., 14-16 amperes; and at 2000 R. P. M. this rate is reduced to 11-13 amperes. The above tests should be made with the generator hot. Every two weeks, or 500 miles, put four or five drops of light machine or engine oil in each of the generator oilers. There is no relay. The circuit between the generator and the battery is controlled by the ignition switch. There is an overrunning clutch at the driving end of the generator to allow it to run as a motor when the battery pressure is above that being produced by the generator. Should the clutch stick it should be well oiled. Oil should be put in until it flows out the drain provided. Put four or five drops of oil in the rear generator oilers once every week. Use light engine oil.

Head lamps are 6-8 volt, 17 cp. Dimmer lamps are 6-8 volt, 6 cp. Dash light is 6-8 volt, 2-4 cp. Tail light is 6-8 volt, 2 cp. A vibrating circuit breaker takes the place of fuses in the lighting circuit. For care of this circuit breaker see Plate No. 12.



Pilot

6-45 (1916-17-18)

Delco Two-Unit Starting and Lighting System. Delco Ignition

Battery is 6 volt, 100 ampere-hour. The negative terminal is grounded.

Contacts open .018 in. Break occurs when the upper dead center mark on fly-wheel is at indicator, spark fully retarded. Firing order is 1, 5, 3, 6, 2, 4.

For testing ignition apparatus see Plate No. 69.

Ammeter shows rate of charge and discharge. There is no relay. Ignition switch controls circuit between generator and battery. There is an overrunning clutch to allow generator to run freely when ignition switch is on and engine idle, as it draws but little current when running free.

Dash and tail lamps are in series. They are 3.5 volt, 2-4 cp.

Head lamps are 6-8 volt, 16 cp.

With the driver who uses his car a great deal at night and drives a very little in the daytime, it is advisable to have a higher charging rate than these generators develop with the factory adjustment. In this case, the third brush should be moved in the direction of rotation of the armature, and the brush sanded. When the charging rate of the generator is increased it is always essential that the charging rate be carefully checked up by the use of the ammeter on the combination switch. In no case should this exceed 20 amperes to any extent, unless it is positively known that the driver never operates his car at fairly high speeds, except for short runs. Checking of the charging rate should be obtained after the brush is well seated and the engine is gradually speeded up, observing the maximum charging rate indicated on the ammeter. This test should be made when all the lights are off.

To sand the third brush, a strip of very fine sandpaper should be inserted between the brush and commutator with the sand side next to the brush, and drawn backward and forward a few times to form the brush so that it will fit the commutator. In a great many instances the charging rate is too high, yet the owner or driver of the car does not make any complaint in regard to the charging rate, his complaint being more often in regard to the short life of his lamps, and the necessity of frequent additions of water to the storage battery.

By studying the driving conditions of the individual cars, it is usually possible to adjust to a charging rate that will give very satisfactory service for all driving conditions.

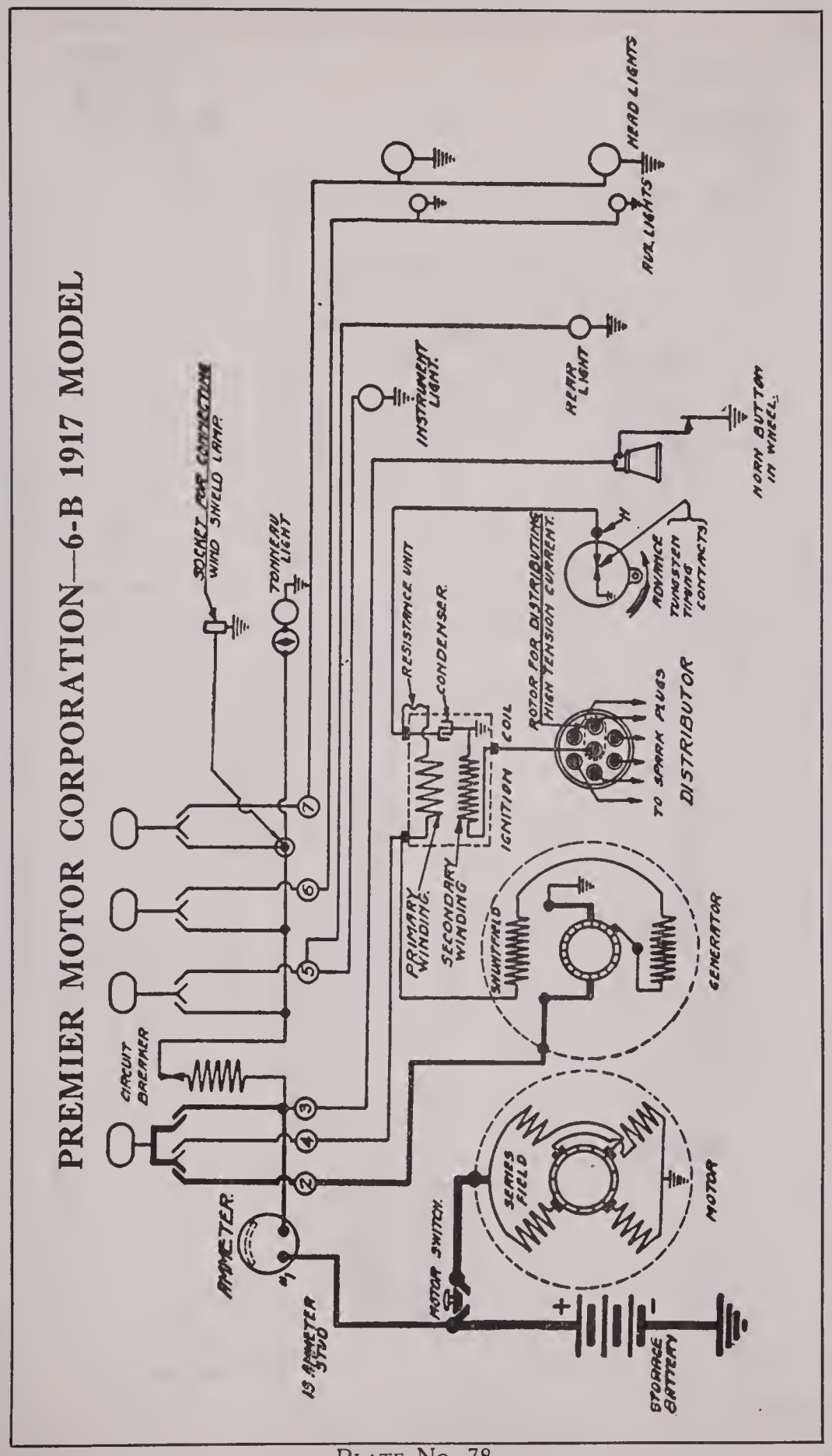


PLATE No. 78.

Premier

MODEL 6B (1917)

DELCO 6-VOLT, TWO-UNIT STARTING AND LIGHTING SYSTEM. DELCO IGNITION

Battery is 6 volt, 120 ampere-hour. The negative terminal is grounded.

Breaker contacts open .020 in. For testing ignition units see Plate No. 69. Break occurs at upper dead center, spark fully retarded. Firing order is 1, 4, 2, 6, 3, 5. Contacts are of tungsten, see Plate No. 20. Spark gap is .025 in. to .030 in. Safety gap is 9/32 in. to 3/8 in. Ammeter shows rate of charge or discharge. There is a circuit breaker to take the place of fuses.

Voltage regulation is by third brush. (See Plate No. 77.)

Tonneau light is controlled by a separate switch. It is 8 volt, 6 cp. All other lights are controlled by combined ignition and lighting switch. Large head lamps are 6 volt, 15 cp. Small head lamps are 6-8 volt, 7 cp. Dash and tail lamps are 6-8 volt, 2-4 cp.

There is a socket provided to attach a spot light to.

There is no relay. Maximum charging rate of 16-18 amperes is reached at 12 to 14 miles per hour.

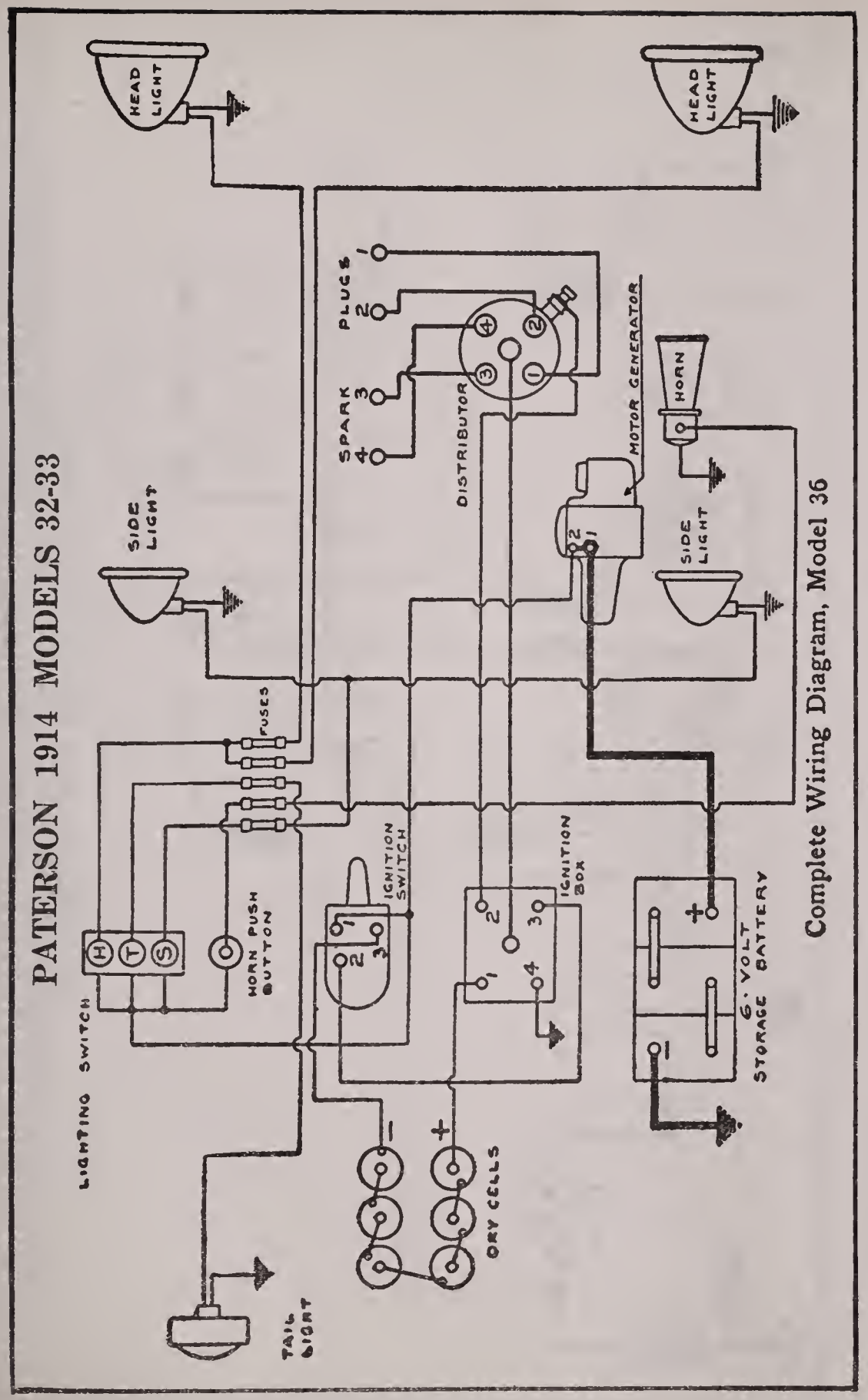


PLATE No. 81

Paterson

32, 33, (1914)

DELCO 1914 JUNIOR, DOUBLE UNIT, STARTING AND LIGHTING SYSTEM
DELCO IGNITION

Battery is 6 volt, 120 ampere-hour. The negative terminal is grounded.

Breaker contacts open .018 in. to .020 in. Break occurs on upper dead center, spark fully retarded. Firing order is 1, 3, 4, 2. For testing of ignition apparatus see Plate No. 69.

An auxiliary set of 6 dry cells, connected in series, is provided for ignition purposes. Negative terminal is connected to ignition switch.

Fuses are 10 ampere. Each head lamp has a separate fuse.

Head lamps are 6-8 volt, 12 cp. Side lights are 6-8 volt, 4 cp. Tail lamp is 6-8 volt, 2 cp. There is no relay.

For care of the motor-generator see Plates 66 and 70.

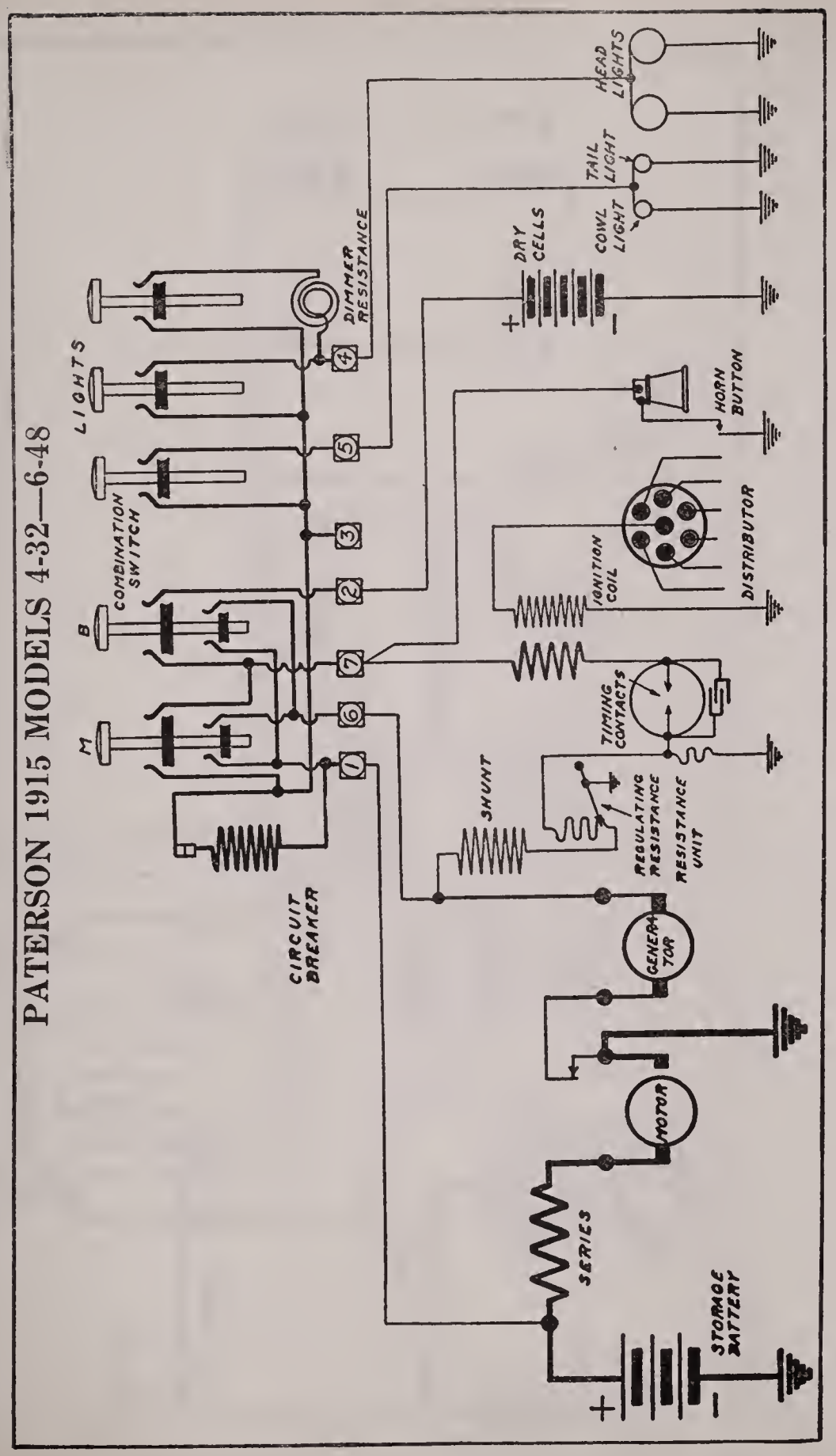


PLATE No. 82

Paterson

4-32, 6-48 (1915)

DELCO DOUBLE-UNIT STARTING AND LIGHTING SYSTEM. DELCO IGNITION

Battery is 6 volt, 120 ampere-hour. The negative terminal is grounded.

Breaker contacts open .018 in. to .020 in. For testing ignition units see Plate No. 69. Break occurs on upper dead center, spark at 1/3 full advance. The firing order of the four-cylinder models is 1, 2, 4, 3.. The firing order of the six-cylinder models is 1, 5, 3, 6, 2, 4. For testing motor-generators see Plates Nos. 70 and 71.

A circuit breaker takes the place of fuses. There is a resistance in back of lighting switch for dimming the head lamps. Head lights are 6 volt, 15 cp. Dash and tail lights are 6-8 volts, 2-4 cp.

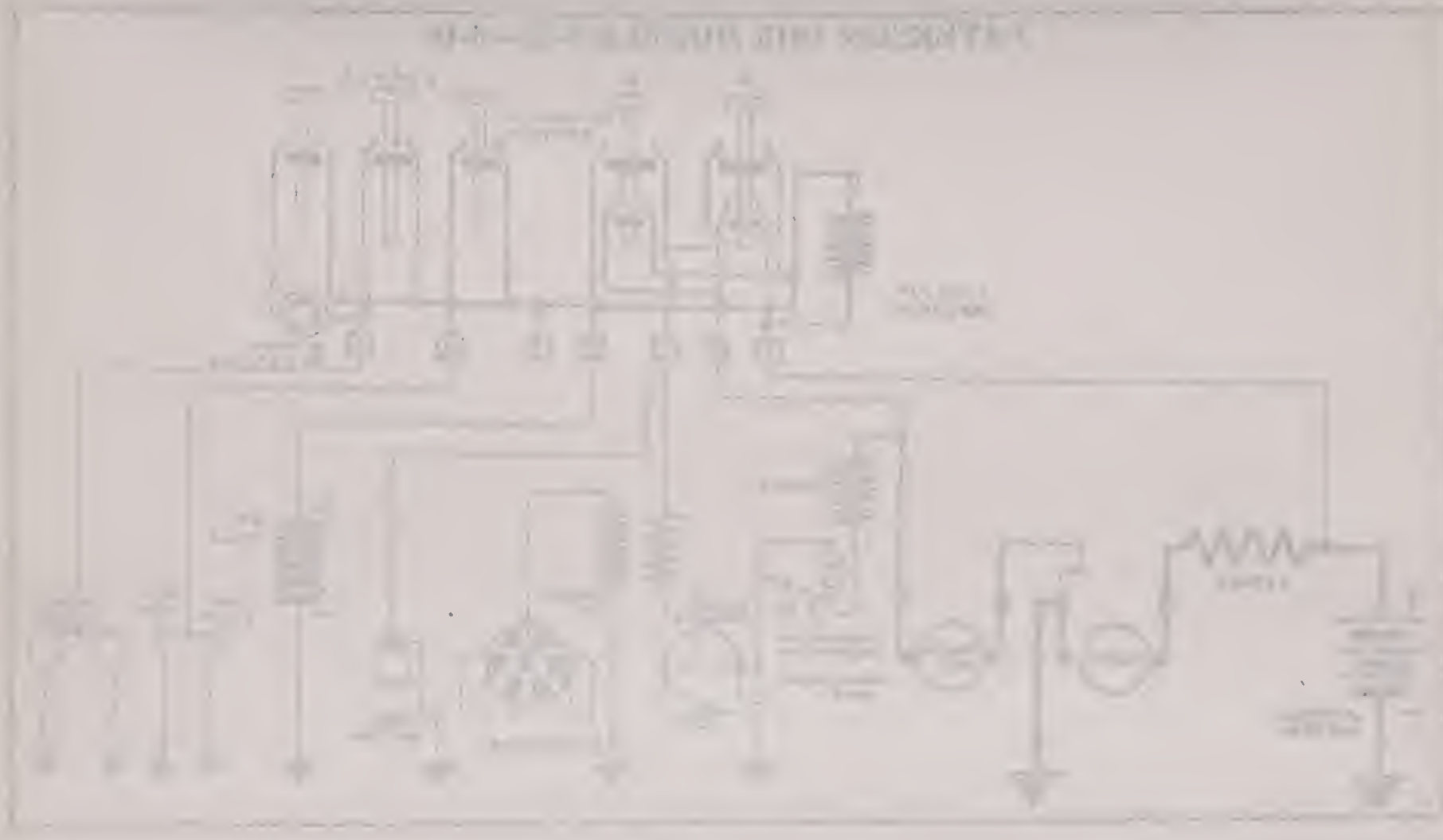
A set of 6 dry cells, connected in series, is provided for ignition purposes. The negative terminal is grounded.

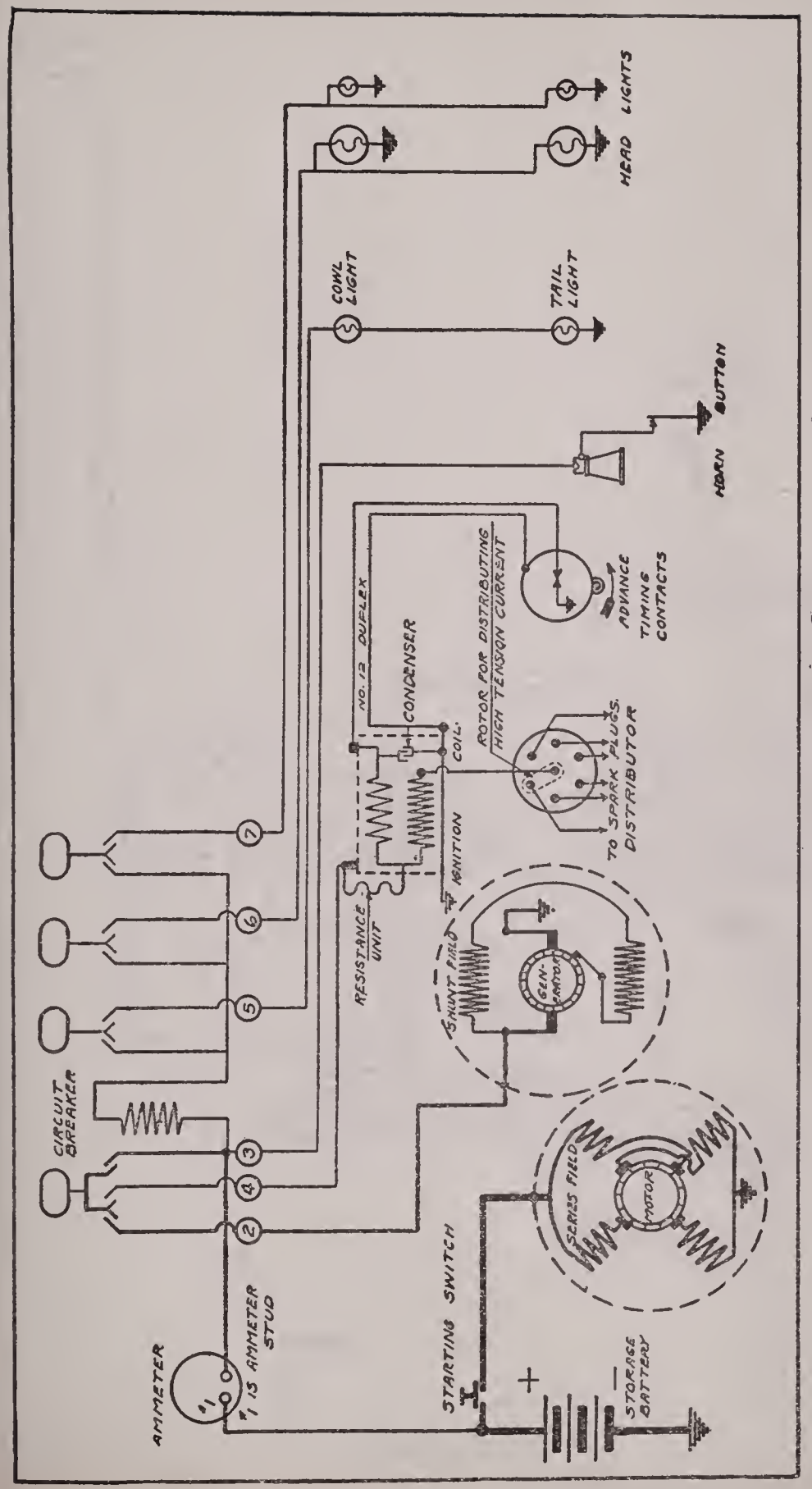
Motor brush is raised to open starting circuit.

There is no relay. Circuit between generator and battery is controlled by ignition switch. Motor is connected to engine by non-automatic, mechanical shift. When ignition switch is closed, generator runs as a motor to facilitate meshing of gears. When starting pedal is depressed gears are drawn into mesh, generator circuit is broken and motor brush is allowed to come into contact with commutator, thus applying full battery pressure to motor and cranking engine. When starting pedal is released motor brush is raised from the commutator, gears are drawn out of mesh and generator circuit is completed. There is a clutch to prevent engine driving motor. There is an overruning clutch at driving end to allow generator to run as a motor when starting or when pressure generator is producing is below that of battery.

Voltage regulation is by a regulating resistance in series with the shunt field. This regulator consists of a spool of "Nichrome" wire with which a sliding contact makes connection. The sliding contact is operated from a governor on breaker shaft. As the speed increases the contact is moved along the spool, thus cutting more resistance into the shunt field and holding voltage down. For adjustment of this regulator see Plate No. 73.

Generator begins to charge battery at about 7 miles per hour. Rate increases to a maximum of 20 amperes with all lights out. It should never exceed this amount.





Paterson

6-42 (1916) and 6-45, 6-45R (1917)

Delco Two-Unit, Single-Wire, Starting and Lighting System
Delco Ignition

Battery is 6 volt, 80 ampere-hour. The negative terminal is grounded.

Breaker contacts open .018 in. to .020 in. Break occurs on upper dead center, spark one-third advanced. Firing order is 1, 5, 3, 6, 2, 4. For testing ignition units see Plate No. 69.

Voltage regulation is by third brush. (See Plate No. 77.) There is no relay. Circuit between generator and battery is controlled by ignition switch.

There is an overrunning clutch to allow generator to run as a motor when the pressure it is generating, is less than that of the battery. When running with engine idle it should not use more than 5 or 6 amperes.

Generator begins to charge battery at about 7 miles per hour. Maximum charging rate should not exceed 20 amperes, with all lights out.

The ball bearing at rear of generator should receive four or five drops of light engine oil each week. The oiler on top of bearing at driving end lubricates overrunning clutch bearing and driving gears. This requires considerable more oil than the other bearing. If too much oil is applied it will drain out at the hole on the bottom of the case. The upper distributor bearing is of the oilless type, and requires no lubricant. This includes all of the lubrication needed in the electric equipment, unless it be a very small trace of vaseline on the breaker cam and distributor track when the car is new. The brushes contain sufficient graphite to lubricate the commutator. Starting motor requires no oil.

There is a circuit breaker to take the place of fuses in the horn and lighting circuits. Dash and tail lamps are in series. They are 3 to 3.5 volts, 2-4 cp. Small or dimmer head lamps are 6-6.5 volt, 7 cp. Large head lamps are 6.5 volt, 16 cp.

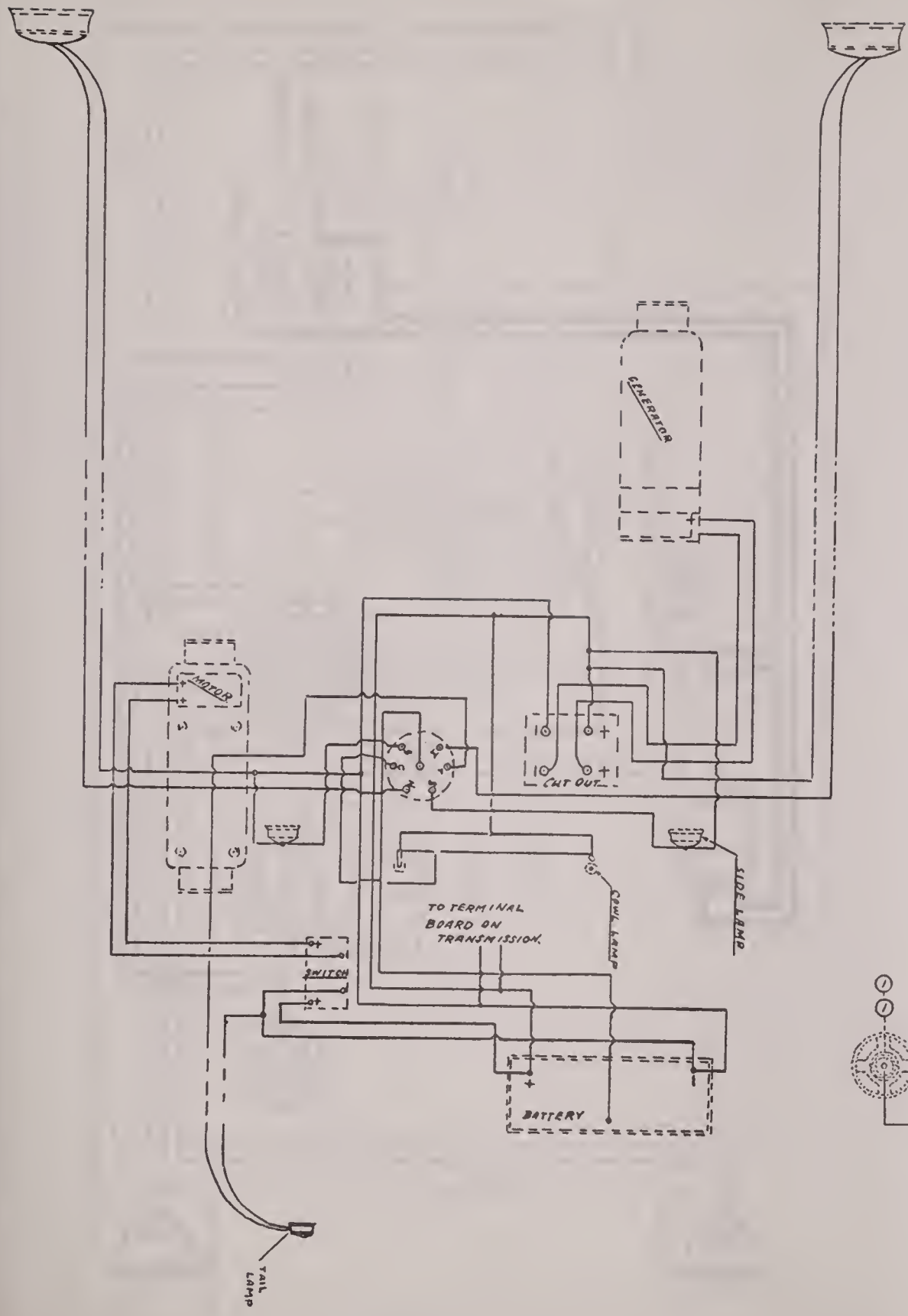


PLATE NO. 85

Haynes

MODELS 26, 27, 28 (1912-13)

LEECE-NEVILLE TWO-UNIT, 12-VOLT, STARTING AND LIGHTING SYSTEM
EISEMANN MAGNETO IGNITION

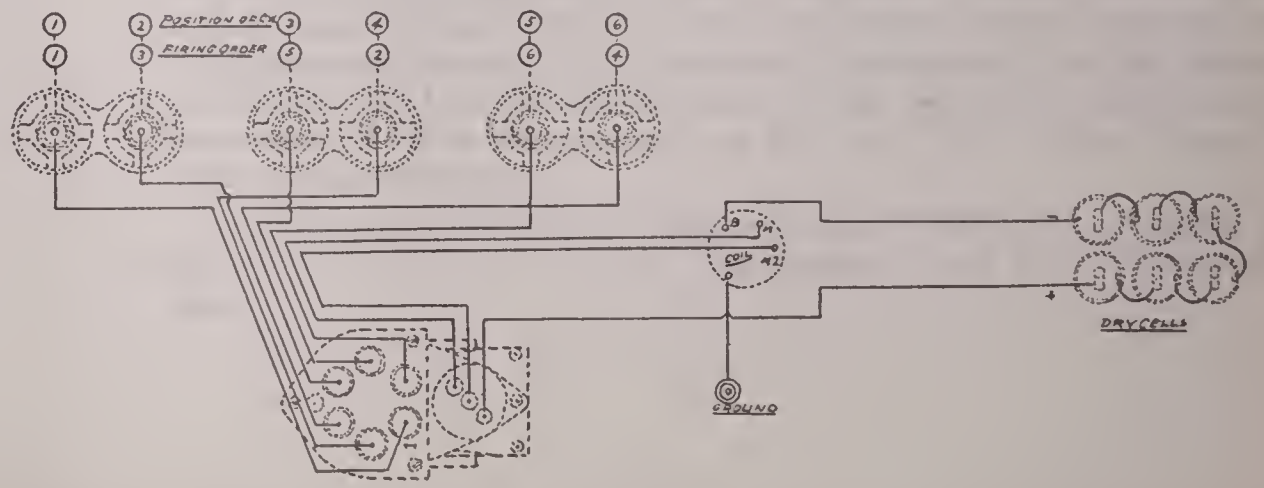
Battery is 12 volt, 100 ampere-hour. The two-wire system is used.

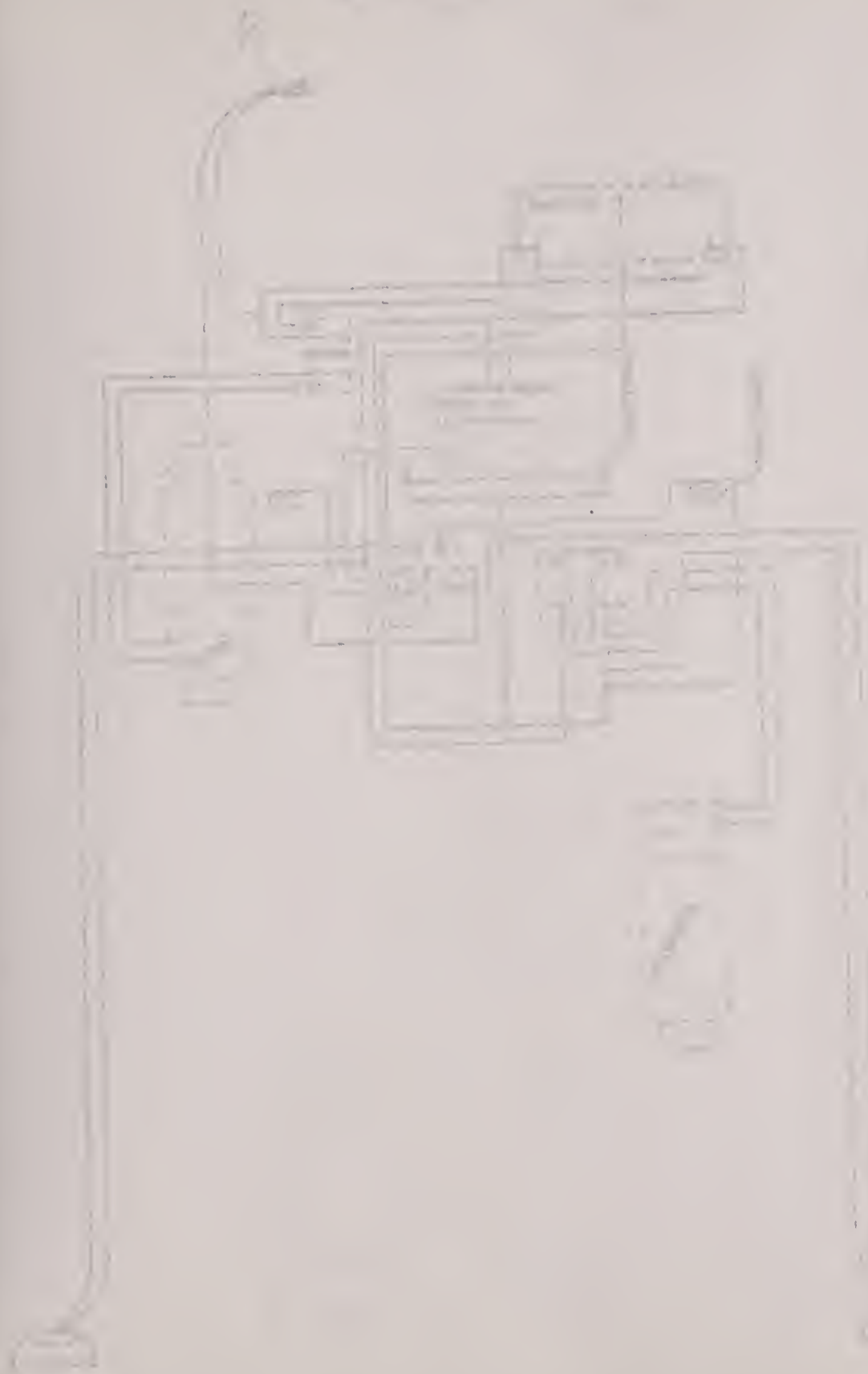
The Eisemann Type EM dual magneto is used on the 1912 and the Type EB dual magneto is used on the 1913 models. Six dry cells connected in series supply the battery current to the magneto. Breaker contacts should open 1/64 in. Clean them with gasoline whenever necessary. If contacts are burned or pitted, resurface them with a fine, flat, jeweler's file or a piece of worn No. 00 sandpaper. For further care of the Type EM magneto see Plate No. 152, and for the Type EB magneto see Plate No. 154. Spark should occur when the top dead center mark on the flywheel is ½ in. to 1 in. past the indicator, spark lever fully retarded. The firing order of the Four is 1, 3, 4, 2. The firing order of the Six is 1, 4, 2, 6, 3, 5. Spark gap should be 1/64 in. to 1/32 in.

The starting motor is connected to the flywheel by a non-automatic mechanical pinion shift. The pinion is shifted by moving a small hand lever. The moving of this lever slides the pinion into mesh and closes the starting switch. When the lever is again moved to the neutral or off position the motor circuit is opened and the pinion is drawn out of mesh. There is an overrunning clutch to prevent the engine driving the motor. Every 1,000 miles put three or four drops of light oil in the oiler at the commutator end of the motor. Every 500 miles lubricate the motor clutch through the ball oiler provided.

Voltage regulation is by a series bucking field. Relay should close at 6-8 miles per hour and open at about 5 miles per hour. The maximum charging rate should not exceed 12-14 amperes at 18-20 miles per hour. The shunt field should not allow more than 4 amperes to flow, at 12 volts pressure. A larger current indicates that there are short circuits in the windings.

Head lamps are 6 volt, 21 cp. Tail lamp is 6 volt, 2-4 cp. Side lamps are 6 volt, 8-10 cp. Cowl lamps are 6 volt, 4 cp.





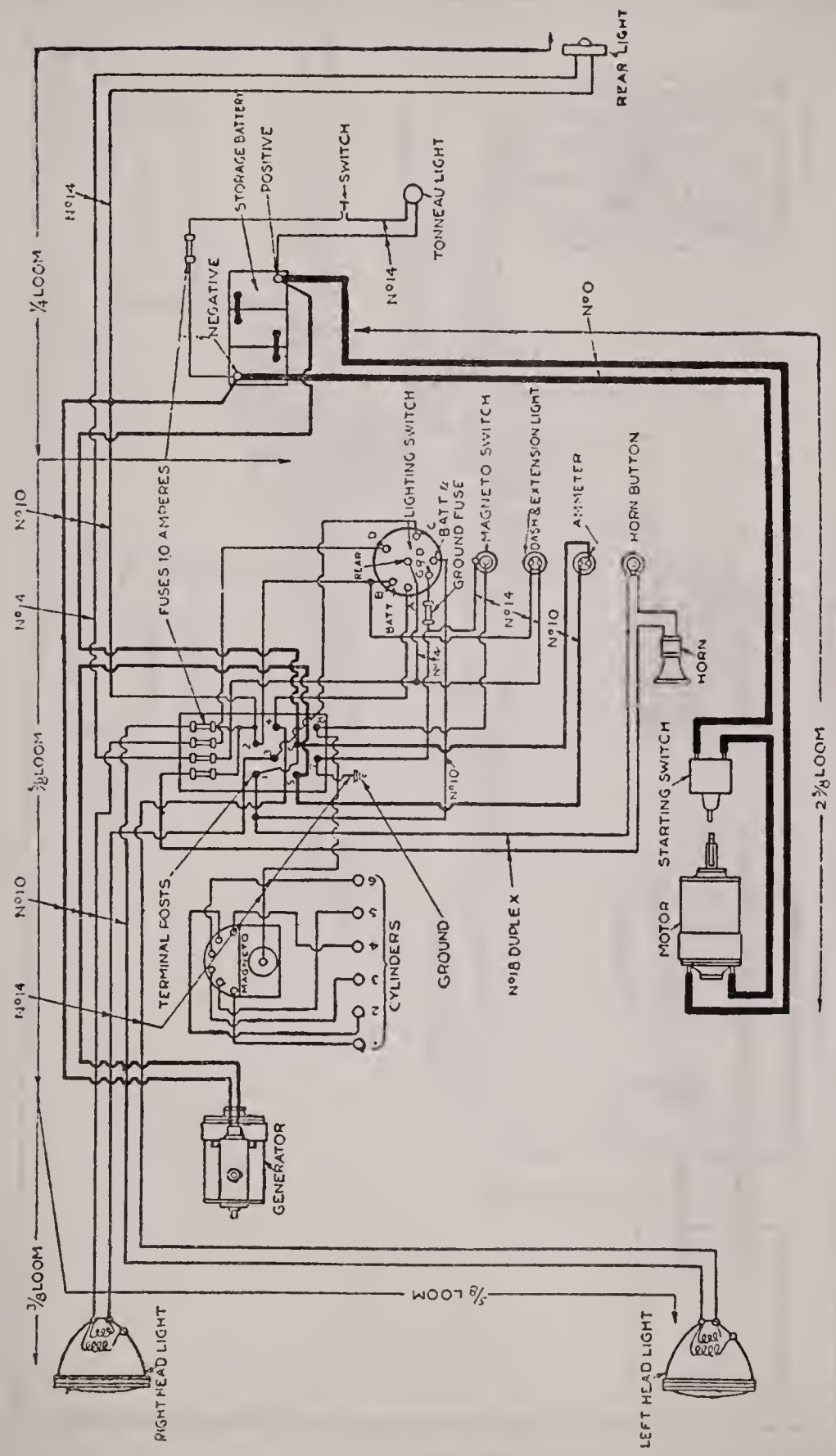


PLATE No. 86

Jeffery

"CHESTERFIELD SIX"

BIJUR STARTING AND LIGHTING SYSTEM. BOSCH MAGNETO IGNITION

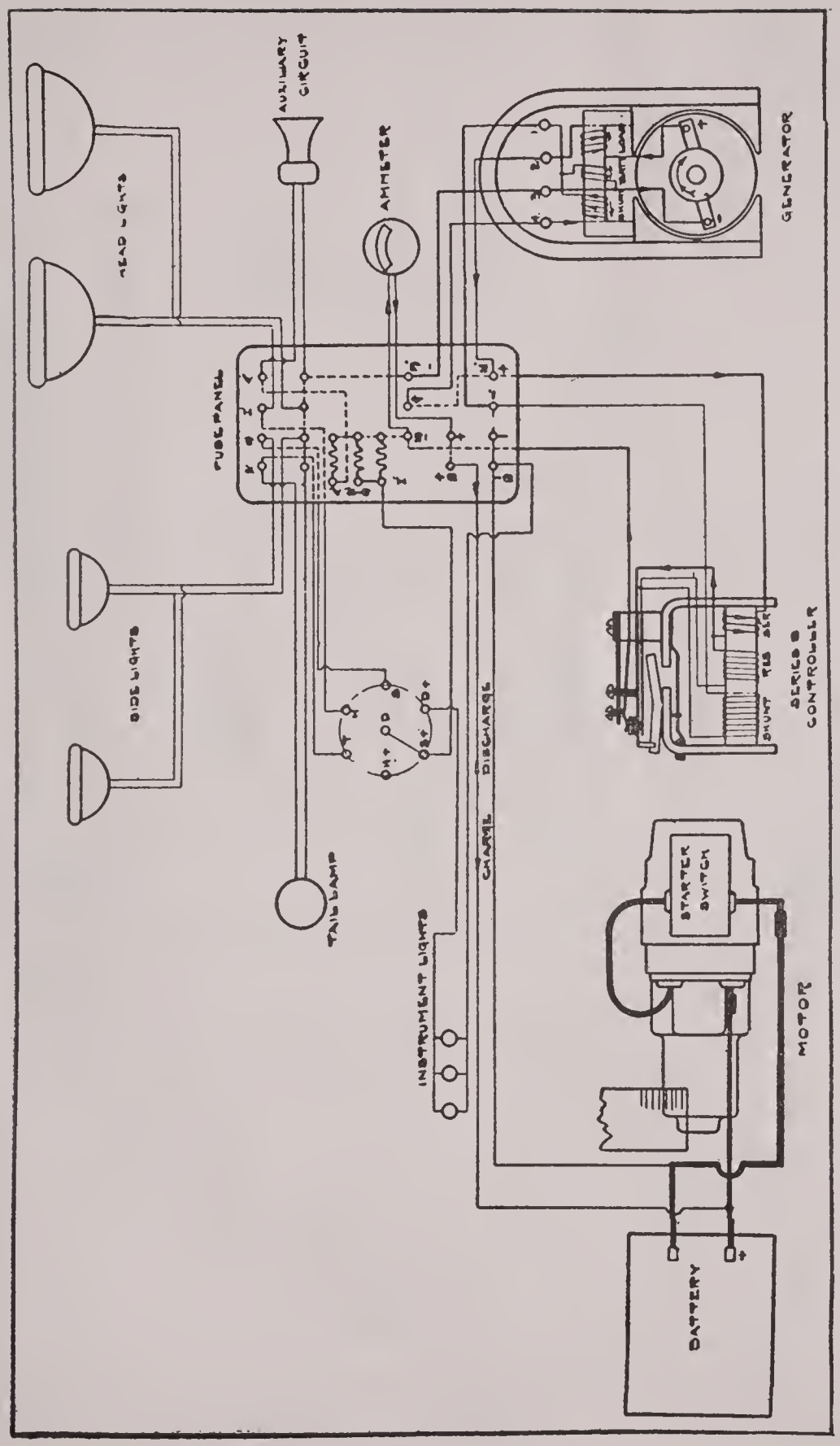
Battery is 6 volt, 100 ampere-hour. The two-wire system is used.

Breaker contacts should open .014 in. to .016 in. Clean with gasoline whenever necessary. Should they become badly burned or pitted, they may be resurfaced with a fine, flat, jeweler's file or a small strip of worn No. 00 sandpaper. Contacts should just begin to separate when the piston entering power stroke is on top dead center, control lever in the fully retarded position. The firing order is 1, 4, 2, 6, 3, 5. Every 500 miles put three or four drops of light machine oil in each of the magneto oilers.

The driving power of the starter is transmitted to the flywheel through a mechanical pinion shift. When the starting pedal is depressed part way, the motor is connected to the battery in series with a resistance. This causes the motor to run slowly, to facilitate the meshing of the gears. Fully depressing the pedal draws the pinion into mesh with the flywheel gear and connects the motor direct to the battery, cranking the engine. Every two weeks, or 500 miles, put two or three drops of light engine or machine oil in each of the motor bearing oilers. At the same time, put eight to ten drops of light engine oil in the oil hole on top of the gear case.

Voltage regulation of the generator is by a vibrating regulator. Relay should close at 8-10 miles per hour. The regulator is mounted on top of the generator. To remove it, loosen the knurled screw and pull the unit upwards, taking care not to damage the connecting pins. The guarantee on the regulator ceases if the seal is broken. There is a disconnecting and reversing plug on one end of the regulator. This plug should be pushed in and turned one-half a turn, until it locks, every 500 miles. This reverses the current across the contacts, which tends to keep them true. Due to the reversible characteristics of the generator, no care need be taken as to which terminal is connected to the battery, as it will automatically assume the correct polarity to charge. The generator output will vary with the state of charge of the battery. It may be as low as 4-5 amperes with battery fully charged and as high as 20-24 amperes when the battery is nearly discharged, no lights burning. Once every two weeks, or 500 miles, put two or three drops of light machine or engine oil in each of the generator oilers.

Head lamps are 7 volt, 20 cp. Dimmer lights are 7 volt, 6 cp. Dash light is 7 volt, 2-4 cp. Tail light is 7 volt, 2 cp. Tonneau light is 7 volt, 6 cp. Fuses are 10 ampere.



Kissel Kar

Models 6-48 and 6-60 (1914)

Esterline Generator. Kissel Starter. Magneto Ignition

Battery is 6 volt, 120 ampere-hour. The two-wire system is used.

Magneto breaker contacts should open .014 in. to .016 in. Clean with gasoline whenever necessary. Should they become badly burned or pitted, they should be resurfaced with a fine, flat, jeweler's file or a small strip of worn No. 00 sandpaper. Contacts should just begin to separate when the piston entering power stroke is on top dead center, spark control lever within one inch of the fully retarded position. The firing order is 1, 5, 3, 6, 2, 4.

The driving power of the starting motor is transmitted to the flywheel by a Bendix drive. Once every 500 miles put three or four drops of light engine oil in each of the motor oilers. Motor should crank engine at about 150 R. P. M.

The field of the generator is produced by permanent magnets, the strength of which is increased by the field windings. The fine winding is the shunt field. The other two are series windings. All current supplied for lights by the generator flow through this winding. As the current flows through it in the same direction as the shunt field, the output is increased every time a light is turned on. The remaining field coil is in the battery circuit. As it is wound in the opposite direction to the other two field coils, it reduces the magnetism in the field, thus regulating the output. The maximum charging rate is 12-15 amperes. Relay should close at 7-10 miles per hour.

Head lamps are 6-8 volt, 21 cp. Side lamps are 6-8 volt, 6 cp. Dash and tail lights are each 6-8 volt, 3 cp. Fuses are 20 ampere.

Plate No. 88

Series 4

Westinghouse Two-Unit Starting and Lighting System
Berling Magneto Ignition

Battery is 6 volt, 163 ampere-hour. The positive terminal is grounded.

Magneto breaker contacts should open .016 in. to .020 in. Spark should occur when the piston entering power stroke is on top dead center, spark control lever in the fully retarded position. The firing order is 1, 3, 4, 2. Clean contacts with gasoline whenever necessary. Should contacts become badly burned or pitted they may be resurfaced with a fine, flat, jeweler's file or a small strip of worn No. 00 sandpaper. Every 500 miles put three drops of light machine oil in each of the two magneto oilers.

The pinion of the starting motor is meshed with the flywheel gear magnetically. The main starting switch is also controlled by magnetism. When the starting button on the dash is pressed, the magnetic switch completes the motor circuit, which draws the pinion into mesh and cranks the motor. This device is described on Plate No. 136 and 203. When in the demeshed position, the clearance between the motor pinion and the flywheel gear should not be less than 3/64 in. and not more than 5/64 in.

Voltage regulation of the generator is by a mechanical regulator, consisting of a cam which cuts a resistance into the shunt field once during every revolution of the armature. As the speed increases this action takes place more frequently and has the same effect as a vibrating regulator, keeping the voltage practically constant after maximum is reached. The generator must not be run at a speed in excess of that which is attained at a high gear car speed of 40 miles per hour, without load. If full lamp load is being carried the generator may be operated at any speed, even though battery is disconnected. To adjust the regulator while the generator is in the car, disconnect the wire leading from the relay to the negative terminal of the battery, attach a voltmeter from the negative terminal of generator to the frame of the car, and switch on the head, side, dash and tail lights. Turn engine until the cam, A, Fig. 2, has lifted the follower, B, to its highest point, loosen nut, C, and adjust the screw, D, until the gap between D and E is .003 in. Tighten C, start the engine slowly and gradually increase the speed until the voltmeter reads 6.5 volts. If further increasing the speed causes the voltage to rise, bend the stop, F, upward until at racing the engine the maximum voltage is 6.5 volts. Should the voltage be below 6.5 bend the stop, F, downward until the proper voltage is reached. This adjustment should be completed before the generator has become warm from operating. Every 500 miles put three drops of light engine oil in the front generator bearing. The driving gears run in a bath of oil which is supplied through a small opening in the end of the main oil line. Maintaining constant level. Surplus oil returns to the oil sump or reservoir.

Head lamps are 6-8 volt, 24 cp. Dimmer lamps are 6-8 volt, 4 cp. Tail light is 6-8 volt, 4 cp. Dash light is 6-8 volt, 4 cp. Trouble light is 6-8 volt, 4 cp. Tungsten filament lamps are used throughout.

Fuse box is mounted on the extreme left side of the instrument panel. The first fuse from the left is a spare one. Second is in head, tail and dash lamp circuits. The third is in side, tail, dash and starting circuits. The fourth is in the horn circuit. The cover is removed by pushing in and turning the knurled button. All fuses are 30 ampere.

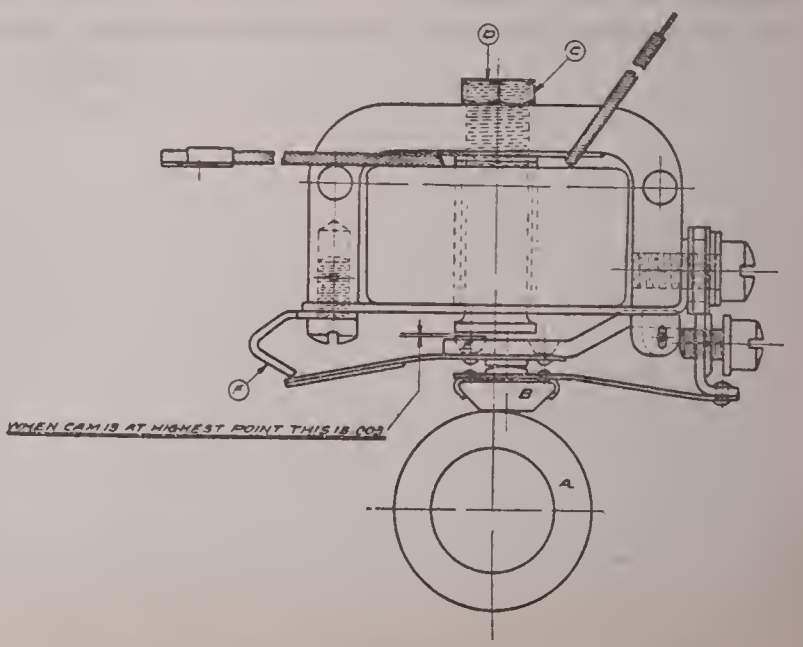


Plate No. 89

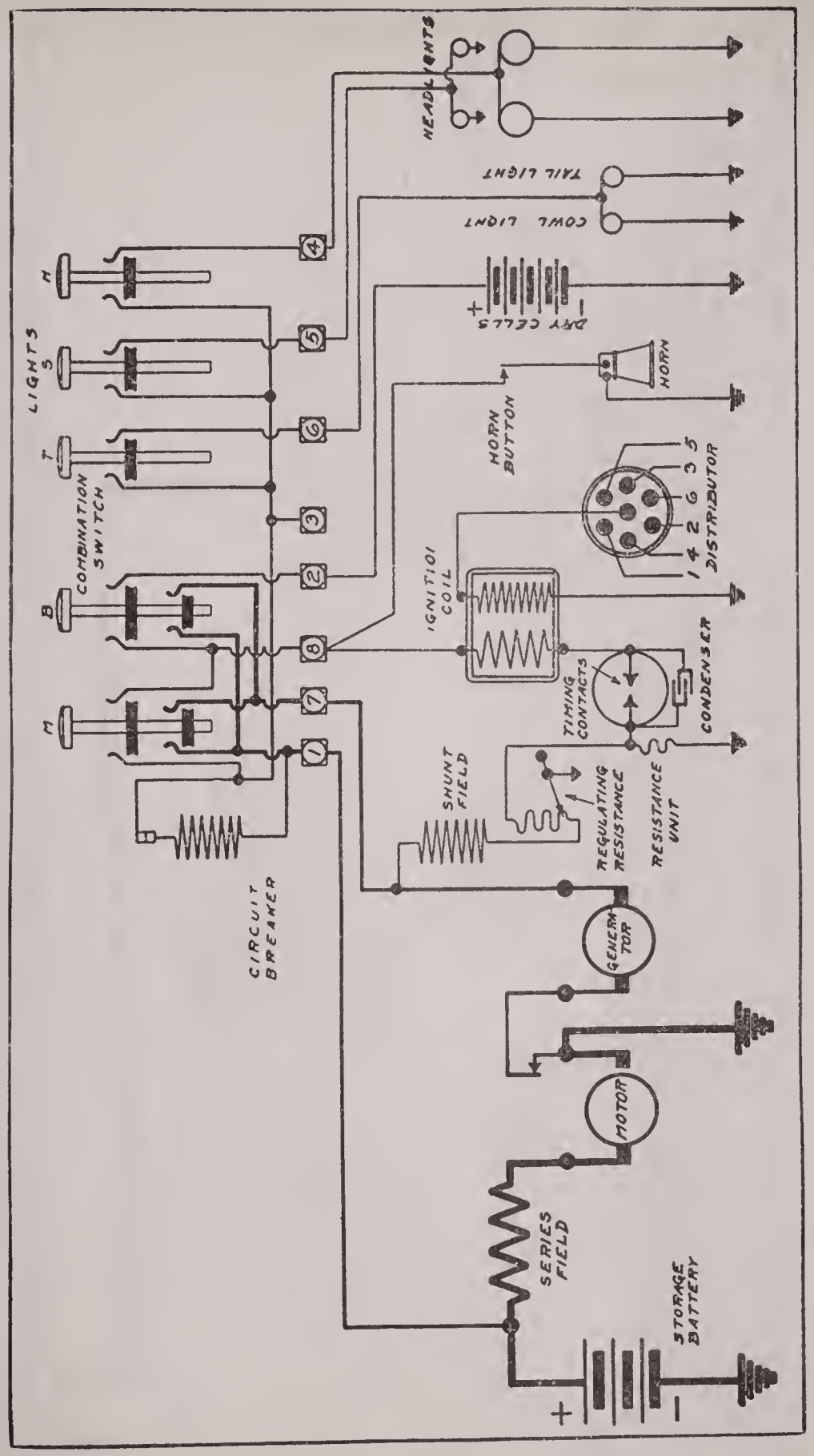


PLATE No. 90

Jackson

6-40 (1915)

DELCO 6-VOLT, DOUBLE UNIT, STARTING AND LIGHTING SYSTEM
DELCO IGNITION

Battery is 6 volt, 100 ampere-hour. The negative terminal is grounded.

Breaker contacts open .018 in. to .020 in. Break occurs when piston is .125 in. before top dead center, compression stroke, spark fully advanced. Firing order is 1, 4, 2, 6, 3, 5. For testing ignition see Plate No. 68.

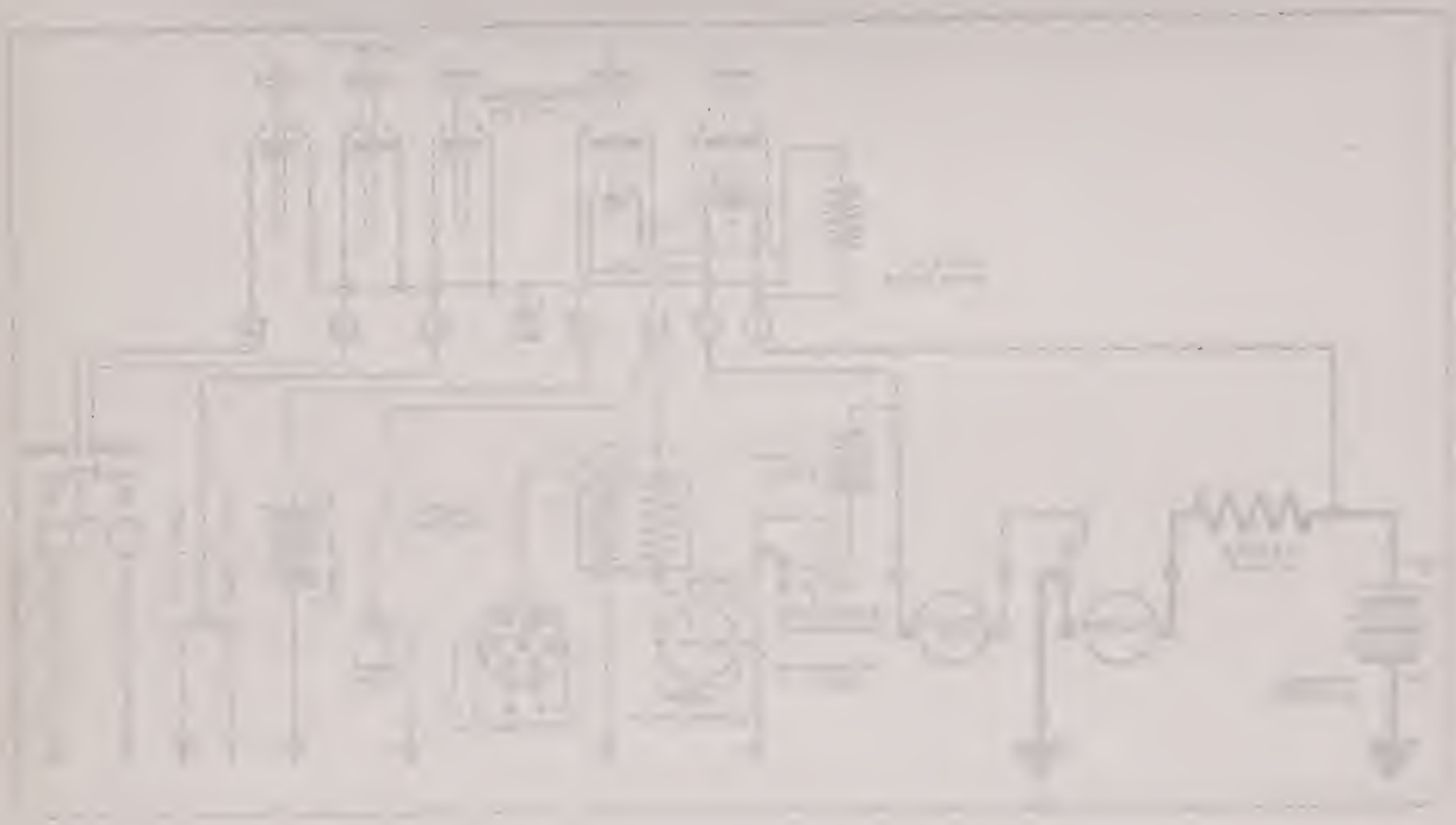
For care and adjustment of starting and lighting system see Plates No. 70 and 71.

There is no relay. A circuit breaker takes the place of fuses. There is a set of dry cells for ignition purposes when needed. There is an overrunning clutch to allow generator to run as a motor while cranking, and when it is not being driven fast enough to produce a pressure, equal to that of the battery, ignition switch closed.

One motor brush is raised instead of using a starting switch. Dash light is 7 volt, 2 cp. Tail light is 7 volt, 2 cp. Large head lights are 6-8 volt, 15 cp. Small head lights are 6-8 volt, 4 cp. Negative of battery is grounded.

Maximum charging rate of 20 amperes is reached at 15 to 18 miles per hour.

Voltage regulation is by a regulating resistance. This device consists of a coil of "Nichrome" wire on which a sliding contact, operated by a governor, rests. As the speed increases, this contact is moved along the resistance, thus cutting more resistance into the shunt field and regulating the voltage.



Liberty

Models 10, 10-A and 10-B (1916-19)

Delco Two-Unit Starting and Lighting System. Delco Ignition

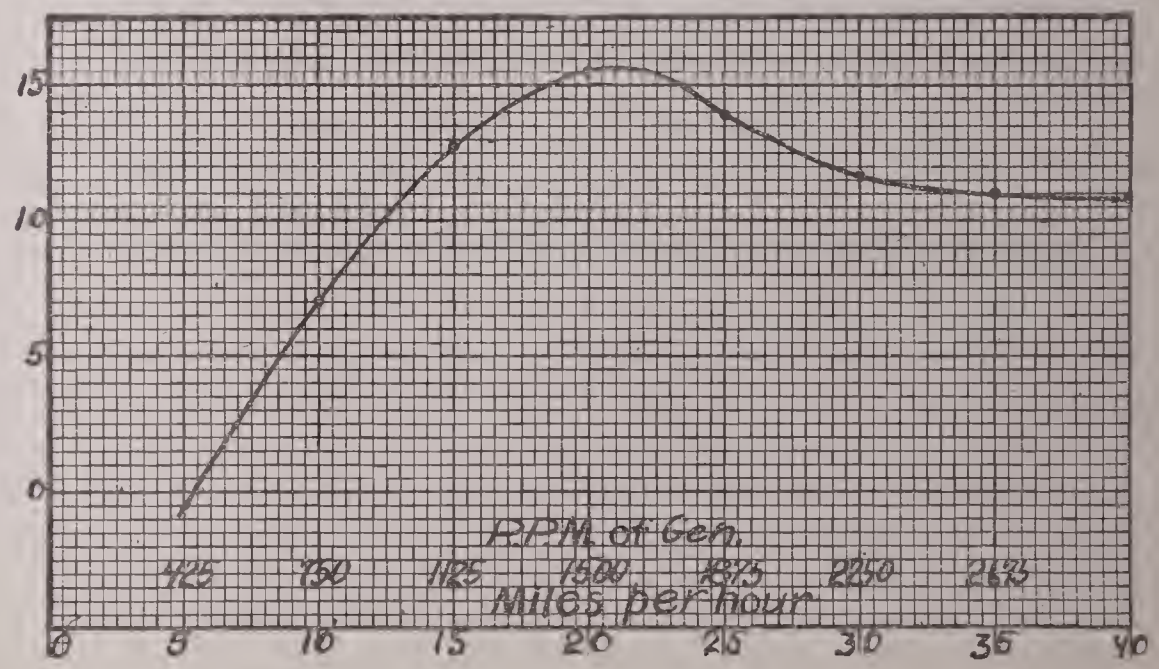
Battery is 6 volt, 94 ampere-hour. The negative terminal is grounded. Battery pressure should be 6.2 volts at 60° F.

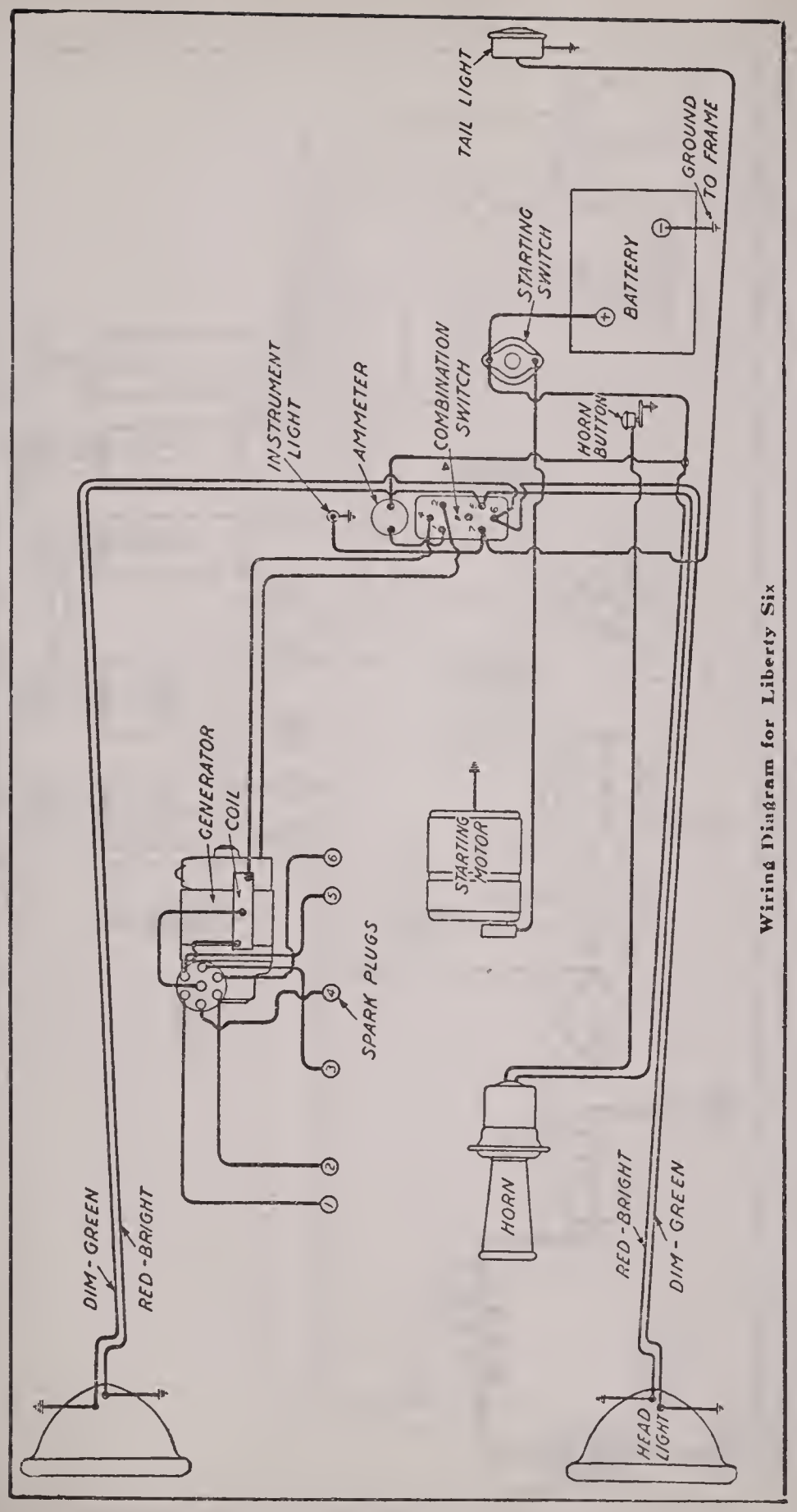
Breaker contacts should open .018 in. to .020 in. Contacts are made of tungsten metal. For care of these contacts see Plate No. 20. Breaker contacts should just start to open when the piston receiving the spark is on top dead center, spark lever in the fully retarded position. The firing order is 1, 5, 3, 6, 2, 4. For testing of the ignition units see Plate No. 68.

The driving power of the motor is transmitted to the flywheel by a Bendix drive. The gear ratio between the motor and the flywheel is 8.53 to 1. The starter requires about 200 amperes to start a new engine turning and 145 amperes to keep it turning at 100 R. P. M. An engine which has been in use for some time will not require so large a current. The starter should give 17.5 ft. lbs. instant torque when the current is first turned on and 11 ft. lbs. constant torque. Put five or six drops of light engine oil in each of the motor oilers every 1,000 miles.

Voltage regulation of the generator is by third brush. There is no relay. The circuit between the generator and the battery is controlled by the ignition switch. There is an overrunning clutch to allow the generator to turn freely as a motor whenever the battery pressure exceeds that being produced by the generator, ignition switch closed. Generator should begin to charge the battery at 7-8 miles per hour. The curve, Fig. 2, shows the rate at which the generator should charge the battery at various speeds. Put several drops of light engine oil in each of the generator oilers every 500 miles.

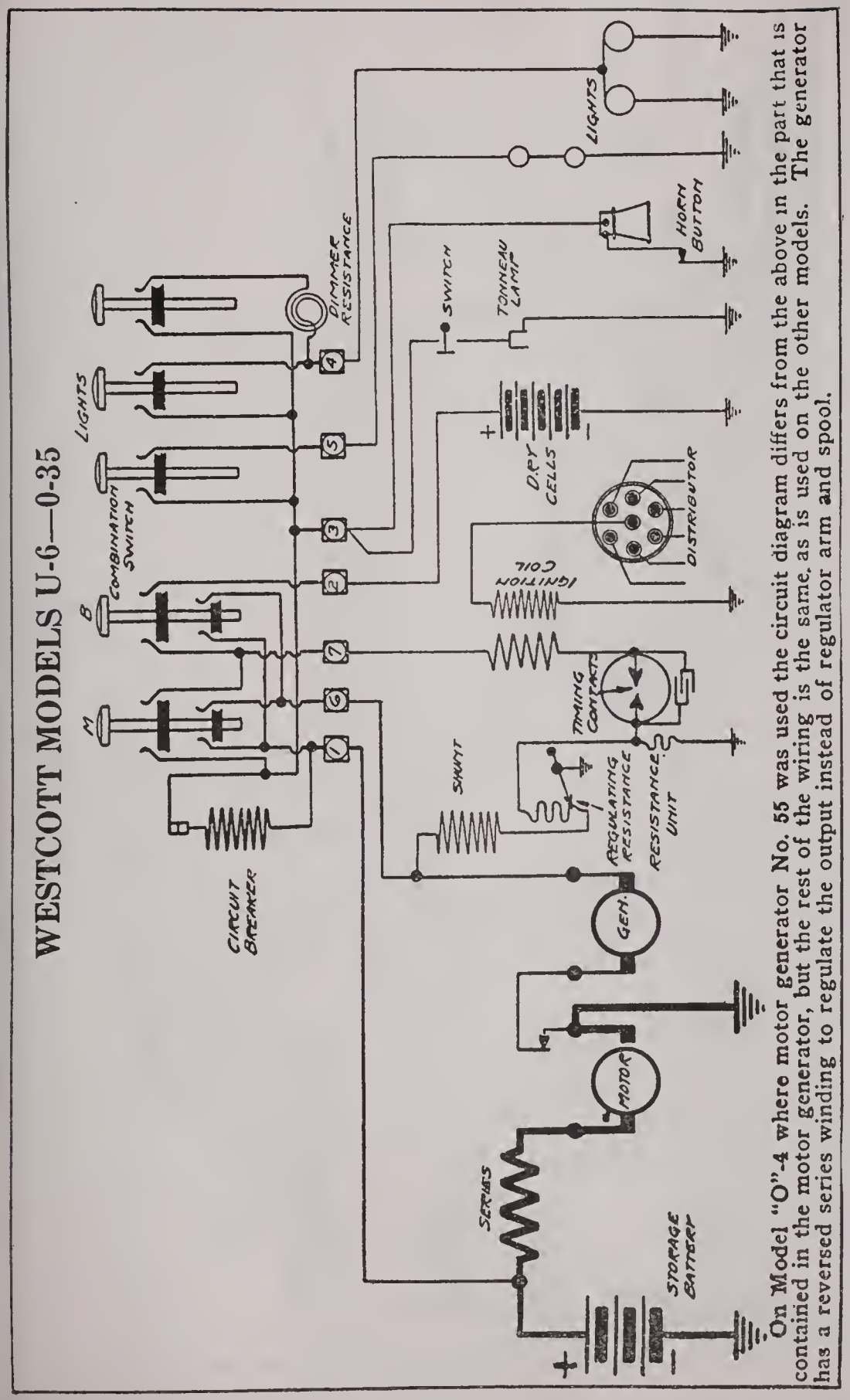
Large head lamps are 6-8 volt, 17 cp. Dimmer lamps are 6-8 volt, 5 cp. Dash and tail lights are each 6-8 volt, 2-4 cp.





Wiring Diagram for Liberty Six

Plate No. 91



Westcott

U-6, O-35 and O-4 (1915)

Delco Double-Unit Starting and Lighting System. Delco Ignition

Battery is 6 volt, 120 ampere-hour. The negative terminal is grounded.

Breaker contacts open .018 in. Breaker cam should be set so that contacts will open when the unit is rocked forward as far as slack in gears will allow and close again when the unit is rocked back, dead center mark on flywheel at indicator, spark retarded. Spark is advanced by both automatic and manual control. Contacts are made of tungsten metal. See Plate No. 20 for the care of the contacts. Firing order is 1, 5, 3, 6, 2, 4. For testing of ignition units see Plate No. 69.

There is a brush-lifting device to take the place of a starting switch. Motor is connected to engine by non-automatic mechanical shift. Where ignition switch is closed, generator runs as a motor to facilitate meshing of gears. Gears are drawn into mesh, generator circuit is broken, and motor brush allowed to come into contact with commutator by depressing starting pedal.

For testing motor-generator see Plates No. 70 and 71.

Voltage regulation is by a regulating resistance in series with the shunt field. This consists of a coil of "Nichrome" wire on which rests a sliding contact, operated by a governor on the timer shaft. As the speed increases, more resistance is thrown into the shunt field, thus controlling the voltage. For adjustment see Plate No. 73.

There is no relay. Generator begins to charge battery at about 7 miles per hour. Maximum rate of 16-20 amperes is reached at 20-22 miles per hour. A circuit breaker located on back of lighting switch takes the place of fuses in lighting circuit.

Head lights are 6-8 volt, 21 cp. Dash and tail lights are in series. They are 3-4 volt, 2 cp. Tonneau light is 7 volt, 2-4 cp.

A set of five dry cells connected in series supply ignition current while starting.

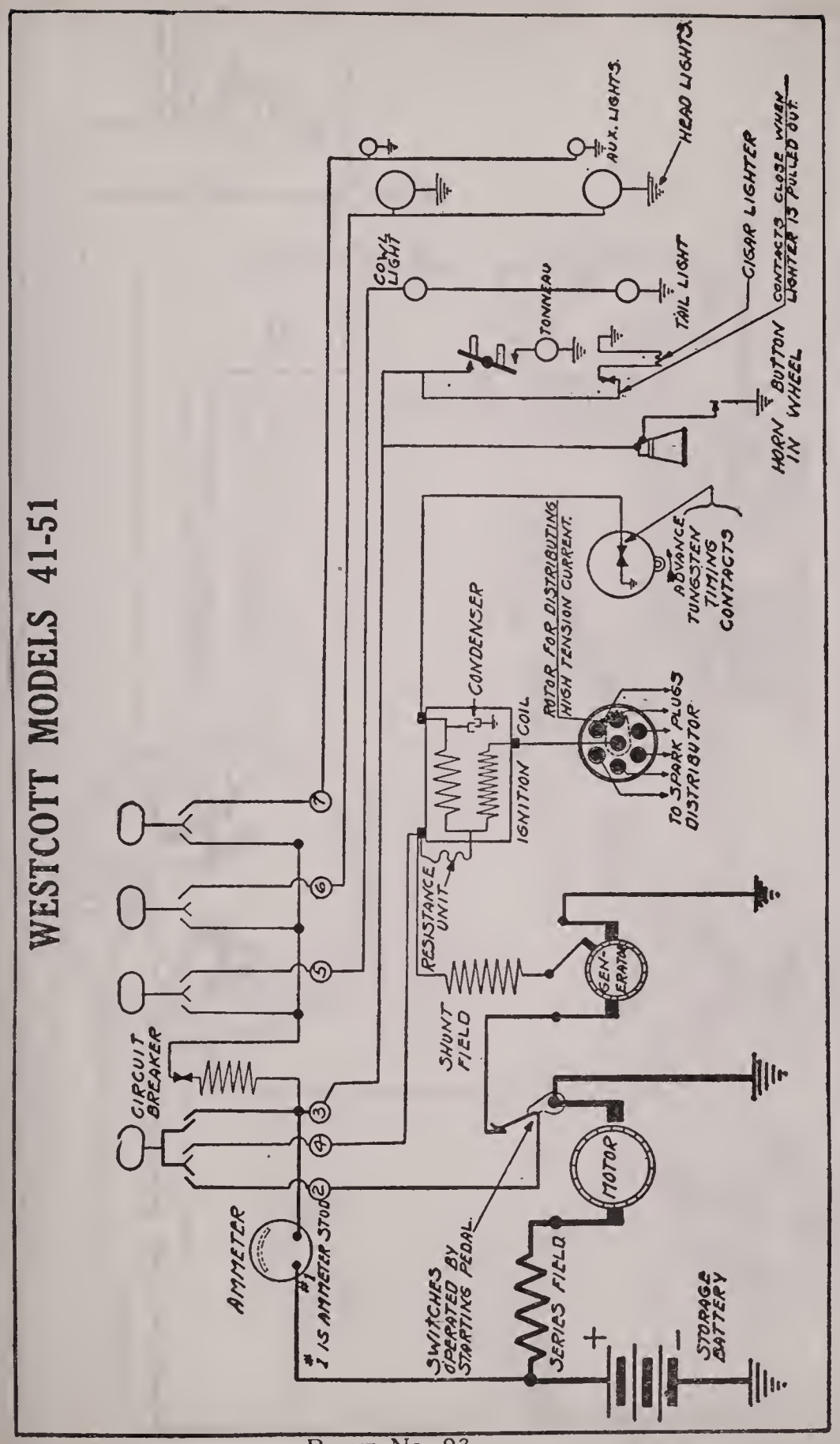


PLATE No. 93

Westcott

MODEL 41-51 (1916)

DELCO DOUBLE-UNIT STARTING AND LIGHTING SYSTEM. DELCO IGNITION

Battery is 6 volt, 120 ampere-hour. Negative of battery is grounded.

Breaker contacts open .018 in. Breaker should set so that when it is rocked forward as far as slack in gears will allow, contacts will open, and when rocked back contacts again close, dead center mark being at indicator and spark retarded. Spark control is by both manual and automatic advancer. For testing of ignition units see Plate No. 69. Contacts are of tungsten metal. See Plate No. 20. Firing order is 1, 5, 3, 6, 2, 4.

Voltage regulation is by third brush. See Plate No. 77. There is no relay. Ignition switch controls circuit between generator and battery. Generator starts to charge at about 7 miles per hour. Ammeter shows rate of charge or discharge. Maximum charging rate of 18-20 amperes is reached at 20-22 miles per hour. There is an overrunning clutch at driving end of generator to allow it to run as a motor while starting or when pressure it is producing is below that of the battery.

Motor is connected to engine by non-automatic mechanical shift. There is a clutch to prevent engine driving motor. Motor brush is raised to open cranking circuit. When ignition switch is closed generator runs as a motor to facilitate meshing of gears. By depressing starting pedal, gears are drawn into mesh and generator circuit opened and motor brush allowed to come into contact with commutator, thus applying full battery pressure to motor and cranking engine. For testing motor-generator, see Plates No. 70 and 71.

There is a circuit breaker to take the place of fuses in the lighting circuit.

Dash and tail lights are in series. They are 3-4 volt, 2 cp. Large head lights are 6-8 volt, 15 cp. Small head lights are 6-8 volt, 4 cp. Tonneau light is 7 volt, 4 cp.

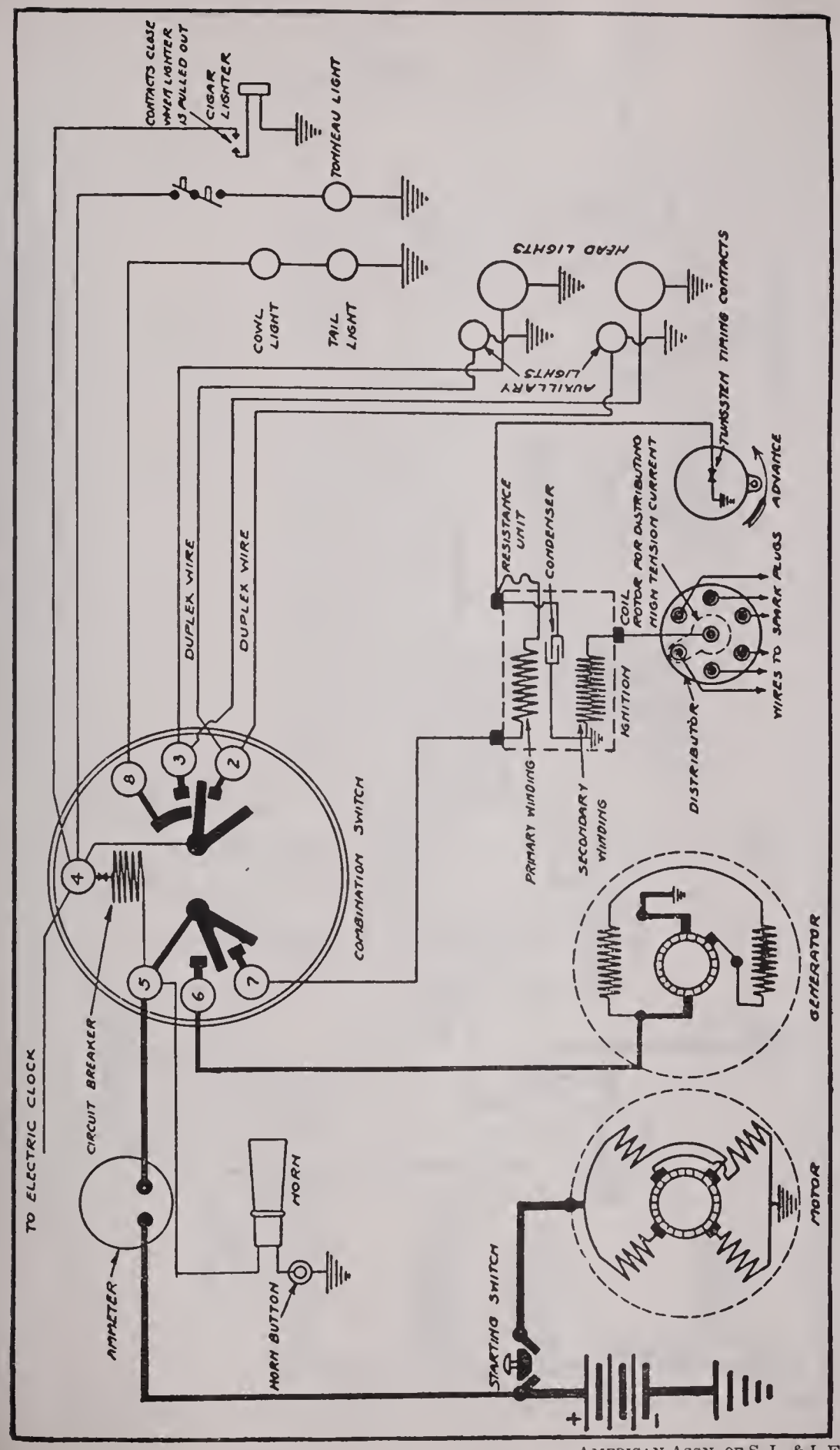


PLATE No. 94

Westcott

SERIES 17 (1917)

DELCO TWO-UNIT STARTING AND LIGHTING SYSTEM. DELCO IGNITION

Battery is 6 volt, 120 ampere-hour. The negative terminal is grounded.

Breaker contacts are made of tungsten metal. For care see Plate No. 20. Contacts should open .018 in. Break should occur when the upper dead center mark on the flywheel is at indicator, spark lever advanced 2 in. on the quadrant. Firing order is 1, 5, 3, 6, 2, 4. Ignition should not consume over 10 amperes with engine idle. For testing of ignition units see Plate No. 69. Once a week put four or five drops of light engine oil in the oiler in the side of the distributor.

Motor is connected to flywheel by a Bendix gear.

Voltage regulation is by third brush. See Plate No. 77 for adjustment of third brush. There is no relay. Ignition switch controls circuit between generator and battery. There is an overruning clutch to allow generator to run as a motor when it is not being driven fast enough to produce a pressure equal to or above the battery pressure. Generator begins to charge the battery at 7-8 miles per hour. Maximum charging rate of 15-16 amperes is reached at 18-20 miles per hour. Maximum generator output should never exceed 25 amperes. Ammeter shows rate of charge or discharge. Once a week put four or five drops of light engine oil in the rear generator oiler. At the same time put about one-half an ounce of oil in the front generator oilers. This oiler provides lubrication to the overrunning clutch. Any excess oil added passes through the bearings and out of the drain provided for that purpose.

There is a circuit breaker on the combined lighting and ignition switch to take the place of fuses in the lighting circuit.

Large head lights are 6-8 volt, 15 cp. Small head lights are 6-8 volt, 4 cp. Tonneau light is 7 volt, 4 cp. Dash and tail lights are in series. They are 3-4 volt, 2 cp.

1916 D-44, 45, 54, 55 D-4 Truck

DELCO 6-VOLT, SINGLE-WIRE, DOUBLE-UNIT SYSTEM. DELCO IGNITION

Battery is 6 volt, 80 ampere-hour or 6 volt, 100 ampere-hour.

Breaker contacts open .020 in. Break should occur when dead center mark on flywheel is 1 in. past indicator, spark at full retard. Firing order of Six is 1, 4, 2, 6, 3, 5. Firing order of Four is 1, 3, 4, 2.

For testing of ignition apparatus see Plate No. 69. Contacts are of tungsten metal. (See Plate No. 20). There is both automatic and manual spark advancer. Ignition coil allows 6 amperes to flow when resistance unit is cold. When unit is heated current is reduced to 3 1/2 amperes. At 1,000 R. P. M. of the engine this is reduced to 1 ampere.

Generator runs slowly as a motor when ignition switch is closed, to facilitate meshing of gears. Gears are meshed and full battery pressure applied to motor by depressing starting switch. There is an overrunning clutch to prevent engine driving motor. There is a grease cup on end of shaft. It should be tightened one turn every week. There is also a clutch at driving end to allow generator to run as a motor. When motoring, shunt field of generator should allow 1¼ amperes to flow. First rush of current when starting pedal is depressed varies from 200 to 600 amperes. With battery reading 1.200 the voltage should not drop below 5 volts during cranking operation.

For testing of motor-generator see Plate Nos. 70 and 71.

Voltage regulation is by third brush. There is no relay. Generator supplies current at car speeds over 7 miles per hour. Charging characteristics are shown in curve. For regulation see Plate No. 77. When the pressure between the two main brushes is 6 1/2 volts the pressure between negative and third brush is about 5 volts, third brush in average normal position. Changing current of this generator should at no time exceed 22 amperes.

Generator should never be run with battery disconnected. To remove generator clutch loosen screw in end of armature shaft and remove lock washer and key washer. Insert armature in a hole in a horizontal bench or box. The hole should be 1/4 in. larger than armature. Allow the armature end frame to drop about 2 in., being careful to have the end frame come squarely in contact with the bench. Hold armature from below so that it will not fall to the floor. Clutch is held together by retaining spring wire, which, when removed, allows the clutch to be disassembled for inspection.

On all except the D-54, D-55 and D-4 models one of the generator brushes is raised while cranking. On these three models the circuit is broken by a switch.

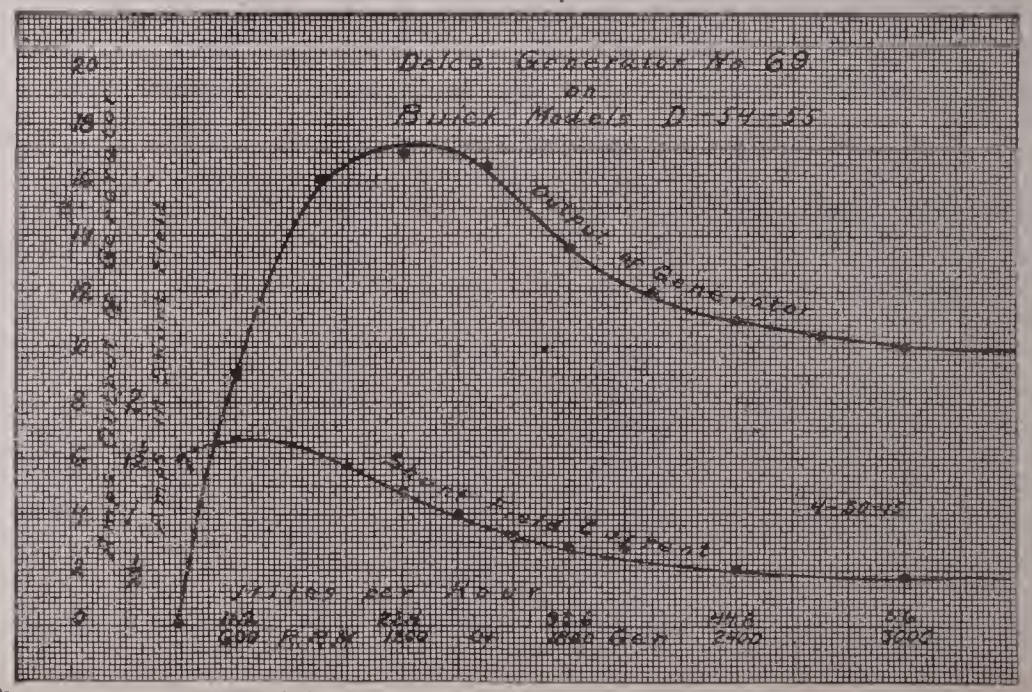


PLATE NO. 95

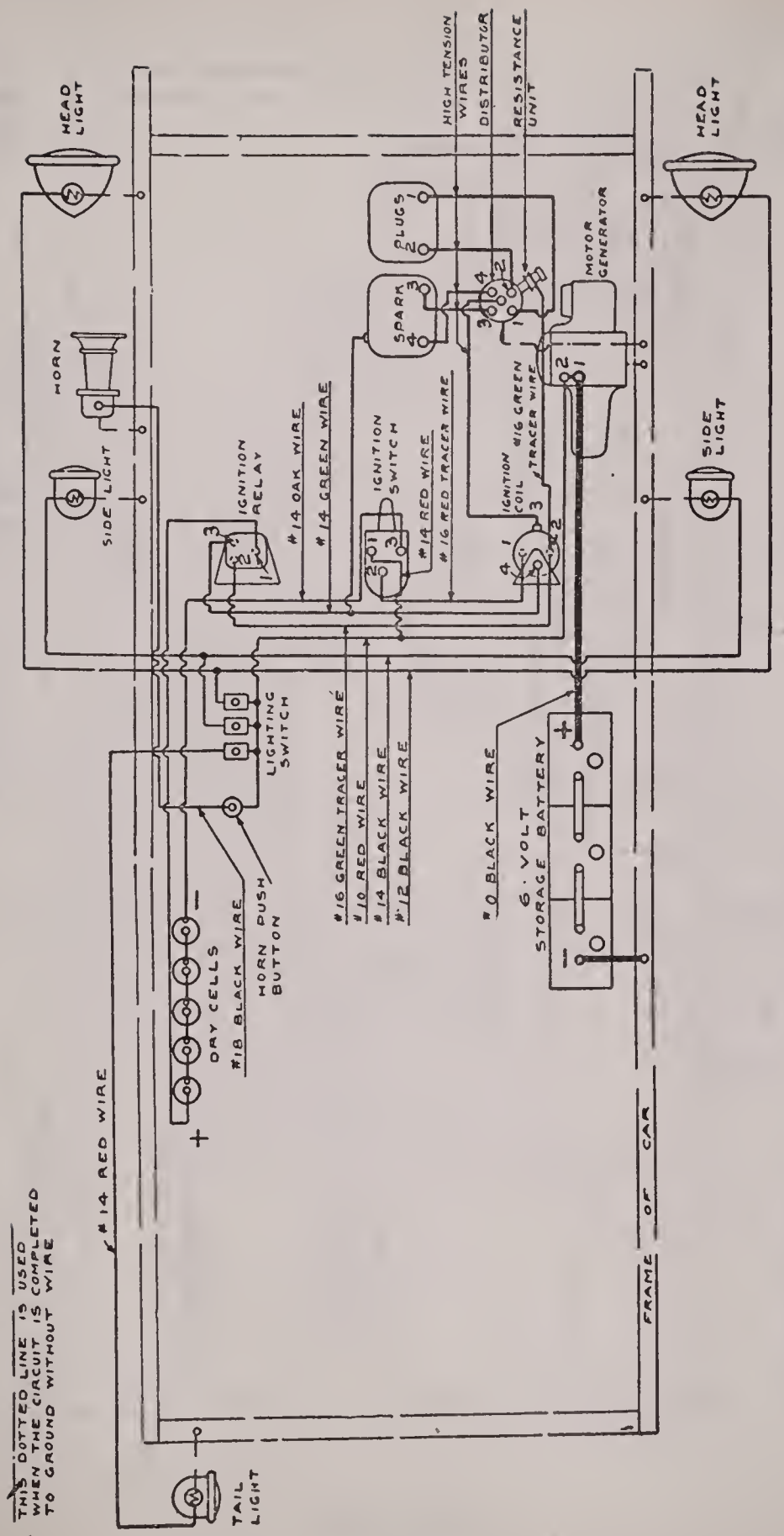


PLATE No. 96

Buick

B-24, 25, 36 AND 37 (1914)

DELCO DOUBLE-UNIT STARTING AND LIGHTING. DELCO IGNITION

Battery is 6 volt, 20 ampere-hour. The negative terminal is grounded.

Breaker contacts should open .018 in. to .020 in. Spark should occur on top dead center, spark lever midway between the fully advanced and the fully retarded positions. The firing order is 1, 3, 4, 2. For care of the ignition relay see Plate No. 68.

The driving power of the motor is transmitted to the engine through a set of reduction gears and an overrunning clutch. When the starting pedal is depressed part way a catch on the brush-lifting rod mechanically closes the relay contacts. This applies the battery pressure to the generator, running it as a motor to facilitate the meshing of the gears. Depressing the pedal further draws the gears into mesh, raises the generator brush and allows the motor brush to come in contact with the commutator, thus applying the full battery pressure to the motor and cranking the engine, in the order named. When the pedal is released a spring returns it to its normal position, thus reversing the above operation. For care of this motor-generator see Plates No. 66 and 67.

Head lights are 6-8 volt, 16 cp. Side lights are 6-8 volt, 6 cp. Dash and tail lights are 6-8 volt, 2 cp.

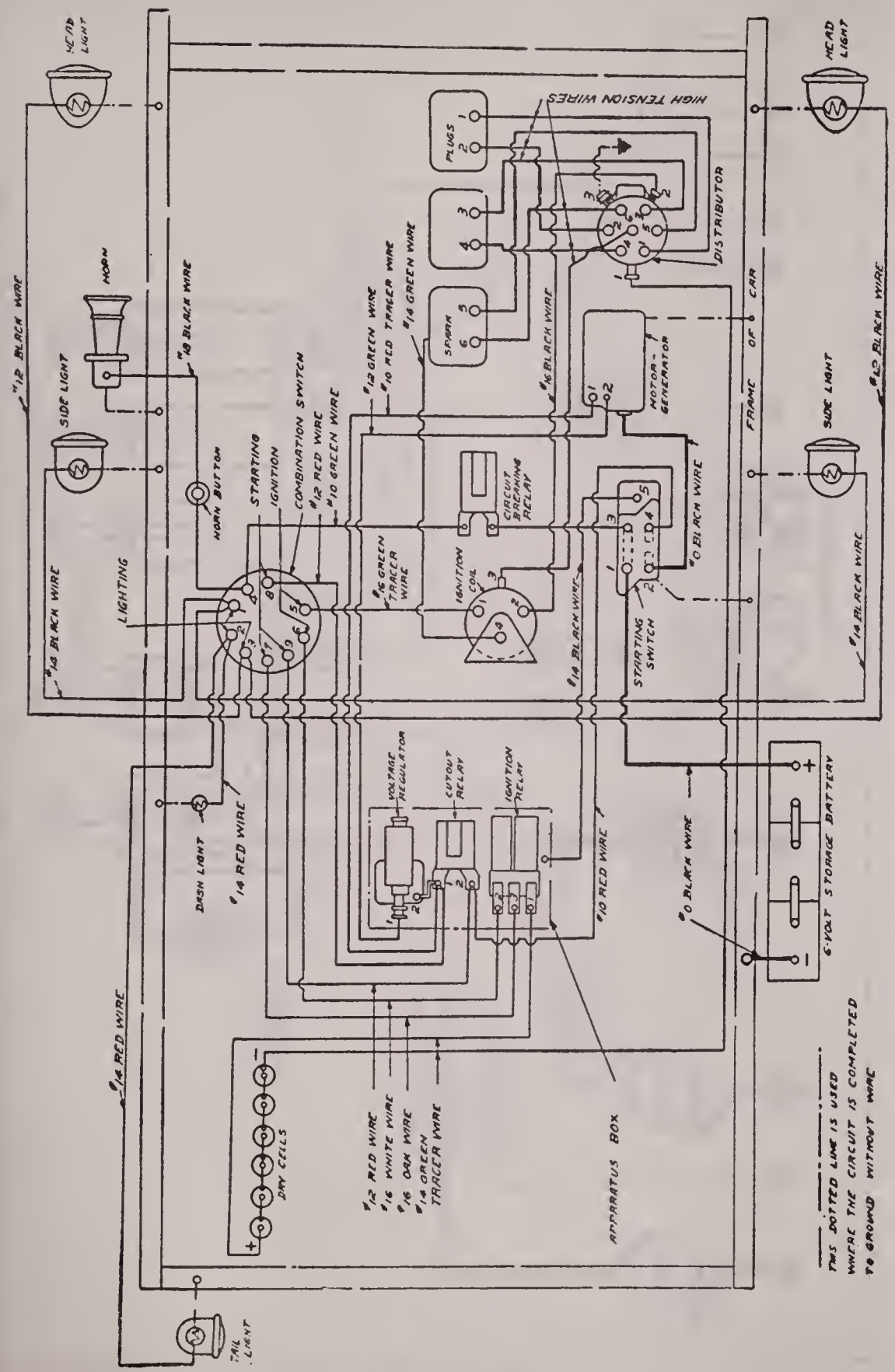


PLATE NO. 97

Buick

MODELS B-54 AND B-55 (1914)

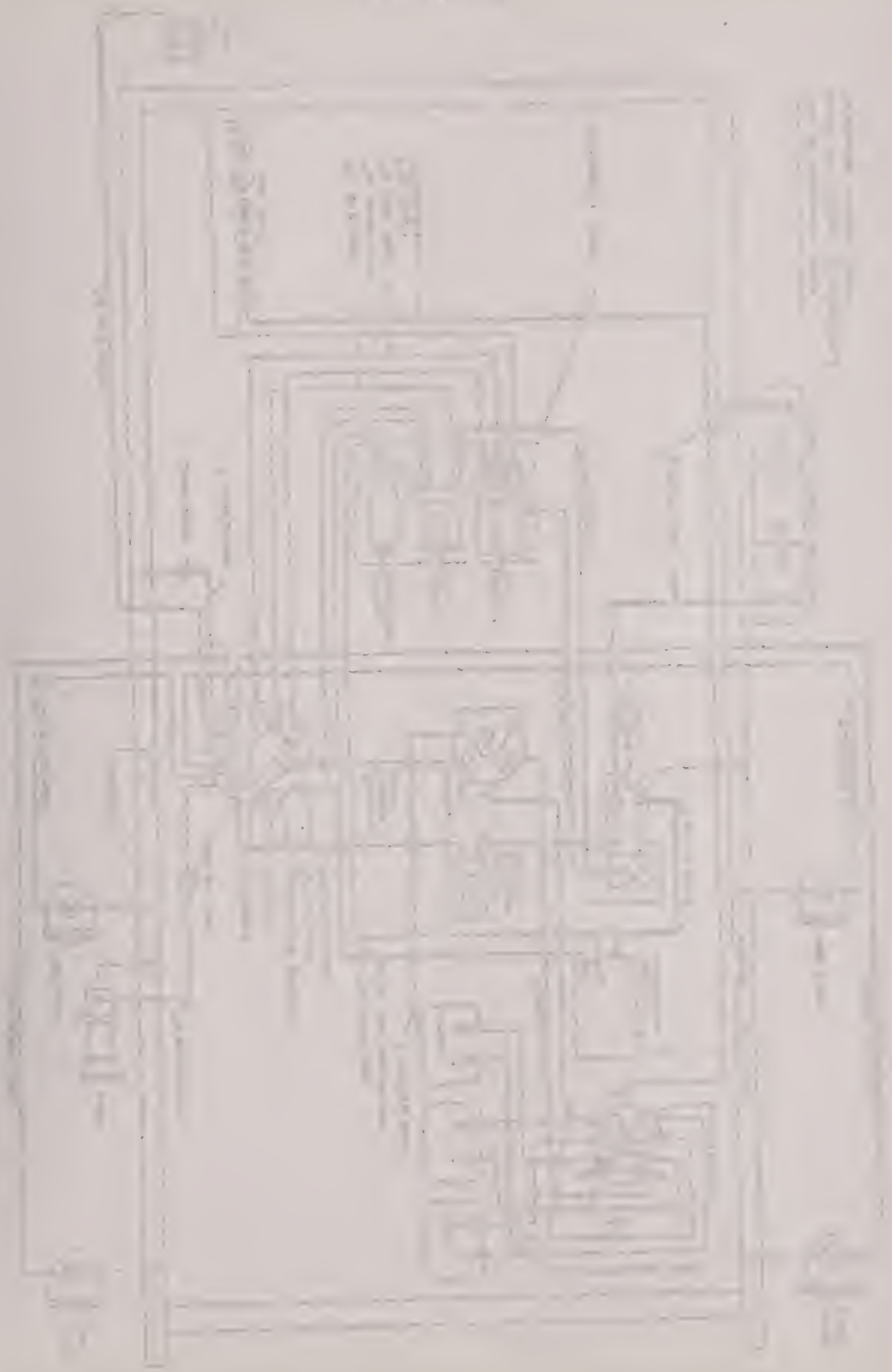
DELCO DOUBLE-UNIT STARTING AND LIGHTING SYSTEM. DELCO IGNITION

Battery is 6 volt, 80 ampere-hour. The negative terminal is grounded.

Breaker contacts should open .018 in. to .020 in. Spark should occur when the dead center mark on the flywheel is 1 in. past the indicator, timer fully retarded. The firing order is 1, 5, 3, 6, 2, 4. For testing of the ignition units see Plate No. 69. For care of the ignition relay see Plate No. 68.

The driving power of the starting motor is transmitted to the flywheel by a set of reduction gears and an overrunning clutch. The gears are drawn into mesh by a mechanical pinion shaft. When the starting button on the ignition switch is closed, the generator runs as a motor to facilitate the meshing of the gears. When the starting pedal is depressed, the gears are drawn into mesh and when gears are fully meshed, the trigger on the motor switch assembly is released, with the result that the motor-switch contacts are snapped back, opening the generator and completing the motor circuits, cranking the engine. When the pedal is released, the motor circuit is broken, the gears are drawn out of mesh, and the generator circuit is again completed. The ignition switch should be placed on the "Mag" position after engine is started, as the cutout relay is shunted out of circuit when the lever is on the "Start" position. For testing and care of the motor-generator see Plates No. 65 and 65A.

Head lights are 6-8 volt, 24 cp. Side lights are 6-8 volt, 6 cp. Dash light is 6-8 volt, 2 cp. Tail light is 6-8 volt, 2 cp.



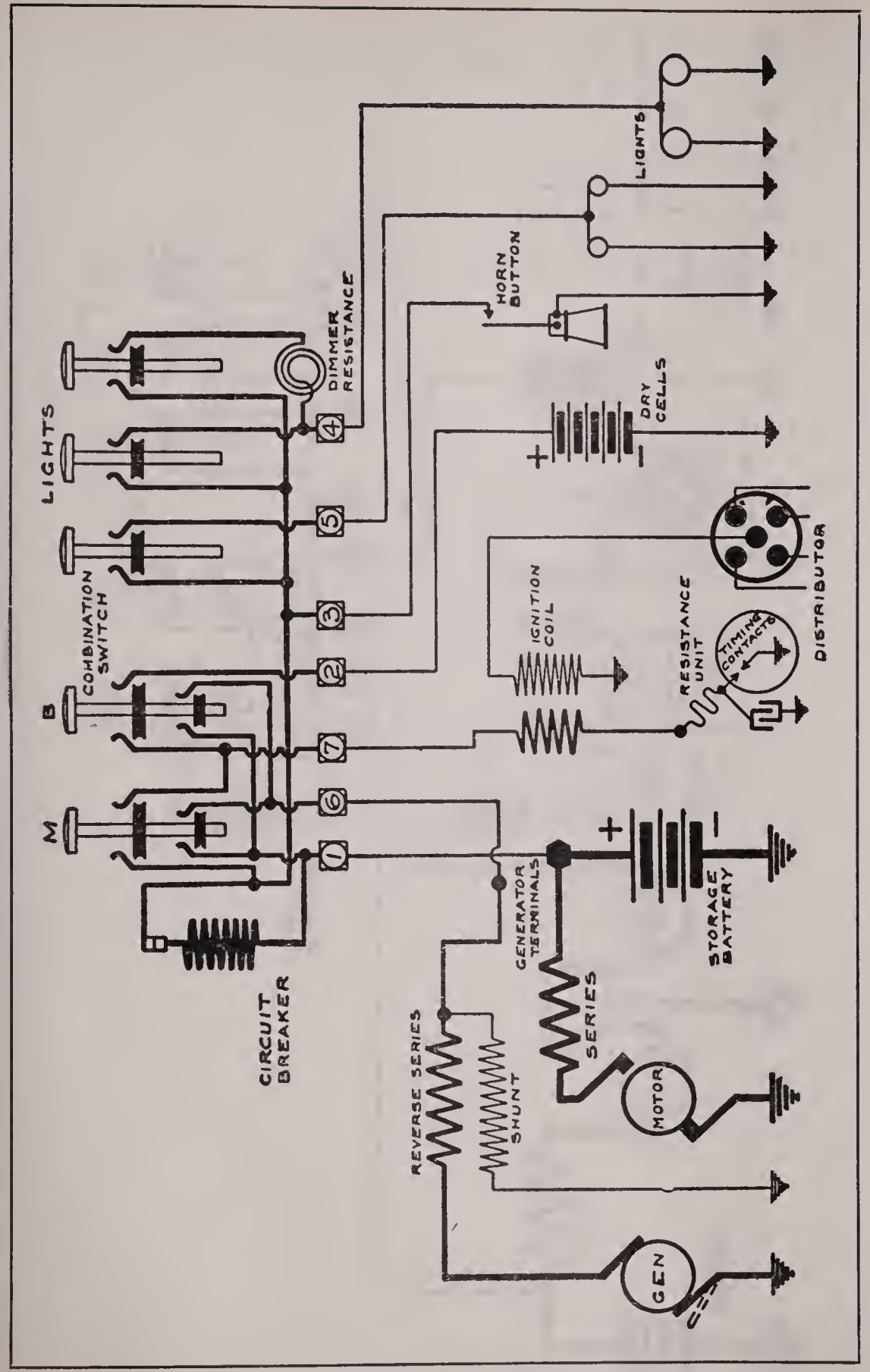


PLATE NO. 98.

Buick

C-24 AND C-25 (1915)

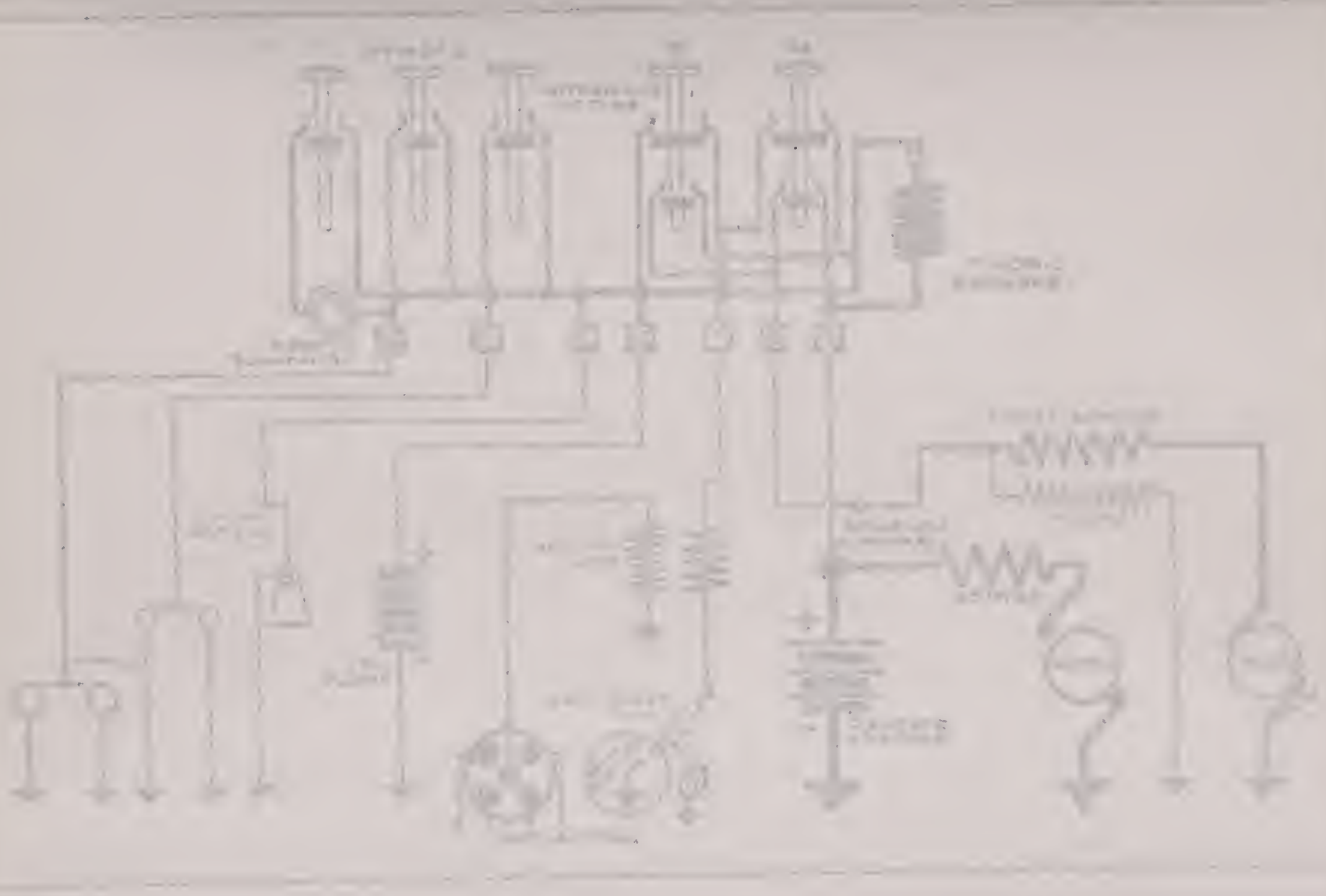
DELCO SINGLE-UNIT STARTING AND LIGHTING SYSTEM. DELCO IGNITION

Battery is 6 volt, 80 ampere-hour. The negative terminal is grounded.

Breaker contacts should open .018 in. to .020 in. Should contacts become badly burned or pitted they may be resurfaced with a fine, flat, jeweler's file or a small strip of worn No. 00 sandpaper. Breaker contacts should just begin to open when the top dead center mark on the flywheel is at the indicator, spark lever midway between the fully advanced and the fully retarded position. The firing order is 1, 3, 4, 2. For directions for the testing of the ignition units see Plate No. 69.

The driving power of the starting motor is transmitted to the flywheel through a set of reduction gears. The positive motor brush is raised to open the motor circuit. When the ignition switch is closed, the generator runs as a motor to facilitate the meshing of the gears. When the starting pedal is depressed, the gears are drawn into mesh and the negative generator brush raised. This process opens the generator circuit and the motor brush is allowed to come in contact with the motor commutator, thus applying the full battery pressure to the motor and cranking the engine. When the starting pedal is released the above operation is reversed. An overrunning clutch is provided to prevent the engine's driving the starter while the gears are in mesh. There is also an overrunning clutch at the driving end of the generator shaft to allow the generator to run as a motor during the cranking operation or when the generator is not being run fast enough to produce a pressure equal to or above that of the battery. There is no relay, the circuit between the generator and battery being controlled by the ignition switch. Should the generator fail to motor when the ignition switch is closed, see that the battery and motor terminals and ground connections are in good order. Should these be found O. K., see that the three contact fingers on the ignition switch all make good contact when the switch is closed. Should the switch be in good order, remove the dust cover from the front end of the motor-generator and try to turn the armature with your fingers. Should the armature turn freely, there is probably a ground or open circuit in the wiring between the generator and the battery or in the generator winding itself. Should you be unable to turn the armature freely, the clutch is sticking. In this case oil the clutch freely. If this does not free the armature, it must be taken apart and repaired. Should the armature turn freely, remove the wire leading to the ignition switch and connect it to the frame of the car, in series with a large lamp, similar to the head lights used. Should the lamp fail to light, ignition switch closed, the wiring is at fault or there is a broken jar in the battery which has allowed all of the electrolyte to leak out. Should the lamp burn brightly, the motor-generator is at fault. Test as on Plates No. 66 and 67.

Head lamps are 6-8 volt, 17 cp. Dash and tail lights are 6-8 volt, 2 cp.



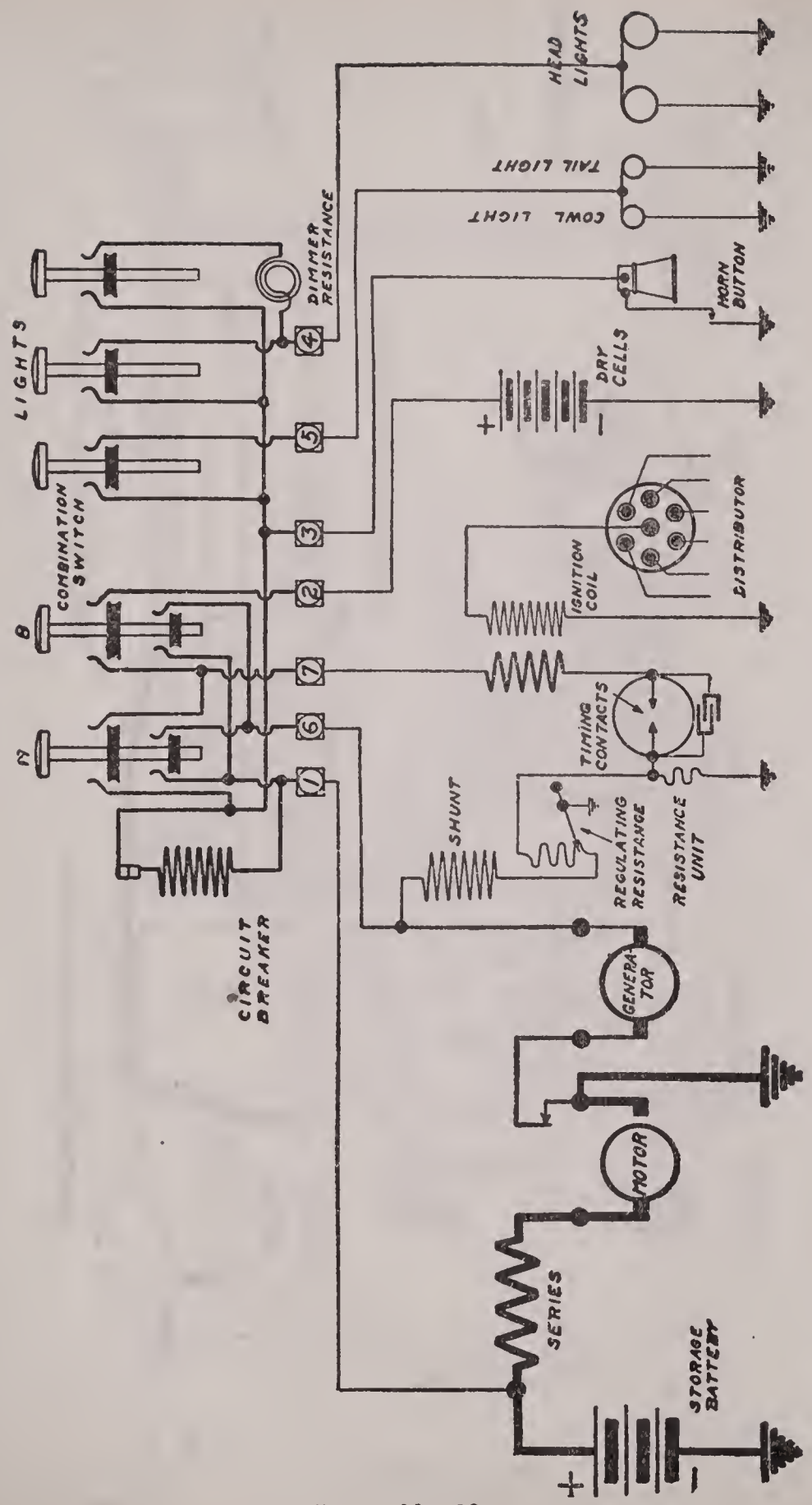


PLATE No. 99

Buick

MODEL C-36, 37, 54 AND 55

DELCO STARTING AND LIGHTING SYSTEM. DELCO IGNITION

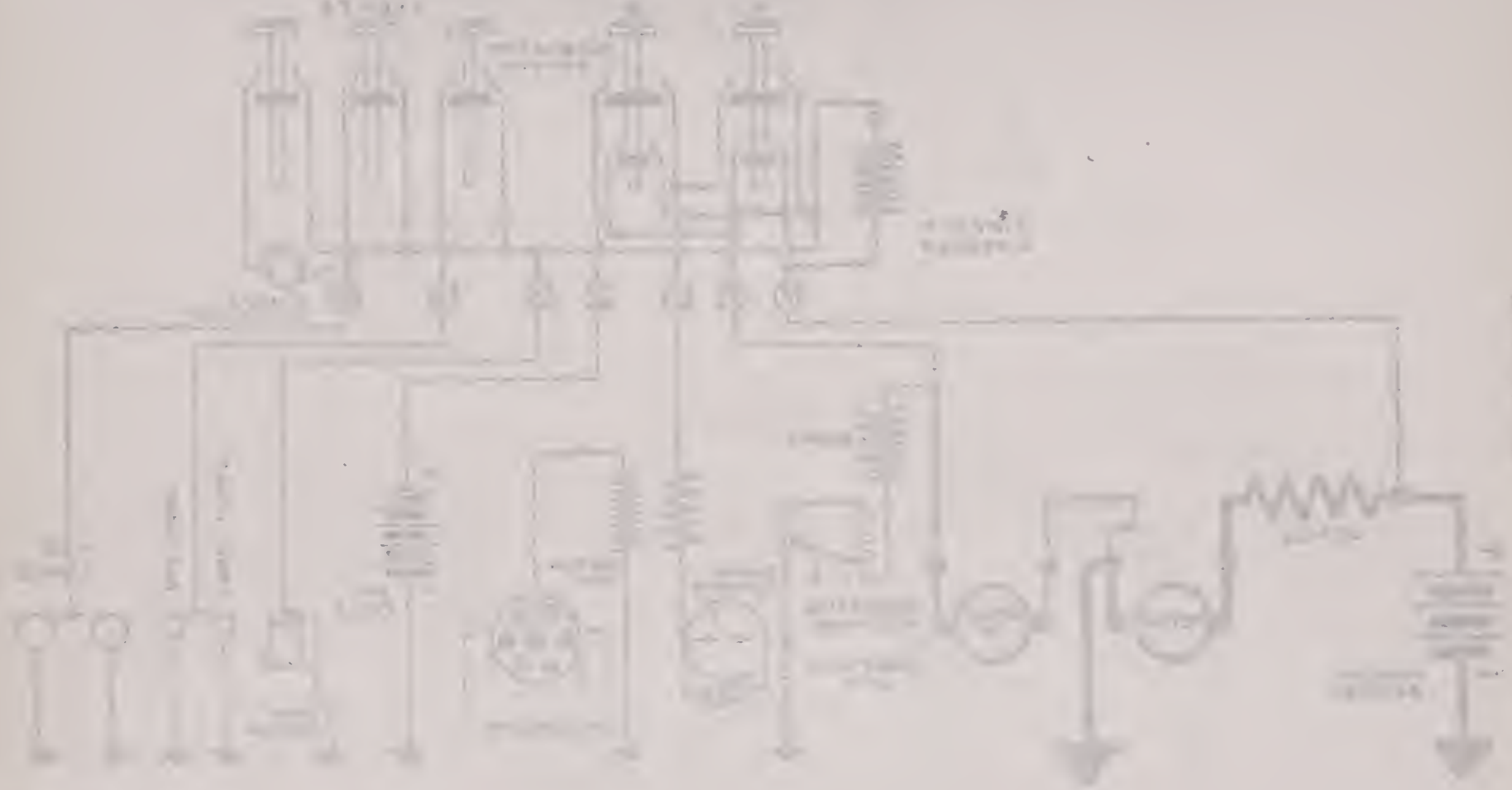
Battery is 6 volt, 100 ampere-hour. The negative terminal is grounded.

Breaker contacts should open .018 in. to .020 in. On the "Six" the contacts should just begin to open when the piston receiving the spark is on top dead center, spark control lever in the fully retarded position. The firing order is 1, 4, 2, 6, 3, 5. On the "Four" the breaker contacts should just begin to open when the piston receiving the spark is on top dead center, spark control lever midway between the fully advanced and fully retarded position. The firing order is 1, 3, 4, 2.

The driving power of the motor is transmitted to the flywheel through a mechanical pinion shift. There is a relay on the Models 36 and 37. When the starter pedal is depressed a catch on the pinion shifting rod mechanically closes the relay contacts, causing the generator to operate as a motor to facilitate the meshing of the gears. After the gears are drawn into mesh the negative generator brush is raised, immediately after which the positive motor brush is allowed to come in contact with the commutator, thus applying full battery pressure to the motor, cranking the engine. On the Models 54 and 55 there is no relay. When the ignition switch is closed, the generator runs as a motor to facilitate the meshing of the gears. When starting pedal is depressed, gears are meshed, generator circuit is broken and motor brush is allowed to come in contact with the commutator, applying battery pressure to motor, cranking the engine.

On the Models 36 and 37 the voltage regulation is by reverse series field. On the Models 54 and 55 the voltage regulation is by regulating resistance in series with the shunt field. This device is described on Plate No. 73. Generator should begin to charge at about 8 miles per hour. Maximum charging rate of 16-20 amperes is reached at about 18 miles per hour. This rate reduces at higher speeds. For testing of motor and generator see Plates No. 70 and 71.

Head lamps are 6-8 volt, 17 cp. Side lamps are 6-8 volt, 6 cp. Dash and tail lamps are 6-8 volt, 2 cp. Fuses are 10 or 20 ampere.



Kissel Kar

Model 4-36 (1915)

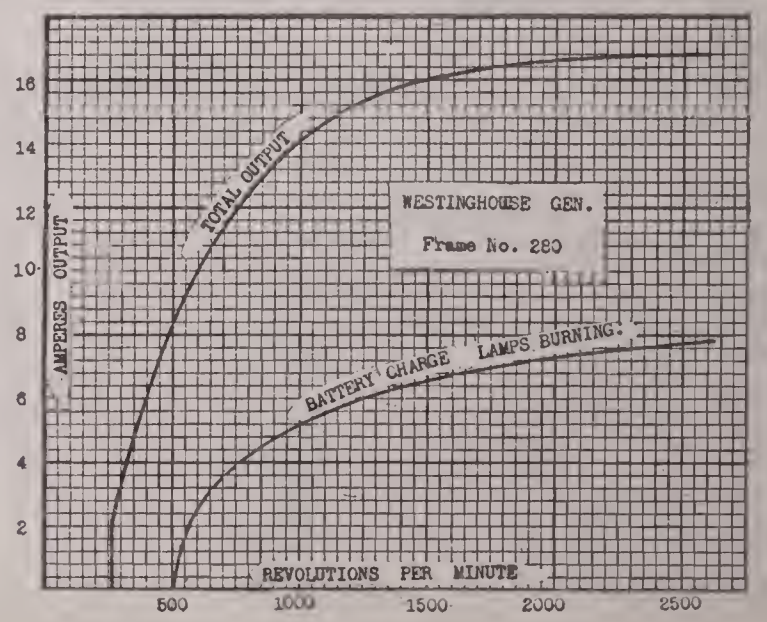
Westinghouse and Kissel Starting and Lighting System
Westinghouse Ignition

Battery is 6 volt, 100 ampere-hour. The positive terminal is grounded.

Breaker contacts should separate .005 in. to .008 in. Spark gap should be .020 in. to .025 in. Spark advance is by a governor on the timer shaft. The governor weights should clear their spring support by approximately .01 in. Breaker contacts should open when the piston entering power stroke is on top dead center, spark lever within one inch of the fully retarded position. The firing order is 1, 3, 4, 2. Distributor brushes should slide freely in their holders and the spring should push them out so that they extend ¼ in. from their holders, when the distributor is removed. These brushes should be retained firmly by their springs so that they do not fall out. Be sure that both these brushes are in place in the distributor. The distributor gear is meshed with the pinion on the generator shaft so that the mark on the edge of the gear, lines up with the tooth of the pinion that is slightly beveled. The starter is of Kissel manufacture. Its driving power is transmitted to the flywheel by Bendix drive. Once every month, or 1,000 miles, put several drops of light oil in each of the motor oilers. Starter should crank engine at approximately 150 R. P. M.

Voltage regulation of the generator is by reverse series field. Relay should close at about 7-10 miles per hour. The maximum charging rate is about 10 amperes at 2200 R. P. M. of the generator. The curve below shows the characteristics of the generator.

Head lamps are 6-8 volt, 18 cp. Tail lamp is 6-8 volt, 2 cp. Dash lamp is 6-8 volt, 2 cp. Dash and tail lamps each take 42 amperes. The head lamps take 3 amperes each. Twenty-ampere fuses are used.



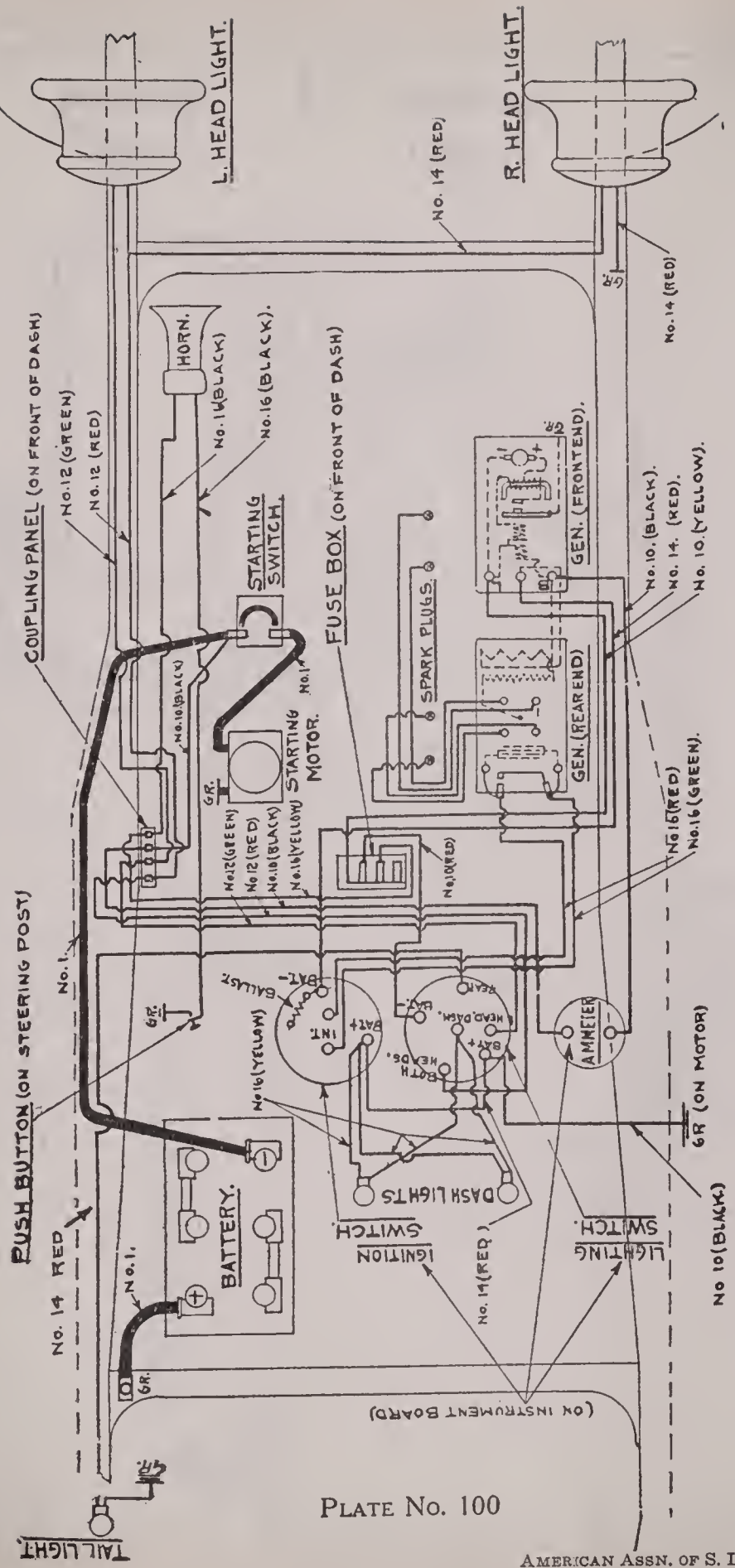


PLATE No. 100

Oakland

MODELS 42, 6-60 (1913)

Oldsmobile

MODEL 53 (1913)

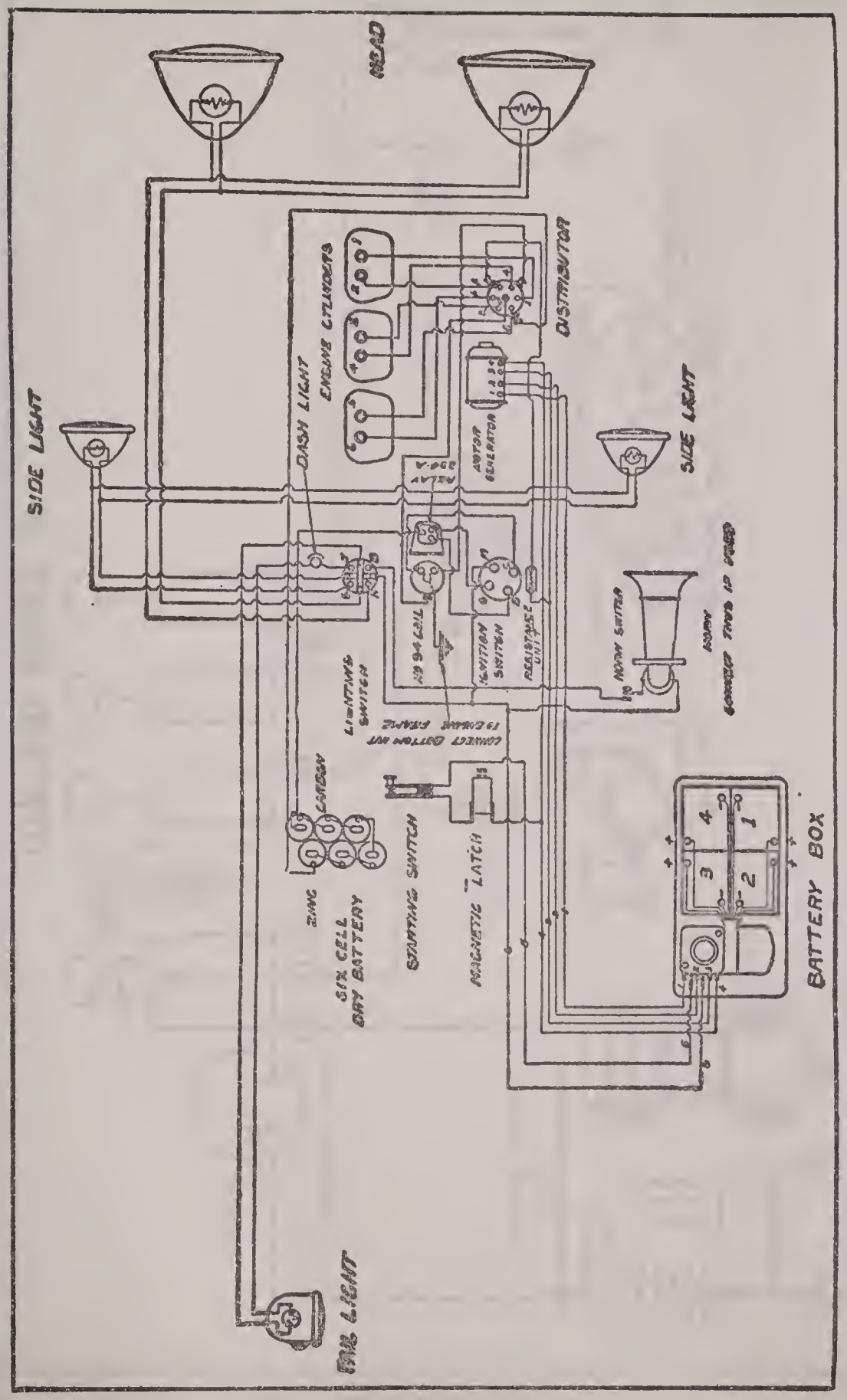
DELCO 6-24 VOLT, SINGLE-UNIT, STARTING AND LIGHTING SYSTEM
DELCO IGNITION

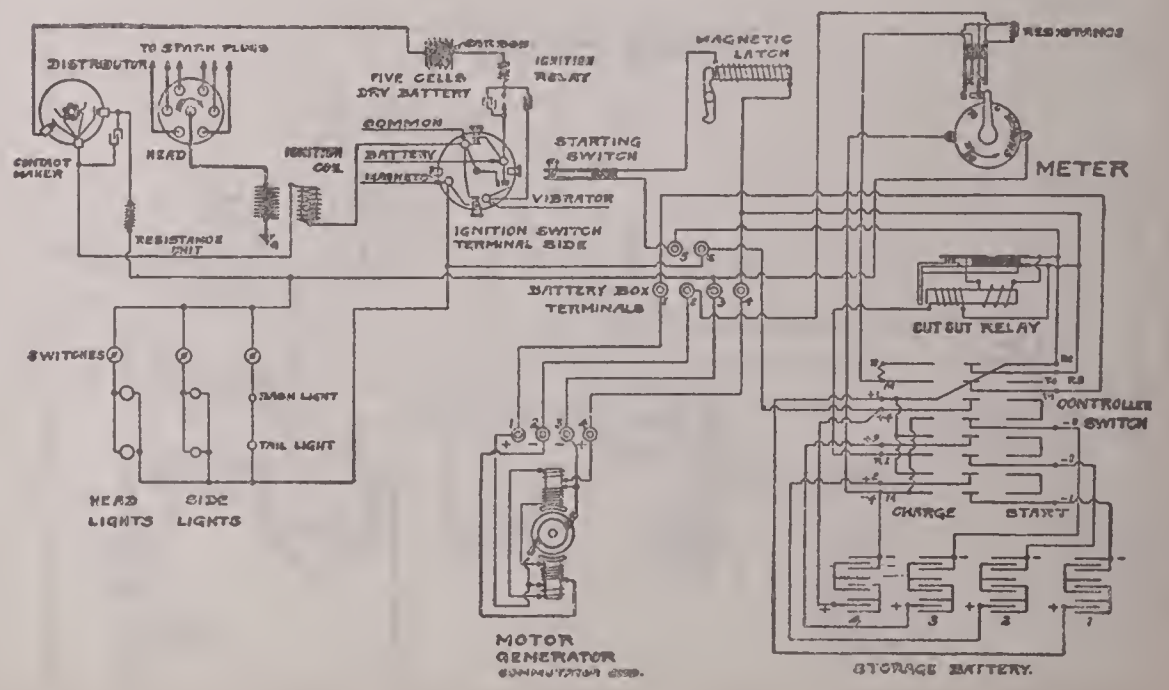
Battery is 24 volt, 35 ampere-hour. The two-wire system is used.

Breaker contacts should open .018 in. to .020 in. Break should occur on top dead center, spark retarded. The firing order is 1, 5, 3, 6, 2, 4. Six dry cells are provided to supply the current for ignition while cranking. An ignition relay is used to produce a shower of sparks across the gap. For the care of this relay see Plate No. 68. A ground in the dry cell circuit may cause the "Mag" ignition to fail entirely yet not affect the dry cell ignition.

For care of the motor-generator, see Plate No. 72.

Head lights are 7 volt, 16 cp. Side lights are 7 volt, 4 cp. Dash and tail lights are in series. They are 3.5 volt, 2 cp.





Oakland

Model 38-50 (1916)

Delco Starting and Lighting System. Delco Ignition

Battery is 6 volt, 100 ampere-hour. The negative terminal is grounded.

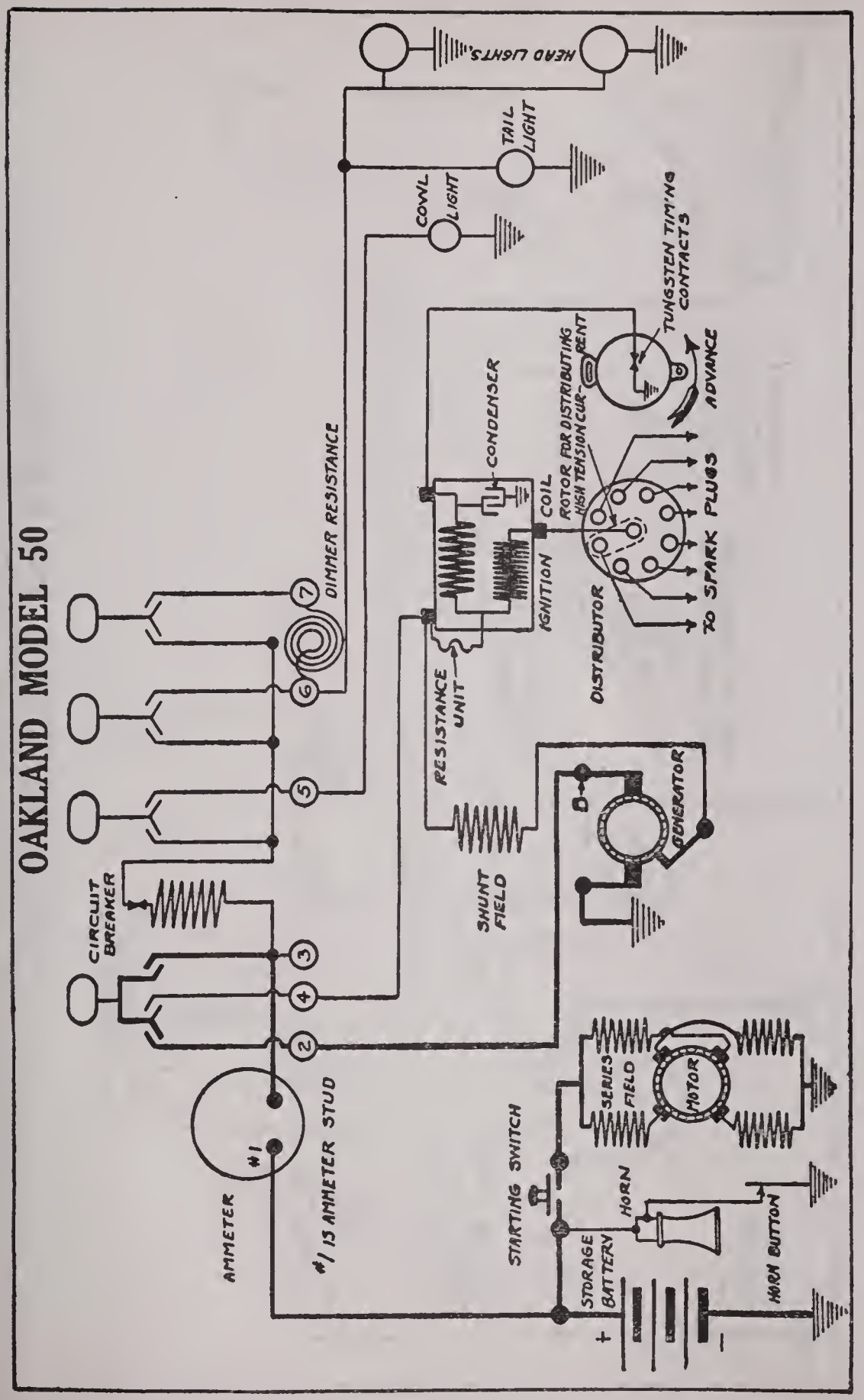
The Model 38, four cylinder car, uses single unit system. The grounded brush is lifted to open starting circuit. Voltage regulation is by third brush. The Model 50, eight cylinder car, uses the two unit system. Motor is four pole instead of two pole as on the other model. On this model a starting switch is provided. Voltage regulation is by third brush. See Plate No. 77. There is no relay. Ignition switch controls circuit between generator and battery. On the Model 38 car the circuit between terminals B on generator and No. 2 on switch is broken during cranking operation.

For testing of ignition units see Plate No. 69. Timing contacts are made of tungsten metal. For care see Plate No. 20. On the Model 38, the break occurs just a trifle after the mark U. D. C. 1-4 on flywheel passes indicator, spark fully retarded. Firing order is 1, 3, 4, 2.

On the Model 50, spark occurs when cylinder on power stroke is on upper dead center, spark at full retard. Firing order is 1, 8, 3, 6, 4, 5, 2, 7.

Ammeter shows rate of charge or discharge. Generator should begin to charge at 7 miles per hour. Maximum charging rate of 14-16 amperes is reached at 16-18 miles per hour. This rate decreases at higher speeds. Maximum output of generator should never exceed 25 amperes. Never run generator with battery disconnected.

Head lights are dimmed by throwing a resistance in series with them. Tail light is on head light circuit. Head lights are 7 volt, 15 cp. Tail light is 7 volt, 2 cp. Dash light is 7 volt, 2 cp.



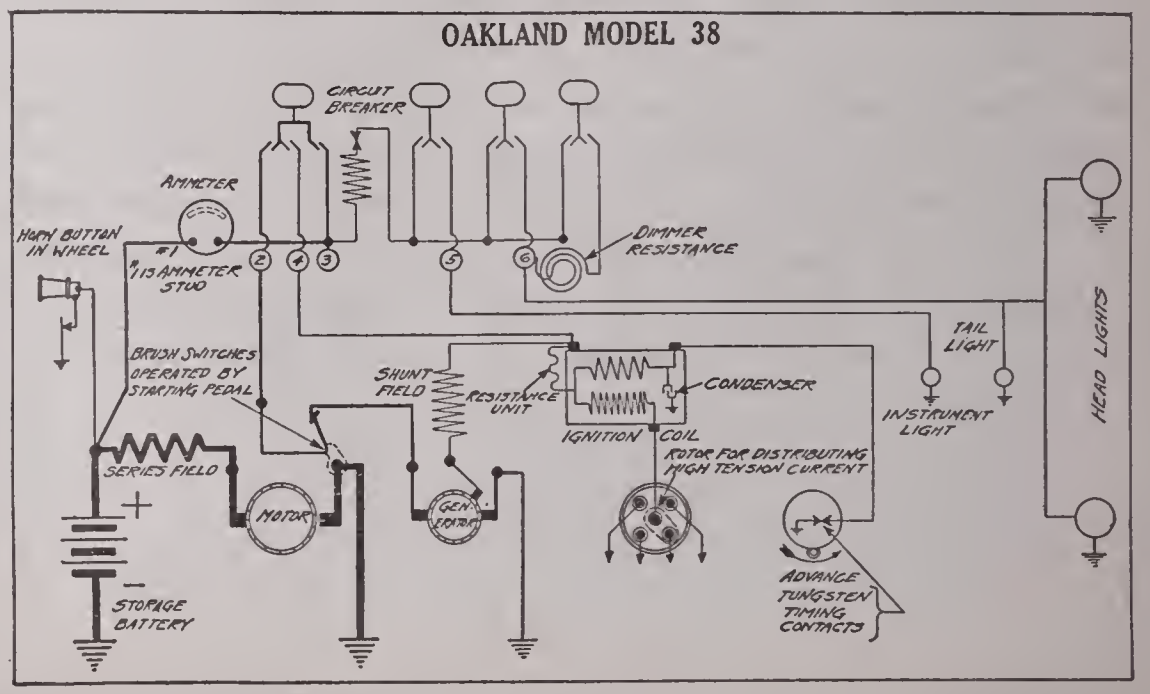


Plate No. 102

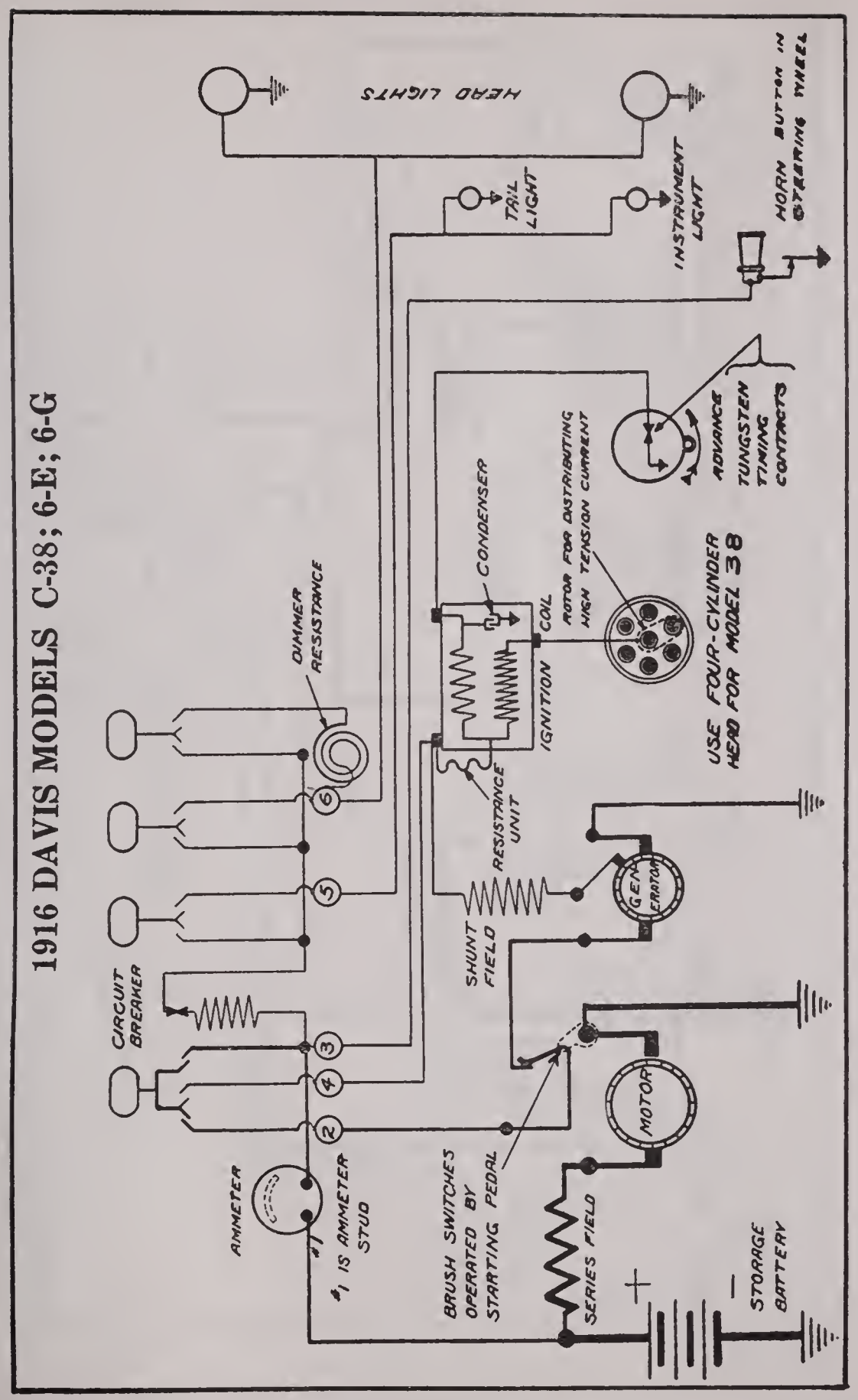


PLATE NO. 104

Davis

MODELS C-38, 6-E, 6-G (1916)

DELCO DOUBLE-UNIT STARTING AND LIGHTING SYSTEM. DELCO IGNITION

Battery is 6 volt, 100 ampere-hour. The negative terminal is grounded.

Timing contacts are of tungsten metal. See Plate No. 20. Contacts open .018 in. Break occurs when dead center mark is 1¾ in. past indicator, spark retarded. Firing order is 1, 5, 3, 6, 2, 4. For testing of ignition units see Plate No. 69.

Voltage regulation is by third brush. See Plate No. 77. There is no relay. Circuit between battery and generator is controlled by ignition switch. There is an overrunning clutch to allow generator to run as a motor while starting or when pressure it is producing is below that of battery, ignition switch being closed, completing the circuit between generator and battery. Generator begins to furnish current at about 7 miles per hour. Ammeter shows rate of charge or discharge. Maximum charging rate should not exceed 20 amperes at 20-25 miles per hour.

Cranking circuit is opened by raising one of the motor brushes. Motor is connected to engine by non-automatic, mechanical pinion shift. When ignition switch is closed generator runs as a motor, to facilitate meshing of gears. When starting pedal is depressed gears are drawn into mesh, generator circuit is broken and motor brush is allowed to come into contact with commutator, thus applying battery pressure to motor, cranking engine. When starting pedal is released, a spring draws the gears out of mesh, raises motor brush and completes generator circuit. There is a clutch to prevent engine driving motor.

A circuit breaker takes the place of fuses in the lighting circuit. Head lights are 6-8 volt, 16 cp. Tail light is 6-8 volt, 4 cp. Dash light is 6-8 volt, 4 cp.

Davis

Models 6I, 6K (1917)

Delco Two-Unit Starting and Lighting System. Delco Ignition

Battery is 6 volt, 120 ampere-hour. The negative terminal of battery is grounded.

Breaker contacts are made of tungsten metal. For care see Plate No. 20. Contacts open .018 in. to .020 in. Break occurs when dead center mark on flywheel is 1½ in. past indicator, spark fully retarded. Firing order is 1, 5, 3, 6, 2, 4. For testing of ignition units see Plate No. 69. Spark gap should be about .030 in.

Motor is connected to engine by Bendix gear. The motor requires no lubrication whatever.

Voltage regulation is by third brush. There is no relay. Ignition switch controls circuit between generator and battery. Generator begins to supply current at 7 miles per hour. Maximum charging rate of 14-16 amperes is reached at 20-22 miles per hour. This rate decreases to 8 amperes at about 40 miles per hour. Maximum generator output should never exceed 20 amperes. Ammeter shows rate of charge or discharge. The curve, Figure 2, shows the output of the generator, although considerable variation may be made by adjusting the third brush. The oiler at the rear of the generator should receive four or five drops of light engine oil every week. Every two weeks put about ½ ounce of light engine oil in the front generator oiler. This oiler provides lubrication to the bearing, distributor driving gears, and the overruning clutch. Any excess oil will flow out the drain provided.

A circuit breaker back of the combination light and ignition switch takes the place of fuses in the lighting circuit.

Dash light is 6-8 volt, 4 cp. Tail light is 6-8 volt, 4 cp. Head lights are 6-8 volt, 15 cp.

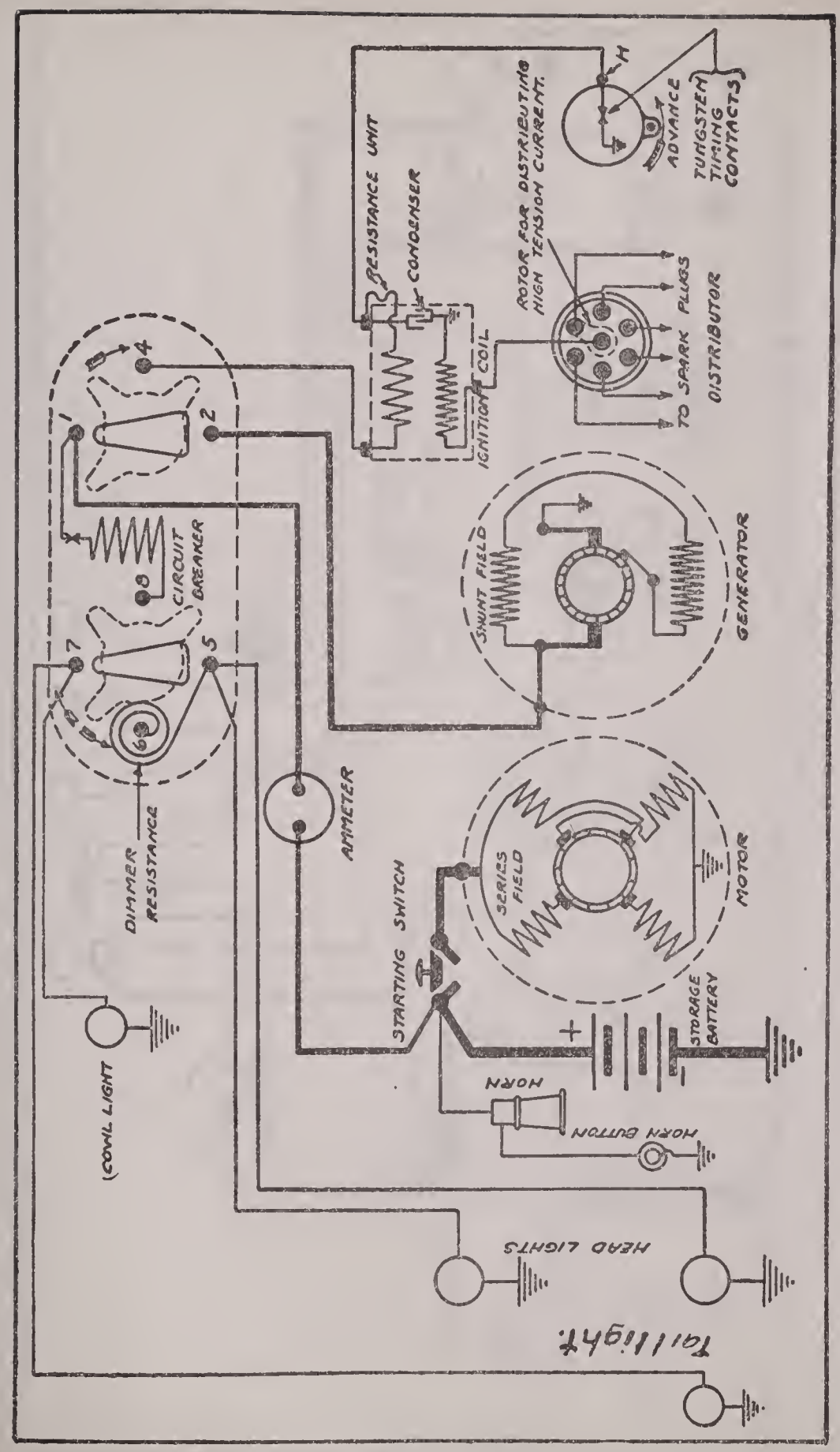
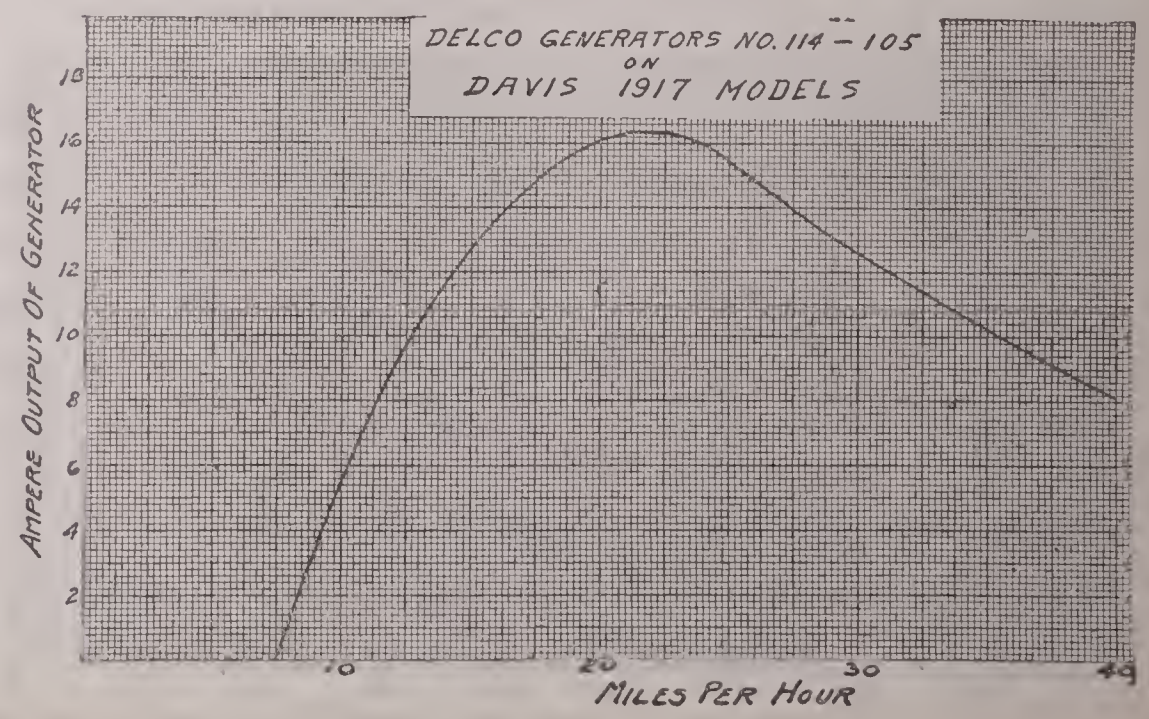


Plate No. 105



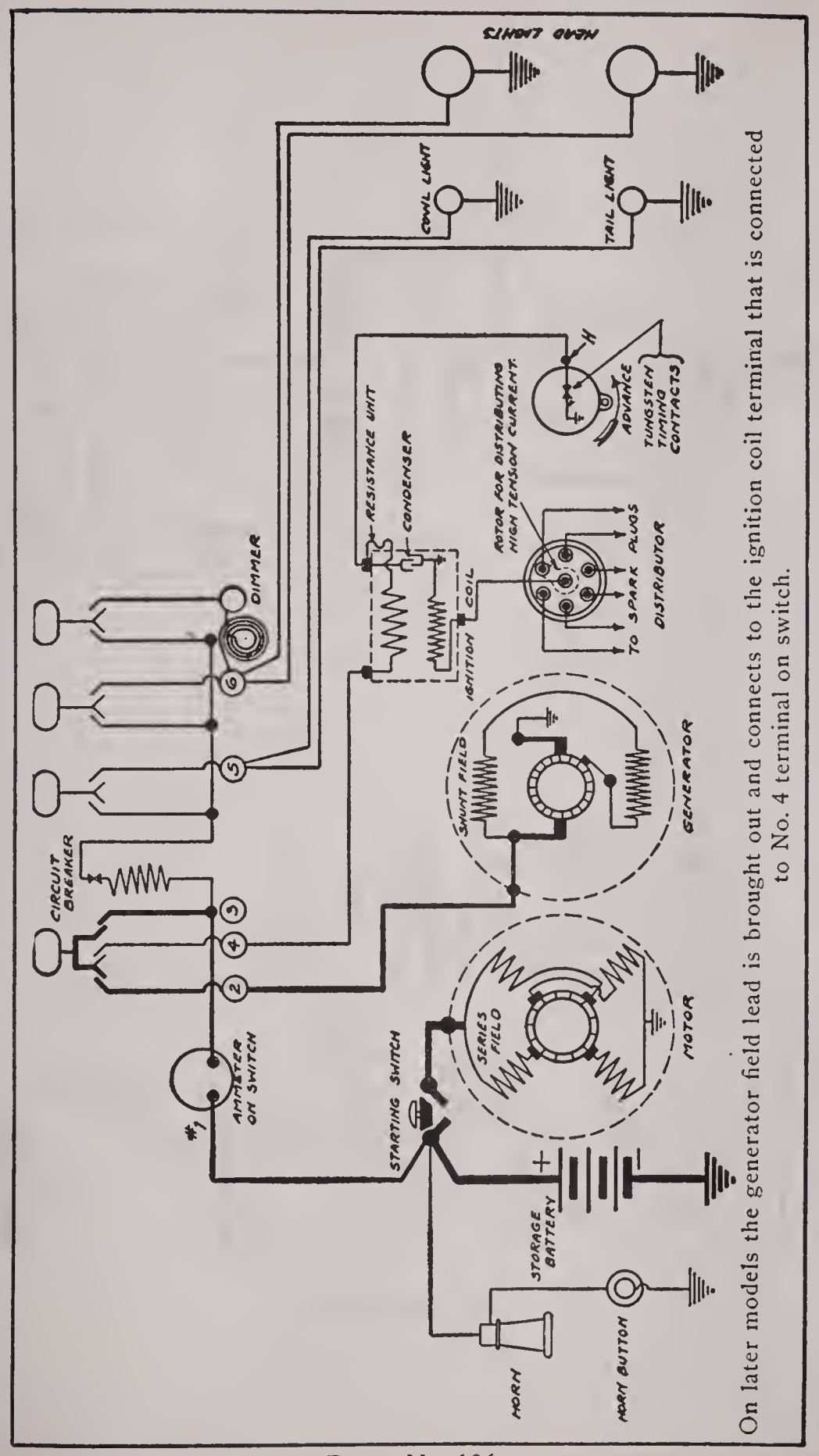


PLATE No. 106

Davis

MODEL 6 J (1917-18-19)

DELCO TWO-UNIT STARTING AND LIGHTING SYSTEM. DELCO IGNITION

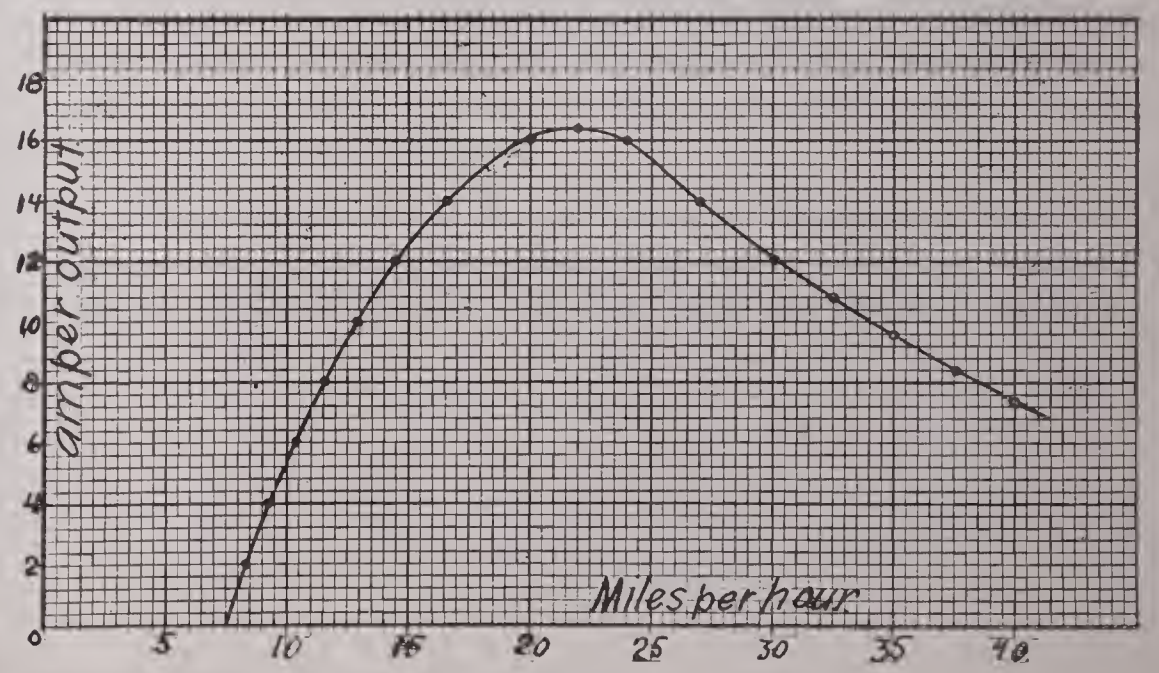
Storage battery is 6 volt, 100 ampere hour. The negative of battery is grounded.

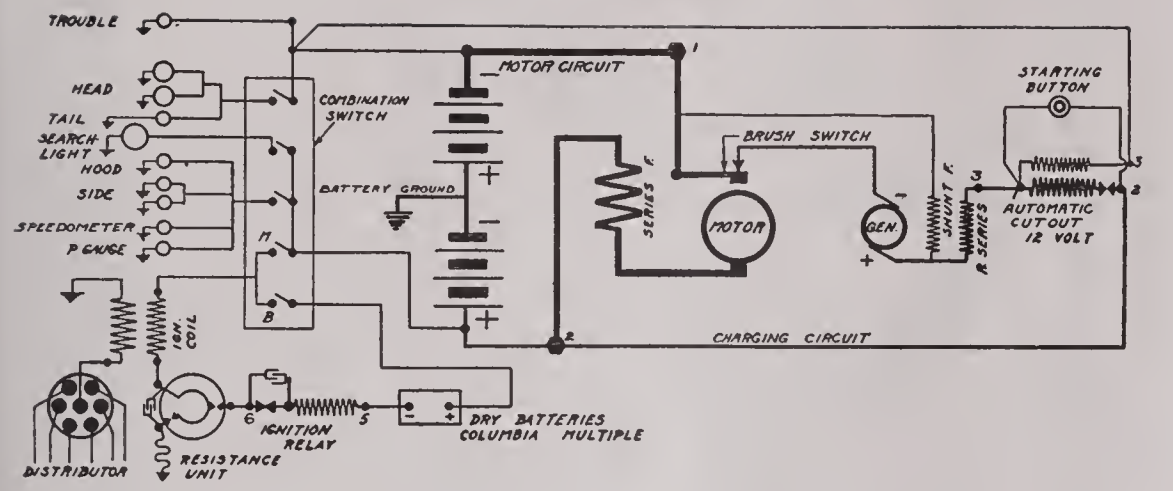
Breaker contacts open .018 in. to .020 in. Contacts are of tungsten metal. For care of these contacts see Plate No. 21. Break occurs when upper dead center mark on flywheel is 1¾ in. past indicator, spark fully retarded. The firing order is 1, 5, 3, 6, 2, 4. The spark gap should be .030 in. For testing of ignition units see Plate No. 69.

Voltage regulation is by third brush. There is no relay. Circuit between generator and battery is controlled by ignition switch. Ammeter shows rate of charge or discharge. Generator begins to charge at about 7 miles per hour. Maximum charging rate of 14-15 amperes is reached at 20-22 miles per hour. This rate decreases to about 8 amperes at 40 miles per hour. Maximum output of generator should never exceed 20 amperes. For adjustment of third brush see Plate No. 77. The curve shown in Fig. 2 is a fair average of the generator output. The output may be varied by the third brush. Every two weeks put ½ ounce of light engine oil in the front generator oiler. This oiler provides lubrication to the front generator bearing, the ignition unit driving gears and the overrunning clutch. Any excess oil will flow out the drain provided. Every week, put four or five drops of light engine oil in the rear generator oiler.

Motor is connected to engine by Bendix drive. The motor requires no oil.

A circuit breaker in back of the combination ignition and lighting switch takes the place of fuses in the lighting circuit. Tail light is 6-8 volt, 4 cp. Dash light is 6-8 volt, 4 cp. Head lights are 6-8 volt, 15 cp.





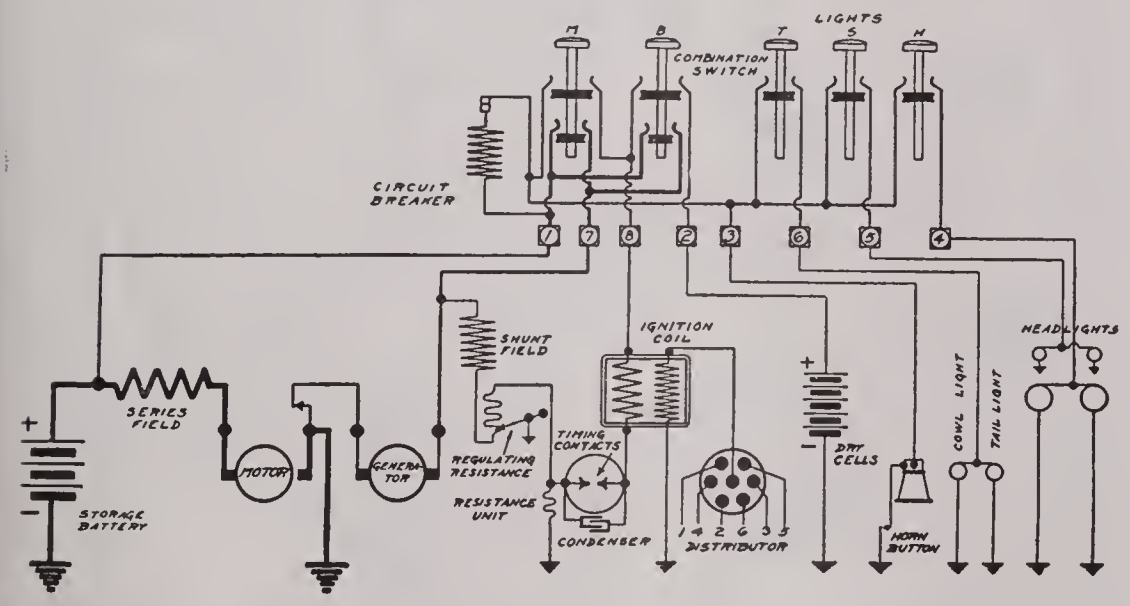


PLATE NO. 107

Auburn

MODEL 6-40, 1916

DELCO 6-VOLT, DOUBLE-UNIT, STARTING AND LIGHTING SYSTEM
DELCO IGNITION

Battery is 6 volt, 80 ampere-hour. The negative terminal is grounded.

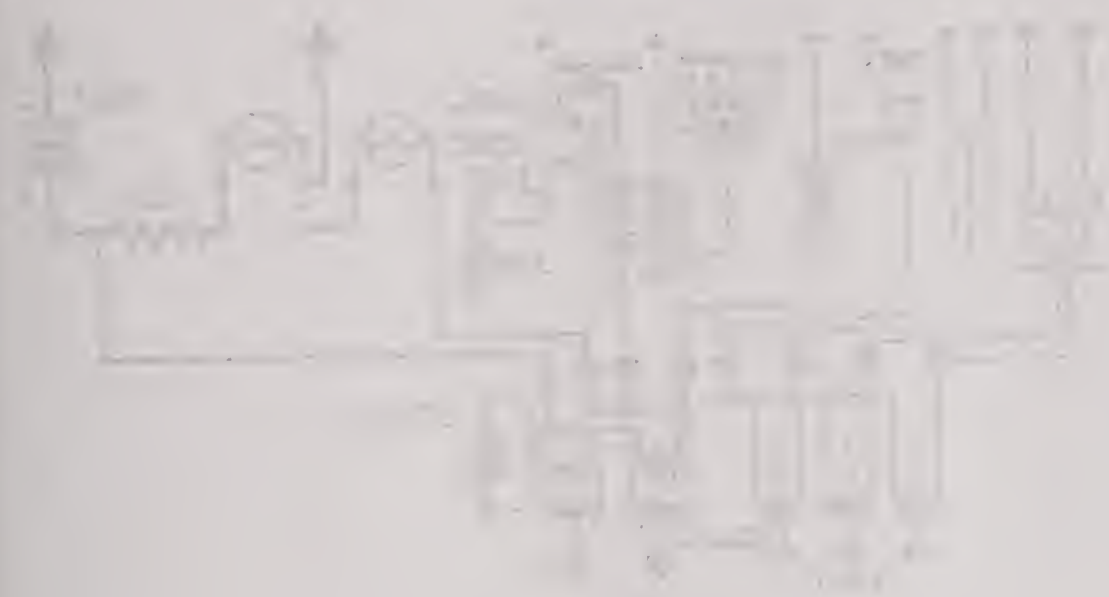
For testing of ignition units see Plate No. 60. Break occurs when dead center mark on flywheel is 1 1/4 in. past indicator, spark retarded. Firing order is 1, 4, 2, 6, 3, 5. There is a set of 5 dry cells connected in series to supply ignition current when starting.

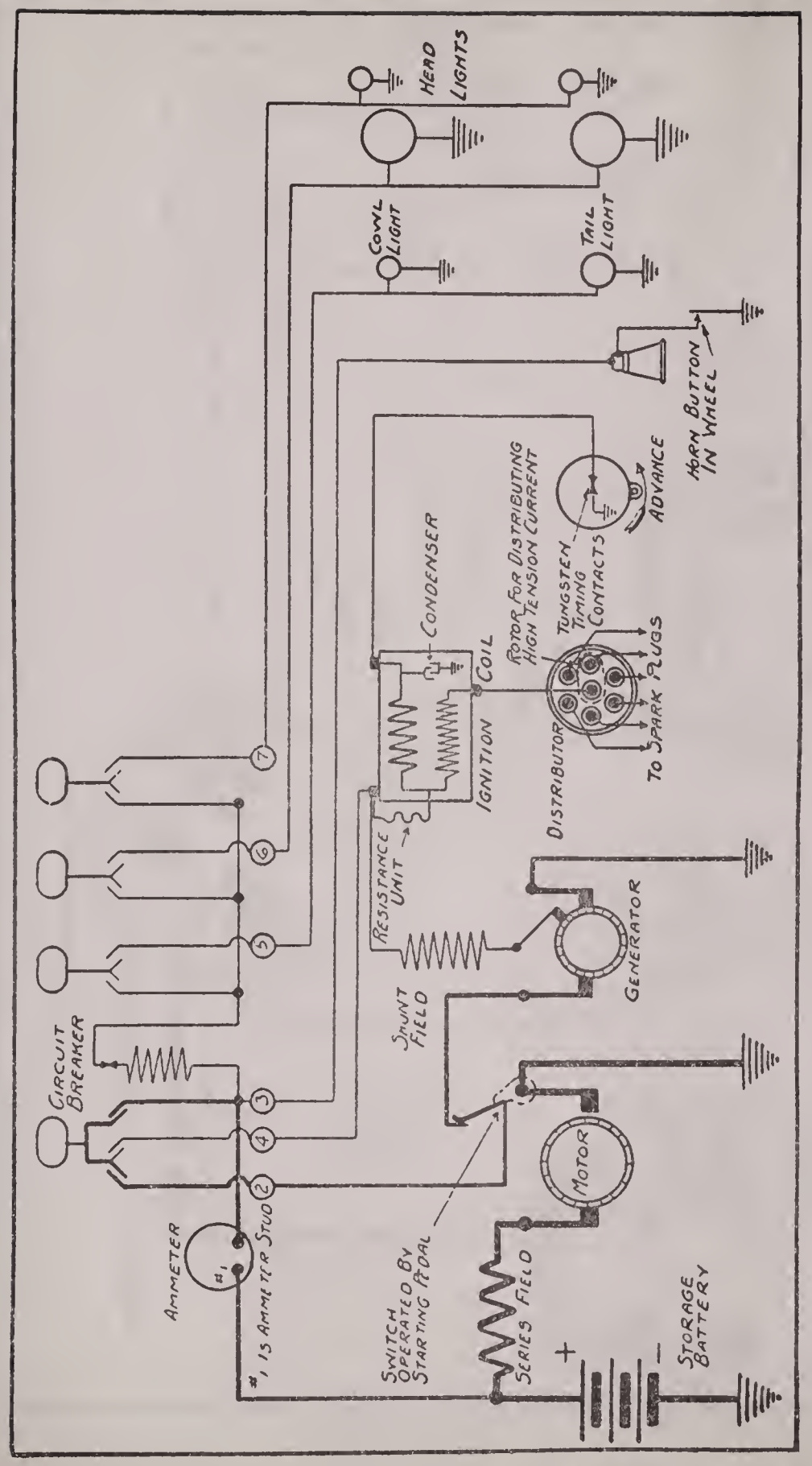
Cranking circuit is broken by raising one of the motor brushes. When the motor brush is allowed to come in contact the negative brush of generator is disconnected from ground. Generator runs as a motor when ignition switch is closed. This is to facilitate meshing of gears.

Voltage regulation is by a variable resistance in series with the shunt field. This consists of a coil of "Nichrome" wire on which a sliding contact rests. Contact is so arranged that it places more resistance in circuit as speed increases. It is operated by a governor on timer shaft. For adjustment see Plate No. 73.

There is no relay, circuit between generator and battery being controlled by ignition switch. There is an over-running clutch at driving end to allow generator to run as a motor when battery pressure is above that which generator is developing. There is a clutch to prevent engine driving motor.

A circuit breaker takes the place of fuses in the lighting circuit. Dash and tail lights are both controlled by same switch. Dash light is 7 volt, 2 cp. Tail light is 7 volt, 2 cp. Small head lights are 7 volt, 6 cp. Large head lights are 7 volt, 16 cp.





Auburn

6-40A (1916) and 6-44 (1917)

Delco Double-Unit Starting and Lighting System. Delco Ignition

Battery is 6 volt, 120 ampere-hour. The negative terminal is grounded.

Break occurs when dead center mark on flywheel is 1¼ in. past indicator, spark fully retarded. Firing order is 1, 4, 2, 6, 3, 5. For testing of ignition units see Plate No. 69.

There is a circuit breaker to take the place of fuses in lighting circuit. Ammeter shows rate of charge or discharge. There is no relay. There is an overrunning clutch to allow generator to run as a motor when starting or when it is not being driven fast enough to produce a pressure equal to or above that of the battery.

The motor is connected to the flywheel by a non-automatic mechanical pinion shift. When the ignition switch is closed the generator runs as a motor to facilitate the meshing of the gears. Moving the starting lever draws the pinion into mesh with the flywheel gear, opens the generator circuit and allows the motor brush to come in contact with the commutator, thus applying the full battery pressure to the motor, cranking the engine. There is an overrunning clutch to prevent the engine driving the starting motor.

Should the generator fail to motor when the ignition switch is closed, first see that the switch contact fingers are in good order, then remove the front cover of the motor-generator and try to turn the armature by hand. Should it turn freely, look for defective battery connection or defective connections at the motor, or open circuits between the motor-generator and the battery. If the armature cannot be turned with the fingers the clutch is sticking and must be taken down and repaired.

For testing of the field coils and the armature, see Plates No. 69, 70 and 71.

Voltage regulation is by third brush. See Plate No. 77. Maximum charging rate with no lights burning should never exceed 20 amperes.

Dash light is 7 volt, 2 cp. Tail light is 7 volt, 2 cp. Small head lights are 7 volt, 6 cp. Large head lights are 7 volt, 16 cp.

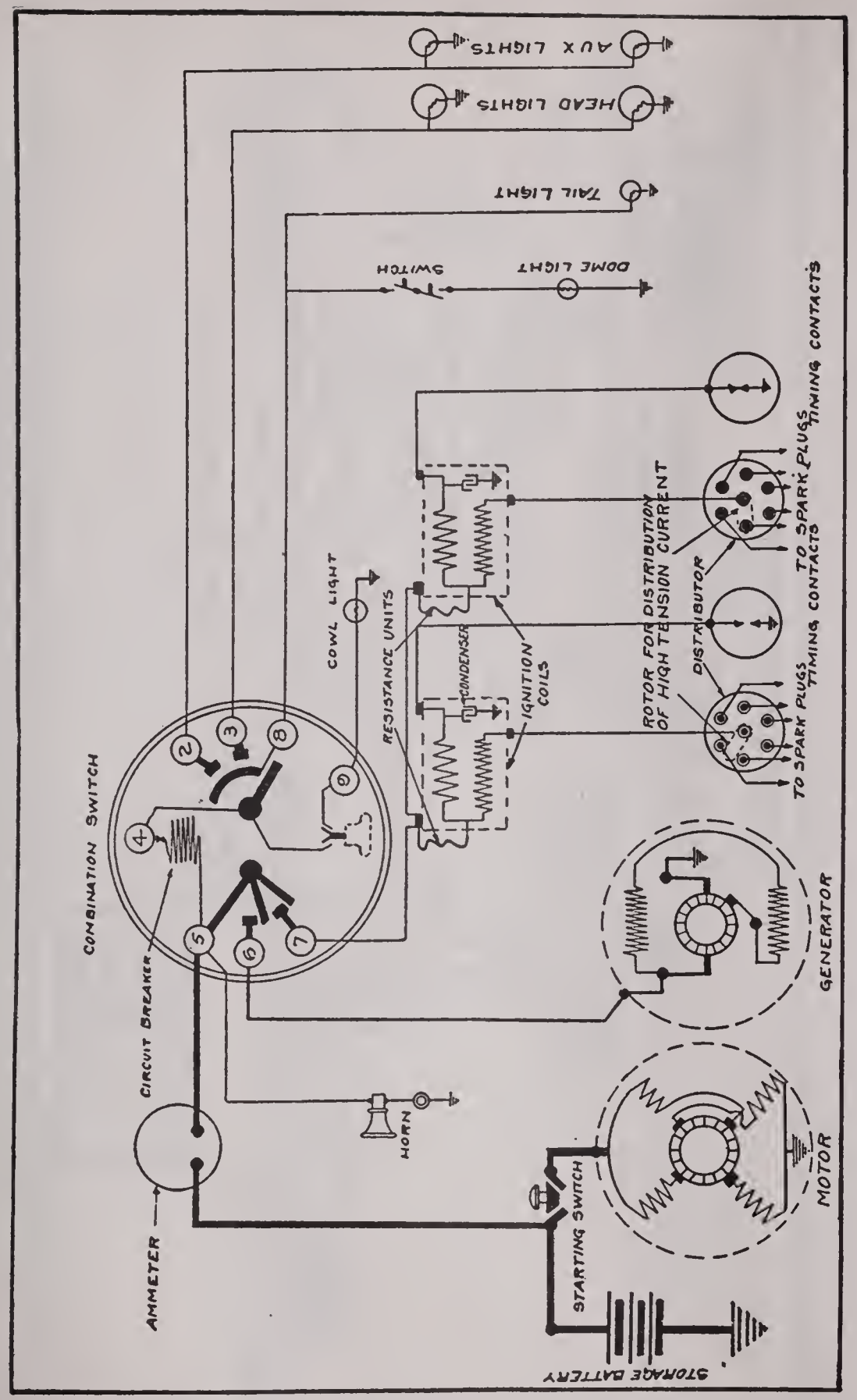


PLATE No. 109

Kissel Car

12 CYLINDER (1917)

DELCO TWO-UNIT STARTING AND LIGHTING SYSTEM. DELCO IGNITION

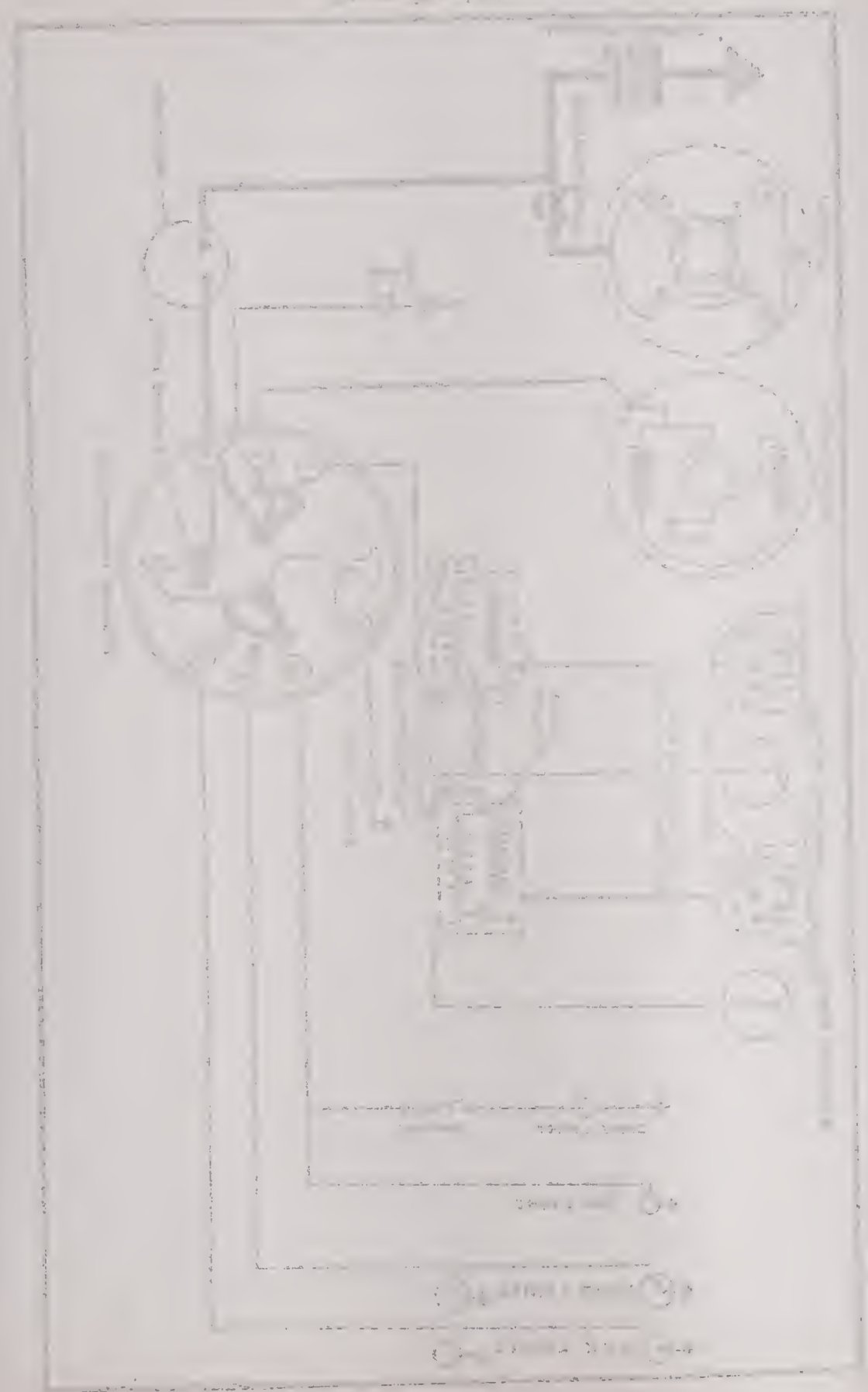
Battery is 6 volt, 100 ampere hour. The negative terminal is grounded.

There are two breakers, two distributors and two ignition coils on each car. (See Plate No. 69 for testing of ignition units.) (See Plate No. 20 for adjustment of tungsten contacts.) Break occurs when dead center mark on flywheel is at indicator, spark fully retarded. Firing order is 1, 5, 3, 6, 2, 4, on the left hand block, and 1, 4, 2, 6, 3, 5, on the right hand block.

Starter is connected to engine by Bendix gear.

Voltage regulation is by third brush. There is no relay. Ignition switch controls circuit between generator and battery. Generator starts to charge at 8-10 miles per hour. Maximum charging rate of 12-14 amperes is reached at 20 miles per hour. This rate reduces to almost nothing at 28-30 miles per hour. Ammeter shows rate of charge or discharge.

There is a circuit breaker to take the place of fuses. The negative terminal of the battery is grounded. Cowl light is 6-8 volt, 1-2 cp. Dome light is 6-8 volt, 4-6 cp. Large head lights are 6-8 volt, 21 cp., when no special lens is used. When a special lens is used, 15 cp. lights are used. Small head lights are 6-8 volt, 4-6 cp. Mazda lamps are used in all circuits.



Cadillac

1912 Model

Delco 6-24-Volt Starting and Lighting System. Delco Ignition

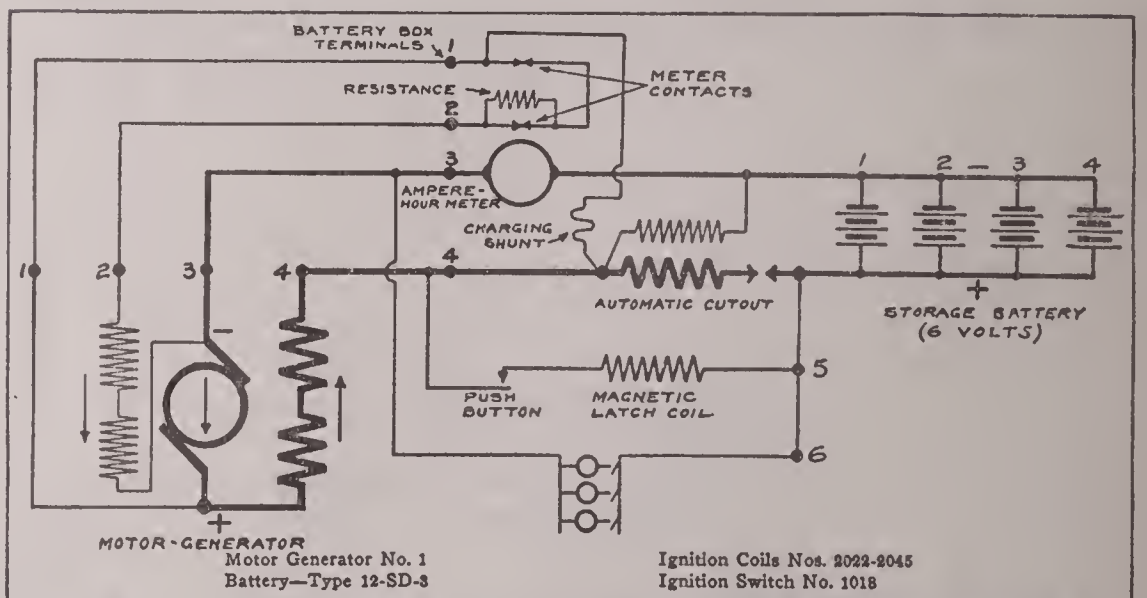
A set of 6 dry cells connected in series supply current for ignition when starting. For care of ignition relay see Plate No. 68. For testing of ignition units see Plate No. 69. Break occurs on upper dead center, spark retarded. Firing order is 1, 2, 4, 3.

A ground in battery ignition may cause magneto ignition to fail yet not affect battery ignition.

For description and care of Delco 6-24 volt system see Plate 72.

For care of Delco relay see Plate No. 86. Maximum charging rate of 20-22 amperes is reached at 18-20 miles per hour. This rate decreases at higher speeds. Charging rate should never exceed 25 amperes.

Dash and tail lights are in series. They are 3.2 volt, 2 cp. Side lights are 6.3 volt, 4 cp. Head lights are 6.4 volts, 16 cp.

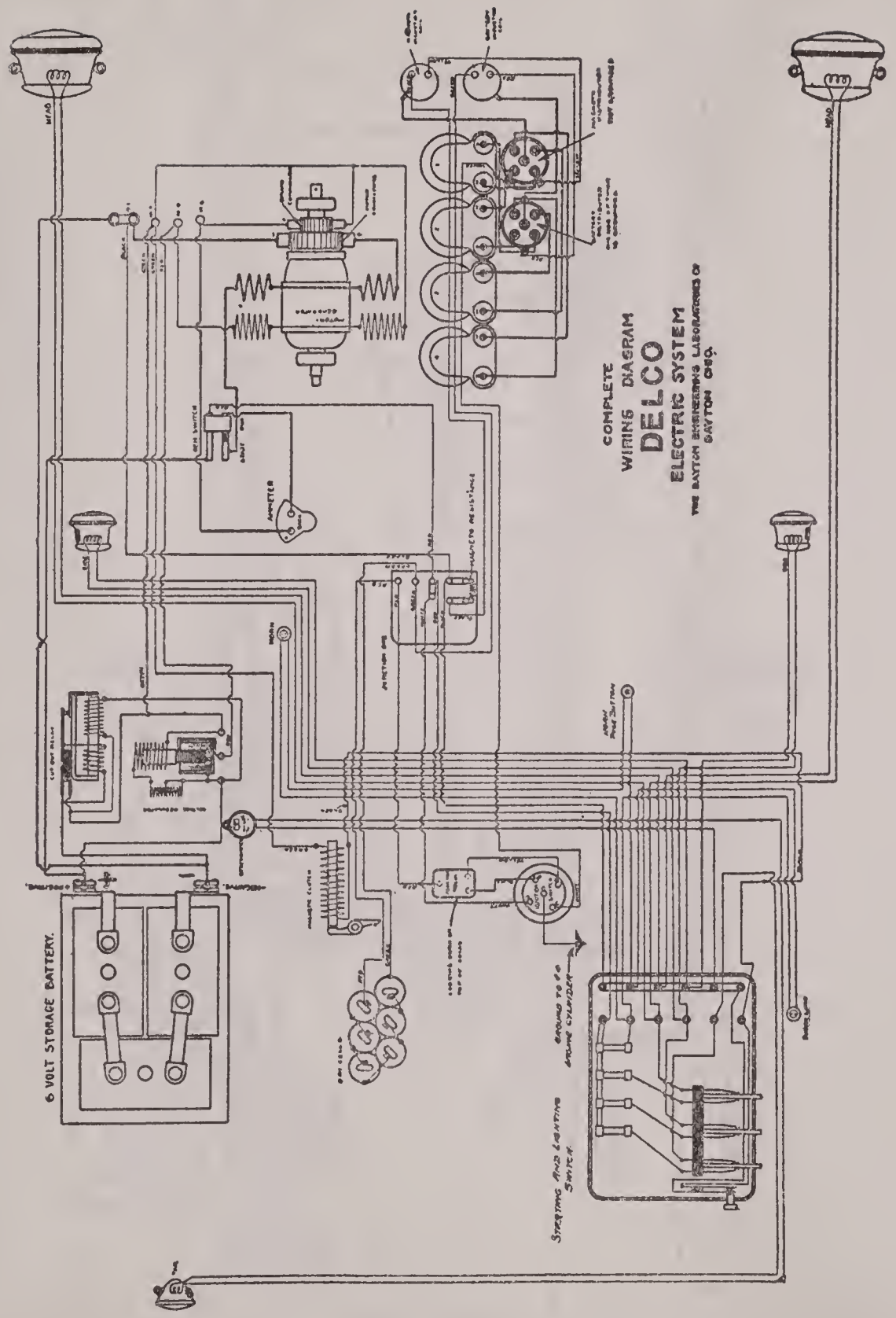


Motor Generator No. 1
Battery—Type 12-SD-3

Ignition Coils Nos. 2022-2045
Ignition Switch No. 1018

Note—This is a simplified circuit diagram applicable to all of the 6-24 volt systems, which shows the connections as they exist when the machine is operating as a generator. The heavy lines indicate the main charging circuit.

Plate No. 110



Cadillac

(1913)

DELCO 6-VOLT, DOUBLE-UNIT, STARTING AND LIGHTING SYSTEM
DELCO IGNITION

Battery is 6 volt, 120 ampere-hour. The two-wire system is used.

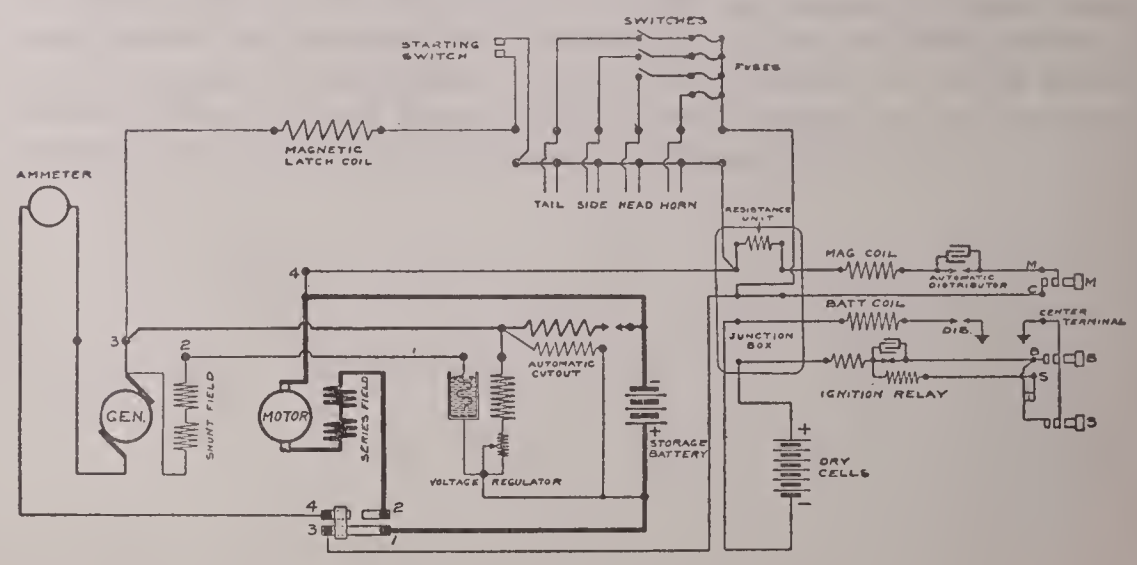
Break occurs on upper dead center, spark fully retarded. Firing order is 1, 2, 4, 3. A ground in battery may cause "Mag" ignition to fail yet not affect battery ignition. A set of six dry cells in series supply ignition current when using ignition relay while starting.

Motor-generator has two separate field windings, two armature windings and two commutators, similar to that described on Plates No. 65, 66 and 70.

Voltage regulation is by mercury regulator. (See Plate No. 65.)

For care of the cutout relay see Plate No. 86. For care of the ignition relay see Plate No. 68.

Dash and tail lights are in series. They are 3.2 volt, 2 cp. Side lights are 6.3 volt, 4 cp. Head lights are 6.4 volt, 16 cp.



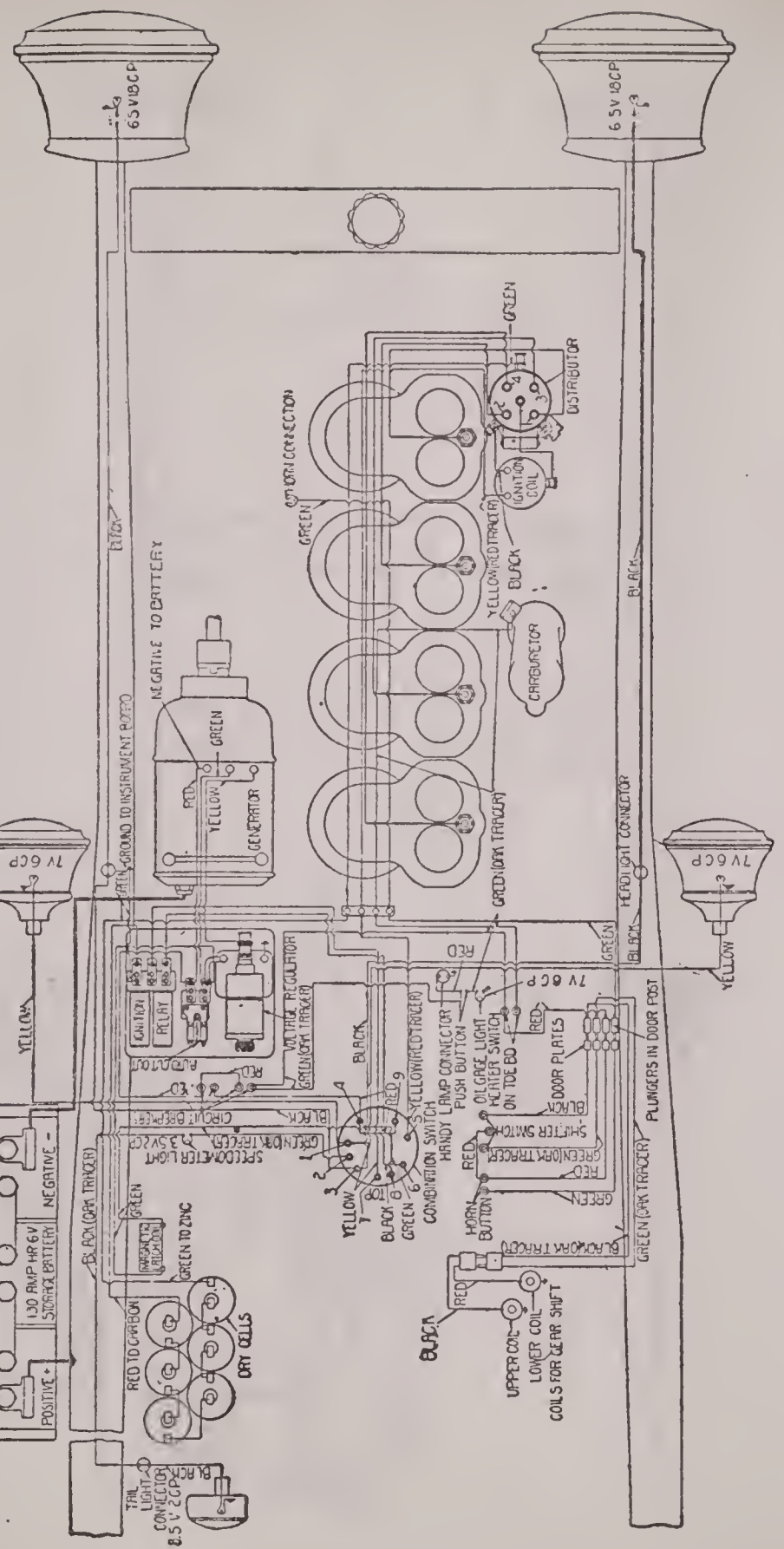


PLATE No. 112

Cadillac

1914 MODEL

DELCO, 1914 LARGE, DOUBLE-UNIT STARTING AND LIGHTING SYSTEM DELCO IGNITION

Battery is 6 volt, 130 ampere-hour. The postive terminal is grounded.

This model of Cadillac uses a system similar to that described on Plates No. 65 and 65A. On this car the motor-generator has two field coils instead of one, as described. Single-wire system is used.

For testing of ignition units see Plate No. 69. For description of ignition relay see Plate No. 68.

Break occurs at upper dead center, spark fully retarded. Firing order is 1, 2, 4, 3.

Spark advance is both automatic and manual. For care of tungsten timing contacts see Plate No. 20. A set of six dry cells connected in series provide current for ignition purposes when ignition relay is being used while starting. Contacts should open .016 in. to .018 in. Spark gap should be about .030 in.

Motor is connected to engine by non-automatic mechanical shift. When ignition switch is on "Batt" side and the button marked "Start" is pushed in, the ignition relay is placed in the ignition circuit (see Plate No. 68), and the circuit through the magnetic latch coil is completed. This closes relay, as described on Plate No. 65, and applies the battery pressure to generator, running it as a motor, to facilitate meshing of gears. Then depressing starting pedal draws gears into mesh, opens generator circuit and allows motor brush to come in contact with commutator, thus applying full battery pressure to motor windings and cranking engine. The operation is reversed when starting pedal is released. There is a clutch at driving end to allow generator to run as a motor, and another in the set of reduction gears, to prevent engine from driving motor.

Cadillac

Model 51 (1915)

Delco 6-Volt, Double-Unit, Starting and Lighting System
Delco Ignition

Battery is 6 volt, 130 ampere-hour. The positive terminal is grounded.

For testing of ignition units see Plate No. 69. Break occurs on upper dead center, spark retarded. Firing order is 1L, 2R, 3L, 1R, 4L, 3R, 2L, 4R. Numbering from the radiator back. Breaker contacts should open .020 in.

Motor is connected to flywheel by non-automatic mechanical shift. One motor brush is raised to open the cranking circuit.

Voltage regulation is by variable resistance. There is a coil of "Nichrome" wire in series with the shunt field. There is a sliding contact, operated by a governor on the distributor shaft, which cuts more resistance into the shunt field as the speed increases. (See Plate No. 73.) A set of dry cells supply ignition current while cranking. There is no relay. A circuit breaker takes the place of fuses. Maximum charging rate with no lights burning should not exceed 15-18 amperes.

Dash and tail lamps are in series. They are 3.5 volt, 2 cp. Side lights are 7 volt, 6 cp. Head lamps are 7 volt, 18 cp.

Ignition should not take more than 2 or 3 amperes with engine running normally.

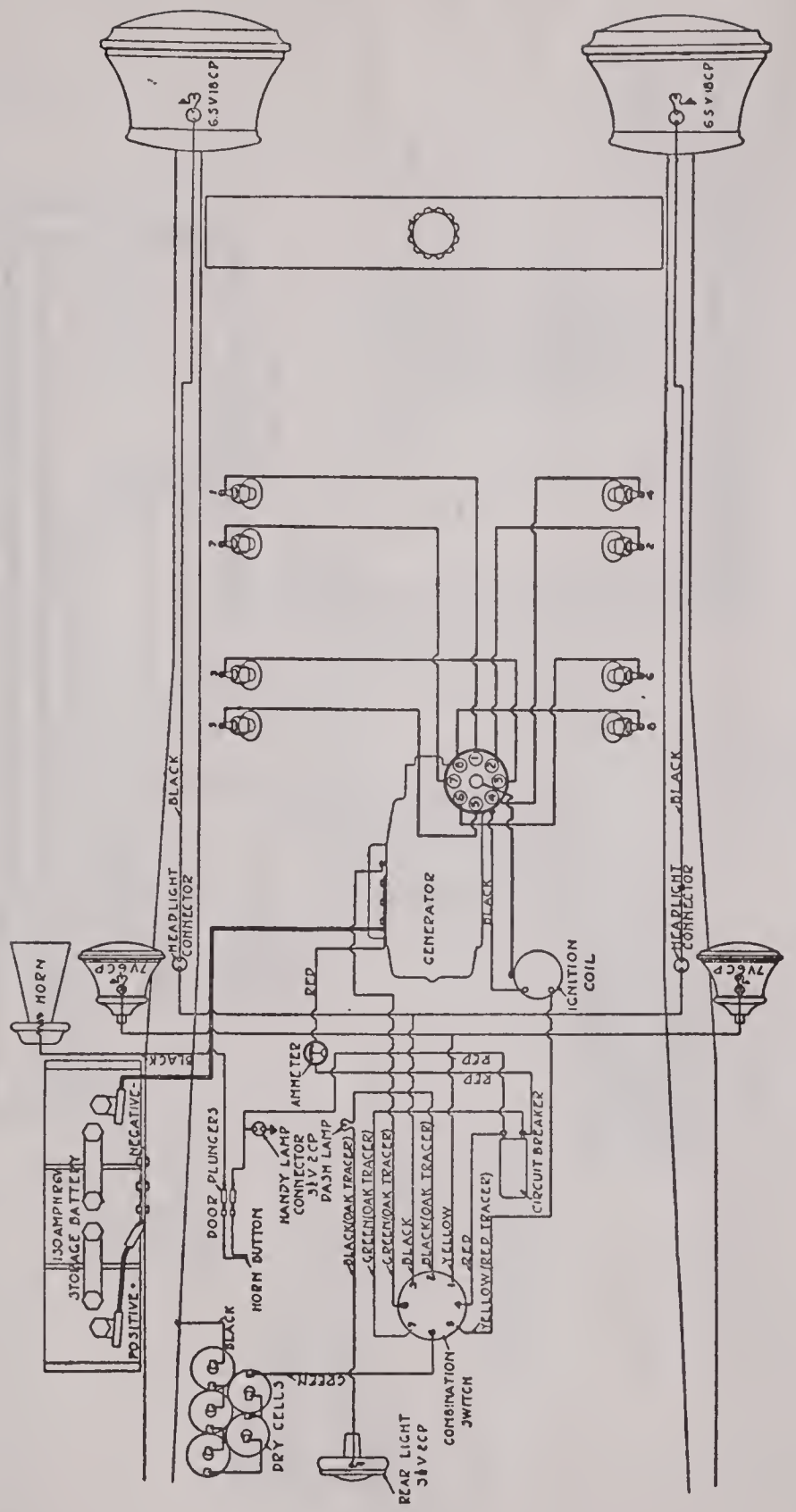
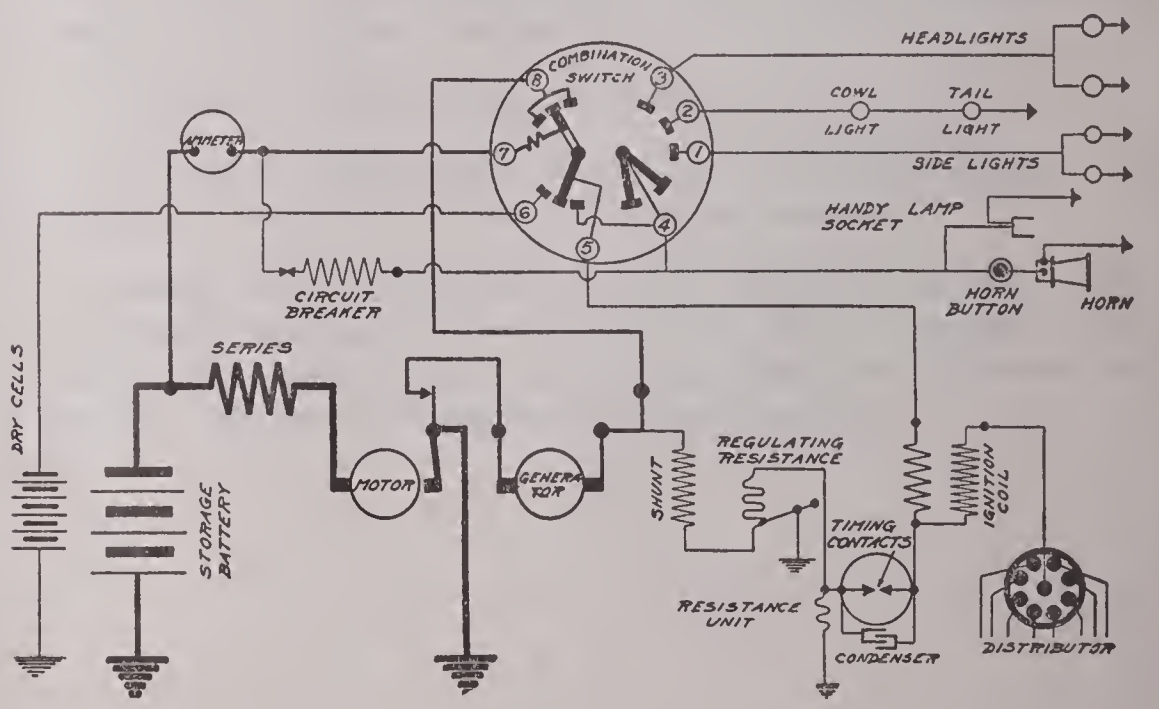
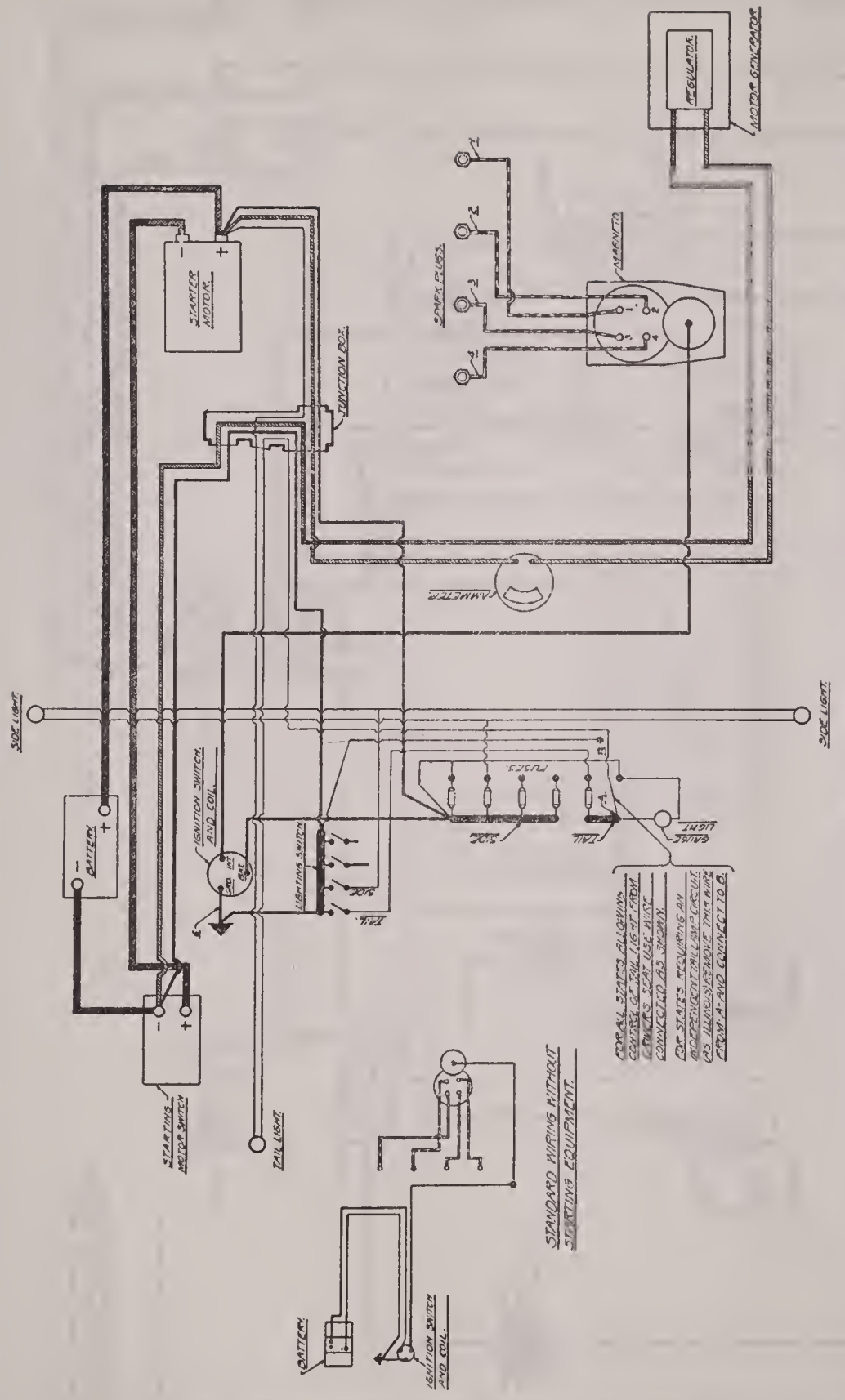


Plate No. 113





Wiring Diagram of Ignition, Lighting and Starting Systems

PLATE NO. 114

Packard Trucks

MODEL E.

BIJUR 6-VOLT, TWO-UNIT STARTING AND LIGHTING SYSTEM
DIXIE MAGNETO IGNITION

Battery is 6 volt, 120 ampere hour. If only ignition battery is provided it is 6 volt, 35 ampere hour. The two-wire system is used.

Type A. V. S. Dixie-44 magneto is used for ignition. There is a vibrator which sends a shower of sparks across spark gap as long as breaker contacts are open and switch is on position marked B, high tension current being produced by magneto windings. As soon as the magneto contacts are closed the current is prevented from flowing through the primary winding, hence sparking is stopped. This is only to be used to facilitate starting and switch should be moved to magneto position as soon as engine starts. Firing order is 1, 2, 4, 3. Manual spark control is used. With spark at full retard break occurs when upper dead center mark on flywheel is at indicator.

Spark gap is .025 in.

Bijur starting and lighting system is used. Voltage regulation by vibrating regulator mounted on top of generator. (See Plate No. 1.)

Motor is connected to the flywheel by a Bendix gear.

Lamp sizes are:—Side and gauge lamps 4 cp., 7 volt, 3/4 in., round bulb. Tail lamp 2 cp., 7 volt, 11/16 in. round bulb. (See note on diagram).

Ammeter shows current generator is supplying to lights and battery. Ammeter should register when engine is running 750 R. P. M. Should ammeter show as high a rate as 25 to 30 amperes it indicates a heavy ground or short circuit. Disconnect battery when car is idle, to prevent discharging, until ground is removed.

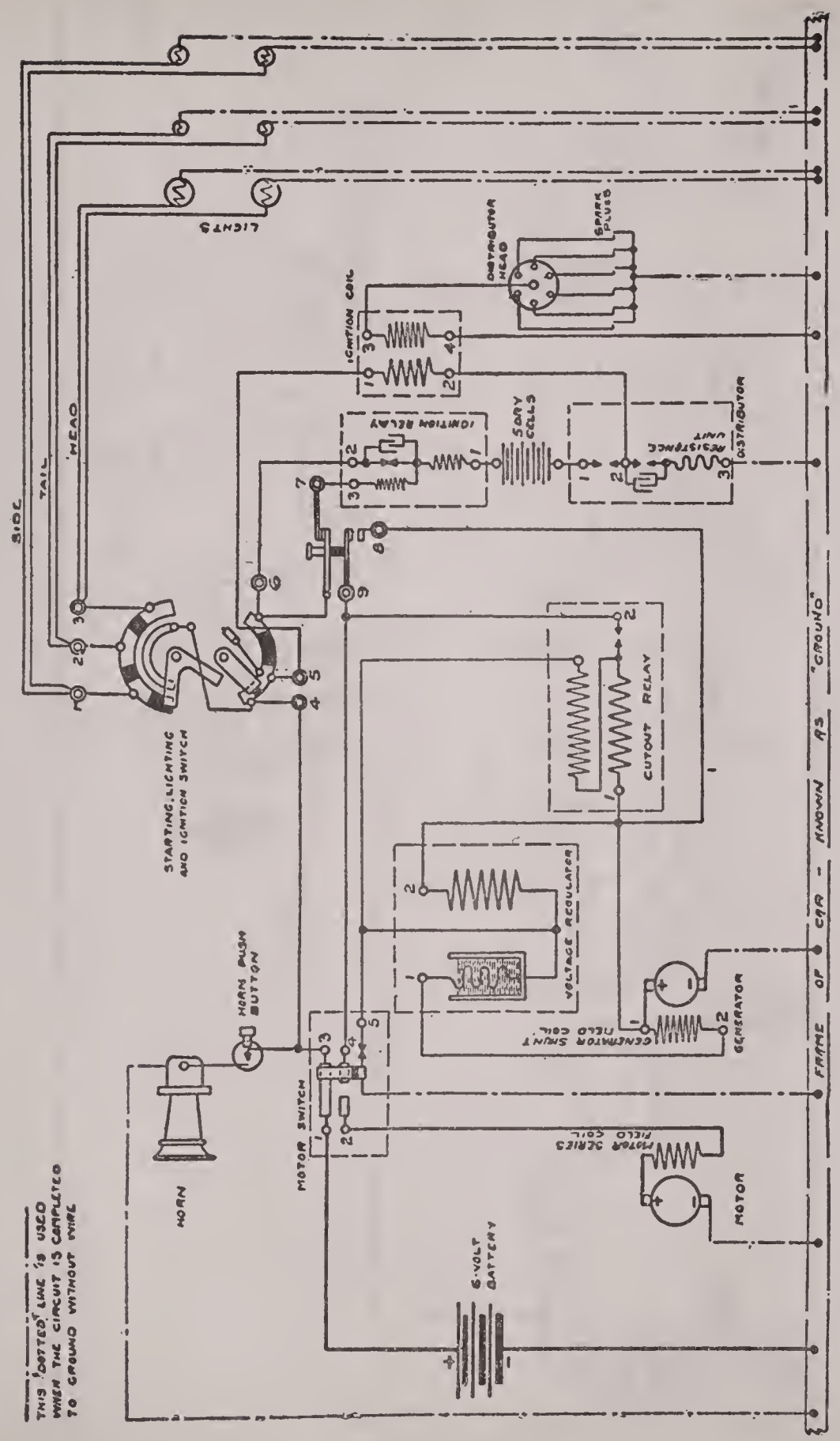


PLATE No. 115

Oldsmobile

MODEL 54 (1914)

DELCO STARTING AND LIGHTING SYSTEM. DELCO IGNITION

Battery is 6 volt, 160 ampere-hour. The negative terminal is grounded.

Breaker contacts should open .018 in. to .020 in. Should contacts become badly burned or pitted they may be resurfaced with a fine, flat, jeweler's file or a piece of No. 00 sandpaper. Contacts should just begin to separate when the piston receiving the spark is on top dead center, spark control lever in the fully retarded position. The firing order is 1, 5, 3, 6, 2, 4. Spark gap should be .028 in to .030 in. For testing of the ignition units see Plate No. 69. For care of the ignition relay see Plate No. 68.

Voltage regulation of the generator is by a mercury regulator, as described on Plate No. 65. The generator should reach the neutral point, that is the speed at which the battery is neither sending current to nor receiving current from the generator, at about 280 R. P. M. The charging rate at 500 R. P. M. should be 7 amperes, at 1000 R. P. M., 10 amperes and at 1500 R. P. M. 12-22 amperes, depending on the state of charge of the battery. Directions for the care of the motor-generator are given on Plates No. 65 and 65A.

Head lights are 6-8 volt, 21-24 cp. Side lights are 6-8 volt, 6 cp. Dash and tail lights are 6-8 volt, 2-4 cp.

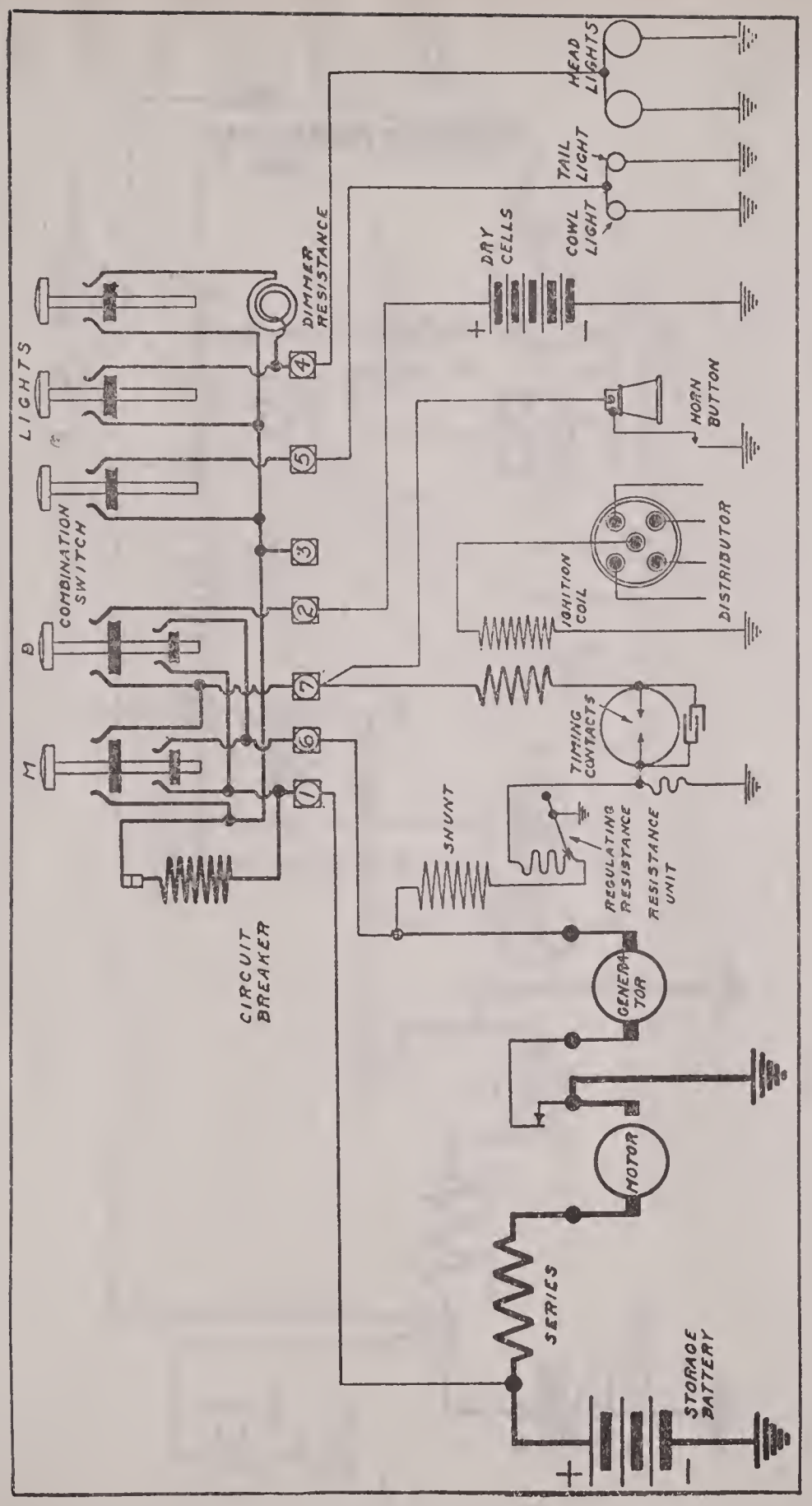


PLATE No. 116

Oldsmobile

MODEL 42 (1915)

DELCO DOUBLE-UNIT STARTING AND LIGHTING SYSTEM. DELCO IGNITION

Battery is 6 volt, 120 ampere-hour. The negative terminal is grounded.

Breaker contacts should open .018 in. to .020 in. Contacts should just begin to separate when the piston receiving the spark is on top dead center, control lever in the fully retarded position. The firing order is 1, 3, 4, 2.

Spark gap should be .028 in. to .030 in. For testing of the ignition units see Plate No. 69.

The driving power of the motor is transmitted to the flywheel by a mechanical pinion shift and an overrunning clutch. The positive motor brush is raised to open the starting circuit. When the ignition switch is closed the generator armature runs as a motor to facilitate the meshing of the gears. When the starting pedal is depressed the gears are meshed; the generator circuit is opened; and the motor brush allowed to come in contact with the commutator,—thus applying full battery pressure to the motor, and cranking the engine. The above operation is reversed when the starting pedal is released. The generator should begin to supply the current at about 350 R. P. M. At 500 R. P. M. the output should be 6-11 amperes, at 800 to 1050 the output should be 16-20 amperes, and at 1500 R. P. M. the output is reduced to 9-14.5 amperes. Voltage regulation is by a regulating resistance in series with the shunt field. A sliding contact, operated by a governor on the timer shaft, rests on this resistance. As the speed increases the contact is moved along the coil, thus cutting more resistance into the shunt field, lessening the amount of current in it and holding the output down. For adjustment of this regulator see Plate No. 73.

Head lights are 6-8 volt, 20 cp. Dash and tail light are each 6-8 volt, 2-4 cp. There is a vibrating circuit breaker to take the place of fuses.

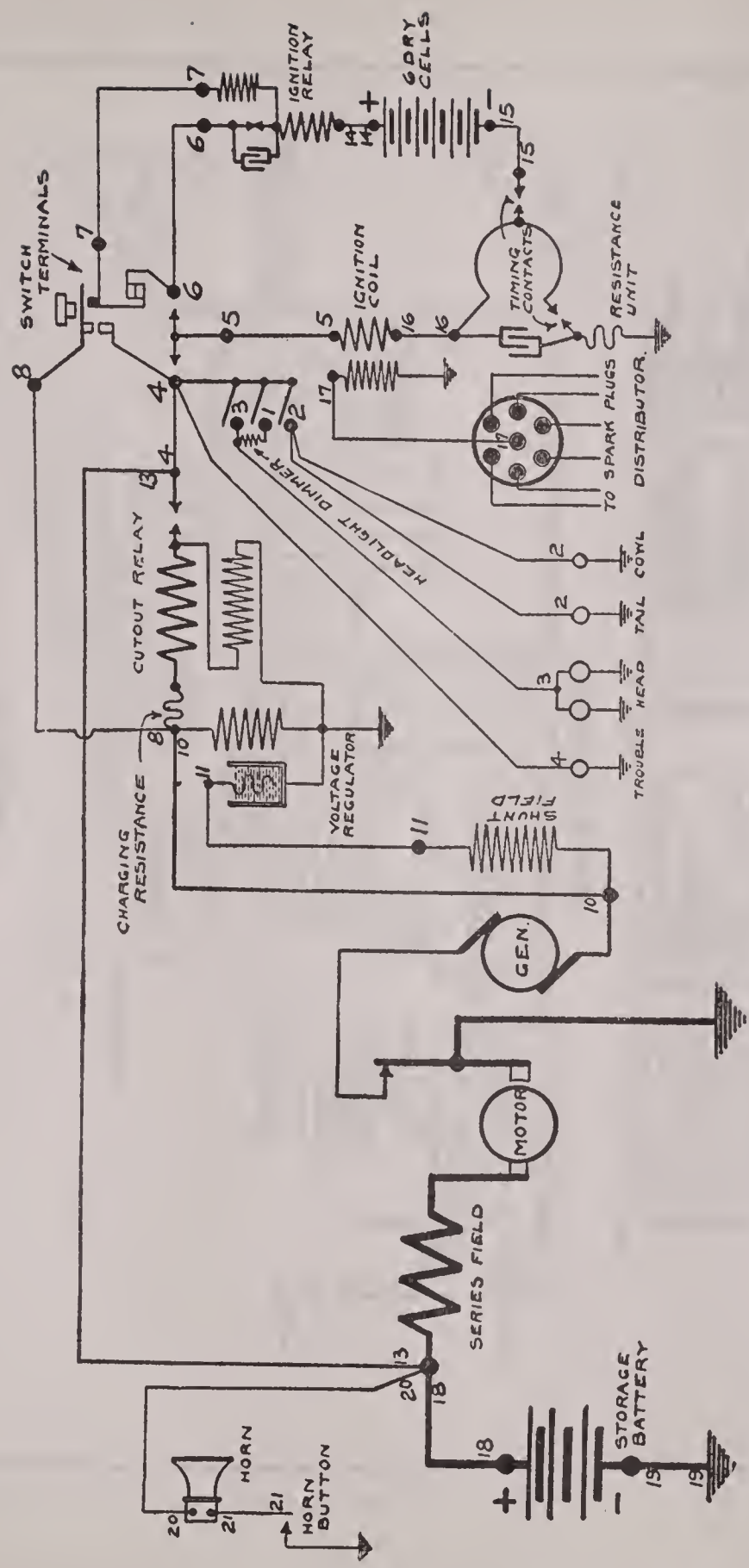


PLATE No. 117

Oldsmobile

MODEL 55 (1915)

DELCO STARTING AND LIGHTING SYSTEM. DELCO IGNITION

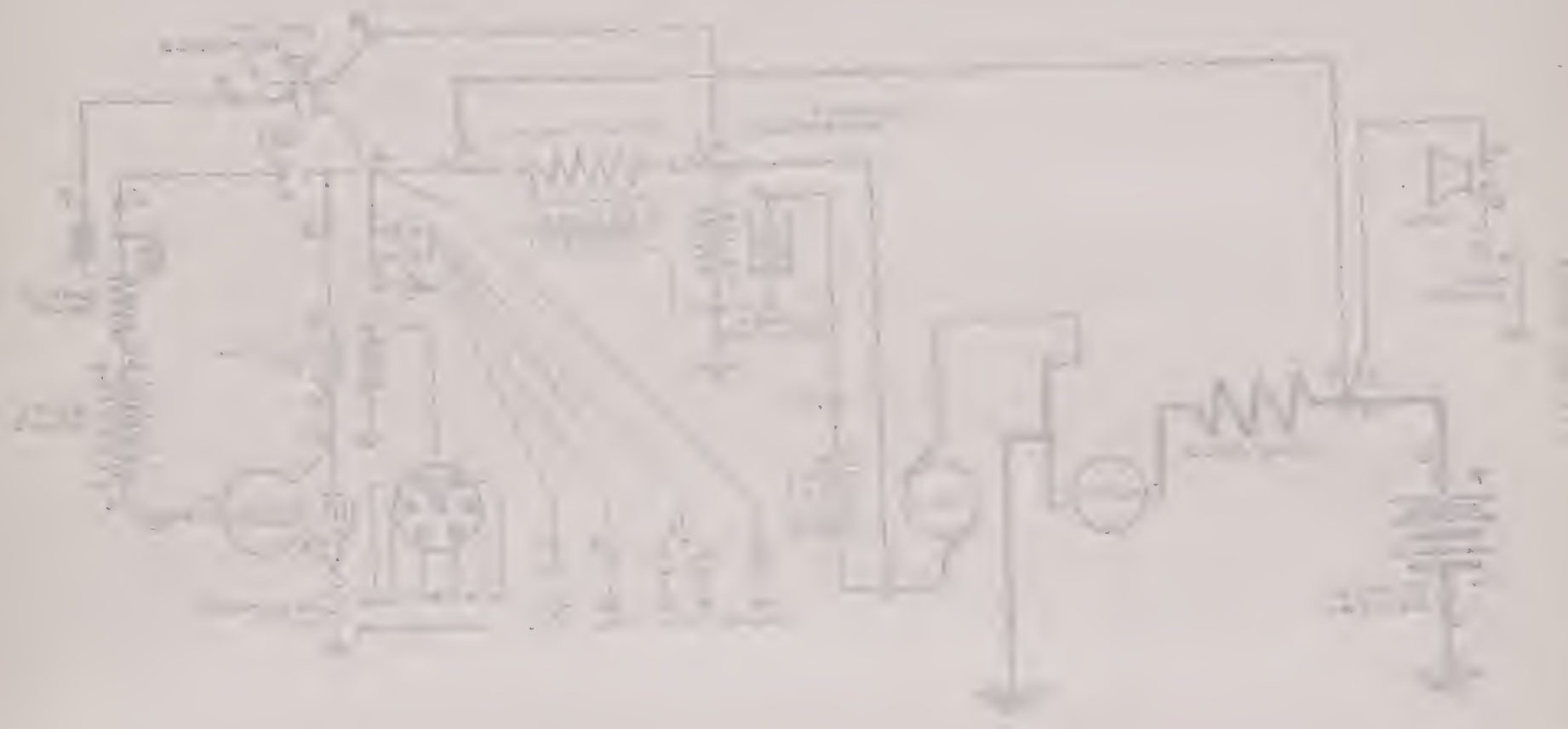
Battery is 6 volt, 120 ampere-hour. The negative terminal is grounded.

Breaker contacts should open .018 in. to .020 in. Should contacts become badly burned or pitted, they may be resurfaced with a fine, flat, jeweler's file. Contacts should just begin to separate when the piston receiving the spark is on top dead center, control lever advanced 1½ in. There is a set of six dry cells, connected in series, to supply ignition current for starting. While starting an ignition relay is used. For care of the ignition relay see Plate No. 68. The firing order is 1, 5, 3, 6, 2, 4. Spark gap should be .030 in.

Connection between the starter and the flywheel is by mechanical pinion shift. When starting pedal is depressed a catch on the pinion shifting rod mechanically closes the relay contacts, which causes the generator to motor. As the starting pedal is depressed, gears are meshed, generator circuit is opened and motor brushes are brought in contact with the commutator, which applies full battery pressure to the starter, cranking the engine.

Voltage regulation is by mercury regulator. This device is described on Plates No. 65 and 65A. Relay should close at approximately 475 R. P. M. of the generator. At 750 R. P. M., the output is 7 amperes; at 1,000 R. P. M., 10 amperes; at 1,500 R. P. M., 14-22 amperes, depending upon the state of charge of the battery. For testing of the motor see Plate No. 70. For testing of the generator see Plate No. 71. Directions for the care of the relay are given on Plate No. 68.

Head lamps are 6-8 volts, 24 cp. Trouble light is 6-8 volt, 4 cp. Dash and tail lights are 6-8 volt, 2 cp.



Oldsmobile

44 (1916) 45, 37 (1917)

Delco Two-Unit Starting and Lighting System. Delco Ignition

A 6 volt 120 ampere-hour battery is used. The negative terminal of the battery is grounded.

Breaker contacts open .018 in. Breaker should be set so that, with the upper dead center mark on the flywheel 1½ in. before the indicator, the contacts will open when breaker is rocked forward as far as slack in gears will allow and close when breaker is rocked back. Spark should be fully advanced during this operation. Firing order is 1, 8, 3, 6, 4, 5, 2, 7. No. 1 cylinder is the one nearest the radiator on the right-hand block. No. 5 is the one nearest the radiator on the left-hand block. For testing of ignition units see Plate No. 69. Spark is controlled by both automatic and manual advance. Contacts are made of tungsten metal. For their care see Plate No. 20. Put four or five drops of light engine oil in oiler on side of distributor housing every week. Firing order of the six-cylinder car is 1, 5, 3, 6, 2, 4. Break occurs just after dead center mark on flywheel passes indicator, spark lever in the fully retarded position.

Rear bearing of generator is of the ball type. The forward bearing is of the roller type. Voltage regulation is by third brush. For adjustment of third brush see Plate No. 77. Generator begins to charge battery at 7-10 miles per hour. Charging rate increases to a maximum of 15-20 amperes at 20-25 miles per hour. Charging rate should never exceed 20 amperes. Put four or five drops of light engine oil in each of the two oilers located one on each end of the generator.

Motor is connccted to engine by Bendix gear. Motor needs absolutely no lubrication.

Ammeter shows rate battery is charging or discharging. There is a circuit breaker to take the place of fuses. It takes 25 amperes to start circuit breaker vibrating, but after it is started, three to five amperes will keep it vibrating.

Large head lights are 6-8 volt, 16 cp. Small head lights are 6-8 volt, 7 cp. Tail light is 6-8 volt, 2-4 cp. Dash light is 6-8 volt, 2-4 cp.

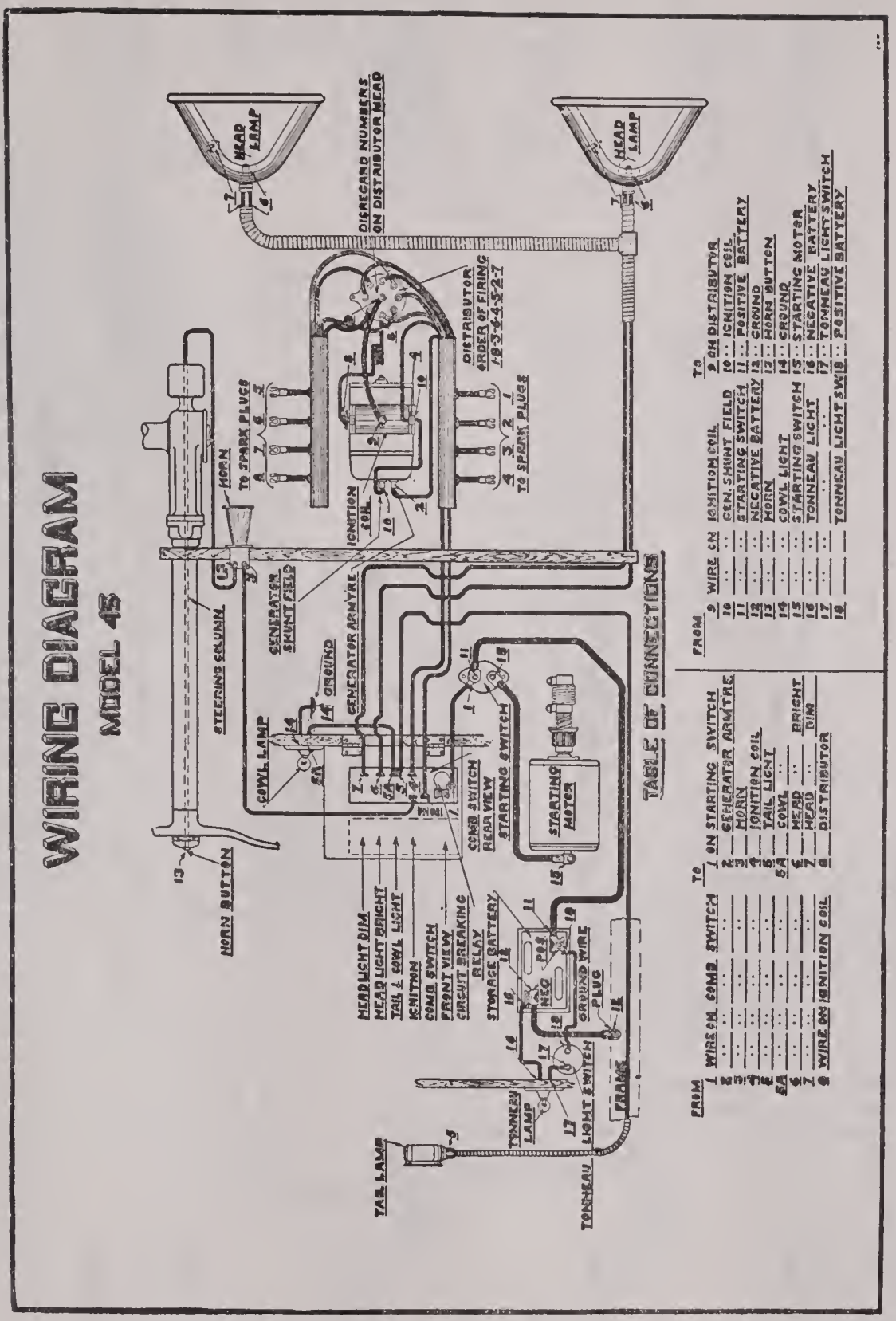
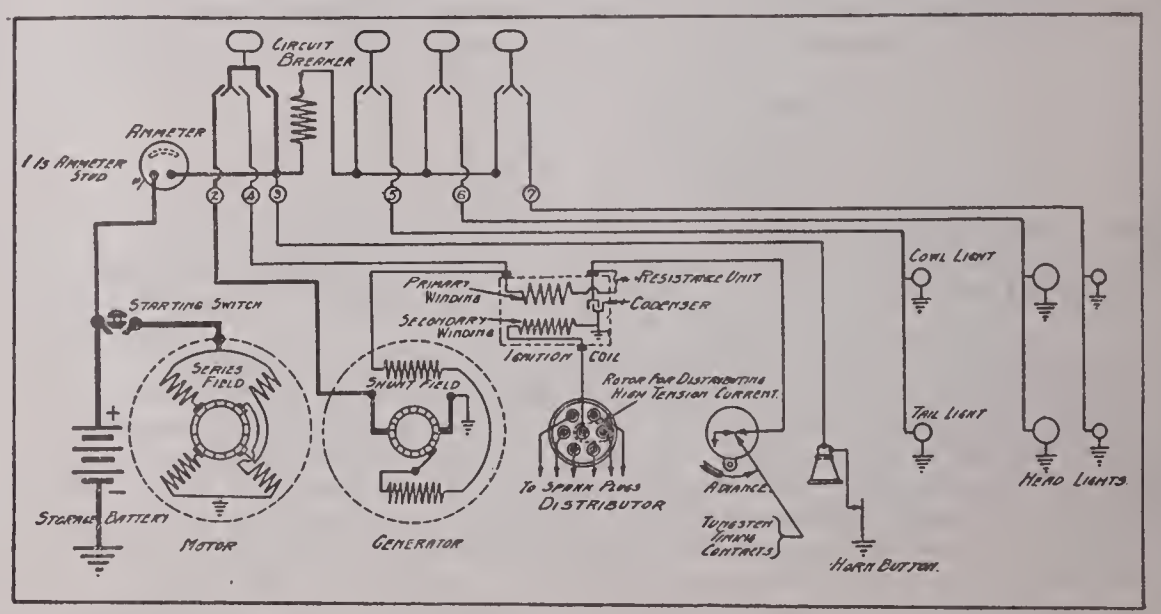
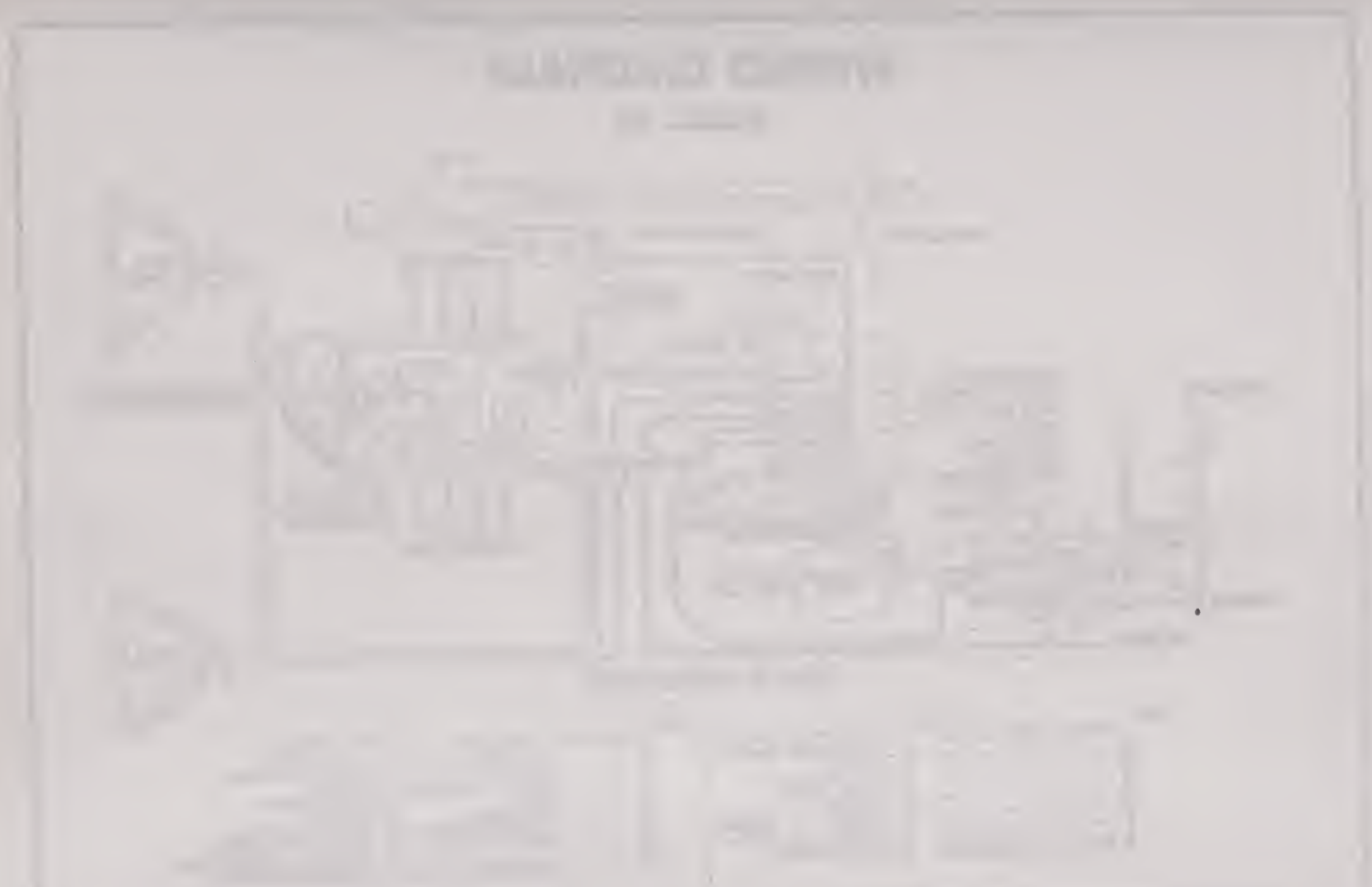


PLATE No. 118





1914 AND 1915

REMY STARTING AND LIGHTING SYSTEM. BOSCH MAGNETO IGNITION

Battery is 6 volt, 120 ampere-hour. The two-wire system is used.

Magneto is Bosch two spark dual. Breaker contacts should open .014 in. to .016 in. Clean contacts with gasoline whenever necessary. Should they become badly burned or pitted, they may be resurfaced with a fine, flat, jeweler's file or a small strip of worn No. 00 sandpaper. Contacts should just begin to separate when piston entering power stroke is on top dead center, spark control lever advanced about 1¼ in. The firing order is 1, 3, 4, 2.

The driving power of the starter is transmitted to the flywheel by a non-mechanical pinion shift. There is an overruning clutch to prevent the engine from driving the starting motor. Three different types of starting motors have been used. The following data applies to Model 5:

R. P. M.	Amperes	Volts
3600-4200	40-56	5.8-6
1900	100	
1700	125	
1500	150	
1350	175	

The following data applies to the 126A starter:

Torque (with 6 in. pulley)	R. P. M.	Amperes	Volts
0 lbs.	4500	40	6.0
4 lbs.	2200	85	5.8
8 lbs.	1600	110	5.6
12 lbs.	1350	135	5.3
24 ft. lbs.	Lock Torque	520	3.6

The following data applies to the 189A starter:

Torque (with 6 in. pulley)	R. P. M.	Amperes	Volts
	3600-4200	40-56	5.8-6
	1900	100	5.8
	1700	125	5.7
	1500	150	5.6
	1350	175	5.5
19-22 ft. lbs.	Lock Torque	700-720	3.6

The starter should crank the engine at 100 to 150 R. P. M. Put several drops of light engine or machine oil in each of the motor oilers every 1,000 miles.

The voltage regulation of the generator is by third brush. Relay should close at about 8 miles per hour. Maximum output of 14-18 amperes is reached at about 10 miles per hour. The following data applies to Model O generator:

Amperes	R. P. M.
0.	300 or less
7.5	500 or less
14-18	1000-1300
12.	2050

On machines up to No. 30,000, the armature draws 4 amperes when battery is connected to brushes, and field draws 1.7 amperes, generator running as a motor. With field disconnected, armature will draw 12 amperes at 6.5 volts, and field 1.3 amperes at 6.5 volts.

The output of the Model OB generator is the same as for the Model O. On this generator there is a "Summer" and "Winter" switch. When switch is placed on "Summer" side, the output will be reduced 3 to 5 amperes. Ignition timer contacts on this generator should open .020 in. to .025 in. Spark gap for battery ignition should be ⅜ in. Once every month, or 1,000 miles, put three or four drops of light engine or machine oil in each of the generator oilers. Relay contacts should open .014 in. to .016 in. The air gap between relay armature and magnet core should be .040 in.

Head lights are 6-8 volt, 24 cp. Side lights are 6-8 volt, 7 cp. Tail light is 6-8 volt, 2 cp. Fuses are 5 ampere. The fuse in the main line is 20 ampere.

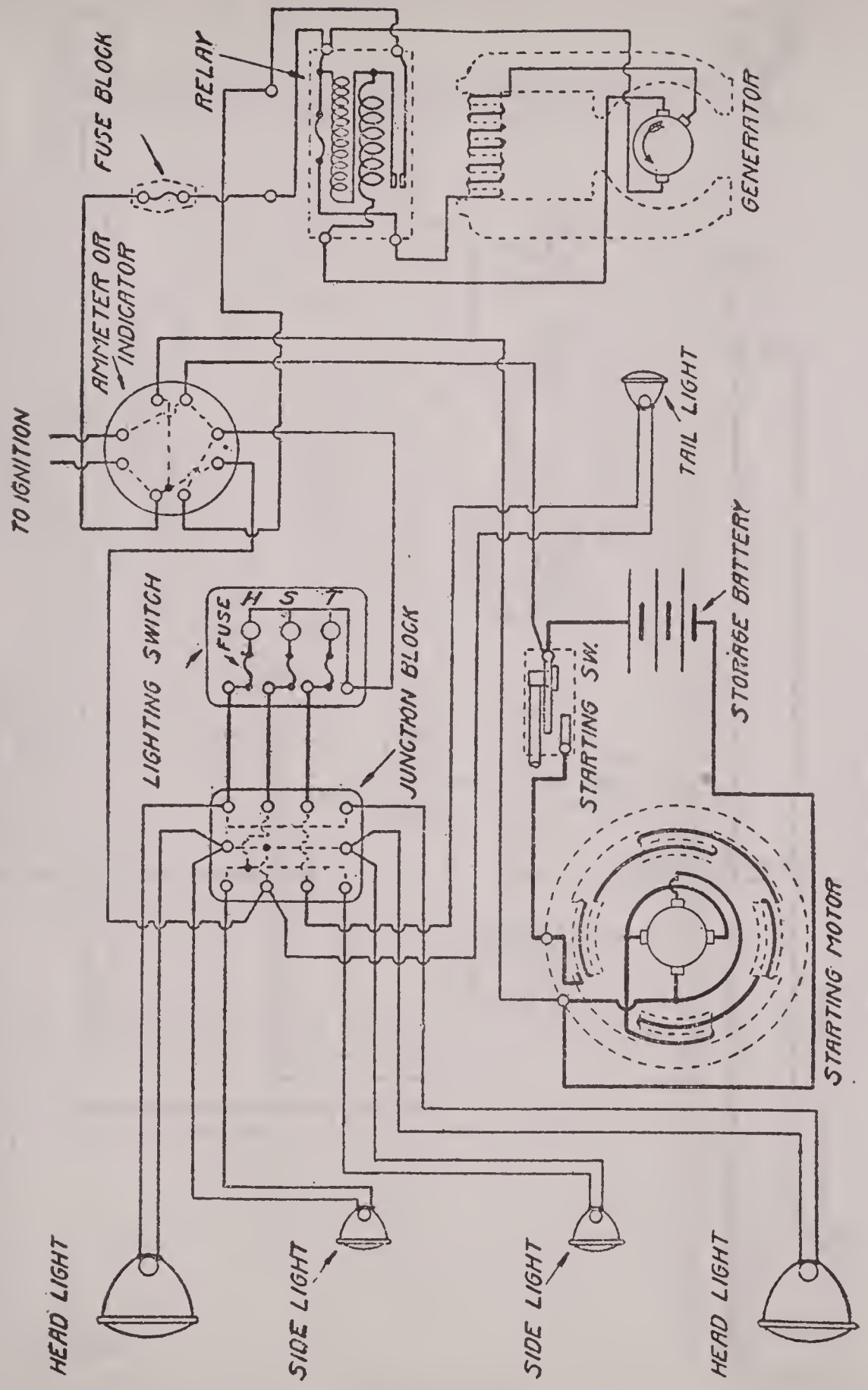
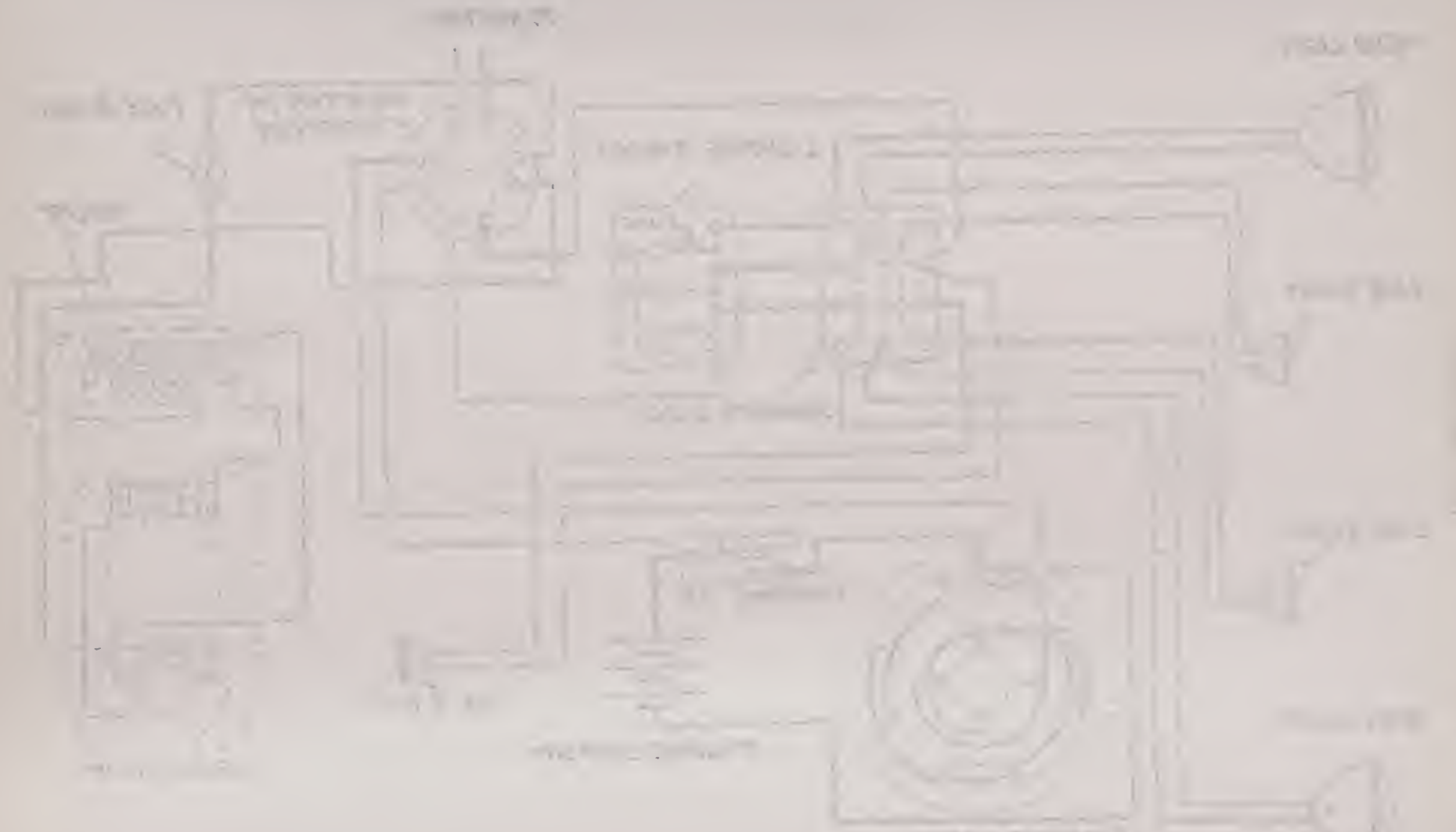


PLATE No. 119



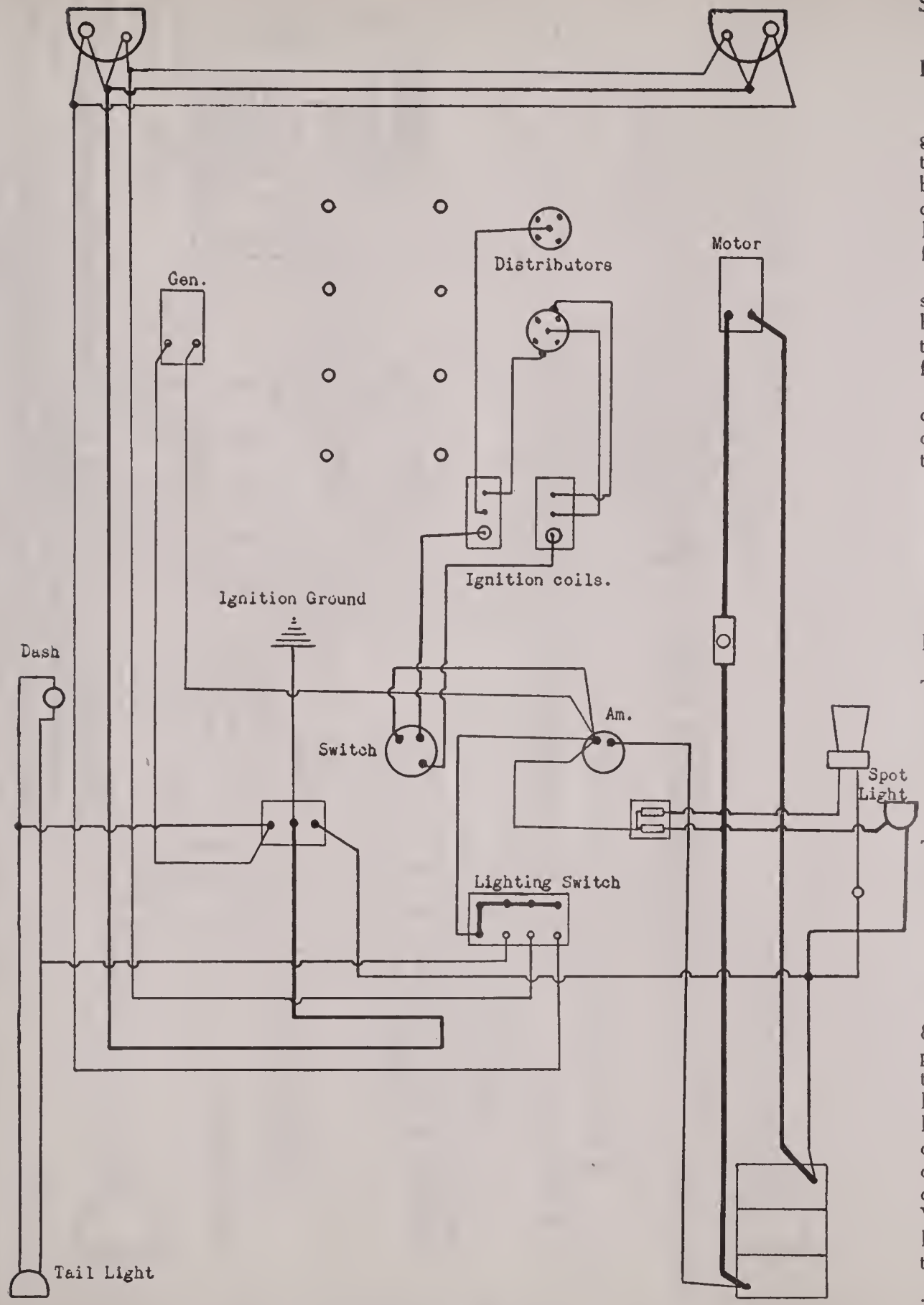


PLATE NO. 120

REMY STARTING AND LIGHTING SYSTEM. BOSCH OR DELCO TWO-SPARK IGNITION

Battery is 6 volt, 120 ampere-hour. The two-wire system is used.

Magneto breaker contacts should open .014 in. to .016 in. Clean them with gasoline whenever necessary. Should they become badly burned or pitted, resurface them with a fine, flat, jeweler's file or a small strip of worn No. 00 sandpaper, carefully blowing out all dirt or filings after, or cleaning with gasoline. Put not more than three drops of light machine oil in each of the magneto oilers every two weeks, or 500 miles. Battery breaker contacts should open .018 in. to .020 in. Resurface them with a very fine, flat, jeweler's file or a small strip of worn No. 00 sandpaper.

The magneto contacts should just begin to open when the piston entering power stroke is on top dead center, spark control lever in the fully retarded position. The battery breaker contacts should just begin to open when the piston entering power stroke is on top dead center, control lever advanced 1½ in. from the fully retarded position. The firing order is 1, 3, 4, 2.

The driving power of the motor is transmitted to the flywheel through a Bendix drive. The starter should crank the average engine at 100 to 150 R. P. M., depending on the condition of the engine. Several models of motor have been used at different times. The following data applies to the Model 5 motor.

R. P. M.	Amperes	Volts
3600-4200	40-56	5.8-6
1900	100	
1700	125	
1500	150	
1350	175	

It should deliver an 8-lb. pull on a 6 in. pulley when running at 1500-1800 R. P. M. It will take about 150 amperes at 5.3-5.4 volts when so operating.

The following data applies to the model 126-A motor:

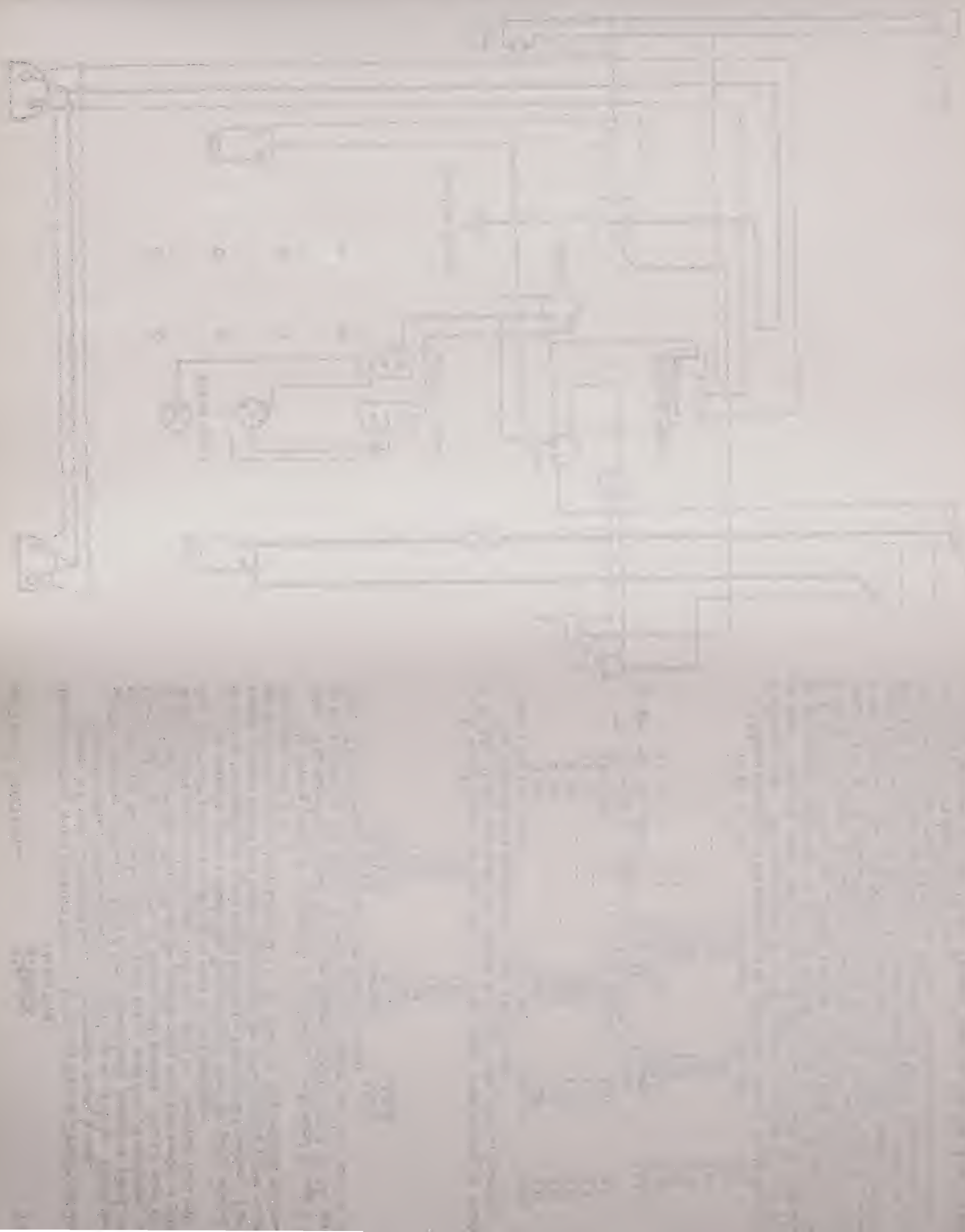
Torque (with 6 in. pulley)	R. P. M.	Amperes	Volts
0 lbs.	4500	40	6.0
4 lbs.	2200	85	5.8
8 lbs.	1600	110	5.6
12 lbs.	1350	135	5.3
24 ft. lbs.	Lock Torque	520	3.6

The following data applies to the Model 189-A motor:

Torque (with 6 in. pulley)	R. P. M.	Amperes	Volts
	3600-4200	40-56	5.8-6
	1900	100	5.8
	1700	125	5.7
	1500	150	5.6
	1350	175	5.5
19-22 ft. lbs.	Lock Torque	700-720	3.6

Voltage regulation of the generator is by third brush. Relay should close at about 8 miles per hour. Maximum output of 14-18 amperes is reached at about 10 miles per hour. Although several different types of generators are used, the following are the approximate output rates of all: At 300 R. P. M. or less, 0 amperes; at 500 R. P. M. or less, 7.5 amperes; at 1000-1300 R. P. M., 14-18 amperes; and at 2050 R. P. M., 2 amperes. On generators having the "Summer" and "Winter" switch, the output will be 3 to 5 amperes less when switch is on the "Winter" side than when it is on the "Summer" side. On Model 0 generators, above serial number 30,000, arm draws 4 amperes and field draws 1.7 amperes when generator is running as a motor. With field disconnected, arm will draw 12 amperes and field 1.4 amperes at 6.5 volts. Relay contacts should open .014 in. to .016 in. The air gap between the relay armature and magnet core should be .040 in.

Head lights are 6-8 volt, 18 cp. Dimmer lamps are 6-8 volt, 4 cp. Tail lamp is 6-8 volt, 2 cp. Dash lamp is 6-8 volt, 4 cp. Spot light is 6-8 volt, 6-12 cp. Fuses on the lighting switch are 4 ampere.



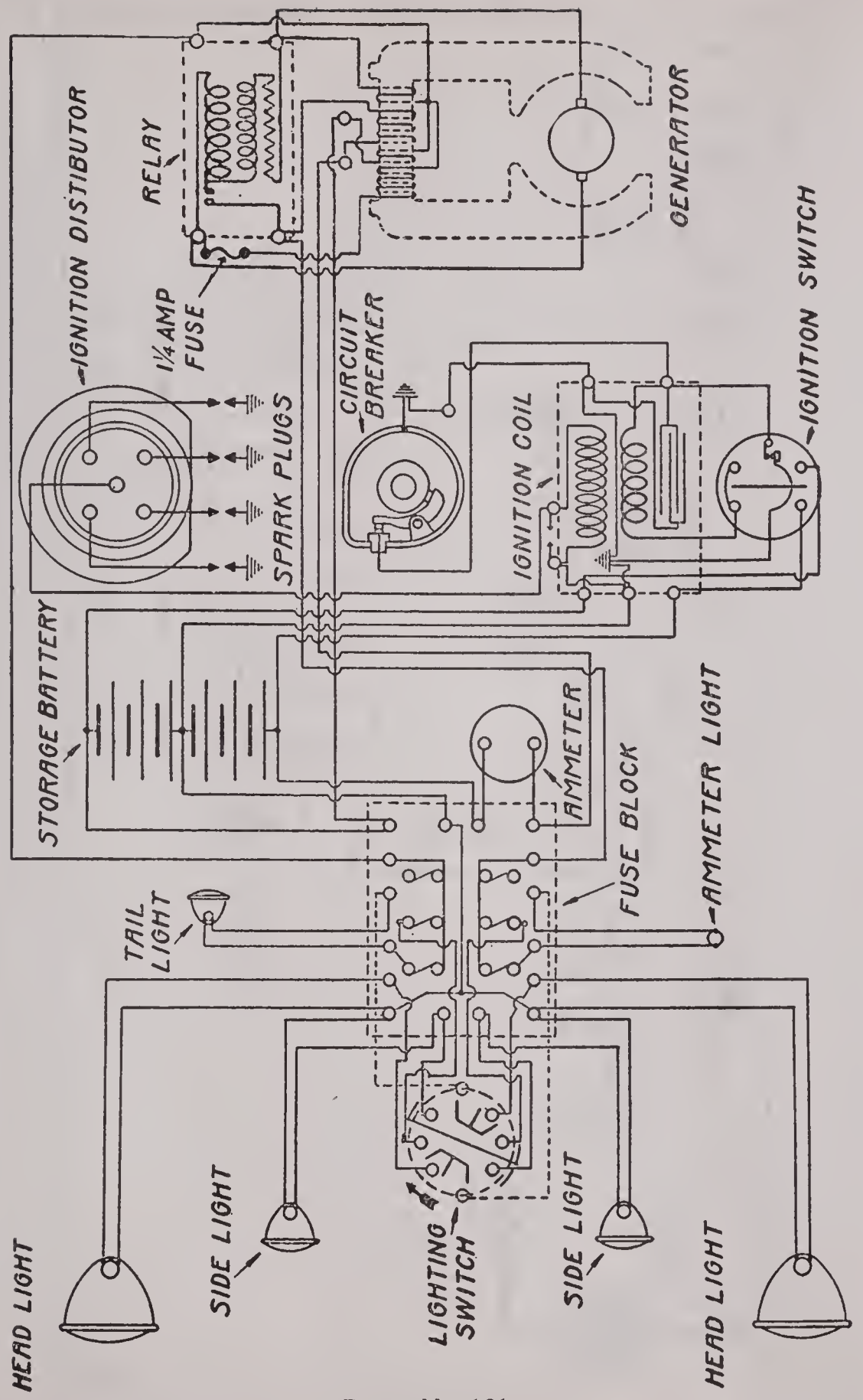


PLATE No. 121

Premier

1915

REMY STARTING AND LIGHTING SYSTEM. REMY IGNITION

Battery is 12 volt, 60 ampere-hour. The two-wire system is used.

Breaker contacts should open .018 in. to .020 in. Should contacts become badly burned or pitted they may be resurfaced with a fine, flat, jeweler's file or a strip of worn No. 00 sandpaper. Break should occur when the piston entering power stroke is on top dead center, spark lever in the fully retarded position. The firing order is 1, 4, 2, 6, 3, 5.

Relay should close at about 8 miles per hour. There is a 1¼-ampere fuse on the relay base, to protect the generator windings. Shunt field draws 1.5 amperes at 12 volts. The generator has three field windings. The shunt winding is composed of 1,000 turns of No. 24 wire. The second winding is composed of 40 turns of No. 12 wire, and the other winding is composed of 40 turns of No. 13 wire. The output of the generator should be 3.5 amperes at 325 R. P. M., and 4.5 to 6.5 amperes at 2,000 R. P. M.

Head lights are 12-14 volt, 17 cp. Side lights are 12-14 volt, 6 cp. Dash and tail lights are 12-14 volt, 2-4 cp.

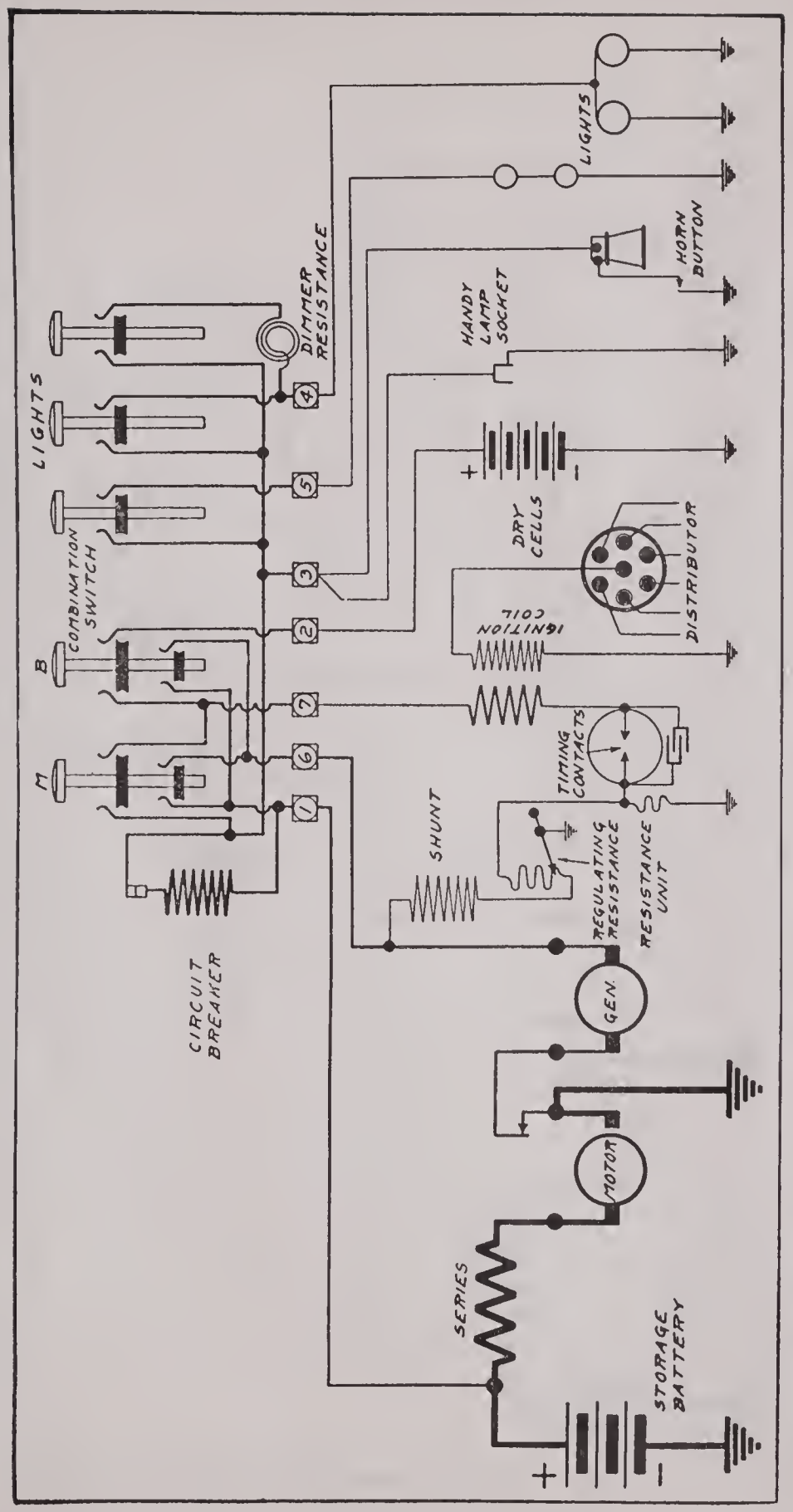


PLATE No. 122

Cole

MODELS 4-40 (1915), 6-66 (1916)

DELCO DOUBLE-UNIT STARTING AND LIGHTING SYSTEM. DELCO IGNITION

Battery is 6 volt, 120 ampere-hour. The negative terminal is grounded.

Breaker contacts open .018 in. to .020 in. A set of five dry cells connected in series supply ignition current while starting. Break occurs on top dead center, spark fully retarded. Firing order of the Six is 1, 5, 3, 6, 2, 4. The firing order of the Four is 1, 3, 4, 2. For testing of ignition units see Plate No. 69.

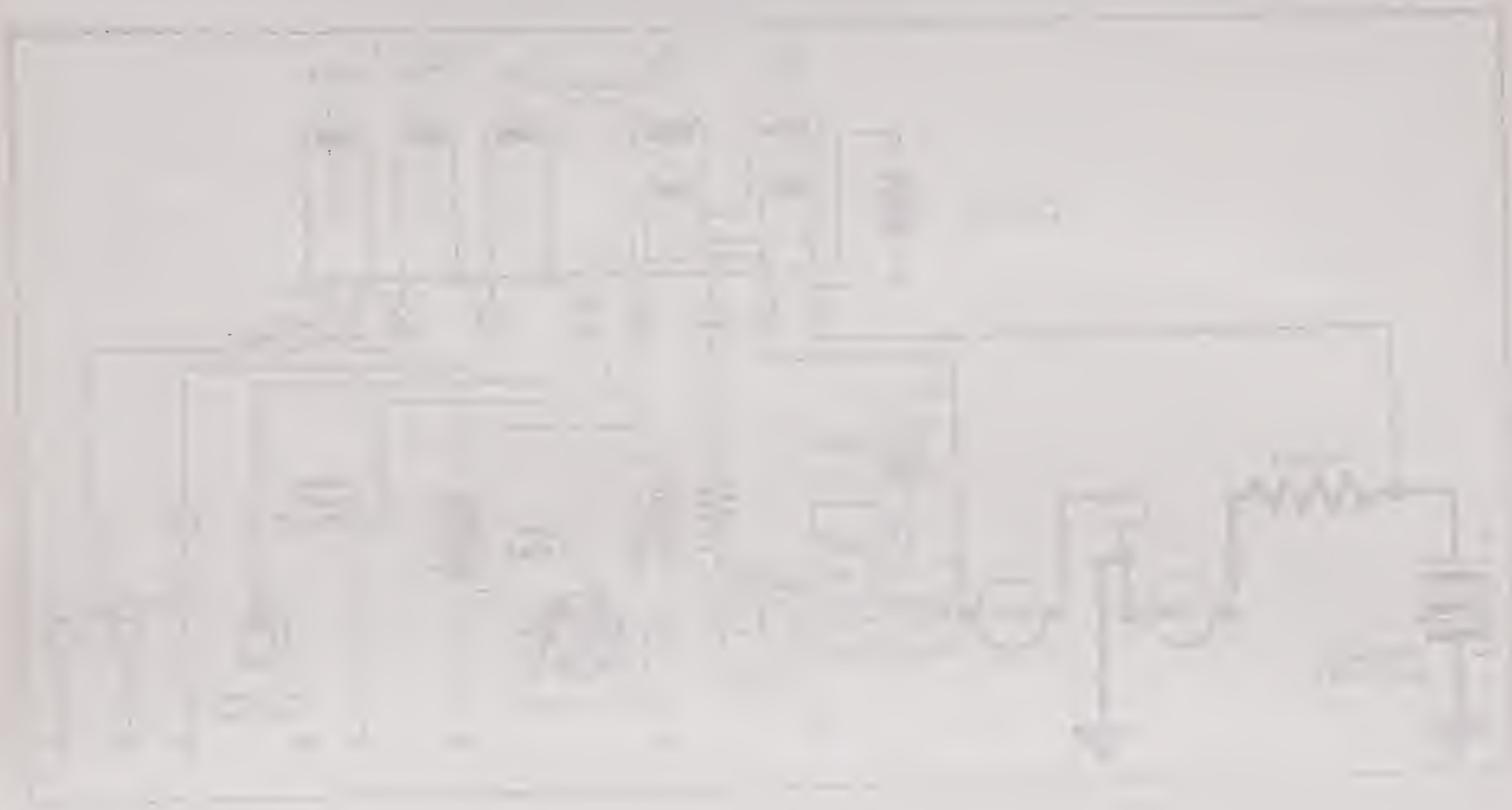
Voltage regulation is by an automatic field rheostat. This device is fully described on Plate No. 73. There is no relay. Circuit between generator and battery is controlled by ignition switch. There is an overrunning clutch to allow generator to run as a motor while starting or when pressure produced by generator is below that of battery.

Motor is connected to engine by non-automatic, mechanical shift.

When ignition switch is closed, generator runs as a motor to facilitate meshing of gears. Cranking circuit is broken by raising one of the motor brushes. When starting pedal is depressed gears are drawn into mesh, generator circuit is broken and motor brush is allowed to come into contact with commutator, thus applying full battery pressure to motor, cranking engine.

For testing of motor-generator see Plates No. 70 and 71.

There is a circuit breaker to take the place of fuses in the lighting circuit. Dash and tail lamps are in series. They are 3.2 volt, 2-4 cp. Head lamps are 6-8 volt, 21 cp.



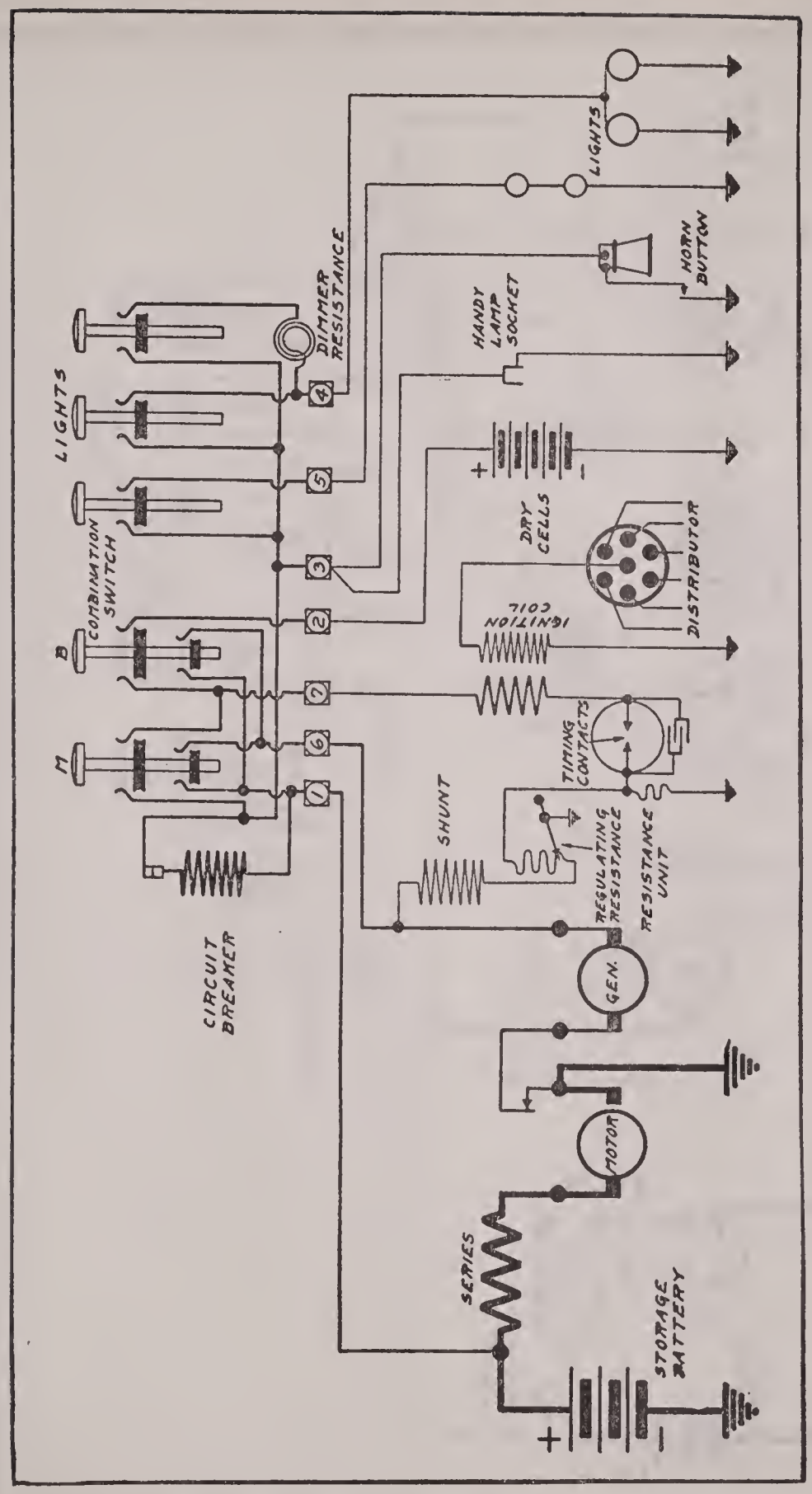


PLATE No. 123

Cole

MODEL 6-50 (1915)

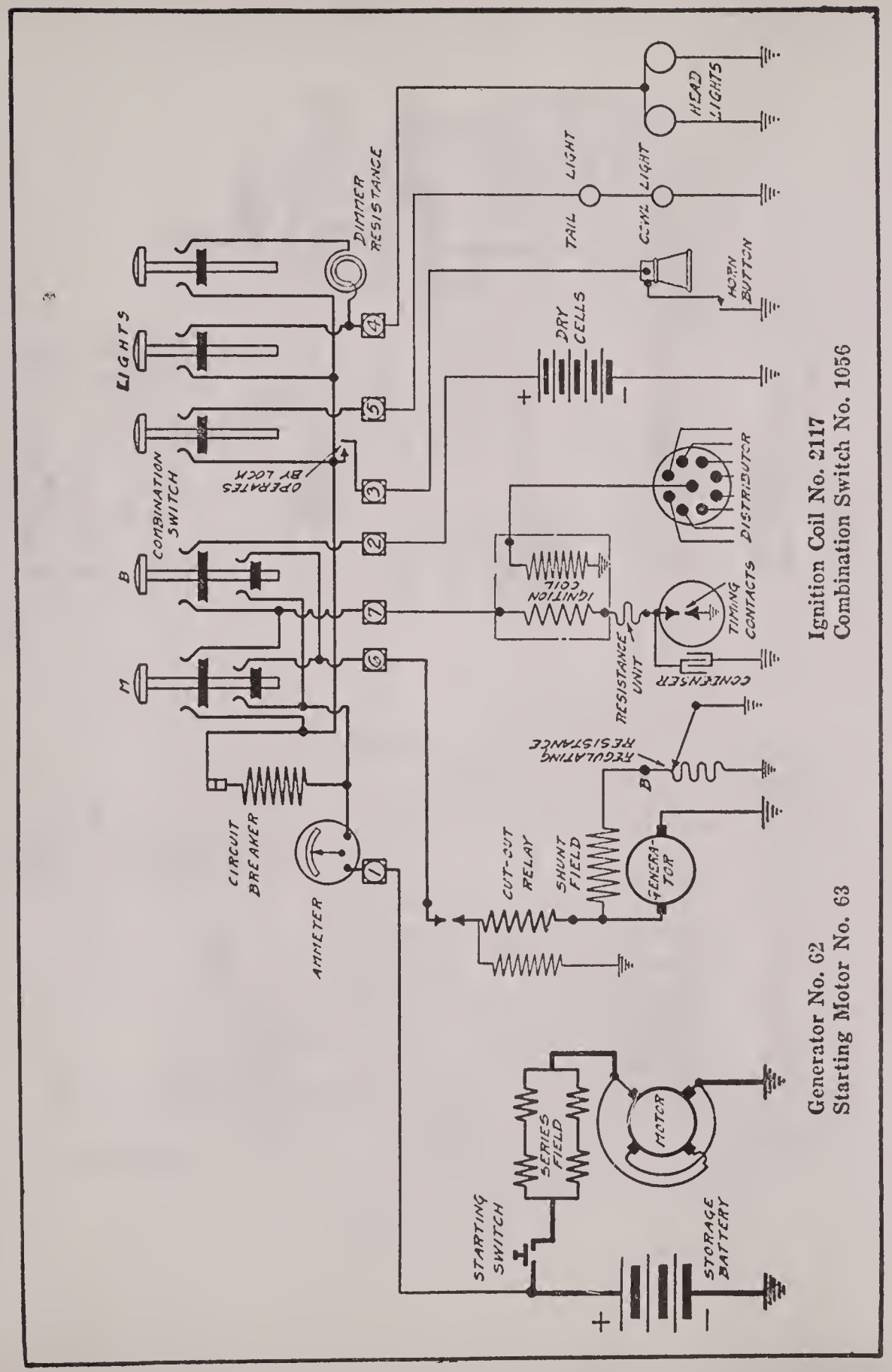
DELCO 6-VOLT, DOUBLE UNIT, STARTING AND LIGHTING SYSTEM
DELCO IGNITION

Battery is 6 volt, 120 ampere-hour. The negative terminal is grounded.

A set of 6 dry cells supply current for ignition while starting. Breaker contacts open .018 in. to .020 in. Break occurs when dead center mark on flywheel is 1¾ past indicator. Firing order is 1, 5, 3, 6, 2, 4. For testing of ignition units see Plate No. 69. For care of tungsten contacts see Plate No. 20. Spark lever should be in the fully retarded position during the timing operation.

Voltage regulation is by a regulating resistance in the shunt field. This consists of a coil of "Nichrome" wire on which a sliding contact operated from a governor on the timer shaft rests. As the speed increases the contact is moved along the resistance wire, thus cutting more resistance into the shunt field and keeping the voltage down. For adjusting this resistance see Plate No. 73. Generator beings to charge at 7 to 8 miles per hour. This rate increases to a maximum of 16 to 20 amperes at 18 to 22 miles per hour. This rate gradually decreases to 10 to 15 amperes as speed increases. Maximum output of generator should never exceed 25 amperes.

A circuit breaker takes the place of fuses in the lighting circuit. Dash and tail lamps are in series. They are 3.5 volt, 2 cp: Head lights are 7 volt, 21 cp.



Cole

Model 850 (1916)

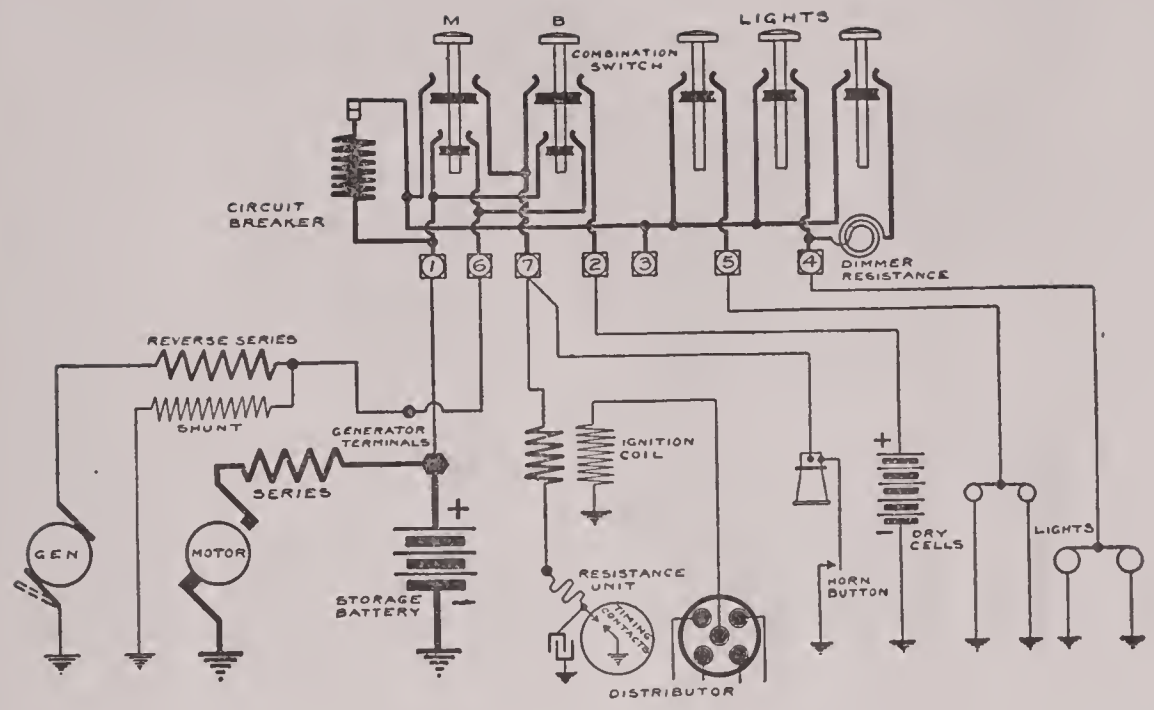
Delco Two-Unit, Starting and Lighting System. Delco Ignition

Battery is 6 volt, 120 ampere-hour. The negative terminal is grounded.

There is a set of five dry cells connected in series to supply ignition current while starting. Breaker contacts open .018 in. to .020 in. For care of tungsten contacts see Plate No. 20. With spark fully retarded, break should occur on top dead center. Firing order is 1, 8, 2, 7, 4, 5, 3, 6. For testing of ignition units see Plate No. 69.

Voltage regulation is by a regulating resistance in series with the shunt field. This regulator consists of a spool of "Nichrome" wire on which a sliding contact, operated by a governor on the timer shaft, rests. As the speed increases this contact is moved along the resistance, increasing the resistance of the shunt field and keeping the voltage down. For adjustment of charging rate see Plate No. 73. Ammeter indicates rate of charge or discharge. Charging rate under ordinary driving conditions should not greatly exceed 15 amperes with all lights out and car running about 20 miles per hour. Maximum charging rate should never exceed 20 amperes at a speed of 20 to 25 miles per hour. This rate should decrease at speeds above 25 miles per hour. Maximum generator output must never exceed 25 amperes. For relay see Plate No. 86.

Dash and tail lights are in series. They are 3.5 volt, 2 cp. Head lights are 7 volt, 21 cp.



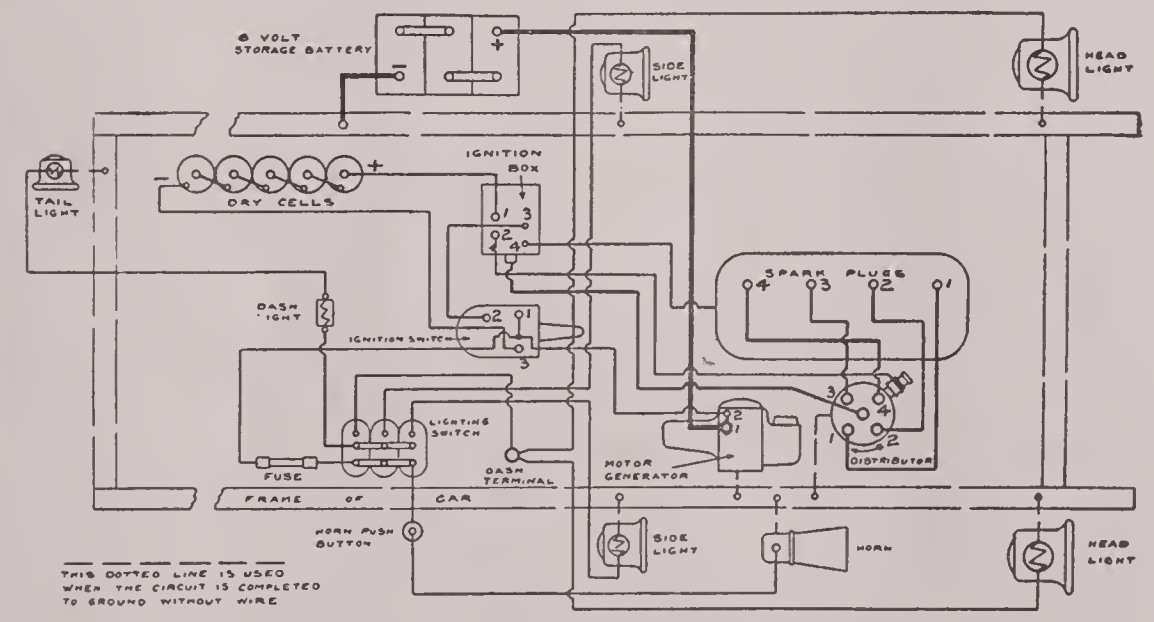


PLATE NO. 125

Cartercar

SERIES 9, 1915

DELCO 6-VOLT, DOUBLE-UNIT, STARTING AND LIGHTING SYSTEM

DELCO IGNITION

Battery is 6 volt, 120 ampere hour. The negative terminal of battery is grounded.

A set of 5 dry cells connected in series supply current for ignition when starting.

Breaker contacts open .018 in. to .020 in. Break occurs when dead center mark on fly wheel is 1 1/4 in. past indicator, spark fully retarded. Firing order is 1, 3, 4, 2. For care of tungsten contacts see Plate No. 21. For testing of ignition units see Plate No. 69.

Voltage regulation is by reverse series field. There is no relay. Circuit between generator and battery is controlled by ignition switch. Generator starts to charge at 7 miles per hour. Maximum rate of 18-20 amperes is reached at 16-18 miles per hour. Maximum generator output should never exceed 25 amperes. There is an over-running clutch to allow generator to run as a motor when starting or when pressure being produced by generator is below that of battery.

Motor is connected to engine by non-automatic, mechanical shift. When ignition switch is closed generator runs as a motor to facilitate meshing of gears. Gears are drawn into mesh, generator circuit opened by raising one generator brush and cranking circuit completed by allowing motor brush to come into contact with the commutator when starting pedal is depressed. This applies the full battery pressure to motor and cranks engine.

There is a clutch to prevent engine driving motor. Cranking circuit is opened by raising of one motor brush, generator circuit is completed and gears are drawn out of mesh when starting pedal is released.

A circuit breaker on back of the light and ignition switch takes the place of fuses in the lighting circuit. Dash light is 6.5 volt, 4 cp. Tail light is 6.5 volt, 2 cp. Head lights are 6.5 volt, 15-18 cp.

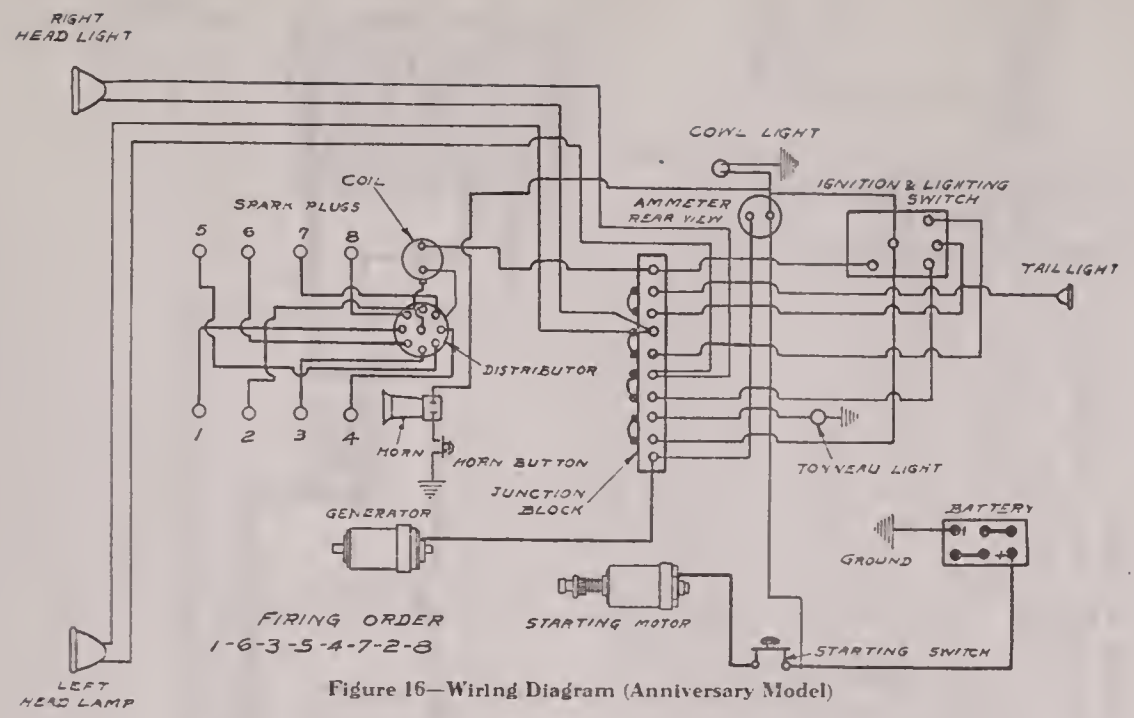
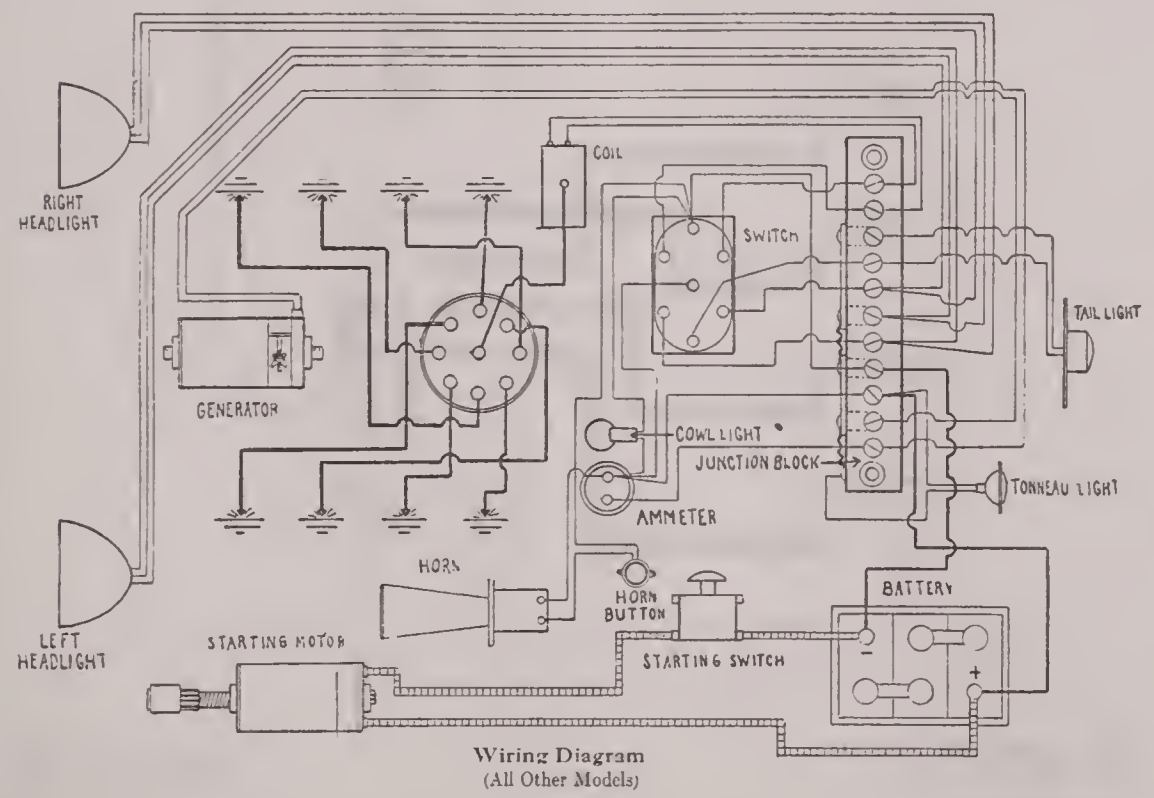


Figure 16—Wiring Diagram (Anniversary Model)



Wiring Diagram
(All Other Models)

PLATE NO. 126

Apperson

8-18 (1918)

BIJUR TWO-UNIT, 6-VOLT STARTING AND LIGHTING SYSTEM. REMY IGNITION

Battery is 6 volt, 120 ampere-hour. The negative terminal is grounded on single wire system. The Anniversary model uses single wire system. All other models use two-wire system.

On the Anniversary models the ignition units are grounded. On other models two wires are used in ignition circuits (except the high tension). Ignition switch reverses current across timer contacts every quarter turn. Contacts open .015 in. to .020 in. They are made of tungsten metal. See Plate No. 20. Break should occur on upper dead center, spark fully retarded. Firing order is 1, 6, 3, 5, 4, 7, 2, 8. No. 1 cylinder is the one nearest the radiator, on the left hand side. No. 5 is the one nearest the radiator on the right hand block. Spark gap should be .025 in. to .028 in., or about the thickness of a smooth dime.

Voltage regulation is by third brush. Ammeter indicates rate of charge or discharge. Relay closes at a speed of 10 to 12 miles per hour. Maximum generator output is 14-15 amperes. There is a 20-ampere fuse in the aluminum case on generator. This is to protect the generator if it is run with high resistance in the charging circuit. Always remove this fuse if generator is to be run with battery disconnected.

Starting motor is connected to engine by Bendix gear.

All lighting wires are rubber covered and carried in either loom or flexide metal conduit. All wires except those composing the starting circuit, are connected to the junction block. All circuits may be tested from this block. To facilitate tracing of wiring, all wires leading to the positive terminal of the battery, or generator, are covered with red insulation.

Focus of head lights is adjustable by the small machine screw at back of lamp shell.

If reflectors are tarnished, clean with rouge moistened with alcohol and applied with a soft piece of chamois. Then polish with rouge and a soft piece of dry chamois skin.

Head lights are 7 volt, 3 ampere, 18 cp. Small headlights 7 volt, .84 ampere, 4 cp. Cowl light is 7 volt, .42 ampere, 2 cp. Tonneau light is 7 volt, .42 ampere, 2 cp. Tail light is 7 volt, .42 ampere, 2 cp.

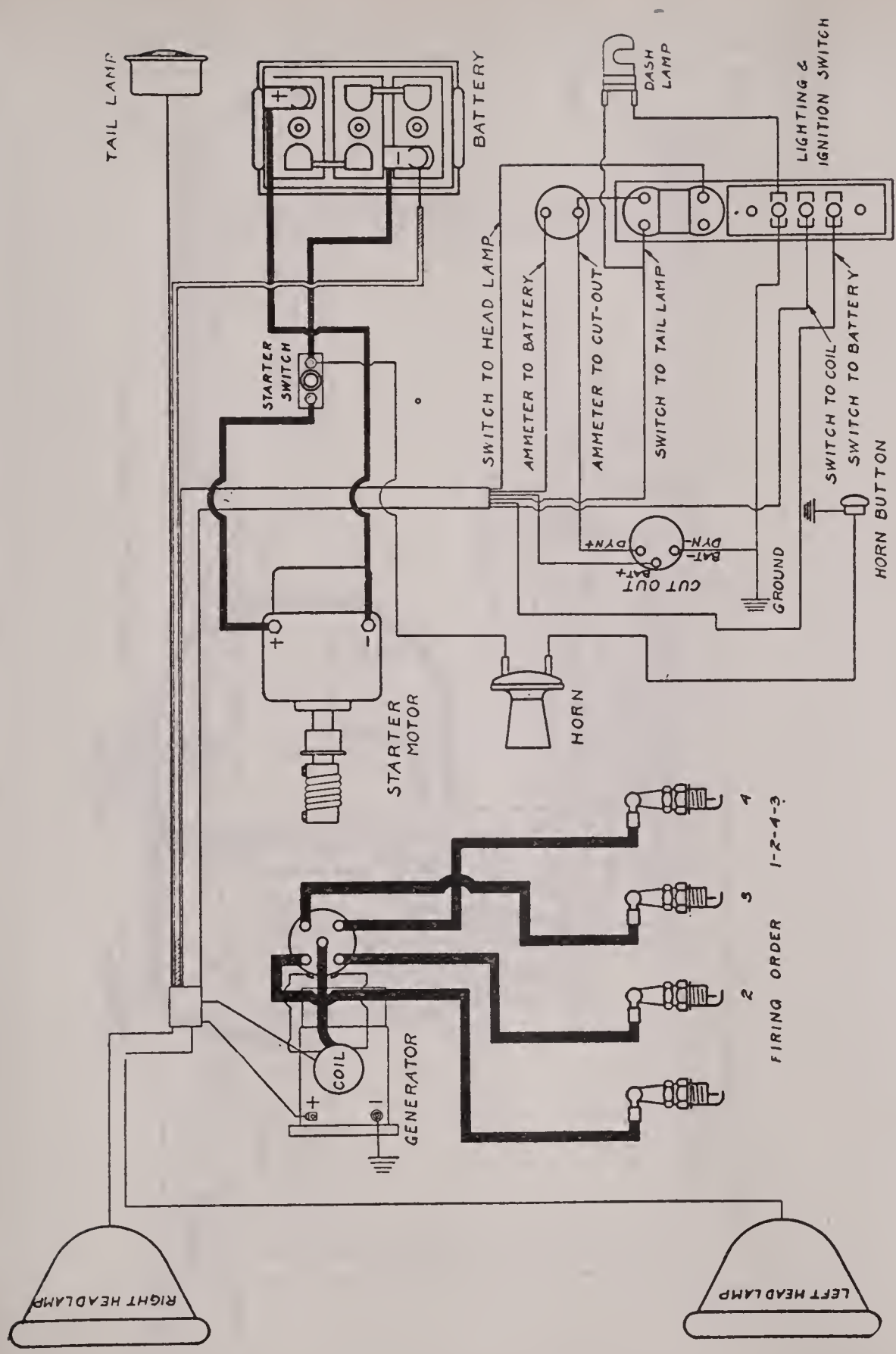


PLATE No. 127

Olympian

AUTO-LITE STARTING AND LIGHTING SYSTEM. CONNECTICUT IGNITION

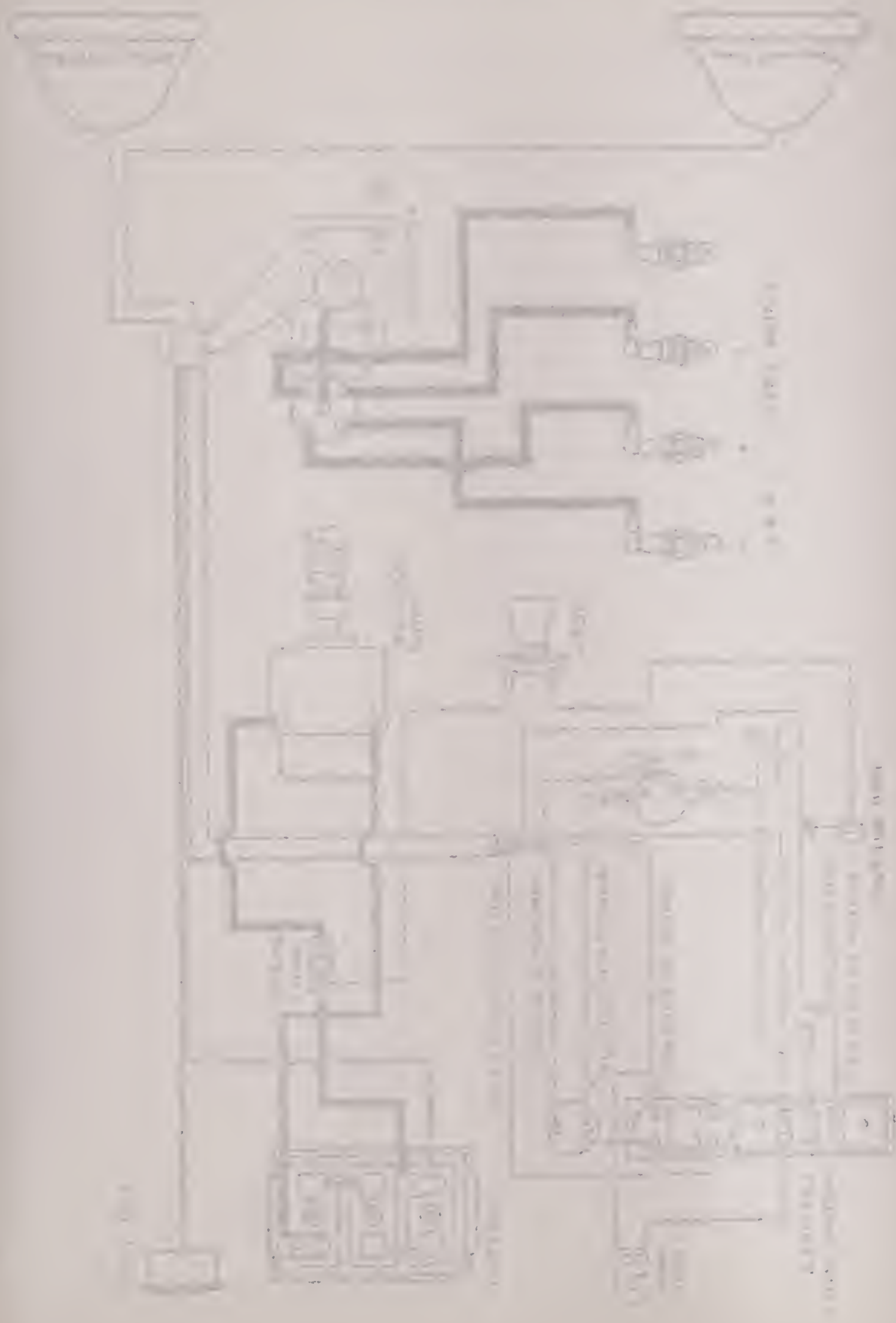
Battery is 6 volt, 80 ampere-hour. The negative terminal is grounded by the wire leading from the relay.

Breaker contacts should open .014 in. to .016 in. Contacts should not be filed or sandpapered. They will function properly even though quite irregular. Their natural color is dark grey. Should they ever become badly corroded they may be cleaned by drawing a piece of very fine sandpaper lightly between them. Do not try to make the contacts smooth, as it is merely a waste. Should they ever become so badly worn as to impair the proper operation of the engine the entire mechanism must be renewed as directed on Plate No. 50. Contacts should just begin to separate when the piston entering power stroke is on top dead center, spark fully retarded. The firing order is 1, 2, 4, 3.

The driving power of the starter is transmitted to the flywheel by a Bendix drive. The motor bearings are packed with grease. The old grease should be removed, the bearing thoroughly cleaned and new grease put in once a season.

Voltage regulation is by third brush system. Relay should close at 6-8 miles per hour. The maximum charging rate of 9-12 amperes is reached at 10 miles per hour. This rate gradually reduces at higher speeds. Generator brushes are made of a special composition best suited for this machine and should not be substituted by other grades. Once every month, or 1,000 miles, put five to eight drops of good light engine oil in each of the generator oilers. Generator terminals must be short circuited if it is to be run with battery disconnected.

Head lamps are 6-8 volt, 15 cp. Dash lamp is 6-8 volt, 2 cp. Tail lamps is 6-8 volt, 2 cp.



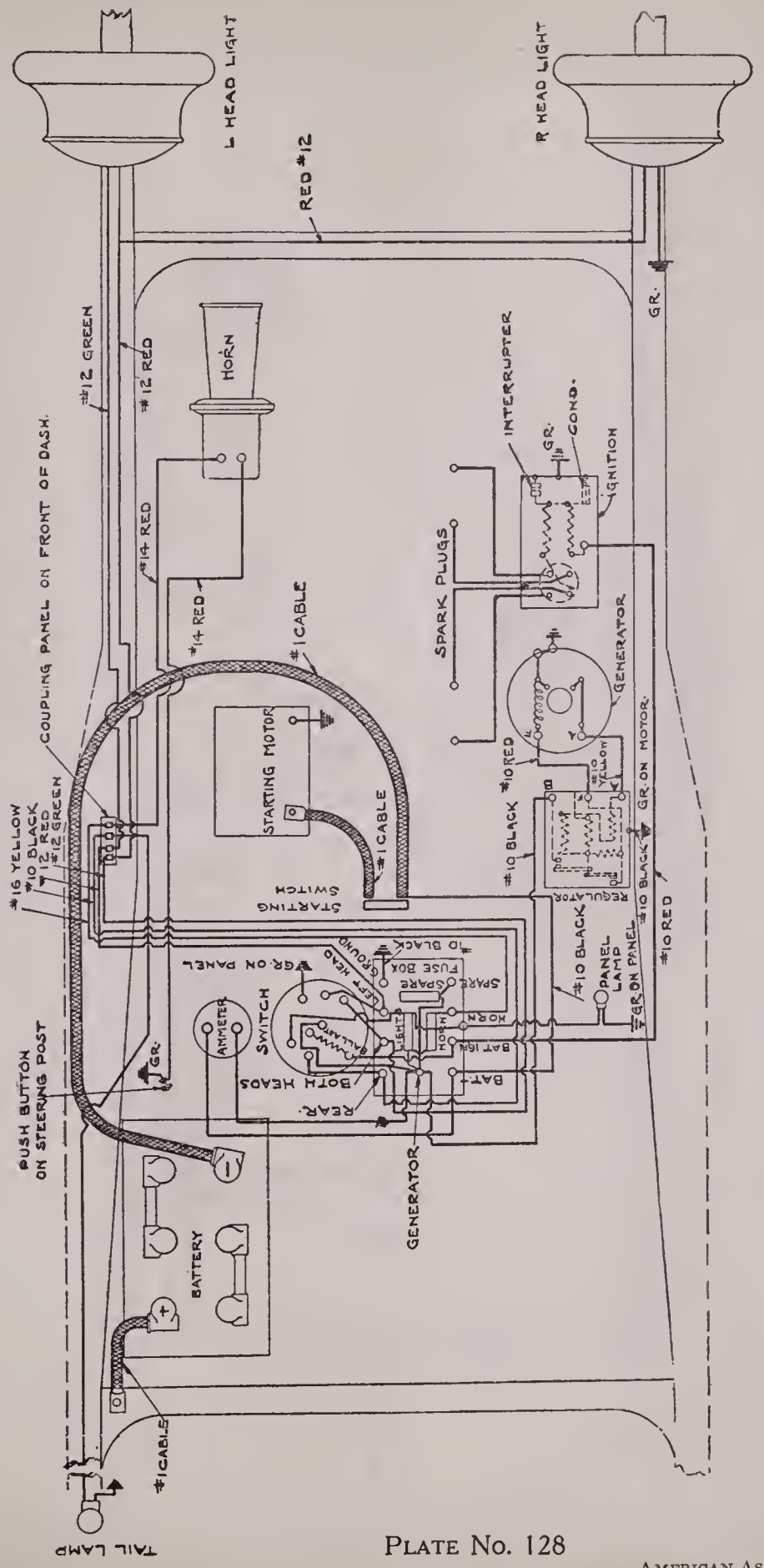


PLATE NO. 128

Kissel Kar

MODELS 4-32 AND 4-36 (1916)

WESTINGHOUSE GENERATOR. KISSEL STARTER. WESTINGHOUSE IGNITION

Battery is 6 volt, 100 ampere-hour. The positive terminal is grounded.

The breaker, ignition coil and distributor are all contained in one case. Breaker contacts should open .008 in. They may be adjusted by means of a screw driver inserted through the hole provided for that purpose. Should contacts become badly burned or pitted, they may be resurfaced with a very fine, flat, jeweler's file. The brush end of the distributor rotor is directly opposite the V notch on the edge of the case when the contacts begin to open, spark lever advanced about one inch. Spark should occur when the piston entering power sroke is on top dead center, spark control lever one inch from the fully retarded position. The firing order is 1, 3, 4, 2. Once every month, or 1,000 miles, put two or three drops of light machine oil in the oiler on the side of the igniter. Spark gap should be .025 in. to .028 in.

The driving power of the starter is transmitted to the flywheel by a Bendix drive. Put four or five drops of light engine oil in motor oilers once every month, or 1,000 miles. The starter should crank the engine at about 100 R. P. M.

Voltage regulation of the generator is by a vibrating regulator. Directions for the care of this regulator are given on Plate No. 6. Relay should close at 7-10 miles per hour. The maximum charging rate of 14-16 amperes is reached at about 20 miles per hour. Put four or five drops of light machine or engine oil in each of the generator oilers once every two weeks, or 500 miles.

Head lamps are 6-8 volt, 18 cp. (When a special diffusing lens is used, 21 cp. lamps are sometimes substituted.) Dash lamp is 6-8 volt, 2 cp. Tail lamp is 6-8 volt, 2 cp. Fuses are 20 ampere.

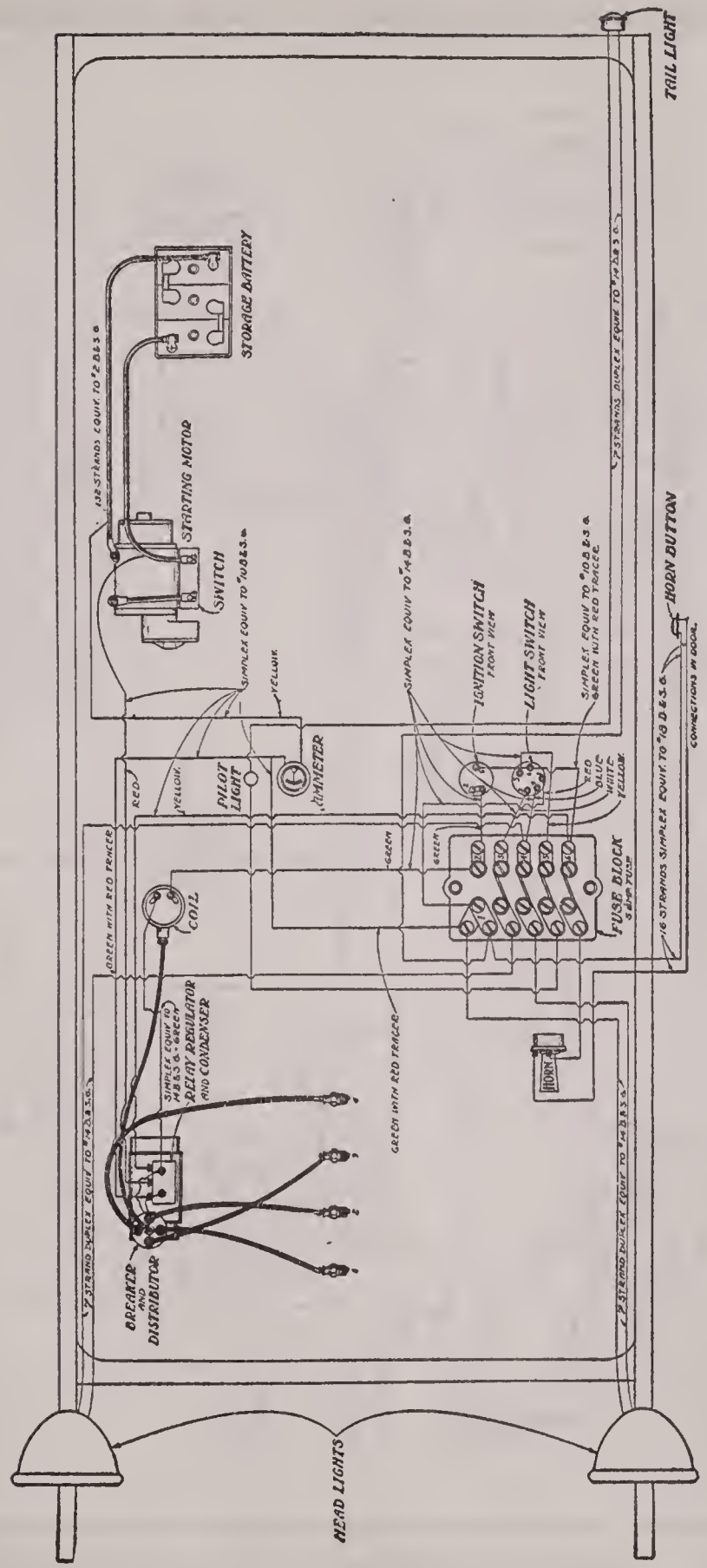


PLATE NO. 129

Reo

MODELS R, S, M, N (1916)

REMY TWO-UNIT STARTING AND LIGHTING SYSTEM. REMY IGNITION

Battery is 6 volt, 100 ampere-hour.

Breaker is carried on the front end of the generator and is driven by spiral gears, from generator shaft. Contacts open .012 in. to .020 in. Surface contacts with a fine, flat jeweler's file or a piece of No. 00 sandpaper. Spark should occur when mark UDC 1-6 on the six cylinder and when the mark UDC 1-4 on the four cylinder is at indicator, spark retarded. Firing order of the six is 1, 4, 2, 6, 3. 5. Firing order of the four is 1, 3, 4, 2. Spark gap should be 1/32 in.

The condenser is contained in the box covering the relay. There are two wires leading from the bottom of the breaker. These must be connected to the two terminals on the side of the condenser case.

Voltage regulation is by a vibrating regulator. Relay is combined with regulator unit. Relay closes at 350 R. P. M. of the engine. The regulator does not become effective until the governor output reaches 10 amperes. This output should be reached at 12-14 miles per hour. The regulator will hold the output between 9 and 11 amperes at all higher speeds. Increasing the spring tension will raise the output. Clean contacts with a piece of soft paper, or in cases of extreme corrosion use a piece of No. 00 sandpaper (preferably a piece which has been used). Do not use sandpaper unless necessary, as its use is apt to affect the output. When replacing cutout be careful not to close the contacts, as they will stay closed if engine is not running. If left in this condition, the battery will be discharged in four or five hours and relay probably burned out. The following data applies to the No. 240 Generator used on the R and S model (four cylinder) cars. Test without ignition.

Amperes	R. P. M.	Volts
0.	360	6. -6.4
7.0	500	6.3-6.7
11.0	800	6.5-6.9
12.1	1000	6.5-6.7
12.5	1500	6.5-6.7

On battery test field draws 2 amperes at 5.9 volts. Generator motoring draws 3 to 4 amperes at 5.8 volts and runs at 240 R. P. M.

The following data applies to the 241 generator used on the Models M and N (six cylinder) cars. Test without ignition. On battery test field draws 2 amperes at 5.9 volts. Generator motoring draws 3 to 4 amperes at 5.8 volts and runs at 390 R. P. M.

Amperes	R. P. M.	Volts
0.	550	6.0-6.4
7.	700	6.3-6.7
10.	800	6.4-7.0
12.	1500	6.5-7.9
12.5	2500	6.5-7.9

(*Continued on Plate No.* 129A)

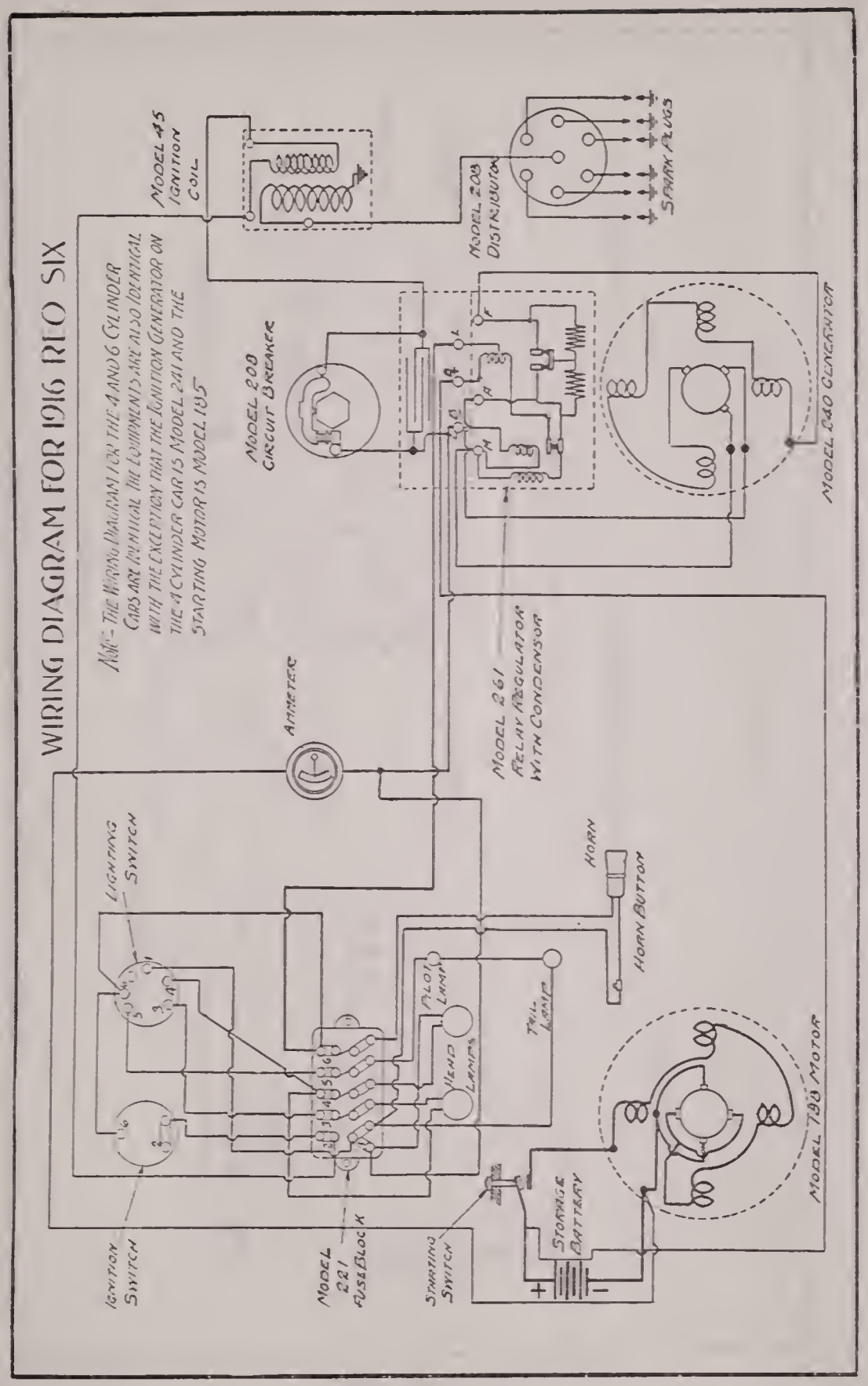


PLATE No. 129A

Reo

MODELS R, S, M, N (1916)

REMY TWO-UNIT, STARTING AND LIGHTING SYSTEM. REMY IGNITION

(*Continued from Plate No.* 129)

The following data applies to the No. 185 Starter used on the Models R and S (four cylinder) cars:

Torque (with 6-in. pulley)	R. P. M.	Amperes	Volts
4 lbs.....	800-1000	55-65	5.9-6.1
8 lbs.....	650-900	65-80	5.8-5.9
16 lbs.....	550-675	95-115	5.6-5.8
24 lbs.....	450-550	120-150	5.5-5.7
40 lbs.....	350-400	175-200	5.3-5.5
54-65 ft. lbs.. Lock Torque		580-620	4.0-4.2

Motor requires about 95 amperes to crank engine at 125 R. P. M.

The following data applies to the No. 188 Motor used on the Models M and N (six cylinder) cars:

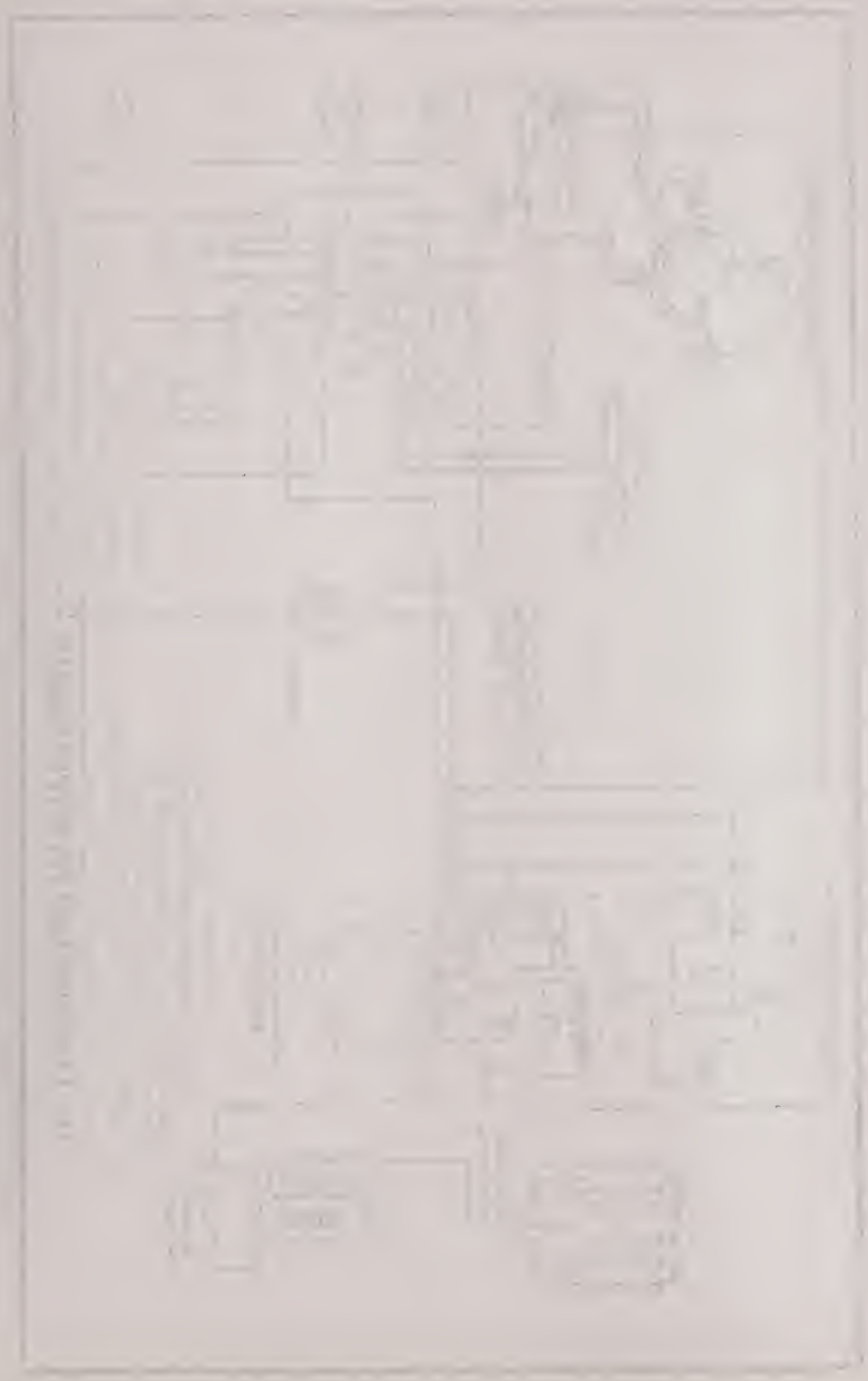
Torque (with 6-in. pulley)	R. P. M.	Amperes	Volts
4 lbs.....	800-1000	55-65	5.9-6.1
8 lbs.....	650-900	65-90	5.8-5.9
16 lbs.....	550-675	95-115	5.6-5.8
24 lbs.....	450-550	120-150	5.5-5.7
40 lbs.....	350-400	175-200	5.3-5.5
54-65 ft. lbs.. Lock Torque		580-620	4.0-4.2

Motor requires about 95 amperes to crank engine at 125 R. P. M.

Starting switch is so arranged that it cannot be closed unless gear shift lever is in neutral position. This is to prevent anyone propelling the car with starting motor. Every 1,000 miles put a few drops of light oil in the oil hole at each end of the motor. Gear case is packed with cup grease. It should be replenished through the removable plug at least once a year. Starting switch is adjustable to wear. Surface contacts with file or emery cloth.

Head lights are 6-7 volt, 15 cp. Dash and tail lights are 3½ volt, 3 cp. Head lights are in series on dim position.

Fuses are 5 ampere. A separate fuse is supplied for each head, the horn and the dash and tail light circuits.



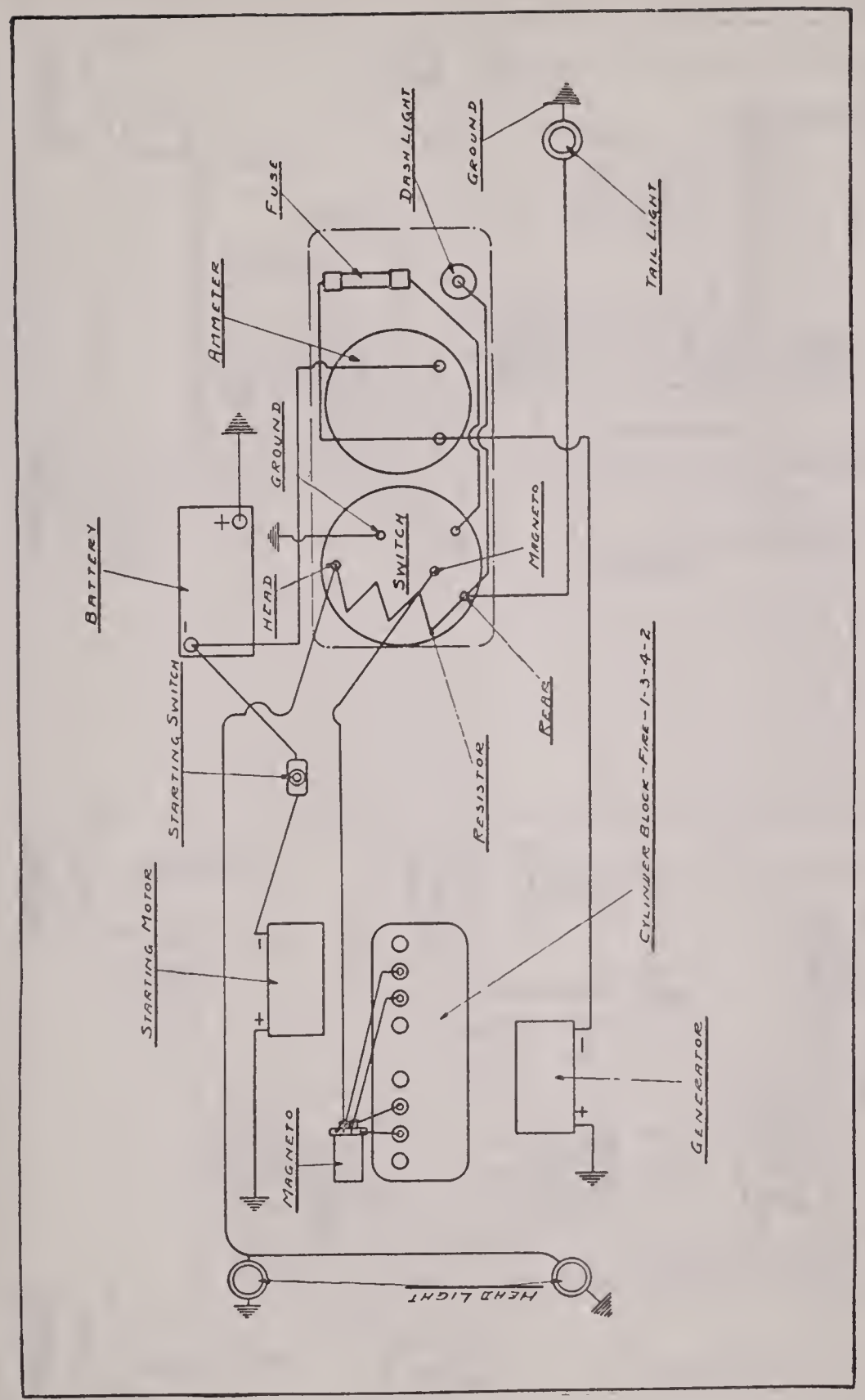


PLATE NO. 130

Winther Motor Truck

BIJUR TWO-UNIT STARTING AND LIGHTING SYSTEM. EISEMANN IGNITION

The models 48, 68 and 88 use Bijur 6 volt system, and the models 108, 128 and 148 use the 12 volt Bijur system.

Battery is 6 volt, 100 ampere-hour or 12 volt, 60 ampere-hour. The positive terminal is grounded.

Break should occur on upper dead center, spark fully retarded. Firing order is 1, 3, 4, 2. To set magneto, turn engine until No. 1 cylinder is on top dead center, remove distributor plate and turn magneto shaft until setting mark "R" is in line with setting screws. On this position the contacts are just beginning to open and the distributor rotor is making contact with wire leading current to No. 1 cylinder. The magneto must then be connected to engine without disturbing the relative position of either.

The contacts should be cleaned with gasoline occasionally, and if badly pitted or burned they should be surfaced with a piece of No. 00 sandpaper. The distributor and rotor should be cleaned with gasoline several times a year. Put one or two drops of 3-in-1 oil in the two oil wells every 1,000 miles. The one on the top of the distributor housing provides lubrication for the armature ball bearing, the distributor plain bearing and the wick to the timing lever body. The other oil well will be found on the extension of the end plate near the driving axle. It lubricates the ball bearing at that end of the magneto. Spark gap should be 1/64 in. to 1/32 in. Contacts open .012 in.

Head lights are 6-8 volt, 12 cp. on the small, and 12-14 volt, 12 cp. on the large models. Dash light is 6-8 volt, 2 cp. on small, and 12-14 volt, 2 cp. on large models. The tail light is 6-8 volt, 2 cp. on the small, and 12-14 volt, 2 cp. on the large models.

Voltage regulation is by vibrating regulator. Generator begins to charge at 6-8 miles per hour. Maximum charging rate of 8-10 amperes is reached at 8-10 miles per hour on 6 volt system. Ammeter shows rate of charge or discharge. Fuse is 20 amperes.

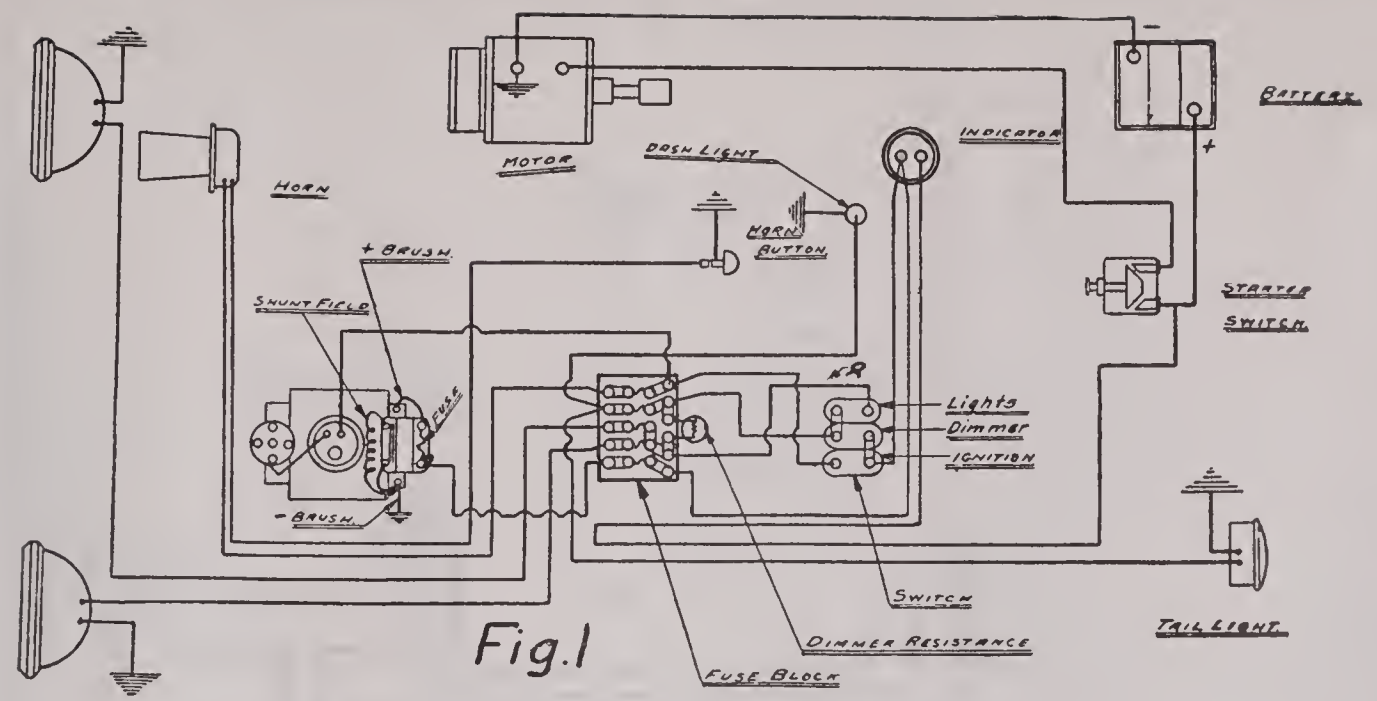


Fig. 1

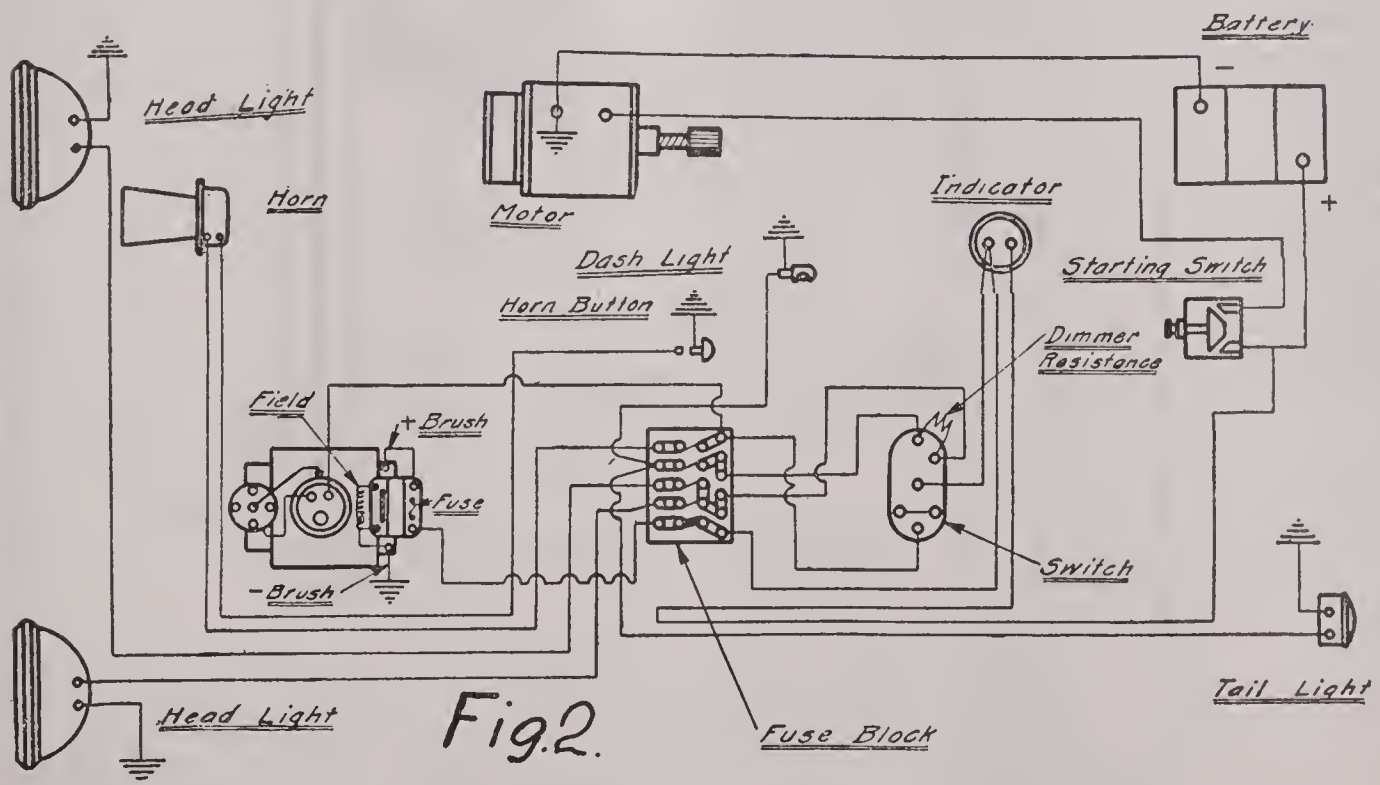


Fig. 2.

PLATE NO. 131

Interstate

MODELS T AND TR

REMY TWO-UNIT STARTING AND LIGHTING SYSTEM. REMY IGNITION

Battery is 6 volt, 80-100 ampere-hour. The negative terminal is grounded at the starting motor.

Breaker contacts should open .025 in. They should be cleaned with No. 00 sandpaper or a fine, flat, jeweler's file. Break should occur when dead center mark is at indicator, spark fully retarded. Firing order is 1, 2, 4, 3. The grease cup below distributor should be tightened two turns every 500 miles. Use medium cup grease in this cup. Put a very small amount of vaseline on breaker cam every 1,500 miles. Rotor moves very close to, but does not touch, the pins in the distributor head.

Motor is connected to flywheel by a Bendix drive. Put four or five drops of good oil in the oiler at each end of the generator every 1,000 miles. The position of rocker ring holding brush rigging should never be changed, as it is set and tested at the factory. Pinion should have about 1½ in. lateral travel on screw shaft.

Voltage regulation is by vibrating regulator. Relay should close at 6-8 miles per hour. Maximum charging rate of 14-15 amperes is reached at 12 miles per hour.

There is a 15-ampere fuse in series with the shunt field. This fuse is located on regulator base. Use commercial 15-ampere fuse wire. When necessary, clean regulator contacts with a piece of No. 00 sandpaper, being very careful not to bend the arm, as a slight variation in the spring tension will greatly affect the output. Too great a tension will raise the voltage abnormally high. Under average running conditions the generator should receive five or six drops of good machine oil every 1,000 miles.

The following data applies to the generator used:

Amperes	R. P. M.	Volts
0.	370	6.
7.	490	6.5
14.2	2200	6.9

On battery test, field draws 3 to 3.5 amperes at 5.9 volts. Generator motoring draws 4 to 4.5 amperes at 5.8 volts and runs at 430 R. P. M.

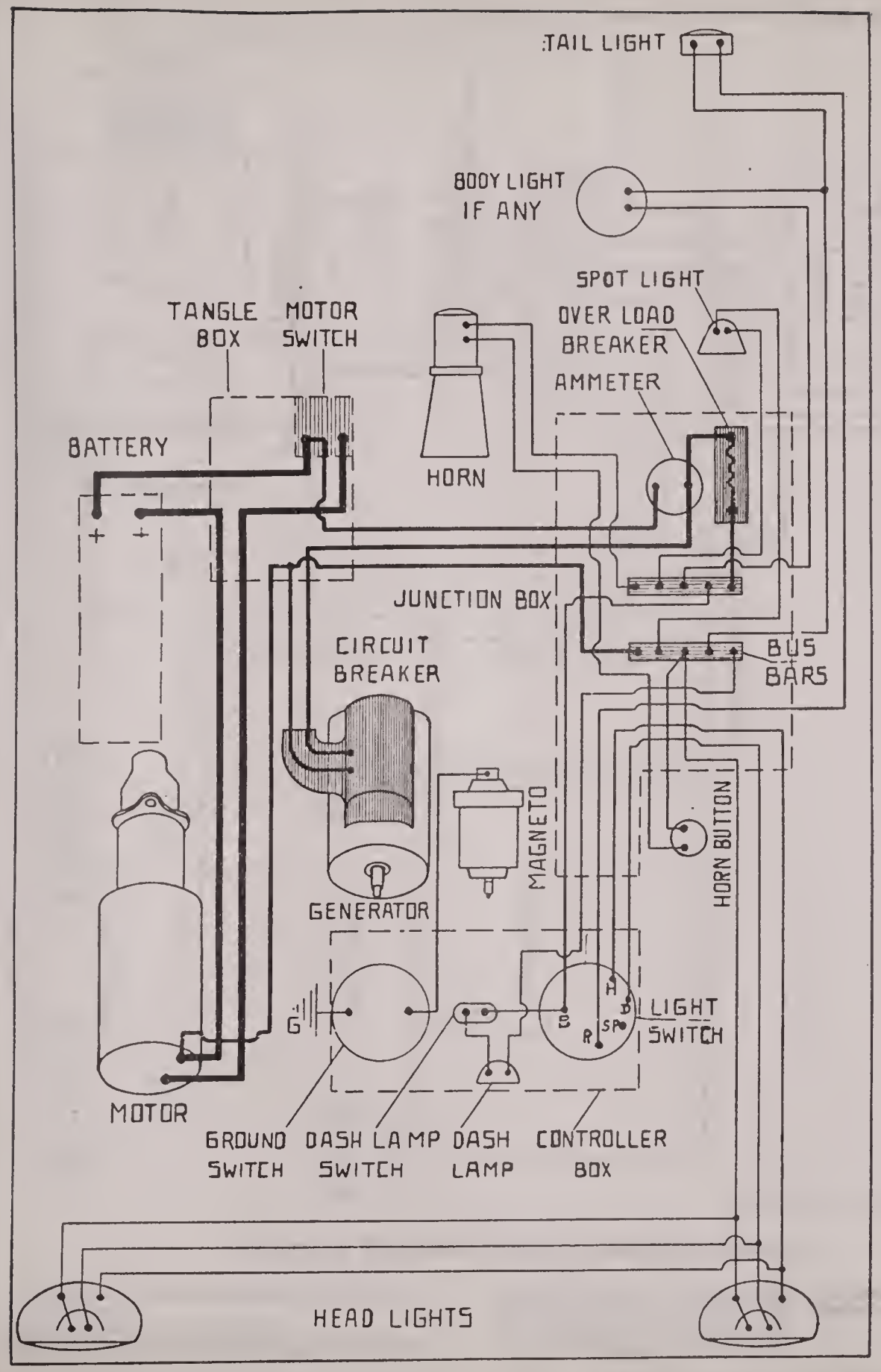
The following data applies to the starting motor:

Torque (with 6 in. pulley)	R. P. M.	Amperes	Volts
0 lbs.....	3600-4200	56-64	6.0
16 lbs.....	1150-1250	200-230	4.7-4.8
24 lbs.....	850-950	290-310	4.5-4.6
40 lbs.....	300-400	450-500	3.5-3.6
14 ft. pounds..	Lock Torque	570-600	3.0

Head lamps are 6-8 volt, 15 cp. Tail lamp is 6-8 volt, 2 cp. Dash lamp is 6-8 volt, 2 cp.

Fuses in head lamp and horn circuits are 8-10 ampere. Fuses in dash and tail light circuits are 4 ampere.

Fig. 1 applies on all Model T cars prior to Serial No. 9,988. Fig. 2 applies to cars after and including Serial No. 9,988. The number plate is on the left, under the front seat cushion.



White

Model GM

Leece-Neville Two-Unit, Starting and Lighting System
Eisemann Magneto Ignition

Battery is 12 volt, 75 ampere-hour. The two-wire system is used.

Every 1,000 miles put three drops of oil in magneto oiler. Break occurs on upper dead center, spark retarded. Spark gap should be between 1/32 in. and 1/64 in. Lower right-hand terminal of the distributor connects to No. 4 cylinder. The upper right-hand plug connects to No. 2 cylinder. The upper left-hand terminal connects to No. 1 cylinder. The lower right-hand plug connects to No. 3 cylinder. No. 1 cylinder is the one nearest the radiator. Firing order is 1, 3, 4, 2. Contacts should open .012 in.

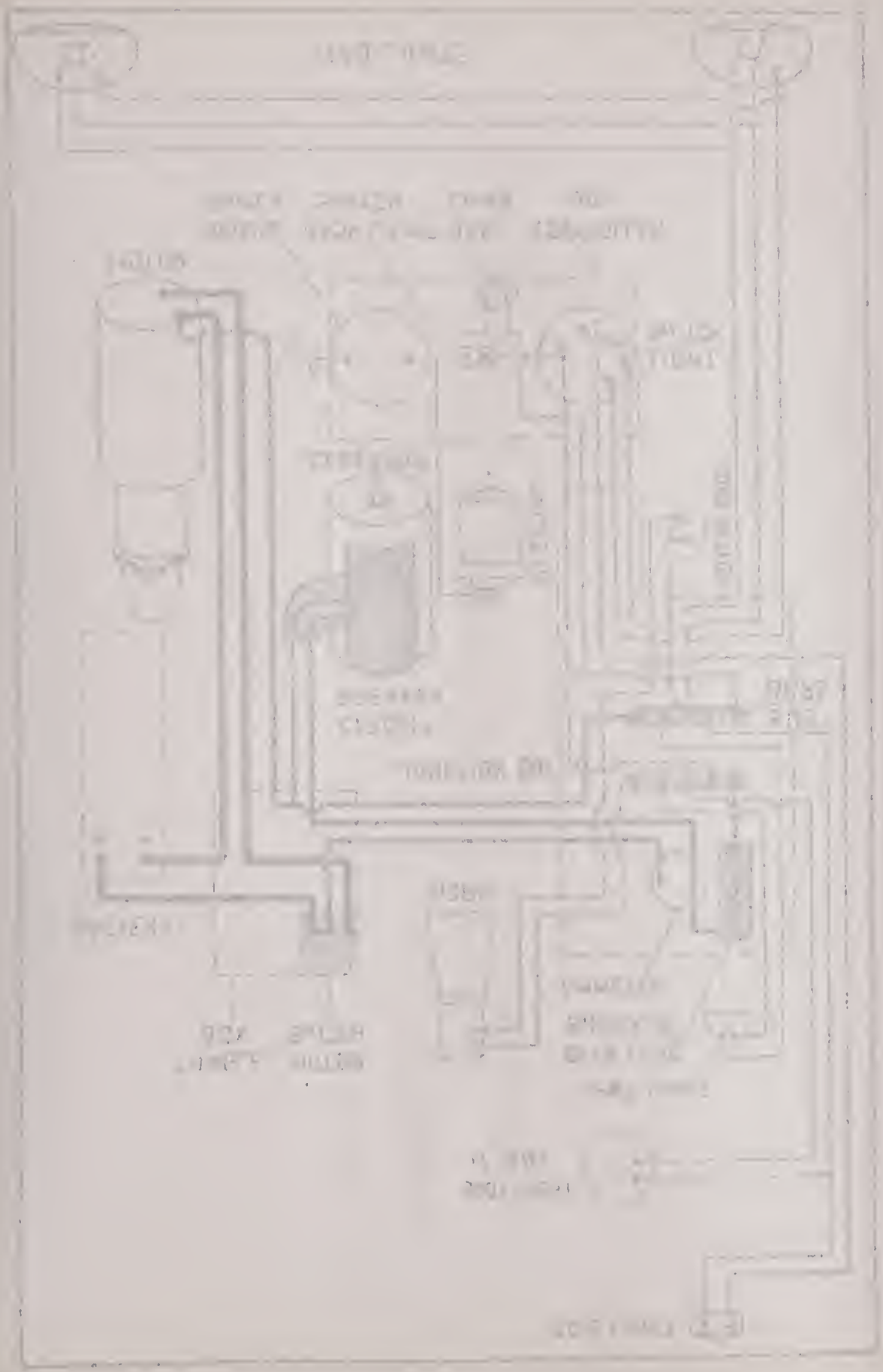
Motor is connected to engine by Bendix gear.

Voltage regulation is by third brush. Relay closes at 7 miles per hour. Maximum charging rate of 10 amperes is reached at 18 miles per hour. Maximum rate should never exceed 12 amperes. The third brush is adjusted by turning the thumb nut. A pair of pliers should be used to turn the nut. Relay opens at 6 miles per hour.

There is a lockout circuit breaker located on the dash, to take the place of fuses in the lighting circuit.

The starting motor and the generator should be lubricated with a few drops of light machine oil every 1,000 miles.

Large head lights are 12 volt, 21 cp. Small head lights are 12 volt, 4 cp. Spot light is 12 volt, 7 cp. Tail light is 12 volt, 2 cp. Dome light is 12 volt, 2-4 cp. Tonneau light is 12 volt, 2 cp.



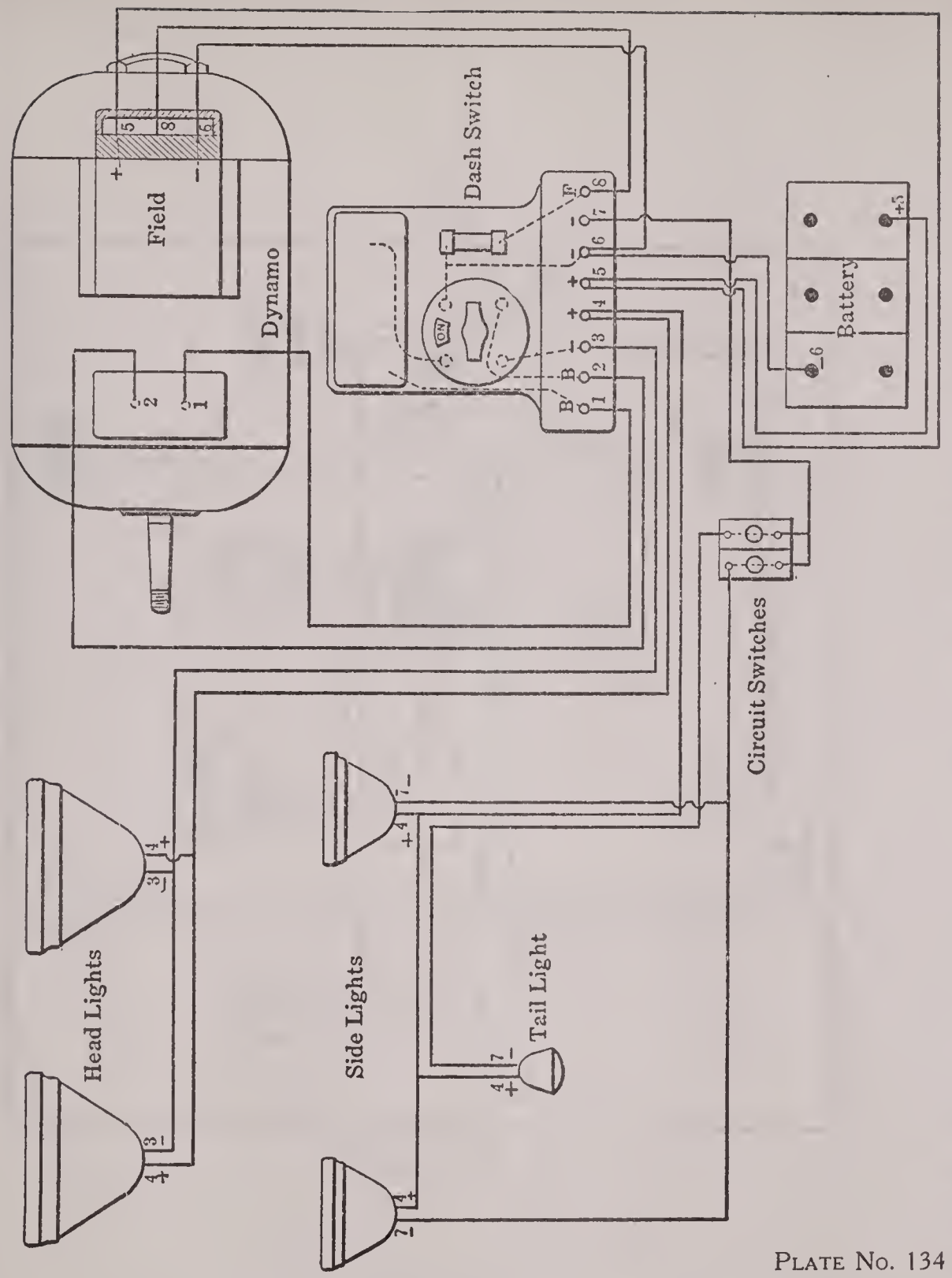


PLATE NO. 134

Wiring of Rushmore Electric Lighting System

Nos. 1 & 2—Leads to Ballast Connections on Dynamo
No. 3—Leads to - Headlights
No. 4—Leads to † Head, Side and Tail Lights
No. 5—Leads to † Dynamo and † Battery
No. 6—Leads to - Dynamo and - Battery
No. 7—Leads to Circuit Switch
No. 8—Leads to Dynamo Field

Locomobile

MODELS 30, 38 AND 48

RUSHMORE LIGHTING SYSTEM. BOSCH DUAL IGNITION

A number of the 1911 and 1912, Model "38" and "48"' Locomobiles and the 1911, 1912 and 1913 Model "30", four-cylinder, Locomobiles are equipped with the Rushmore lighting system. The two-wire system is used.

Battery is 6 volt, 80 ampere-hour, to 6 volt, 160 ampere-hour.

There is no starting motor supplied with this system.

Ignition is by Bosch Type ZR, dual magneto. The firing order of the four-cylinder cars is 1, 2, 4, 3. The firing order of the six-cylinder cars is 1, 5, 3, 6, 2, 4. The spark gap should be .028 in. to .030 in. Spark should occur when the piston is .375 in. to .420 in. before top dead center, spark fully advanced.

Voltage regulation is by bucking field. The amount of current passing through this coil is regulated by a smaller coil of iron wire, known as the ballasting coil. This coil of iron wire is not to produce magnetism, but to regulate the current flowing in the field coil. When it is cold, the resistance is very low; hence it acts as a short circuit, allowing practically no current to flow through the bucking field coil. As the speed increases the coil is heated, increasing its resistance. This forces more current to go through the bucking field coil, bucking out some of the magnetism produced by the main shunt coils. It reduces the magnetism in proportion to the speed, thus practically constant voltage is maintained above a certain speed. Assuming that the battery is in good condition, the voltage will be 6¼ to 6½ volts, depending on the state of charge of the battery. The output of the dynamo is determined by the size of wire in the ballast coil. The size must be reduced if smaller lamps are used and increased if larger lamps are used.

The shunt field takes about 1½ amperes. To protect it there is a 4-ampere fuse mounted on the switch block.

The wires leading from the generator to the switch block and from the switch block to the battery should be No. 12 gauge B. & S. For 25 cp. head lights the wires should be at least No. 14, and for 30 to 50 cp. headlights the wires should be at least No. 12 B. & S.

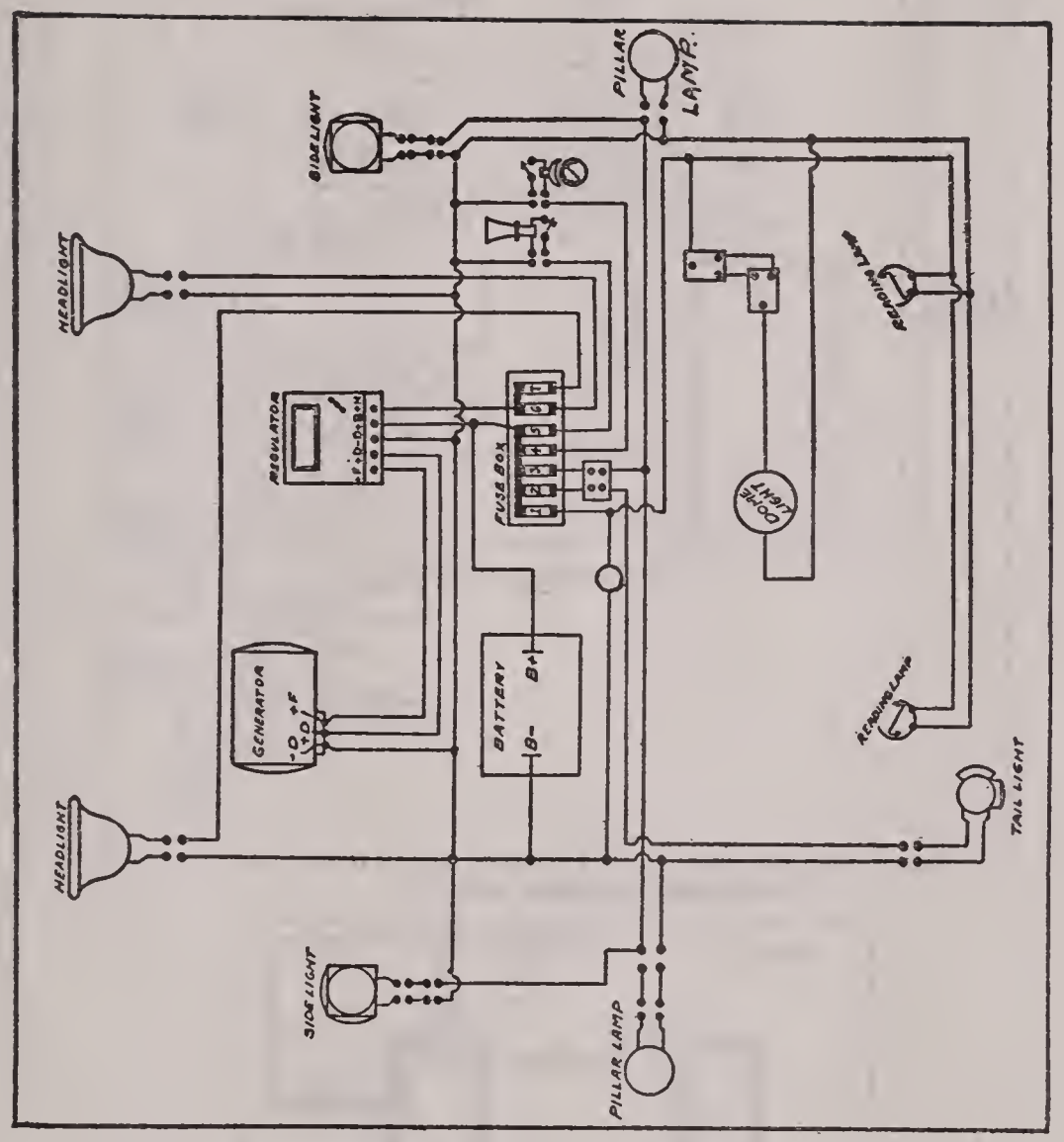


PLATE NO. 135

Locomobile

MODELS 30, 38 AND 48 (1913)

ADLAKE LIGHTING SYSTEM. BOSCH ZR6 DUAL MAGNETO IGNITION

Battery is 6 volt, 120 ampere-hour.

Firing order is 1, 5, 3, 6, 2, 4. Spark should occur when the top dead center mark on the flywheel is at the indicator, spark lever in the fully retarded position. Magneto breaker contacts should open .035 mm. Battery breaker should open .040 mm. Spark gap should be .028 in. to .030 in.

The two-wire system is used in all lighting circuits. Referring to the fuse board as shown in diagram, No. 1 fuse is in circuit with the dome, reading and trouble lights. No. 2 is in the tail light circuit. No. 3 is in the side and pillar light circuit. No. 4 is in the dash light circuit. All of the above-named fuses are 5 ampere. No. 5 fuse is in the horn circuit. This is a 10-ampere fuse. No. 6 is in the right head light and No. 7 in the left head light circuit. The last two fuses are 5 ampere.

On the regulator base there are two fuses. The upper, or main line, fuse is 10-ampere. The other is in the shunt field circuit. It is 5 ampere.

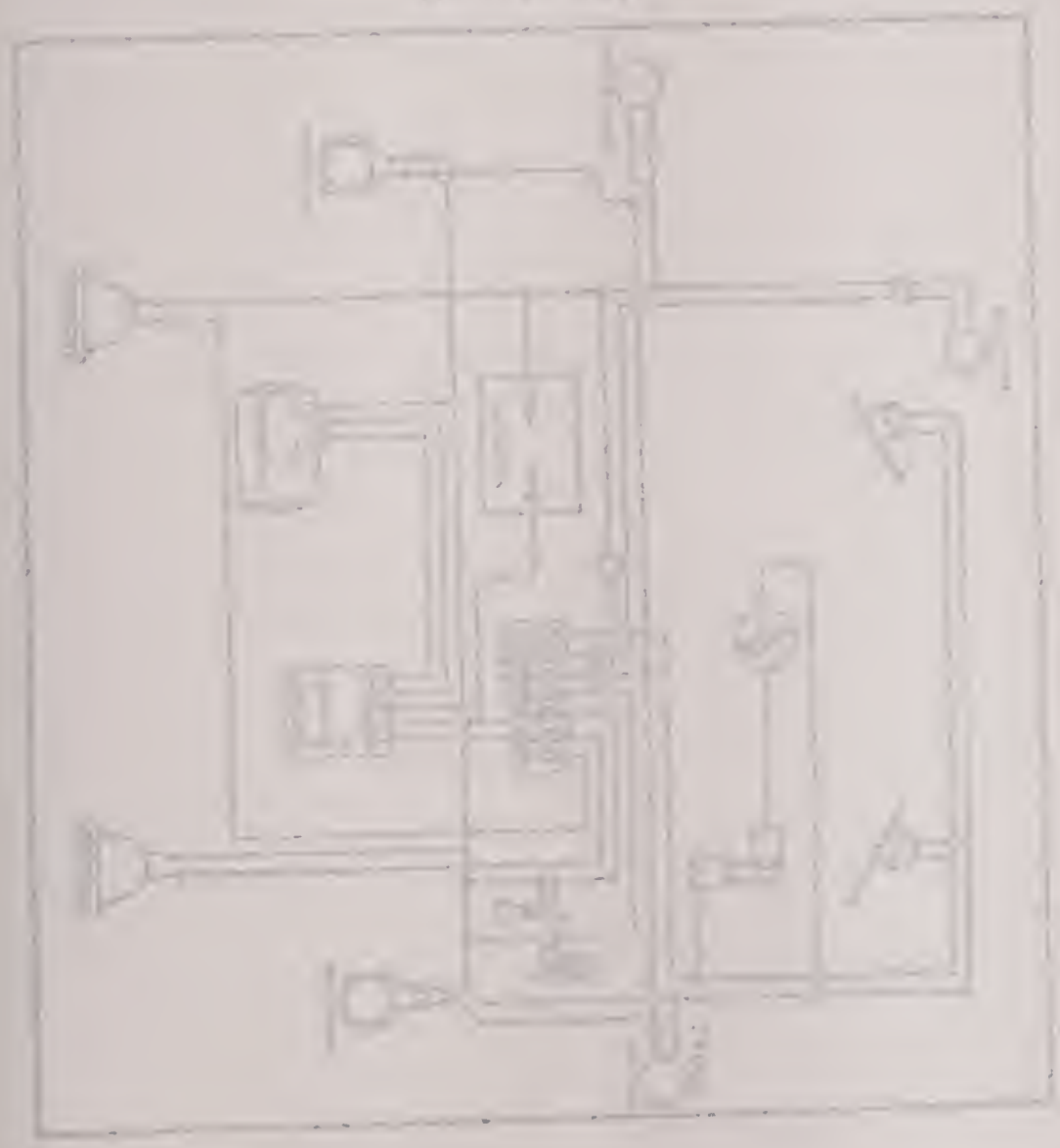
Head lights are 7 volt, 21 cp. Side lights are 7 volt, 6 cp. Tail light is 7 volt, 3 cp. Dash light in the roadster is 7 volt, 6 cp. On all other models the dash light is 7 volt, 3 cp. Trouble light is 7 volt, 6 cp. Pillar lights are 7 volt, 6 cp. Dome light is 6 volt, 6 cp. Reading lamps are 7 volt, 6 cp. Use Mazda or Tungsten filament lamps in all circuits.

Voltage regulation is by a mechanical, magnetic regulator, the action of which is easily understood. Inspect and clean every month, being careful not to change the adjustment. In cleaning the dashpot, see that none of the shot are lost. Never use any oil on it, as oil will clog it. Wipe the dashpot and piston with a cloth moistened with gasoline. Put one drop of good, light machine oil in each of the bearings carrying the wheel. See that the brush moves easily in the holder and that the brush springs exert a light, but firm, pressure. Wipe the segments with a cloth slightly moistened with gasoline and remove all dirt in the small spaces between them.

Every 1,000 miles put 40 drops of oil in each of the oil holes on top of the generator. At the same time remove the aluminum plate at the front end of the generator and inspect the commutator and brush.

When the brushes are worn so that only 1/16 in. remains outside the holders, they should be replaced. This should not be required oftener than one or two years. Be sure to sand the new brushes in well with No. 00 sandpaper. When the commutator is inspected clean commutator, brushes and the inside of the case with a cloth moistened with gasoline.

Batteries used range in size from 6 volt, 80 ampere-hour to 6 volt, 160 ampere-hour, according to the model car it is on and the service required.



Locomobile

"38" Type R-7 and "48" Type M-7 (1916-17)

Westinghouse Two-Unit Starting and Lighting System
Eisemann Dual Ignition

Battery is 6 volt, 120 ampere-hour. The positive terminal is grounded.

The Eisemann EM-6 magneto is used. The coil for battery ignition is back of the ignition switch on the dash. The magneto has two sets of contacts. The magneto breaker is grounded when switch is on "Batt" position. The same distributor is used for both magneto and battery ignition.

On the "48", the spark should occur when piston is 7/16 in. from top dead center, spark advanced.

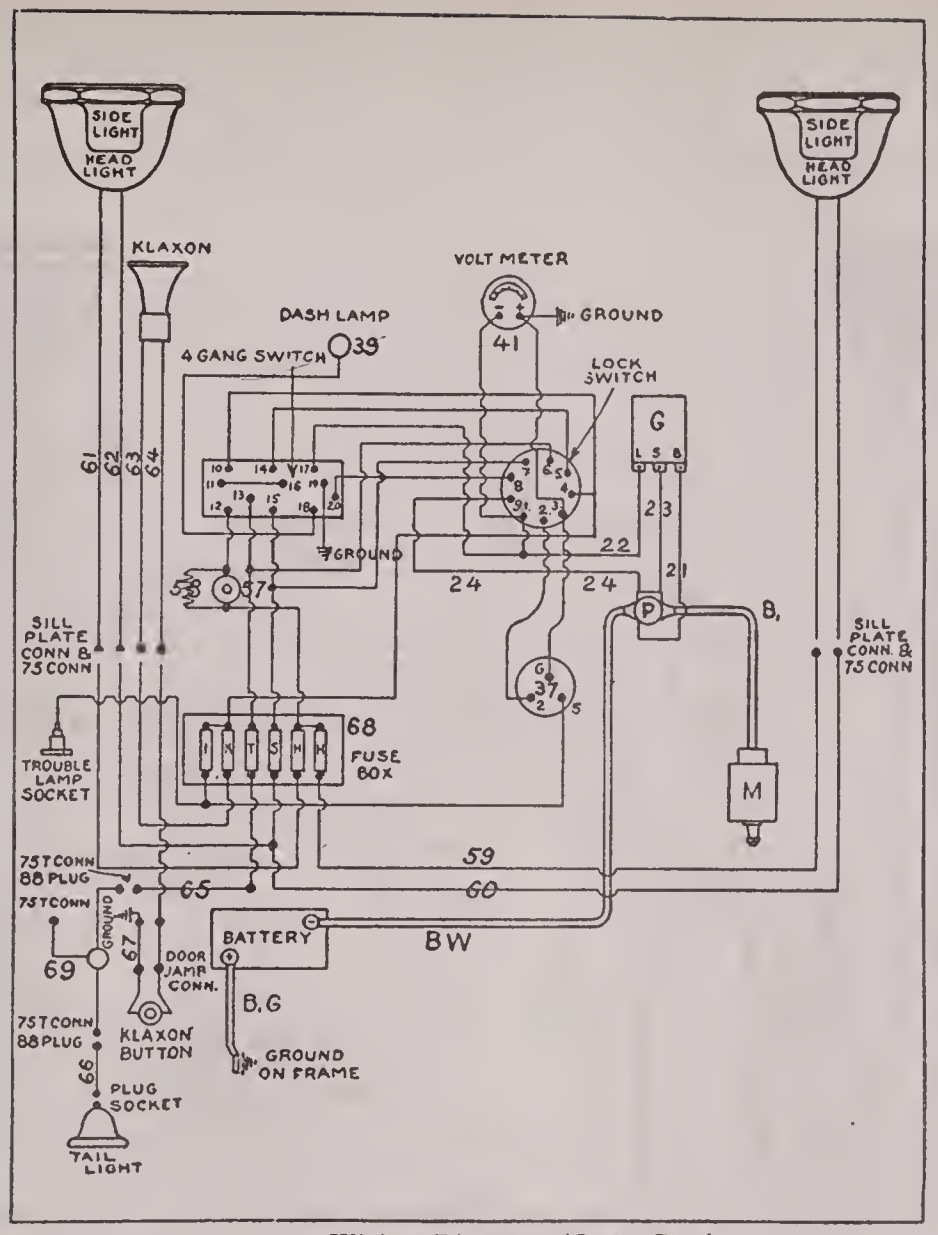
On the "38", the spark should occur when piston is 5/16 in. before upper dead center, spark fully advanced.

The battery ignition is set to give the spark after piston has started its downward stroke. Firing order is 1, 5, 3, 6, 2, 4. Breaker contacts open .012 in. Spark gap should be .028 in.

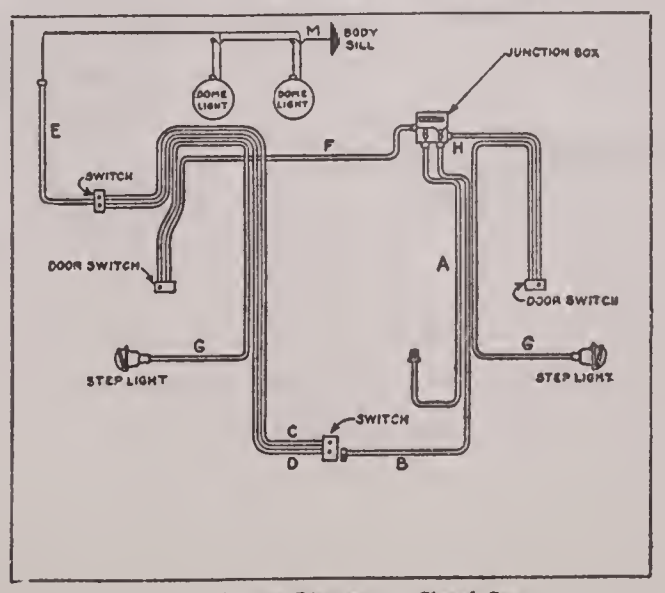
The starting motor should develop .7 horsepower at 5.25 volts. It should crank the "38" at 125 R. P. M. and the "48" at 115 R. P. M. Motor is connected to engine by a magnetic pinion shift. When the starting button is depressed, the current flows through the electro-magnet and the motor, which are in series. The electro-magnet pulls the pinion into mesh. There is a short-circuited winding around the field coils of the motor. This winding acts as a magnetic brake, keeping the speed of the motor down for a short time. The motor rapidly picks up speed and cranks the engine. As the starting motor gains speed it uses less current, hence, the electro-magnet, being in series with the motor, has less power, and a spring acting against it draws the pinion out of mesh. When the speed of the engine reaches 300 R. P. M., the generator develops enough pressure to close the cutout switch, which grounds the generator. The generator then ceases to supply current to the primary relay switch magnet and allows the switch to open. This breaks the motor circuit. No harm can result from leaving one's foot on the starting button, or depressing starting button when the engine is running, unless it is throttled down below eight miles per hour.

Voltage regulation is by reverse series field. The generator is wound with special wire, which increases in resistance as temperature rises, thus reducing the charging rate, if the battery becomes overheated from too rapid a charge. Relay should close at 8 miles per hour.

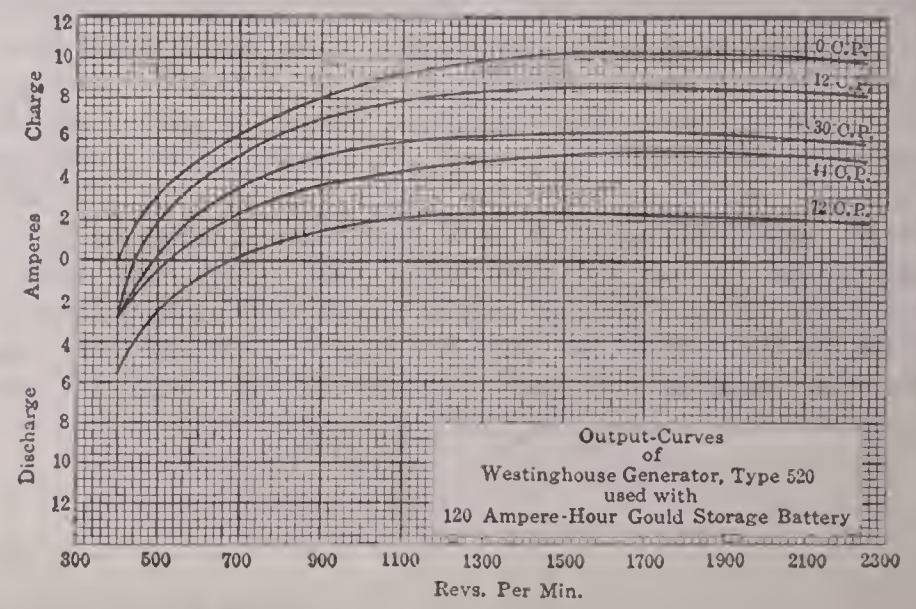
Head lights are 16 cp. Side lights are 6 cp. Tail light is 4 cp. Dash light is 2 cp. Trouble light is 6 cp. Tonneau light is 2 cp. Step lights are 2 cp. Dome light is 2 cp. All lights are 6-8 volt. All fuses are 10 ampere.



Wiring Diagram (Open Cars)



Wiring Diagram on Closed Cars



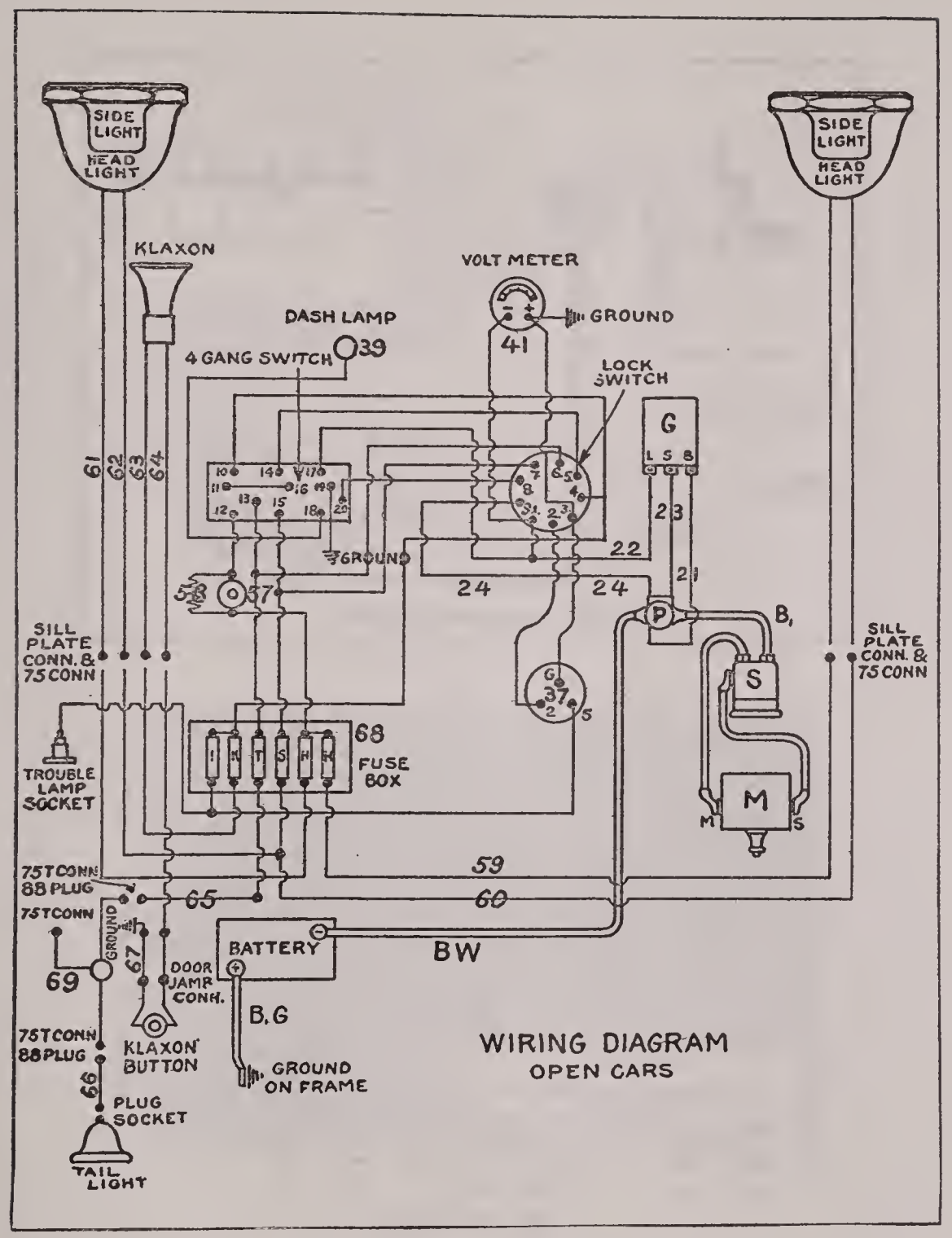


PLATE NO. 137

Locomobile (1915-1916)

"38"—TYPE R6 "48"—TYPE M6

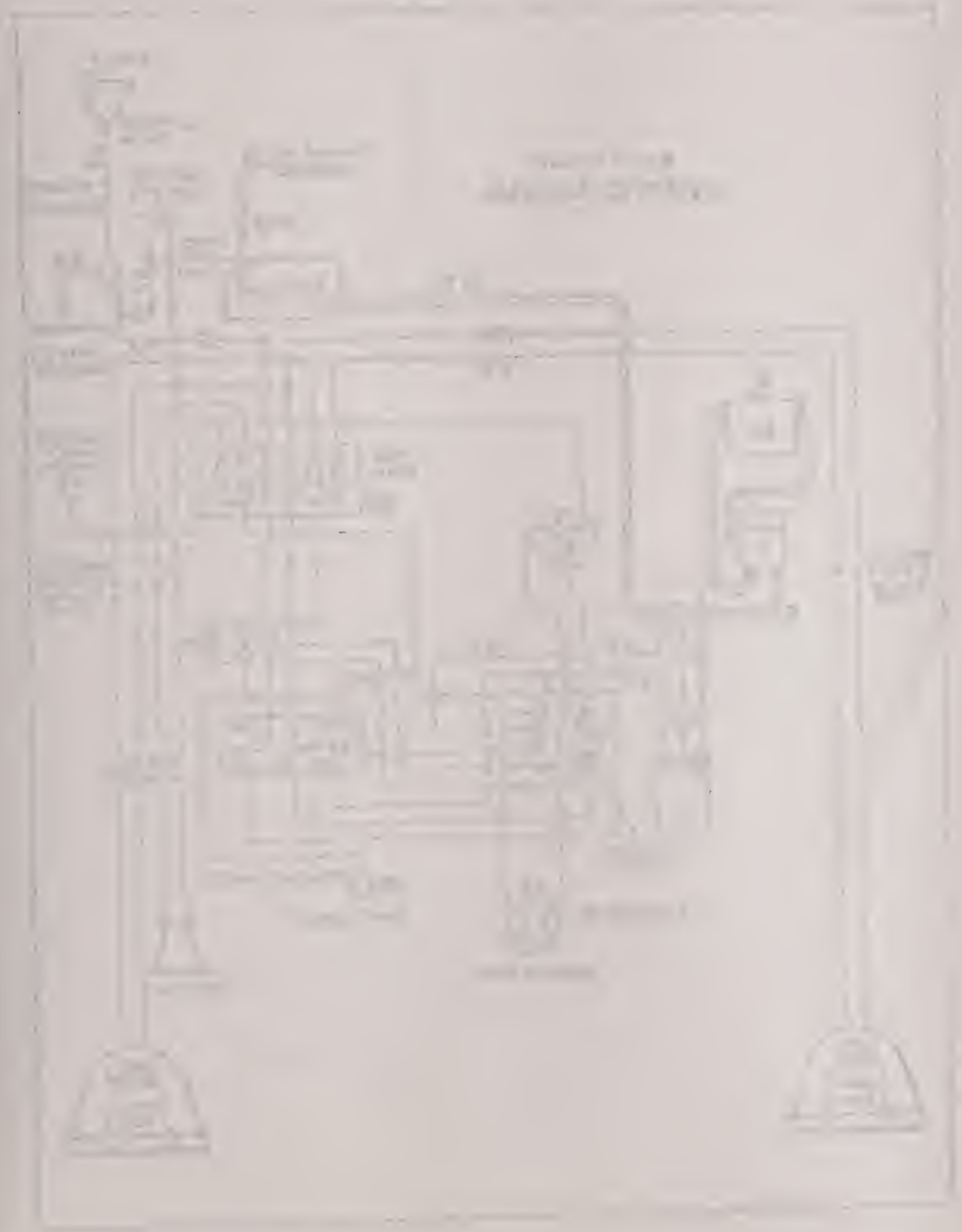
WESTINGHOUSE TWO-UNIT STARTING AND LIGHTING SYSTEM
BOSCH DUAL IGNITION

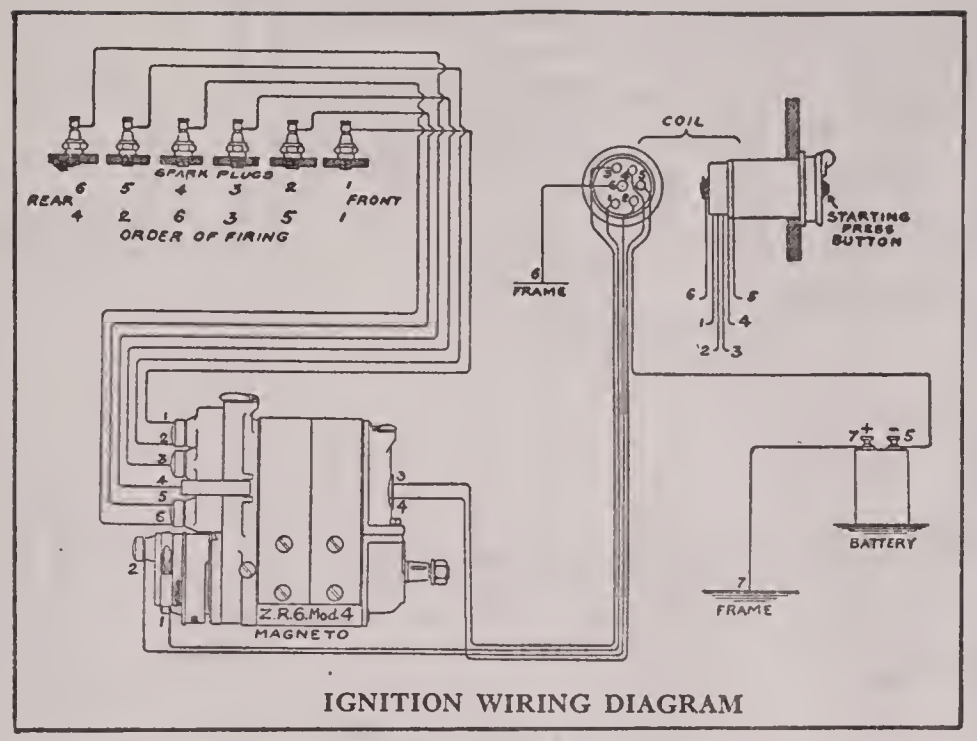
Battery is 6 volt, 120 ampere-hour.

Magneto is Bosch ZR6 Model 4. The magneto has two separate breakers, one for magneto, and one for battery ignition. The same distributor is used for both battery and magneto ignition. On the "48" the spark should occur when piston on compression stroke is 7/16 in. before upper dead center, spark fully advanced. On the "38" the spark should occur when the piston on compression stroke is 5/16 in. before upper dead center, spark fully advanced. The battery breaker is set to give spark after piston is past upper dead center, spark retarded. Firing order is 1, 5, 3, 6, 2, 4. Either Bosch or Sootless spark plugs are recommended by the Locomobile manufacturers. Spark gap should be .028 in. to .030 in. Magneto breaker contacts should open .035 mm. Battery contacts should open .40 mm.

Starting motor develops .7 horsepower at 5.25 volts. It should spin the "38" at 125 R. P. M. and the "48" at 115 R. P. M. Starter is connected to engine by a magnetic pinion shifting device. This device consists of a solenoid in which an iron core is free to move in and out. The solenoid is located below the motor. In the solenoid there is a series or pull-in coil which pulls the iron core in and forces the pinion into mesh. There is also a shunt coil which holds the core in. When the starting switch is closed the current flows through the series coil and the motor. This allows the motor to turn slowly until gears are meshed. When the gears are meshed the solenoid coil is cut out of the motor circuit and the shunt coil in the solenoid is placed across the line to hold the gears in mesh. This arrangement applies full battery pressure to motor, thus cranking engine. When the engine reaches a speed of 300 R. P. M. the voltage produced by generator is sufficient to close the cutout switch. This grounds the wires 23 and 24, which being grounded at both ends, cease to carry current to the primary switch magnet P, and allows it to open. This opens the holding coil circuit. There then being no magnetism produced by the holding coil, a brake quickly brings the starting motor gears to rest. An overrunning clutch prevents engine driving the motor. No harm can result from closing the starting circuit when the car is running above 8 miles per hour. There is a small name-plate which covers an inspection hole on the pinion shift switch. If the motor operates feebly and battery is fully charged, remove the mud pan and name-plate and see that the sliding copper contact makes a good electrical connection with the two contact fingers. This contact should exist at the very start of the travel and last until just before gears are meshed. A sharp click can be heard when the primary relay switch (P)

(*Continued on Plate No.* 138)





IGNITION WIRING DIAGRAM

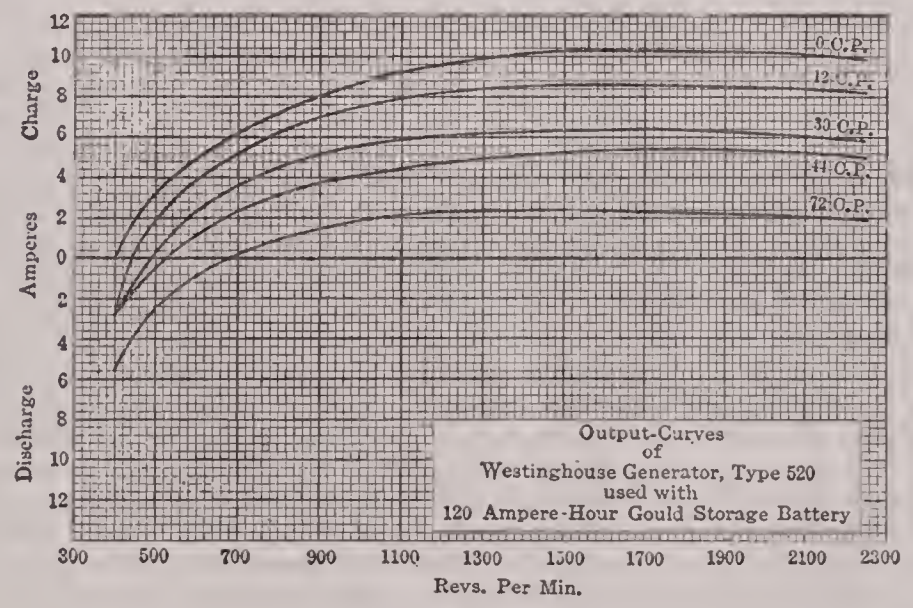


PLATE NO. 138

Locomobile (1915-1916)

"38"—TYPE R6 "48"—TYPE M6

WESTINGHOUSE TWO-UNIT STARTING AND LIGHTING SYSTEM
BOSCH DUAL IGNITION

(*Continued from Plate No.* 137)

operates, if the ear is placed close to it. There are no adjustments in this switch. If it should stick, a sharp blow of a hammer on the side of the case will loosen it. Should it fail, examine wires 23 and 24 to see if they are alive when starting button is used. If not, the trouble is in the circuit formed by them.

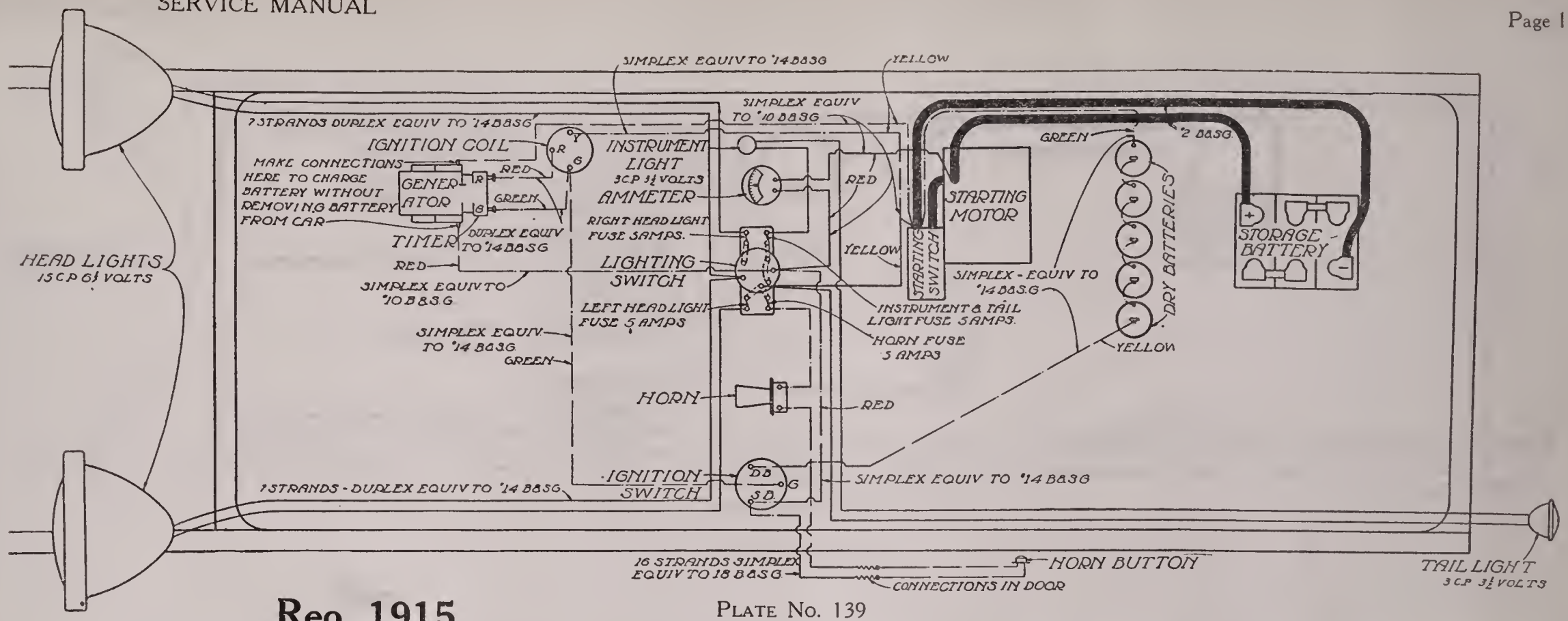
Should motor fail to operate when starting switch is closed, see that primary relay is O. K. If this unit is working properly, either (1) the gear shift is sticking or (2) there is an open circuit in the gear shift switch or motor. To test motor, take a long piece of No. 10 wire and run it from the negative battery terminal to motor terminal marked N (diagram). If motor spins, gear shift switch is at fault. If motor does not spin, it is at fault. Remove and inspect whichever is at fault. Should there be any difficulty of meshing gears, the motor is not getting its proper initial spin. See that the sliding contact makes good electrical connection with the two contact fingers.

Voltage regulation is by reverse series field. The generator is wound with a special wire which increases in resistance as the temperature rises, thus preventing overheating of the battery caused by too rapid a charge. When driving, the voltmeter should show 7 to 7.5 volts. A higher pressure may be due to a loose connection in the charging circuit, a sulphated battery cell, or level of electrolyte too low. If lights burn excessively bright with engine running, but burn dim with engine idle, there is a loose or dirty battery connection or battery is getting dry.

All lights are 7 volt Mazda. The following sizes are used: Head, 21 cp. Side, 6 cp. Tail, 3 cp. Dash, 3 cp. Trouble, 6 cp. Tonneau, 6 cp: Step, 3 cp. Dome, 3 cp., 6 volt.

If necessary to operate car without lock switch, due to trouble with same, run a wire from No. 1 to No. 4 and No. 5. Connect No. 8 and No. 9 terminals. Tape No. 2 terminal.

If telephone battery is worn out replace it with an Eveready No. 710. Merely turn cover of battery box, lift it off and take out old battery. Put in the new battery, taking care that the bare spot on side of battery makes connection with contact spring in case, and put cover back on.



Reo, 1915

PLATE NO. 139

MODELS R, M (1915)

REMY, 6 VOLT, TWO-UNIT, STARTING AND LIGHTING SYSTEM. REMY IGNITION

Battery is 6 volt, 100 ampere-hour.

Breaker is operated from the rear end of the generator armature shaft. Contacts should open .012 in. to .020 in. Smooth contacts with a very fine, flat, jeweler's file or a piece of No. 00 sand paper. Break should occur when the mark UDC 1-6 or UDC 1-4 on flywheel is at indicator, spark fully retarded. To time generator to engine, turn engine to above named position, hold down button on distributor and turn armature shaft until the button is felt to drop into the recess in the distributing gear. Connect generator to engine without changing the relative position of either. No attention need be paid to breaker when so setting, as it is set to break at the proper time when distributor is in the above position. Spark must never be set to occur more than 1 in. past dead center, with spark fully retarded. Firing order of the 6 cylinder is 1, 4, 2, 6, 3, 5. Firing order of the 4 cylinder cars is 1, 3, 4, 2. Spark gap should be 1/32 in. The condenser is located on the side of generator. There is a set of 5 dry cells connected in series to supply ignition when storage battery is low or out.

Voltage regulation is by third brush. Relay is mounted on front end of generator. it should close at about 300 R. P. M. of the generator. There is a 10 ampere fuse beside the relay. It is in the shunt field circuit. If generator is to be run with battery disconnected this fuse must be removed. When replacing fuse be careful not to press down relay contact bar as it will stay down if engine is not running. With contacts closed and engine idle, the battery will discharge at a rate of 20 amperes in addition to that being used by lights. This rate may burn out the relay and will discharge the battery in four or five hours. The maximum output of generator, in addition to that used for ignition, should be 12-15 amperes at 25 miles per hour with switch on "Winter" side and 8-10 amperes with switch on "Summer" side.

Brushes are of a special copper-carbon composition and must not be substituted by others. On the "Four" there is a generator switch on the side of generator. This switch has three positions, one for summer or low charging rate, one for winter or high charging rate and one marked "Off". It should be placed in the "Off" position before battery is disconnected. The following data applies to the generator. (Test without ignition.)

R. P. M.	300	500	1000-1300	2000
Amperes	0	7.5	14-18	12

On battery test field draws 2 amperes at 6.3 volts. Generator motoring draws 2.5 amperes at 6.4 volts and runs at 210 R. P. M.

Battery is 6 volt, 120 ampere-hour.

The following data applies to the starting motor used on the 6 cylinder car:

Torque (with 6 in. pulley)	R. P. M.	Amperes	Volts
0 lbs.	2000-2300	80-90	5.8-5.9
7 lbs.	1700-1900	95-105	5.5-5.8
9 lbs.	1520-1650	100-120	5.0-5.5
17 lbs.	1000-1200	200-210	3.2-3.4
18 ft. Lbs.	Lock Torque	500-550	

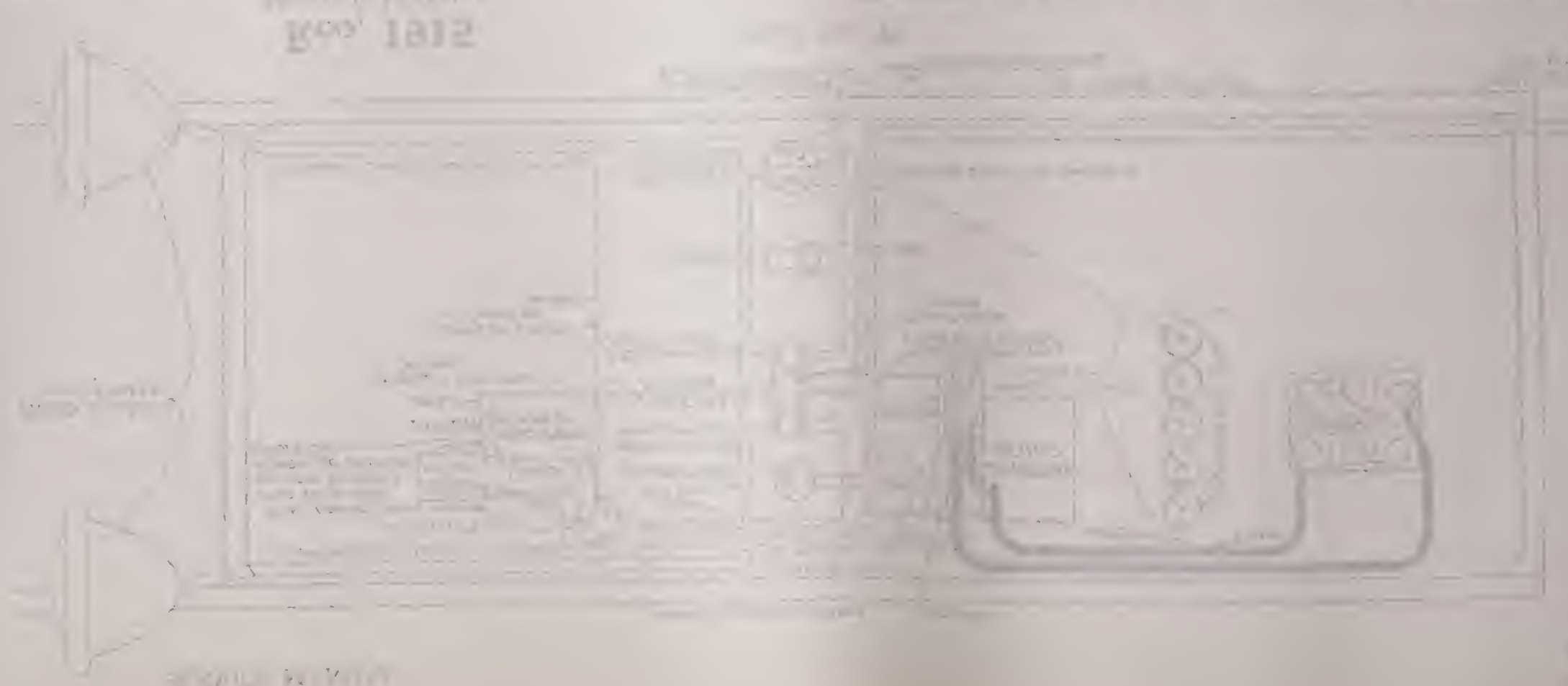
The following data applies to the motor used on the 4 cylinder cars:

R. P. M.	Amperes	Volts
3800-5000	35-50	5.8-6
1700	100	
1500	120	

Four-pound pull on 6 in. pulley, 1700-2000 R. P. M., 105 amperes, 5.6-5.8 volts. All machines above No. 4400 have new block brush holder. All machines above No. 4600 have new head.

Both motors require about 95 amperes to crank the engine at 125 R. P. M.

Mazda lamps are used in all circuits. Head lamps ar 6½ volt, 15 cp. Head lamps are in series on dim position. Dash and tail lights are in series. They are 3½ volt, 3 cp. The tail light is provided with a switch for controlling at the lamp as required by some city ordinances and state laws.



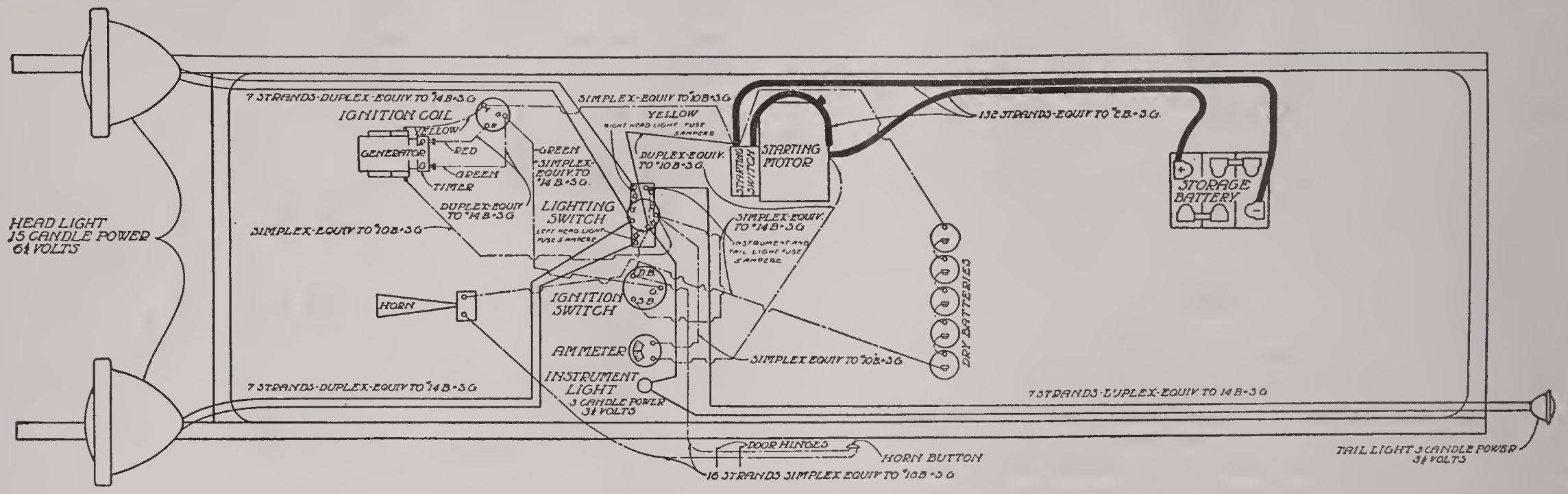


PLATE NO. 140

Reo

MODEL R (1914)

REMY, TWO-UNIT, 6 VOLT, STARTING AND LIGHTING SYSTEM. REMY IGNITION

Battery is 6 volt, 100 ampere-hour.

Distributor and breaker are driven from generator shaft. Breaker contacts should open .020 in. to .025 in. Spark should occur when the mark UDC 1-4 is ½ in. to 1 in. past indicator, spark fully retarded. To time generator to engine, turn engine until the mark UDC 1-4 on flywheel is at indicator, No. 1 piston at end of compression stroke, spark retarded. Then press on the button on distributor and turn generator armature until the plunger on button catches in the recess on timing gear. Then attach generator to engine without changing the relative position of either. Firing order is 1, 3, 4, 2. Spark gap should be 1/32 in. There is a set of 5 dry cells connected in series to supply ignition current when storage battery is out or disconnected.

Voltage regulation is by third brush. There is a generator switch on side of generator. The winter position provides a high charging rate. With switch on this position the maximum charging rate will be 12-15 amperes at 25 miles per hour. If switch is placed on the position marked summer the rate will be reduced to 8-10 amperes. Switch should be placed in the "Off" position before battery is disconnected. Relay is mounted on front end of generator. It should close at about 300 R. P. M. of the engine. There is a 2 ampere fuse beside the relay. This fuse is in the shunt field circuit. It will blow if car is run over 10 miles per hour with battery disconnected. When renewing the fuse be careful not to press the relay contact arm down, as the contacts will remain closed if engine is idle and battery will discharge at about a 20 ampere rate, in addition to that used by lights. This rate may burn out the relay and will discharge battery in four or five hours. Clean relay contacts with No. 00 sand paper or a fine, flat, jeweler's file. Relay contacts should open .040 in. Air gap between armature and pole pieces is .018 in. to .022 in. On machines up to 30,000 armature draws 4 amperes and field draws 1.7 amperes. Above serial number 30,000, on battery test, generator armature draws 12 amperes, from brush to brush, field open, at 6.5 volts. Field draws 1.3 amperes at 6.5 volts. The following table gives the output of generator at various speeds, test to be made without ignition.

R. P. M.	300 (or less)	500	1000-1300	2050
Amperes	0	7.5	14-18	12

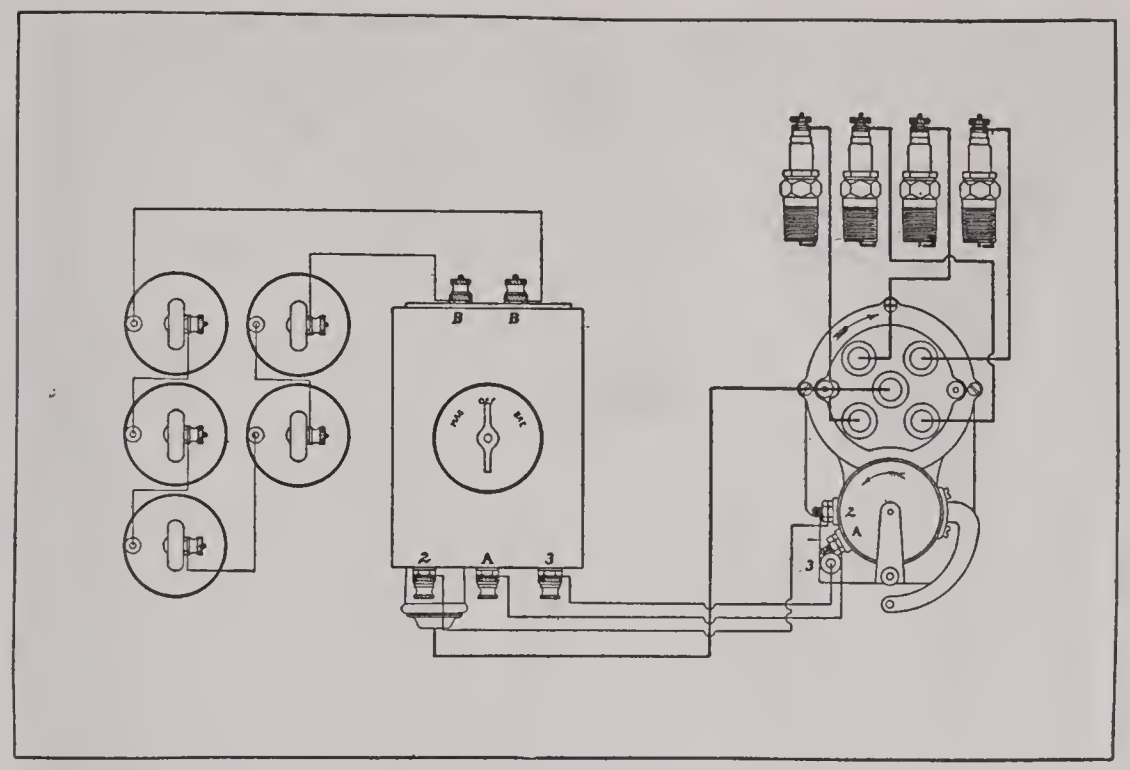
When the generator switch is placed on the side marked "Summer Driving," the rate is reduced 3-5 amperes.

Starting motor drives flywheel through a worm gear. Starting switch is mounted on the side of the motor. Operation of driving medium is easily understood when it is seen. When the starting pedal is depressed, the motor circuit is completed and the pinion forced into mesh with flywheel gear. When pedal is released the pinion is drawn out of mesh and the motor circuit opened. The motor is provided with ball bearings. The grease with which the bearing is packed should be renewed at least once a year. Should the sliding bars on the starting switch become badly pitted they may be turned over to a new position and the contacts cleaned with emery cloth. The following data applies to the starting motor.

R. P. M.	Amperes	Volts
3800-5000	35-50	5.8-6
1700	100	
1500	120	

Four-pound pull on 6 in. pulley, 1700-2000 R. P. M., 105 amperes, 5.6-5.8 volts. All machines above No. 4400 have new block brush holder. All machines above No. 4600 have new head.

Motor requires about 95 amperes to crank engine at 125 R. P. M. Mazda lamps are used in all circuits. Head lights are 6.5 volt, 15 cp. They are in series when dim. Dash and tail lamps are in series. They are 3.5 volt, 3 cp. Tail lamp is provided with a socket switch, allowing it to be controlled only from the rear of car as required in some cities and states.



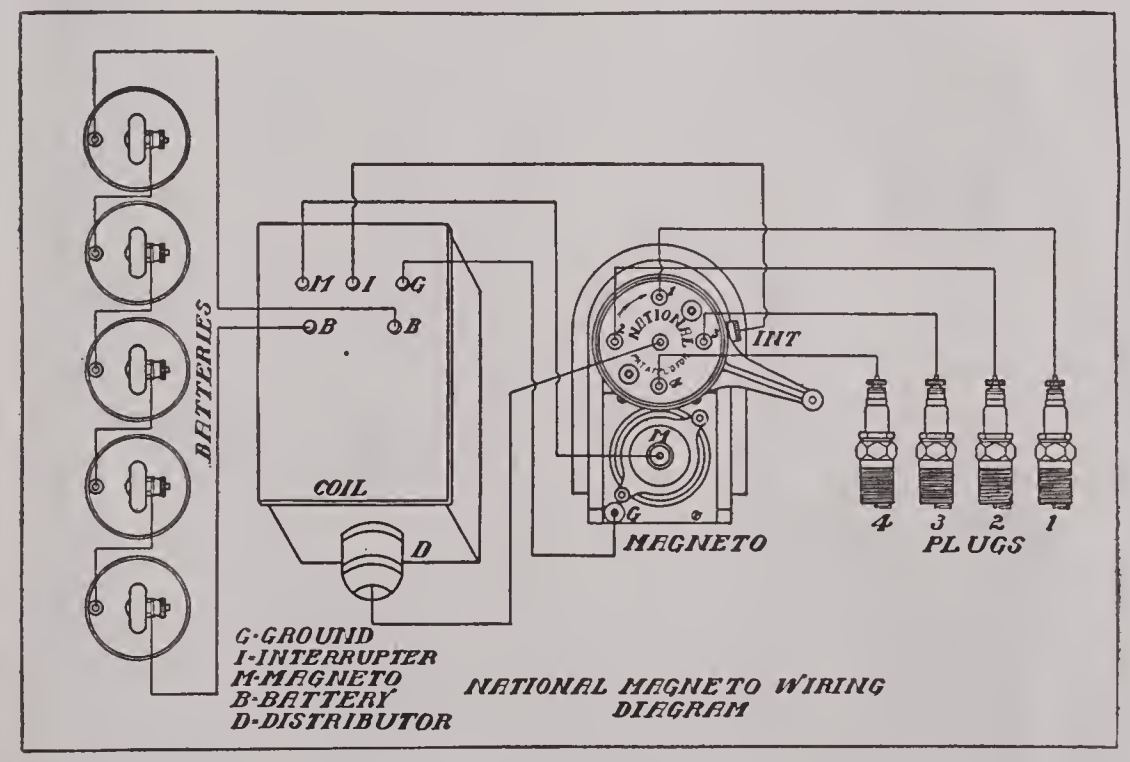


PLATE NO. 141

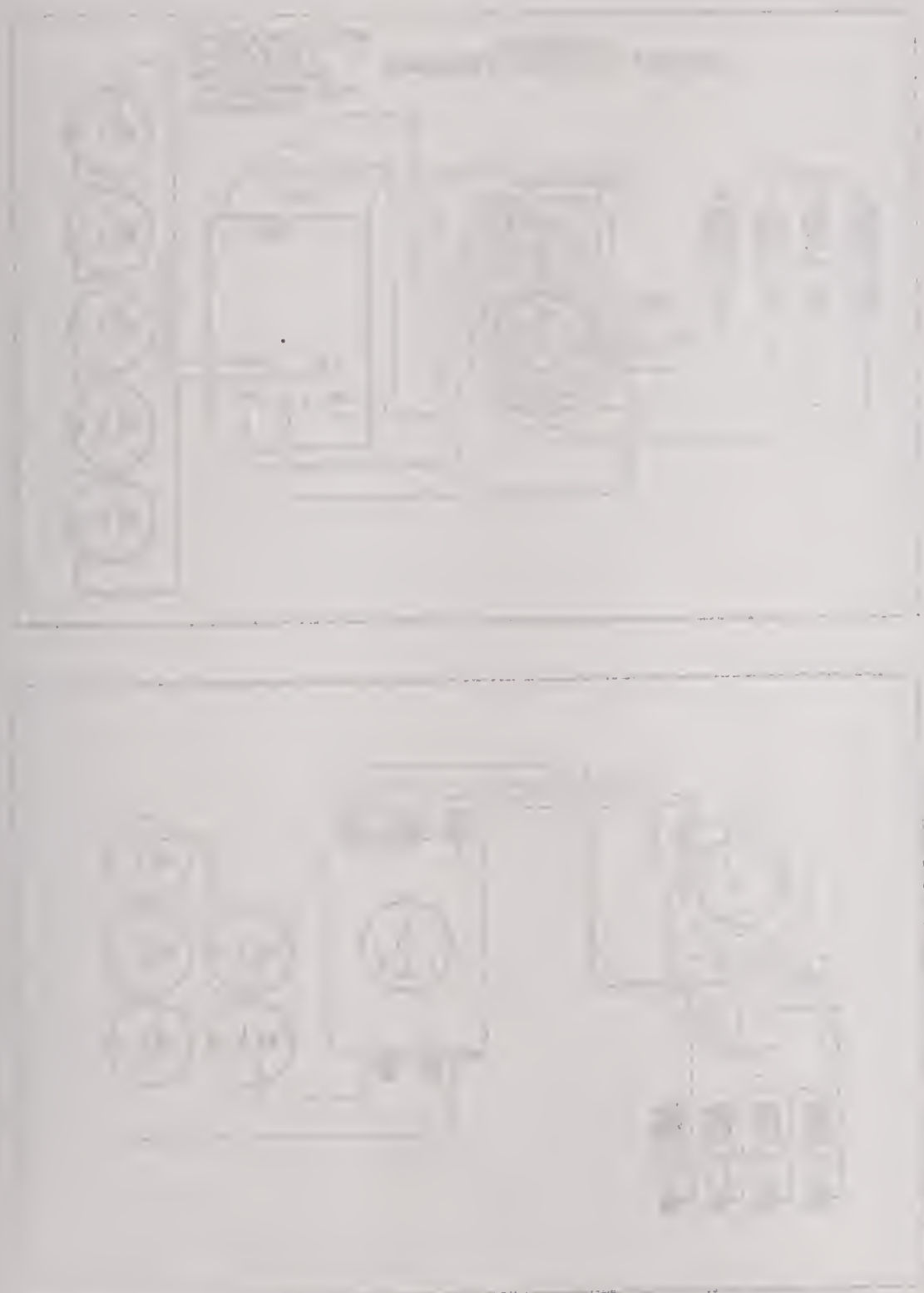
Reo

1912-13 R & S MODELS
NATIONAL OR SPLITDORF IGNITION SYSTEM

In both cases a low tension magneto is used in conjunction with a reserve set of dry cells, an ignition coil being used to transform the current. The same distributor is used for both magneto and battery ignition. Breaker contacts should open .014 in. to .018 in. Clean with gasoline whenever necessary. If contacts are badly burned or pitted they may be resurfaced with a fine, flat, jeweler's file or a worn piece of No. 00 sandpaper. Spark gap should be about .030 in. Magneto breaker should open when the mark U. P. C. 1 and 4 on flywheel is 1 in. to 1½ in. past indicator, spark fully retarded. The firing order is 1, 3, 4, 2.

If for any reason it is necessary to change the point of firing, it will be necessary to shift the position of the magneto driving gear with regard to the cam shaft gear. Shifting this gear one tooth changes the point of firing 1.9 in., measured on the rim of the flywheel. If this amount is too much, it may be reduced to one-half that amount by shifting the gear 180°, or half a turn. This shifts the gear 13½ teeth, as there are 27 teeth on the gear. This changes its relative position to the cam shaft gear just one-half tooth. It may be well to note here that this one-half revolution does not change the magneto setting if the universal joint is disconnected before turning the gear, the armature shaft and magneto and cam shafts of motor remain stationary, the universal joint and gear being turned just 180°, or one-half revolution.

Magneto will not produce a hot enough spark to ignite the gas, when engine is running at less than 225 R. P. M.



Reo

Models T and U (1918-19)

Remy 6-Volt, Two-Unit Starting and Lighting System. Remy Ignition

Battery is 6 volt, 100 ampere-hour.

Breaker contacts should open .018 in. to .020 in. Break should occur on top dead center, spark fully retarded. The firing order is 1, 3, 4, 2. Spark gap should be .030 in. to .032 in. Use medium cup grease in the grease cup under the breaker head. Tighten this cup one turn every 500 miles. If contacts are badly burned or pitted they may be resurfaced with a fine, flat, jeweler's file or a piece of worn No. 00 sandpaper.

The starting motor is connected to the engine through a ratchet clutch on the propellor shaft, between the main clutch and the transmission case. Put three or four drops of light machine oil in each of the motor oilers every 1,000 miles. The reduction gear case is packed with heavy grease which should be replenished once a year. The grease may be injected through the plugged hole. The motor requires 95 amperes to crank the engine at about 125 R. P. M. The following data applies to the motor:

Torque (with 6 in. pulley)	R. P. M.	Amperes	Volts
4 lbs.	2500	90-100	5.4-5.6
8 lbs.	1900	140-145	5.1-5.3
12 lbs.	1000	220-225	4.7-4.9
16 lbs.	850	225-260	4.5-4.7
20 lbs.	600	290-300	4.2-4.5
9 ft. lbs.	Lock Torque	550-575	3.3-3.4

Voltage regulation of the generator is by third brush and a thermostat. Relay should close at about 7 miles per hour or 350 R. P. M. of the generator. Relay contacts should open about .020 in. They may be cleaned by drawing a piece of soft paper between them. If badly burned or pitted they may be resurfaced with a fine, flat, jeweler's file or a piece of worn No. 00 sandpaper, after which all dust must be carefully blown out. When cleaning the relay, care must be taken not to close the contacts, as they will remain closed, burning out the coils and discharging the battery in a short time if generator is not running. The maximum charging rate, with thermostat contacts closed, will be about 12 amperes at 15 miles per hour. This rate will be reduced to about 6 amperes after the thermostat is heated enough to cause the contacts to separate. Should generator be run with battery disconnected, the thermostat resistance unit will burn out, thus opening the shunt field circuit and protecting the generator windings. This unit should be replaced as soon as possible, as the battery is not properly charged with the equipment in this condition.

The following data applies to the generator:

Test (without ignition, generator cold, thermostat closed):

HIGH BATTERY			LOW BATTERY		
Amperes	R. P. M.	Volts	Amperes	R. P. M.	Volts
0.	350	6.40	0.	330	5.9
7.	510	7.13	7.	500	6.24
13.	690	7.76	13.	680	6.58
20.	1100-1500	9.0	18.	1000-1200	6.84

On battery test, field draws 5 amperes at 6.4 volts. Generator motoring draws 4.75 amperes at 6.4 volts and runs at 245 R. P. M.

Every 1,000 miles, put five or six drops of light machine oil in each of the generator oilers.

Mazda lamps are used in all circuits. Head lights are 6-8 volt, 15 cp. Dash and tail lights are in series. They are 3-4 volt, 2 cp.

The fuse block is located on the engine side of the dash. Use commercial 5-ampere fuse wire in all circuits when replacing fuses.

Apperson

4-40, 6-45, 6-48, 6-17.

BIJUR 6-VOLT, TWO-UNIT STARTING AND LIGHTING SYSTEM. DELCO IGNITION

Battery is 6 volts, 80 ampere-hour. The negative terminal is grounded.

Delco Ignition is used. Break occurs when dead center mark on flywheel is just past indicator, spark fully retarded. Firing order is 1, 5, 3, 6, 4, 2. Contacts open .015 in. to .020 in. Spark gap should be about .025 in. to .028 in., or about the thickness of a smooth dime. Contacts are made of tungsten metal. For care see Plate No. 20.

Starter is connected to engine by non-automatic mechanical shift. Pinion is carried on square shaft. Pinion is driven into mesh by pulling out starting handle. Moving contact makes proper connections to start motor, in series with a resistance, until pinion is fully meshed with flywheel gear and then turns full battery pressure onto motor, running it at full power and cranking the engine.

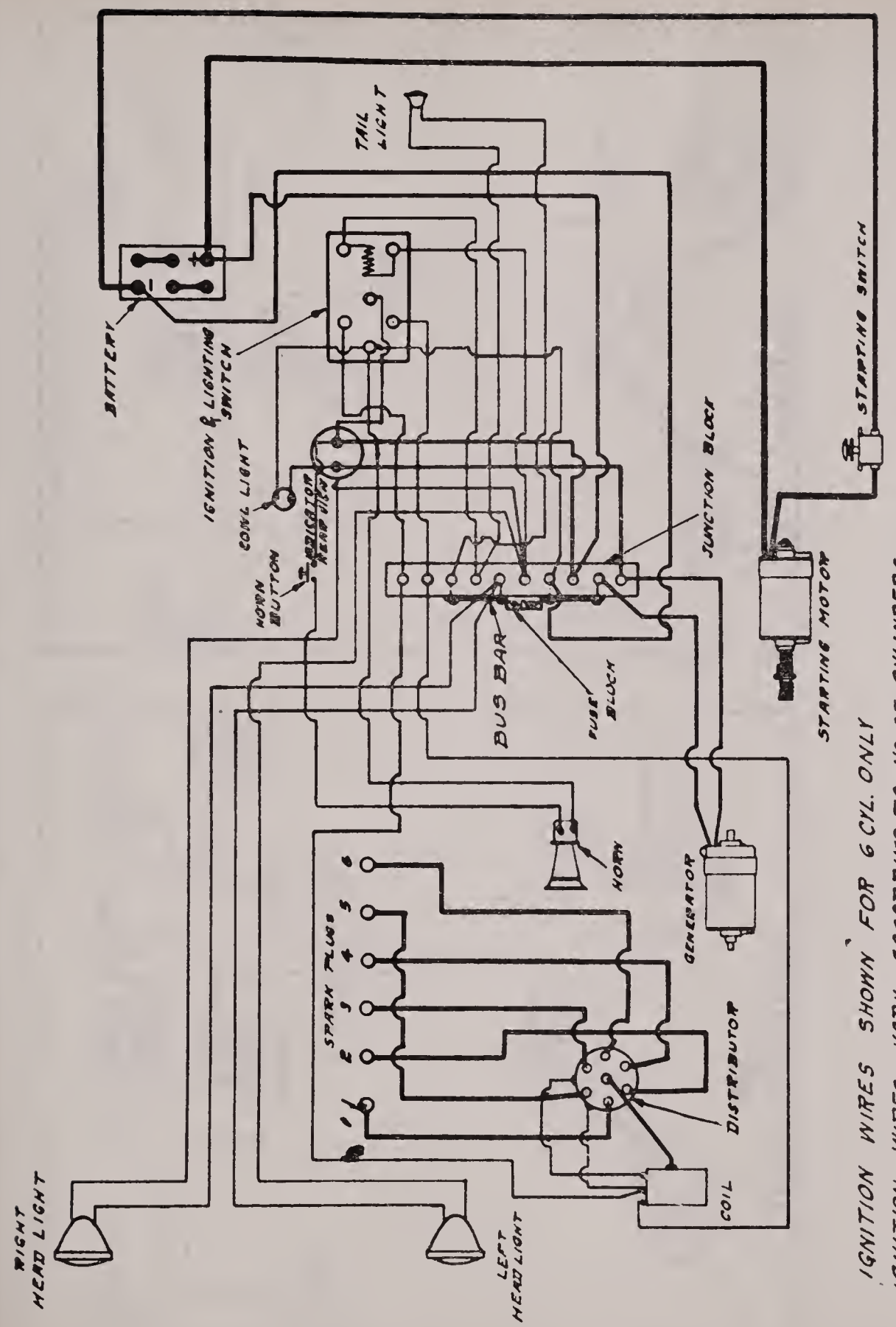
Every two weeks or 500 miles put two or three drops of thin neutral oil in each of the two oilers of motor and generator and at the same time put a little thin grease on the square shaft of starting motor.

Relays closes at 10 miles per hour. Relay is built into generator. Manufacturers forbid adjustment of relay.

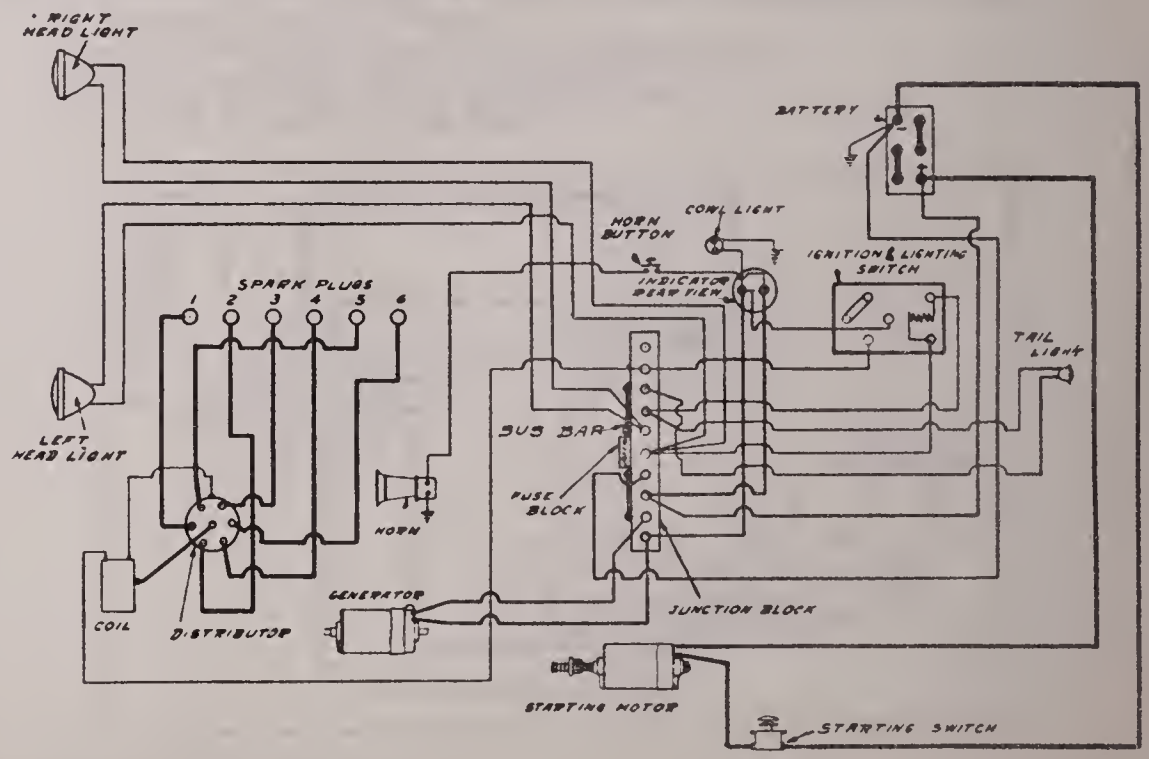
There is a 20-ampere fuse, to protect generator winding, in the small aluminum cap mounted on generator. Remove fuse if generator is to be run with battery disconnected.

Light may be supplied direct from battery when generator is removed without making any electrical changes. Lights are controlled by two-gang lighting switch on cowl. Head lamps are 6.5 volts, 20 cp. Cowl and rear lamps are 7 volt, 4 cp. Indicator indicates "Charge," "Discharge" or "Floating." It should indicate floating with car running 12 miles per hour and all lights burning bright or charge with no lights on when car is running 10 miles per hour or over. The warranty on this system ceases if repairs are attempted by unauthorized parties.

Dash and tail light each take .42 of an ampere. Head lights take 3 amperes.



IGNITION WIRES SHOWN FOR 6 CYL. ONLY
IGNITION WIRES VARY ACCORDING TO NO. OF CYLINDERS



INSULATED BATTERY

PLATE No. 143

Ricker Trucks

Westinghouse Two-Unit Starting and Lighting System
Berling Dual Magneto Ignition

Battery is 6 volt, 100 ampere-hour. The positive terminal of the battery is grounded.

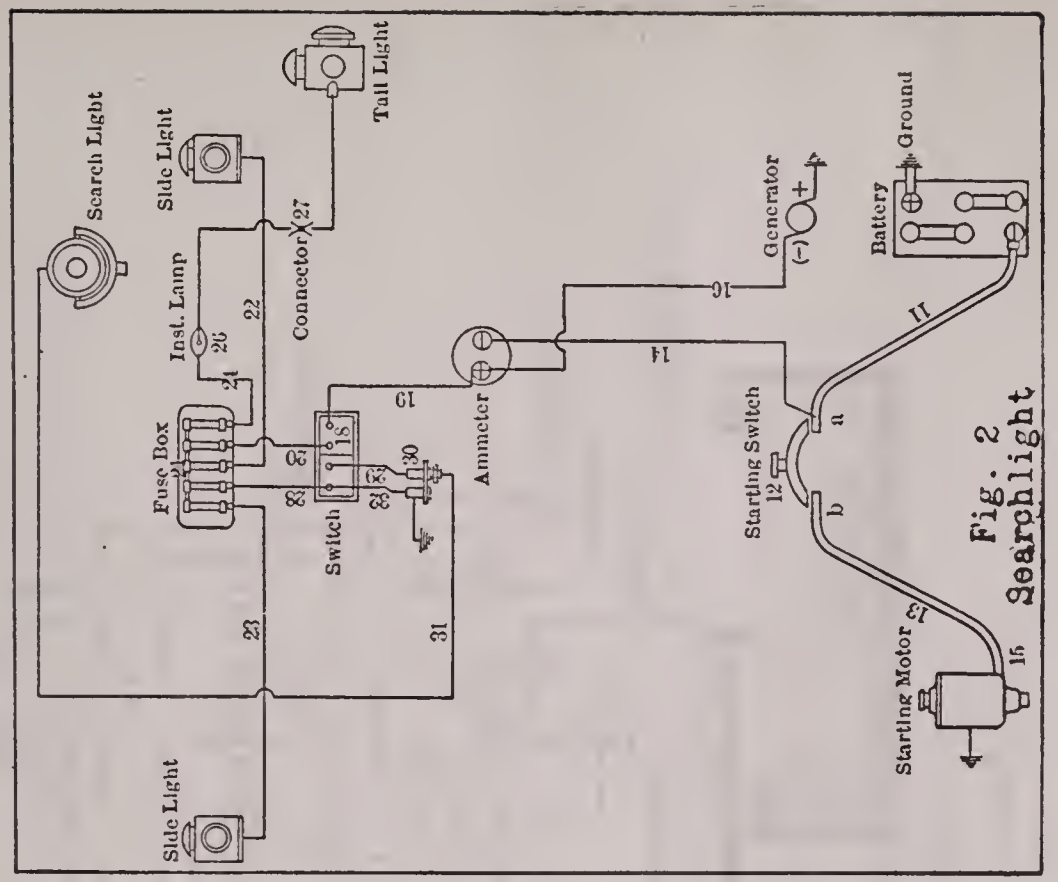
The same distributor and the same set of plugs is used for both magneto and battery ignition. The spark should occur when piston is 5/16 in. from upper dead center, spark fully advanced. Breaker contacts open .35 mm. Points should not require adjustment more than once a year. Every 1,000 miles put several drops of "Three-In-One" or similar oil in each of the oil cups. Clean contacts and distributor with gasoline whenever necessary. Surface contacts with No. 00 sandpaper on a fine flat jeweler's file. Spark gap should be .028 in. Firing order is 1, 2, 4, 3.

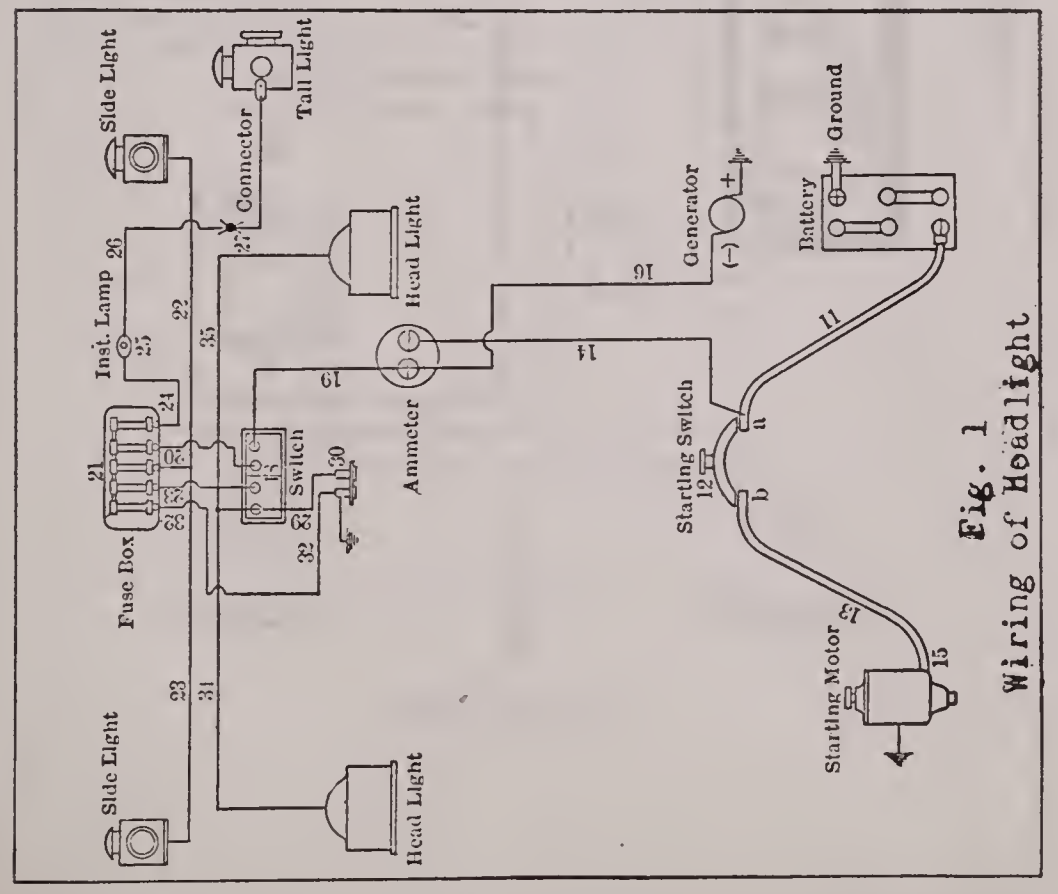
Motor is connected to engine by a magnetic pinion shift. This is merely a solenoid in series with the motor. When the circuit is first completed there is a heavy rush of current which forces a spiral pinion into mesh with the spiral gear on the flywheel. The teeth on these two gears are cut spiral to facilitate meshing and demeshing. When motor is driving the engine the pressure tends to keep the gears in mesh, but as soon as the engine tends to drive motor, the pressure will force the pinion out of mesh. As the motor speeds up it takes less current, therefore, the solenoid, which is in series with the motor, loses much of its power and the pinion is drawn out of mesh by the combined action of a spring acting against the solenoid and the pressure exerted on the spiral gears by the flywheel, as explained above. There is a short circuited field coil to prevent the motor running too fast before pinion gears are meshed. See Plate No. 136 for a more detailed description.

The oilers at each end of the motor should have three or four drops of good light oil every month. Put a few drops of oil on pinion shaft at the same time. Motor may be removed by loosening the clamp nut and sliding motor out. When replacing motor be sure that the pinion meshes freely to the proper depth.

Voltage regulation is by third brush. Relay should close at 500 R. P. M. of the engine and open at 450 R. P. M. of the engine. The maximum charging rate should be 12 amperes at full truck speed. The oilers at each end of the generator should receive three or four drops of oil once a month.

Figure 1 is the wiring diagram when head lights are used.
Figure 2 is the wiring when a search light is used.
Figure 3 is the ignition wiring diagram.





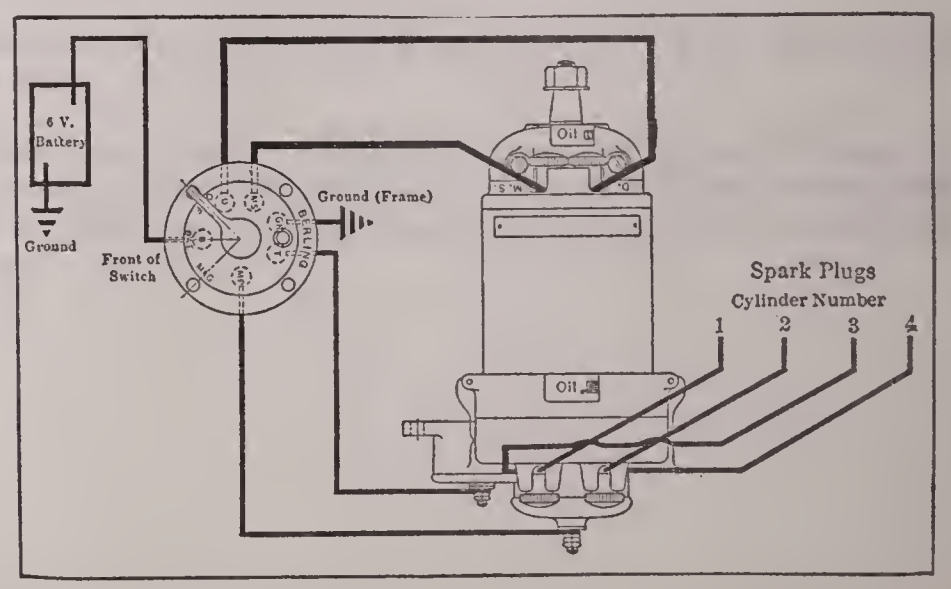
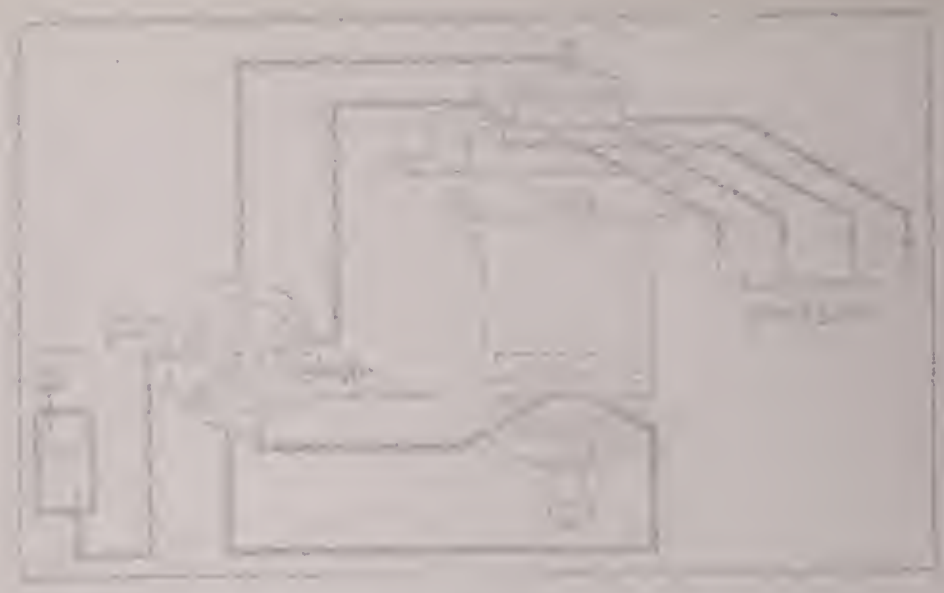
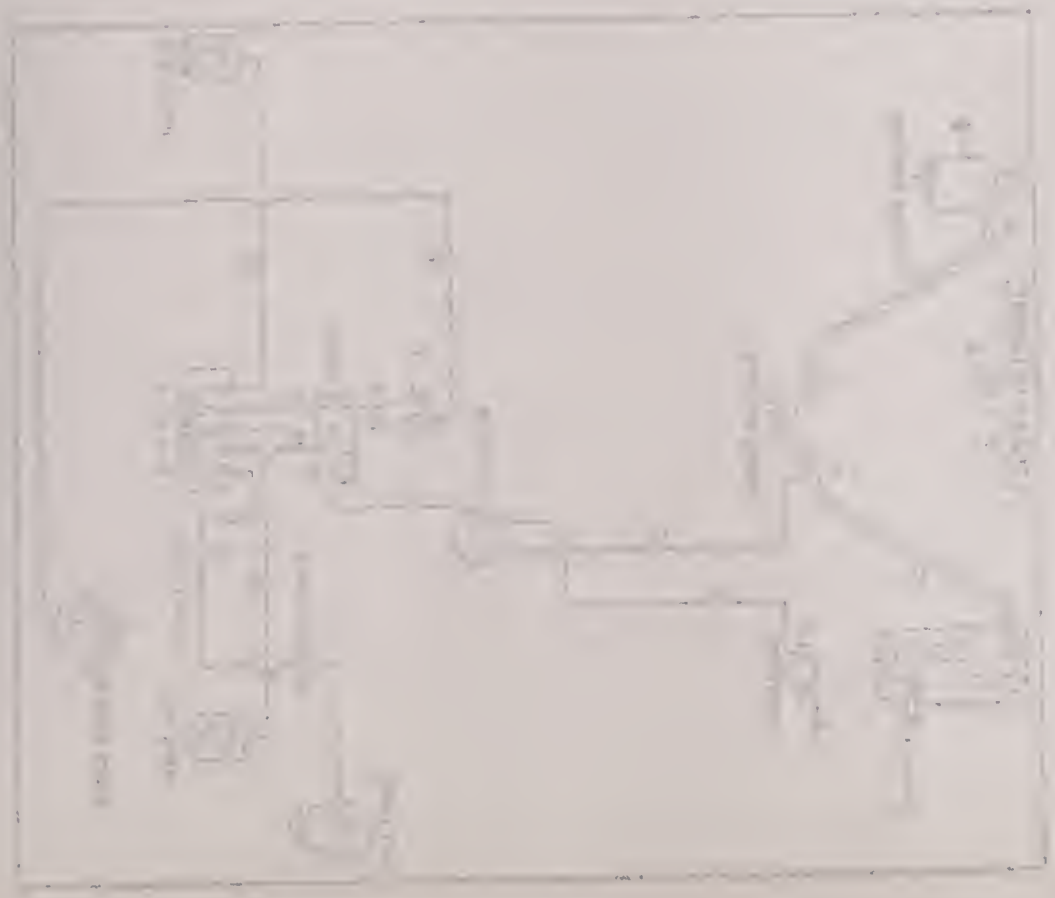


PLATE No. 144





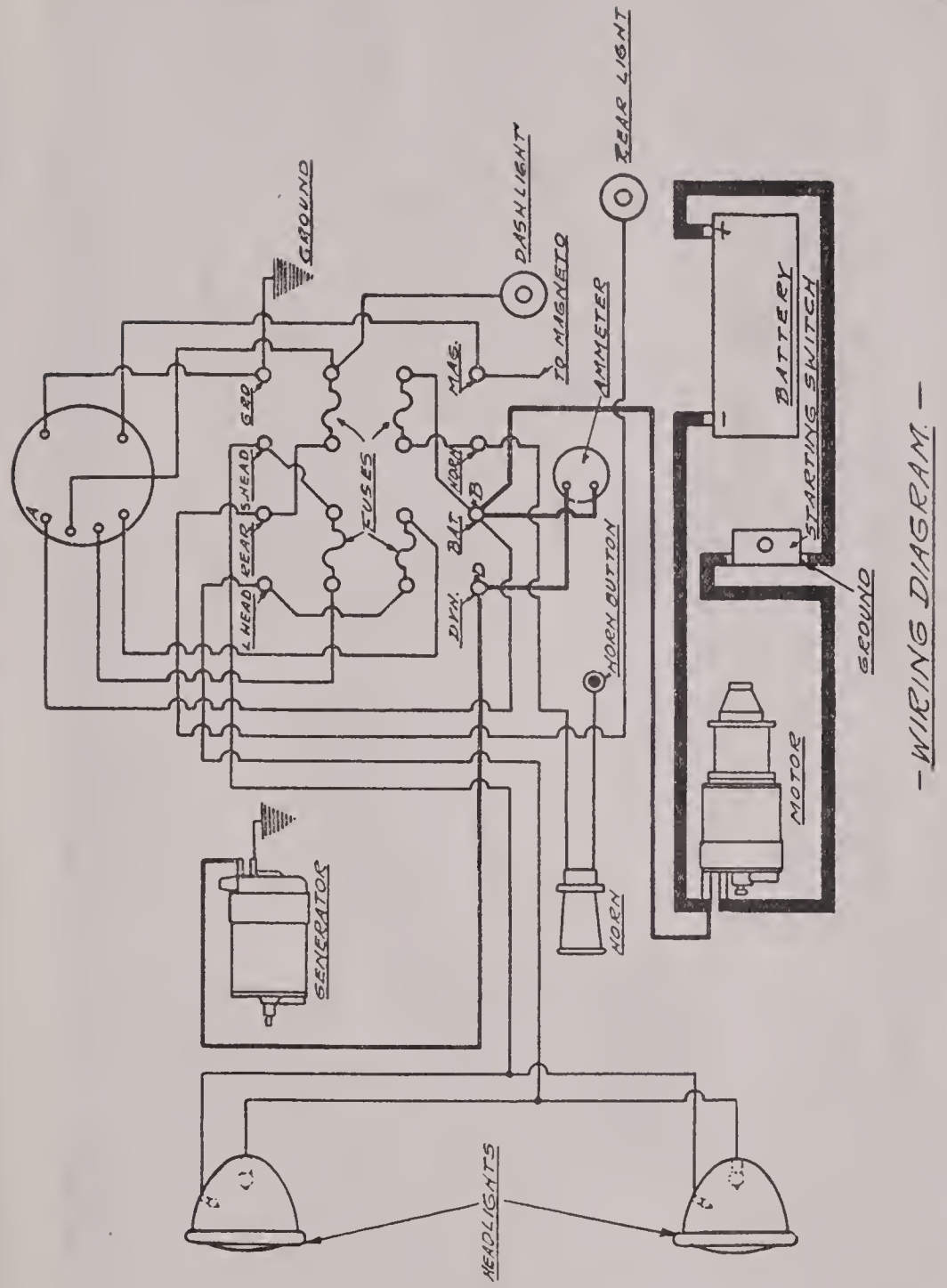


PLATE NO. 145

Jordan Sixty

(ALL MODELS)

BIJUR 6-VOLT, TWO-UNIT STARTING AND LIGHTING SYSTEM. BOSCH IGNITION

Battery is 6 volt, 80 ampere-hour. The positive terminal is grounded at the starting switch.

Break occurs when the mark 1-6 DC on flywheel is 5/8 in. to 3/4 in. before indicator, spark advanced, No. 1 piston on compression stroke and distributor segment making connection with wire leading to it. Firing order is 1, 5, 3, 6, 2, 4. Spark gap is .020 to .025 in.

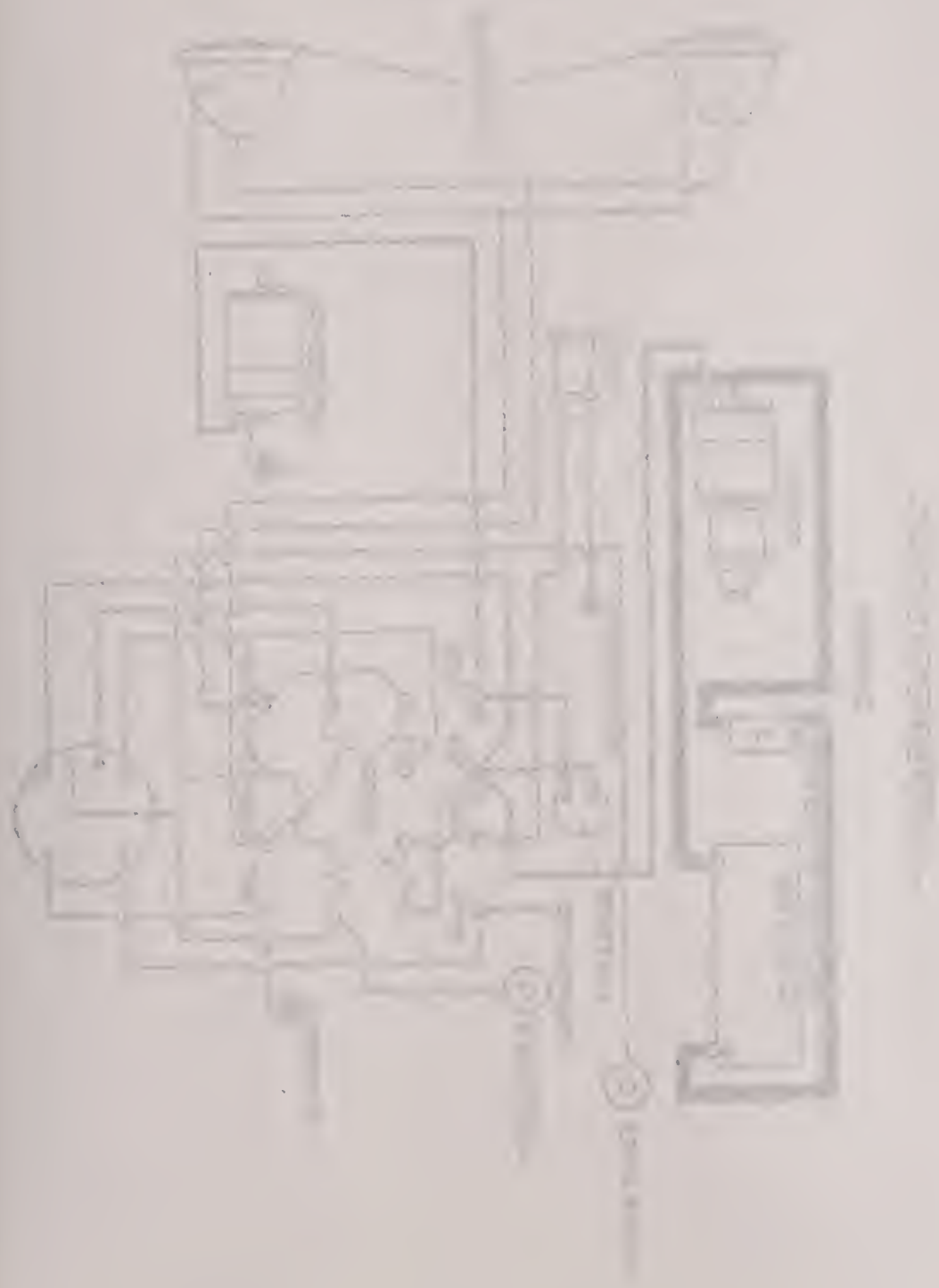
Starter is connected to flywheel by Bendix drive.

Generator is driven from water circulator shaft. Voltage regulation is by third brush. Relay closes at 10 miles per hour. Maximum output 12 to 14 amperes. Relay is located in generator. There is a 15-ampere fuse to protect generator windings, in the aluminum case at rear of generator. Due to the reversible characteristics of the generator, it makes no difference which terminal is connected to battery, as generator will automatically assume the correct polarity to charge the battery.

If generator is run with battery disconnected the fuse must be removed. Every 500 miles or two weeks put a few drops of thin neutral oil in the two oilers on generator and the one on the motor.

Head lamps 7.5 v., 18 cp. Small head lamps 7.5 v., 4 cp. Dash and tail lamps 7.5 v., 3 cp.

On cars below serial No. 500 the ammeter will show discharge with engine idle and lights burning. On cars above serial No. 500 the meter will show generator output, and should not register at speeds below 10 miles per hour, no matter how many lights are burning.



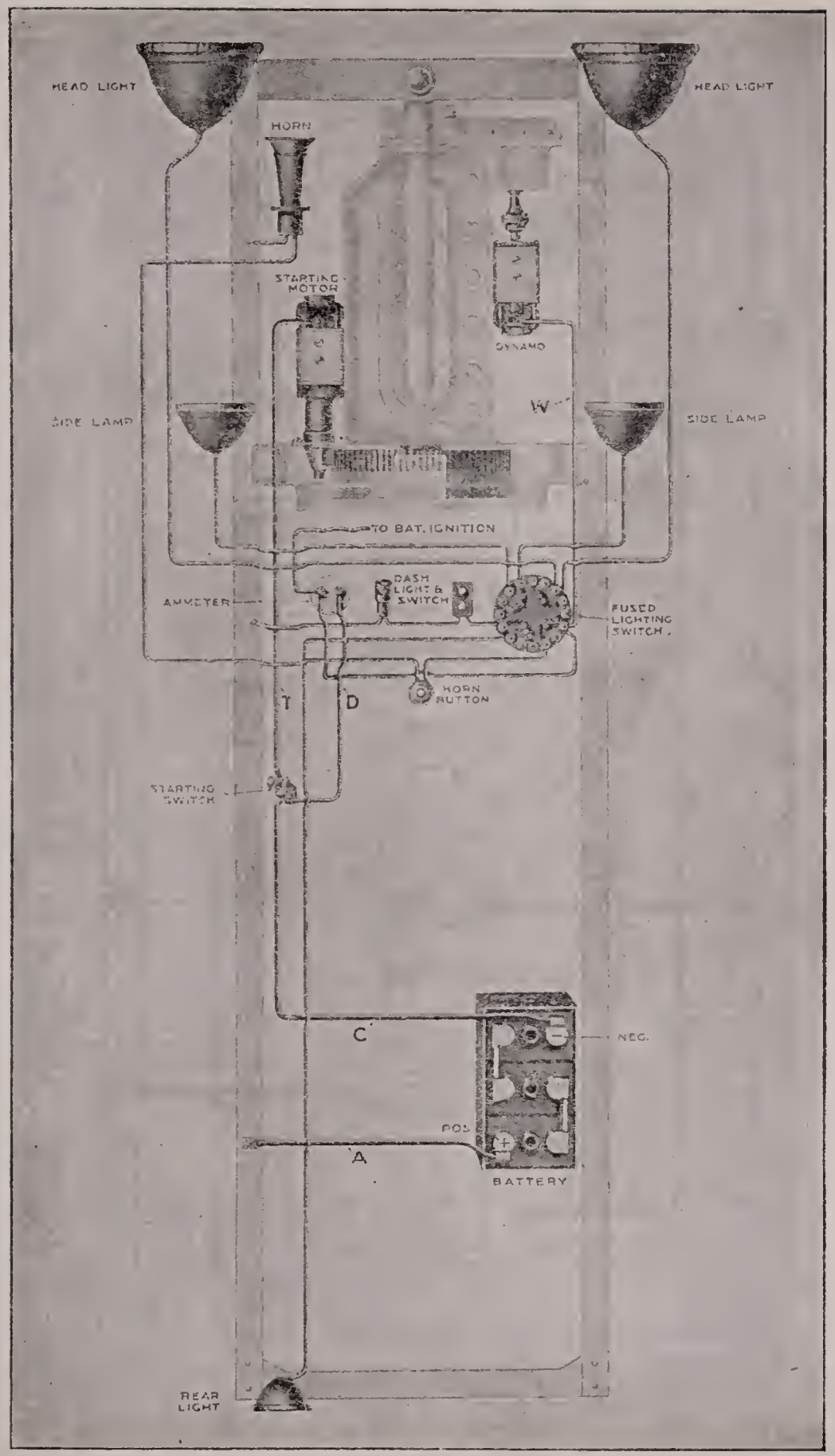


PLATE No. 146

Gray & Davis

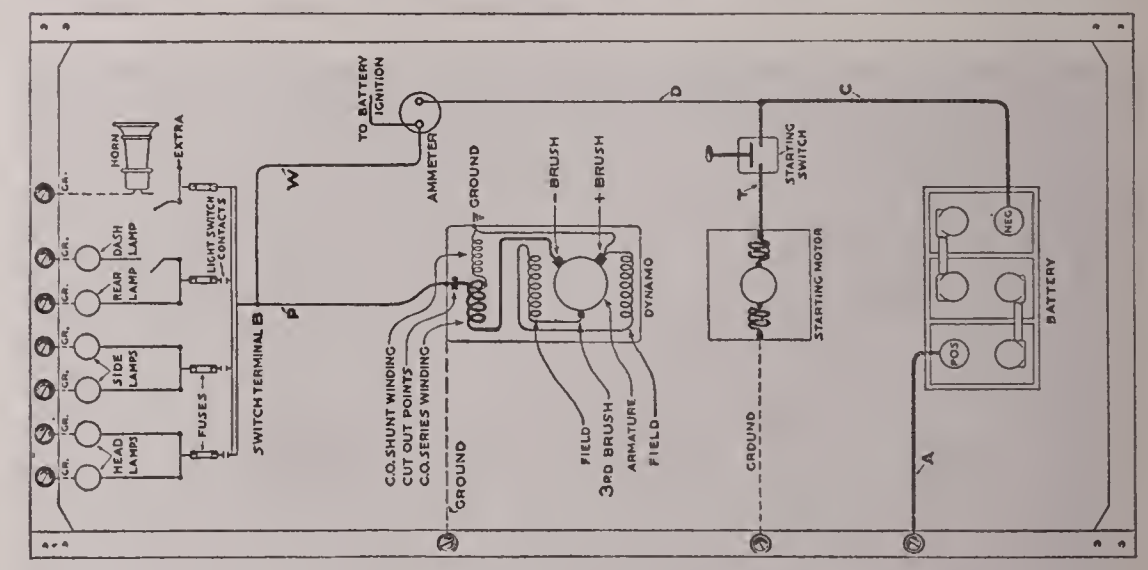
A-75, THREE-BRUSH GENERATOR
TWO-UNIT, 6-VOLT, SINGLE WIRE SYSTEM

Starting motor is connected to engine by a Bendix gear. Put 8-10 drops of machine oil in the oilers at each end of the generator every two weeks or 2,000 miles. If motor rotates when starting switch is depressed but pinion does not mesh with flywheel, clean screw shaft with kerosene or gasoline. If lamps dim excessively when starting switch is depressed, battery is weak.

Voltage regulation is by third brush. Direction of rotation of armature is indicated by arrow on front end of generator. The machine is designed to run at 1½ times engine speed. The 1½ times engine speed generator begins to charge at 650 R. P. M. The engine speed generator begins to supply the current at 500 R. P. M. On either type the relay should close at 7-9 miles per hour. Maximum charging rate should be 12-15 amperes at 13-18 miles per hour. This rate should taper off to 10 amperes at higher speeds. Ammeter should indicate 0 to 3 amperes charge immediately after relay closes.

Large head lights should be 7 volt, 16 cp. The head lights require about 2.6 amperes each. Small head lights should be 7 volt, 4 cp. These lamps require about .85 amperes each. Dash and tail lights should be 7 volt, 2 cp. These take about 4 amperes each. Mazda lamps are used in all circuits.

If the head light reflectors are tarnished, polish with a soft piece of chamois and rouge or crocus, moistened with alcohol. After this wipe off and then polish with a soft dry chamois and a little dry rouge. This will give a very high polish. Chamois used for this purpose should be kept in a dust-proof container. Use a rotary motion when polishing.



Gray & Davis

Model 76, Two Brush, Two-Unit System

Battery is 6 volt, 80 ampere-hour. The positive terminal of the battery is grounded.

Voltage regulation is by vibrating regulator. Relay is combined with regulator. Relay-regulator is in the case mounted on top of the generator. The direction of rotation of the generator armature is indicated by the arrow on front of frame. The generators are designed to run at 1½ times engine speed and at engine speed. The engine speed generator delivers its full output of 10 amperes at 500 R. P. M. The 1½ times engine speed generator delivers its full output at 650 R. P. M. Either type should be geared to engine to give full output at 10-12 miles per hour. Relay should close at 7 to 10 miles per hour. This rate should remain practically constant at higher speeds. If it continues to increase or is abnormally low at 13-14 miles per hour, the relay-regulator must be adjusted. Cleaning of contacts or, if necessary, increasing spring tension will increase the generator output. Before adjusting regulator, see that there are no high resistance joints in charging circuit and that battery is in good condition. Clean relay-regulator contacts, by drawing a piece of soft paper between them. If badly corroded or burned, surface with a piece of worn No. 00 sandpaper. Do not use sandpaper unless necessary, as its use too freely will affect the output.

Relay should open with a discharge current of 0-2 amperes. Put 8-10 drops of light machine oil in each of generator oilers every 200 miles or every 2 weeks.

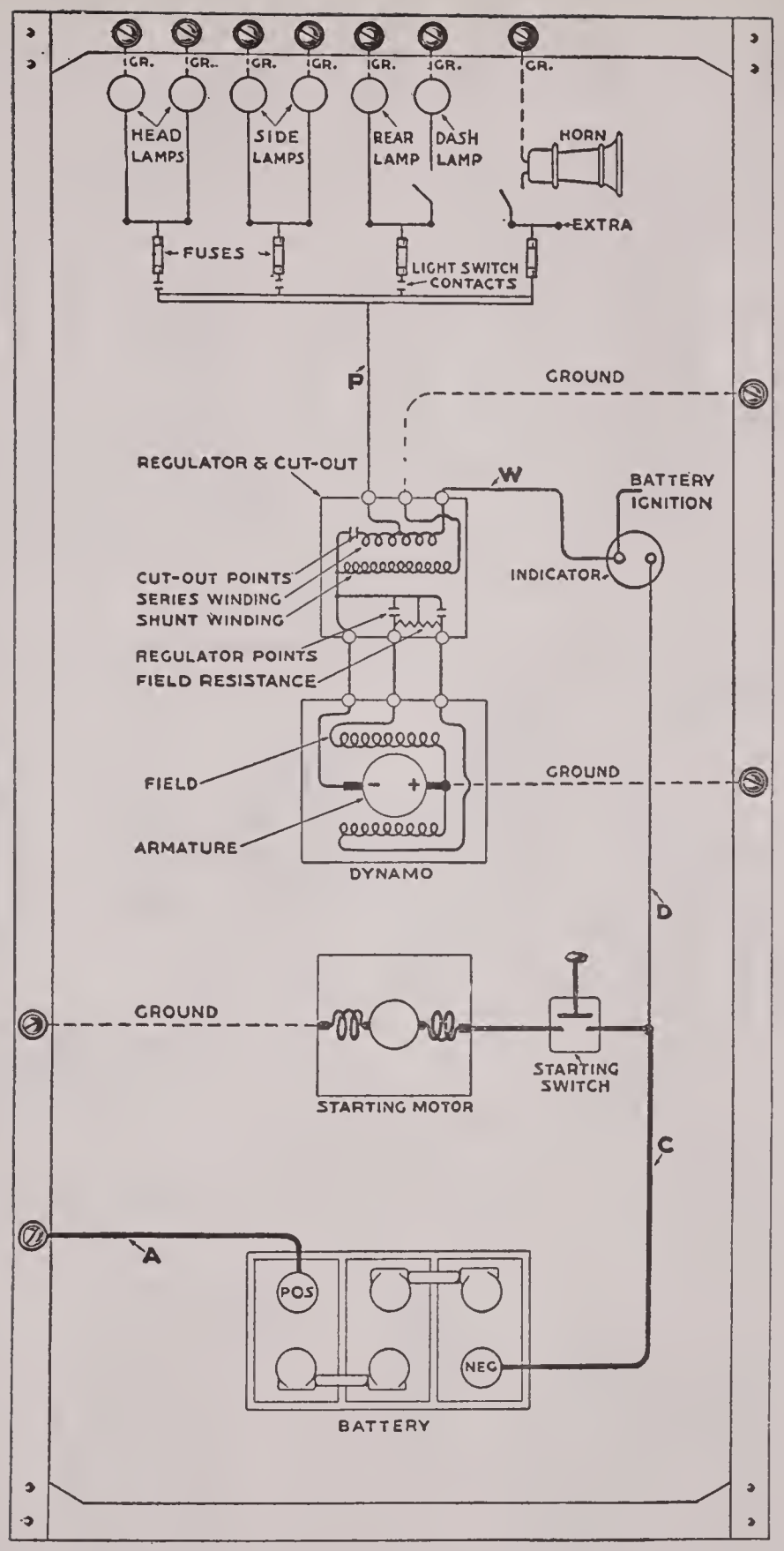
Head lights are 7 volt, 16 cp. Side lamps are 7 volt, 4 cp. Tail light is 7 volt, 2 cp. Dash light is 7 volt, 2 cp. Head lights take about 2.6 amperes. Side lights take about .7 amperes. Dash and tail lights take .3 to .4 amperes each.

Fuses are all 10 ampere.

Starting motor is connected to engine by a Bendix gear. Put 8-10 drops of medium weight machine oil in each of the motor oilers every two weeks.

Wires leading from generator to battery and switch should be No. 10 B. & S. Wires from switch to head lamps should be No. 12 B. & S. Cables from battery to starting motor No. 1 B. & S., or larger. All other wires are No. 14 B. & S.

A means of focusing the head lights is provided, back of reflector. Its operation is easily understood when seen. If lamp reflectors are tarnished, clean with a piece of chamois and rouge moistened with alcohol. Polish with a piece of soft chamois and a little dry rouge or crocus. When polishing use a rotary motion. Do not rub from the center of the reflector to the outer edge.



TECHNICAL WIRING DIAGRAM

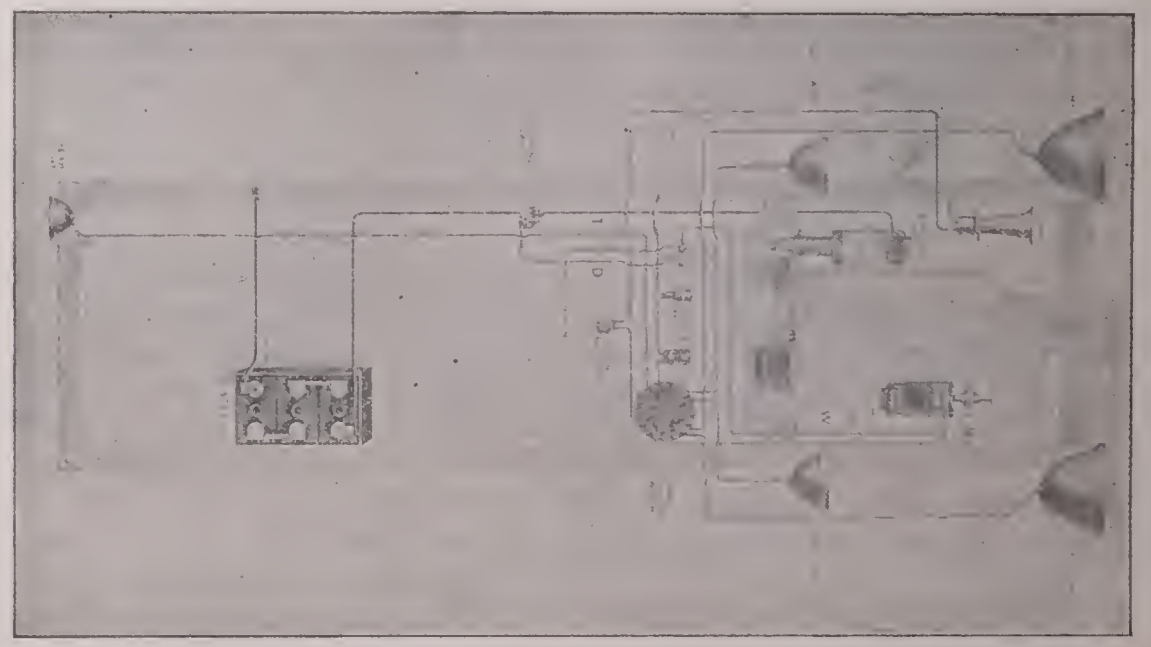
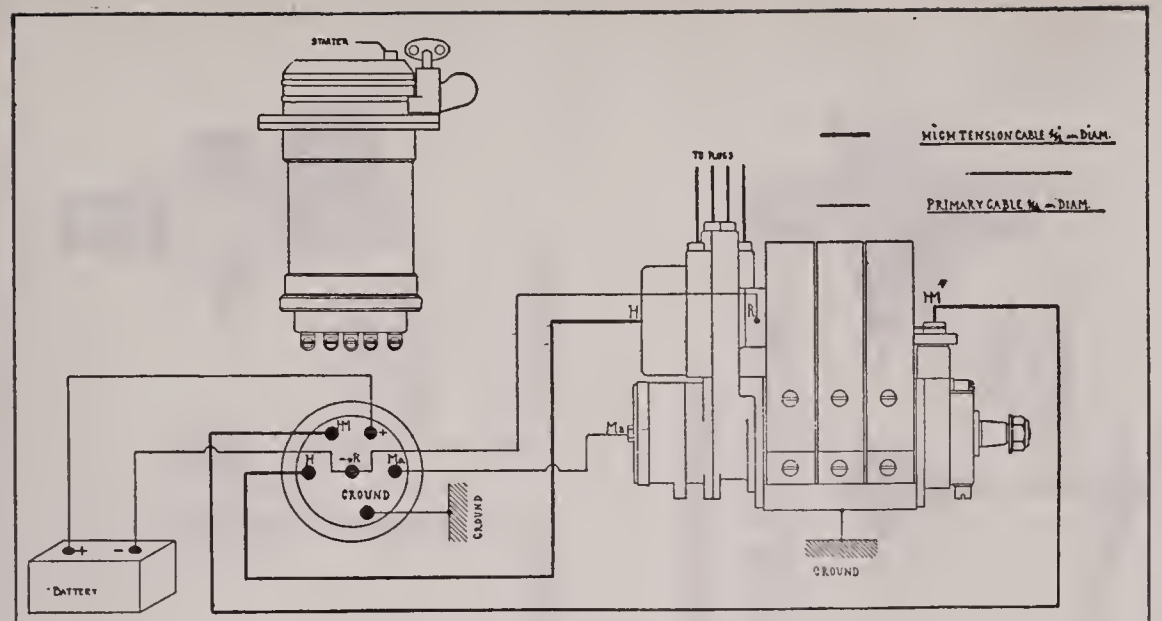


Plate No. 147

Eisemann Magnetos

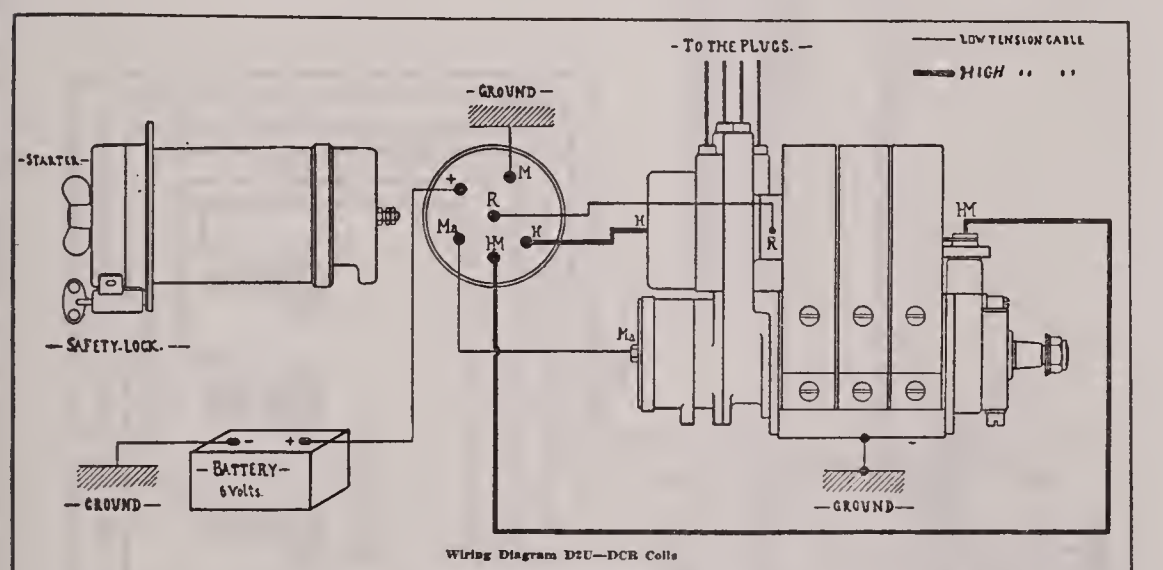
Types EA, EU, ED.

Single and Dual Ignition



Wiring Diagram—DT Coil

Fig. 1



Wiring Diagram D2U—DCR Coils

NOTE.—This cut shows the D2U coil. The DCR connections are exactly the same, but the terminals on the bottom of the coil, according to the symbols, occupy different positions on the plate Wire according to the symbols.

Fig. 2

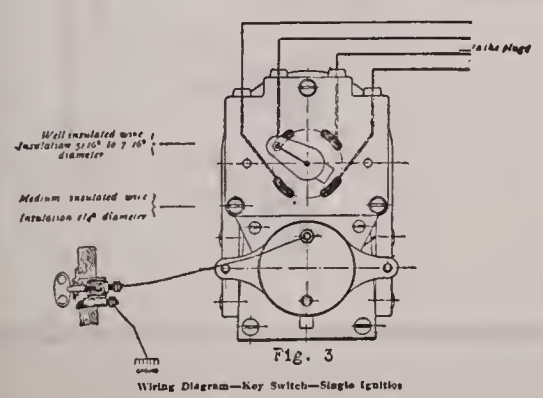


Fig. 3

Wiring Diagram—Key Switch—Single Ignition

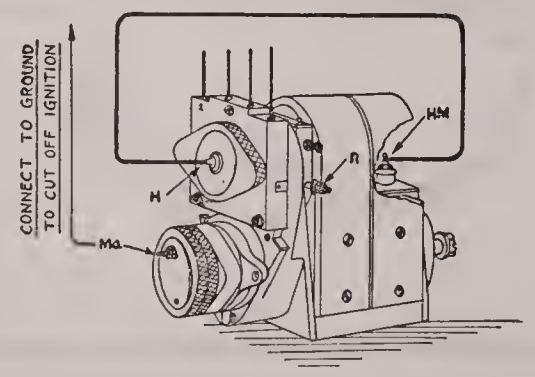


Fig. 4

Plate No. 149

Single and dual ignition is used on the Hudson Super-Six, Essex, Hupmobile, Maxwell, Studebaker, Chandler, Cleveland, Oakland, Buick, Cadillac, Chevrolet, Oldsmobile, Reo, Overland, Willys-Knight, Stutz, Packard, Peerless, Pierce-Arrow, Lexington, Marmon, Moon, Nash, Paige, Jordan, Franklin, Dodge, Ford, Saxon, Hudson, Gray, Scripps-Booth, Detroit, Elcar, Gardner, Haynes, Hupp, Jewett, Kissel, Lexington, Locomobile, Marion, Mercer, Moon, Nash, Oldsmobile, Paige, Peerless, Pierce-Arrow, Reo, Stutz, Studebaker, Willys-Knight.

These three types of magnetos are identical in design and construction, the only difference being in the size.

The high tension cables must be 5/16 in. in diameter. The low tension cable must be 1/4 in. in diameter. These sizes must be used in order to insure an accurate fit between the wire and wall of the terminal. To connect wire to terminal, scrape the insulation off for 3/16 in. and clean the wire well. Then screw the end of the wire into the terminal. Merely pushing it in will not do. It must be screwed in, to insure good contact.

Timing to engine: In order to time the magneto to the engine, turn the engine to point where break should occur, spark retarded. This point is usually about 1 in. past dead center, measured around the flywheel. With engine in this position, disconnect magneto and turn the armature, in the direction it rotates when the engine is running, until the contacts just open, and then again connect the magneto to engine without disturbing the relative position of either.

Contacts should open 1/64 in. to 1/32 in. They should be cleaned with gasoline whenever necessary. The distributor and collector ring and brushes should also be cleaned once or twice a season with a cloth moistened with gasoline. If badly burned or pitted, clean contacts with a fine, flat, jeweler's file or a piece of worn, No. 00 sand paper.

There is an oil well at the driving end and one at each corner of the triangular end plate. The latter lubricates the front bearing and the wick in the timing lever body. Do not lubricate both of these wells, only the one most convenient, as they both lead to the same place and if both are oiled the surplus oil may cause trouble.

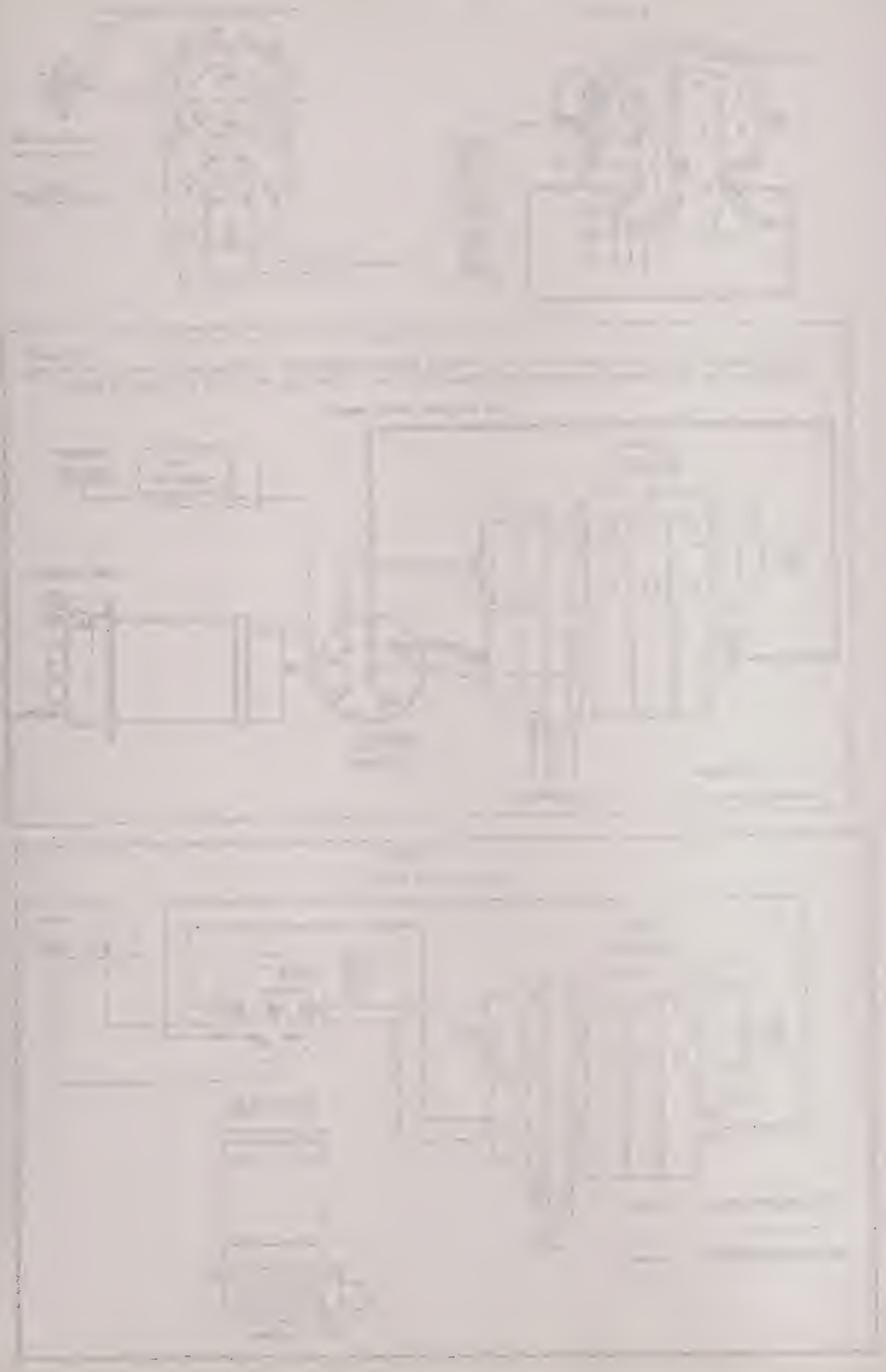
Every 1,000 miles put a few drops of clean light machine oil in the oiler at the driving end and one of the oilers in the end plate.

Spark gap should be 1/64 in.

Wiring diagram of single ignition is shown in Figure 3. The other diagrams apply to the dual system. Several types of coils are used. The type D. T. coil has an electrical vibrator which is set in operation when the switch is placed on battery position, providing the battery contacts are closed. If they are open, the vibrator may be set in operation by depressing the button on switch. Diagram of system using this coil is shown in Figure 1. The other makes of coils used are practically the same. The diagram Figure 2, applies to all of them. The terminals are arranged differently on the different models, but are connected to magneto and battery according to the symbols as shown.

The terminal on end of breaker should be grounded to stop engine. (See Figure 4). Do not close throttle entirely before ignition is cut off. If engine is stopped with throttle partly open the cylinders are left full of gas and starting is made easier. If throttle is closed, the cylinders are left full of air, which must be forced out and replaced with gas before engine starts to fire.

If coil or switch get out of order, engine may be operated on magneto alone by connecting the terminals HM and H with a piece of cable, similar to that used in the high tension circuit, as shown in Figure 4.



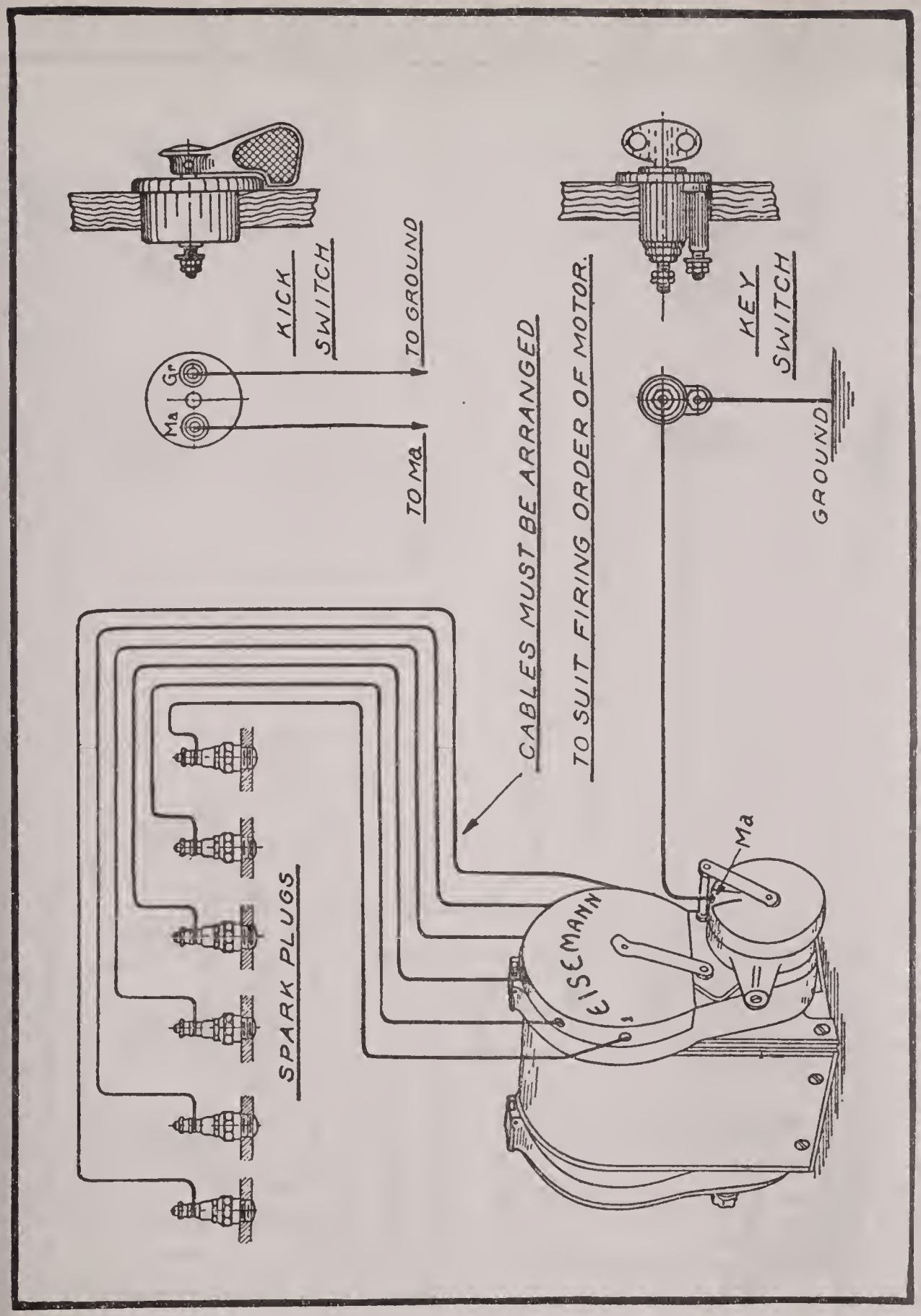


PLATE No. 150

Eisemann Magneto

TYPE GN6

Direction of rotation of these magnetos is indicated by the arrow on the driving end. On 4 cycle, 6 cylinder motors the magneto rotates at 1½ times engine speed. On 2 cycle, 6 cylinder motors the magneto must rotate at twice engine speed.

The proper fastening of the high tension cables to the distributor is of the utmost importance to insure good contact and make it moisture proof. Figure 2 shows proper method of connecting.

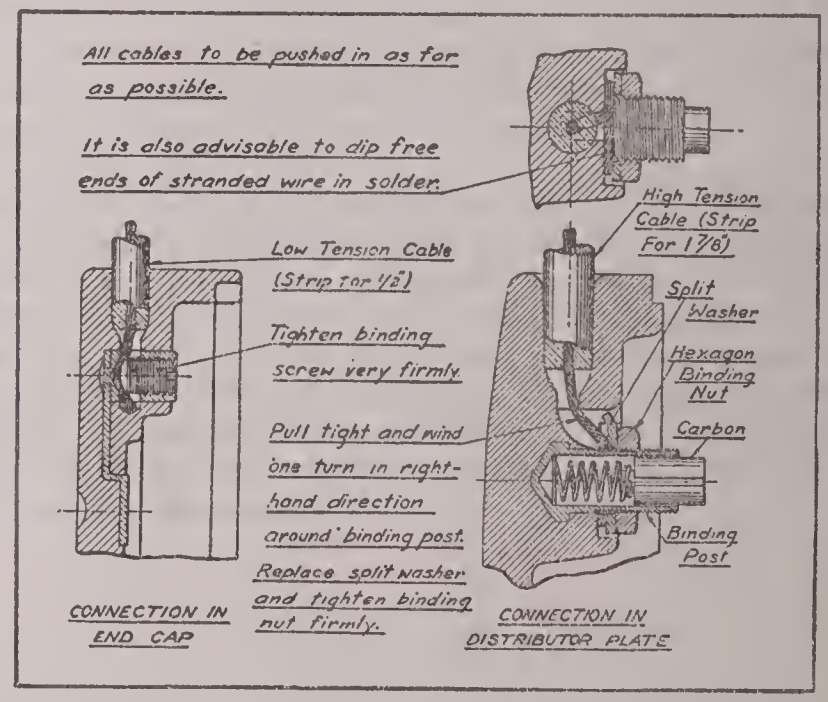
When stopping the motor, the throttle should be left partly open and the ignition switch placed in the "Off" position. This leaves a charge of gas in the cylinders, which greatly aids in starting the motor. If throttle is entirely closed, the cylinders will be filled with air which must be forced out and replaced with gas before engine will begin to fire.

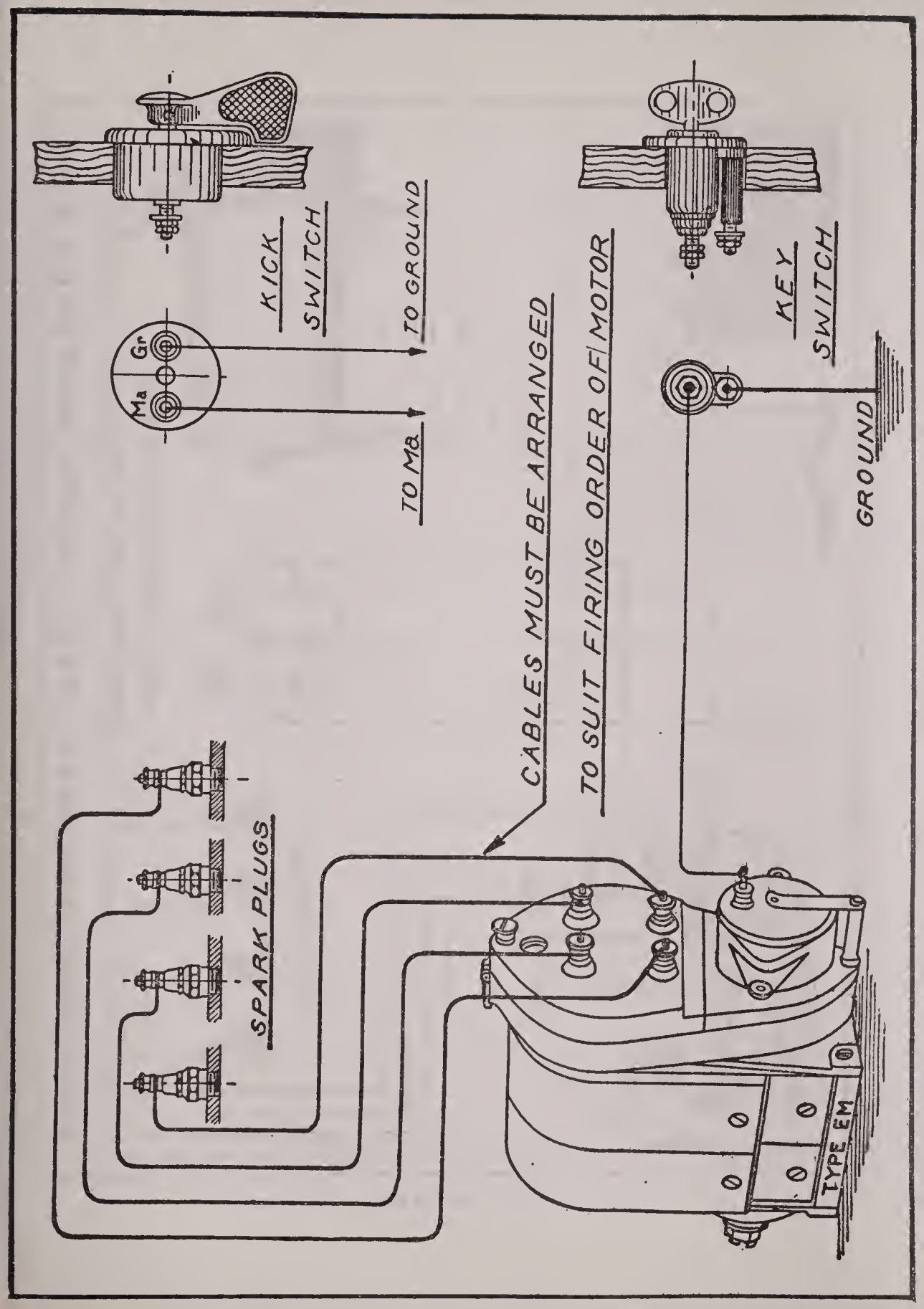
There is an oil well located at the top of the distributor. This well provides lubrication for the armature ball bearing, the distributor, plain bearing and to the wick in the timing lever body. There is another well on the top of the gear casing at driving end and lubricates the bearings at that end.

One or two drops of light, clean machine oil should be injected into each of the oilers every 1,000 miles. Do not over oil.

The platinum contacts should be well cleaned with gasoline whenever necessary. If the contacts are badly burned or pitted, they may be resurfaced by the careful use of a fine, flat, jeweler's file or a worn piece of No. 00 sand paper. The distributor collector ring and brush should be thoroughly cleaned with a cloth moistened with gasoline once or twice a season at least. Contacts should open 1/64 in. to 1/32 in.

Spark gap should be about 1/32 in.





Eisemann Magneto

Type EMA

This magneto is made for both four- and six-cylinder engines. For a four-cycle, six-cylinder engine, the magneto must rotate at 1½ times engine speed. For a four-cycle, four-cylinder engine, the magneto must rotate at engine speed. For a two-cycle, four-cylinder engine, the magneto must rotate at twice engine speed. For a two-cycle, six-cylinder engine, the magneto must rotate at three times engine speed.

This magneto is equipped with an automatic spark controller. A number of spindles are made to make the controller applicable to any motor. There are spindles produced to provide an advance of 19, 25, 38, 45 and 60 degrees. For use in connection with these spindles there are 16 different springs made. With these parts it is possible to produce 160 advance curves, and many more by varying the length of the stop on the bronze nut. A motor of high compression will not stand the same amount of advance as a motor of low compression.

There is also a device to facilitate the timing of the magneto. To time the magneto to the engine, turn engine so that No. 1 piston is on upper dead center, compression stroke. Next turn the magneto armature until No. 1 appears below the peephole at top of distributor plate, then hold the magneto in that position by inserting the setting key at rear of the governor housing, to hold the armature in that position. To make sure that the spark is retarded, see that the key fits into the hole provided for that purpose in the governor. Then connect the magneto to the engine and remove the setting key.

Contacts should open 1/64 in. Clean with gasoline whenever necessary. If contacts are badly burned or pitted, resurface them with a fine, flat, jeweler's file or a worn piece of No. 00 sandpaper. Carefully blow out all dust or filings when finished.

The distributor and collector ring and brush should be carefully cleaned with a cloth moistened with gasoline, once or twice a season.

Spark gap should be 1/64 in.

There is an oil well on top of the distributor gear housing. This oiler provides a means of lubricating the timing lever bearing and the fiber part of the contact lever, through the medium of a wick placed in the timing lever bearing. A few drops of clean, light machine oil should be injected into this oiler every thousand miles. There is also an oiler at the driving end, on the governor housing. Every few hundred miles three or four drops of light machine oil should be placed in this oiler, to prevent governor sticking.

Two types of grounding switches are provided. The key type is usually used on pleasure cars and the kick type is used on commercial vehicles. Both lock the ignition in the "Off" position when removed.

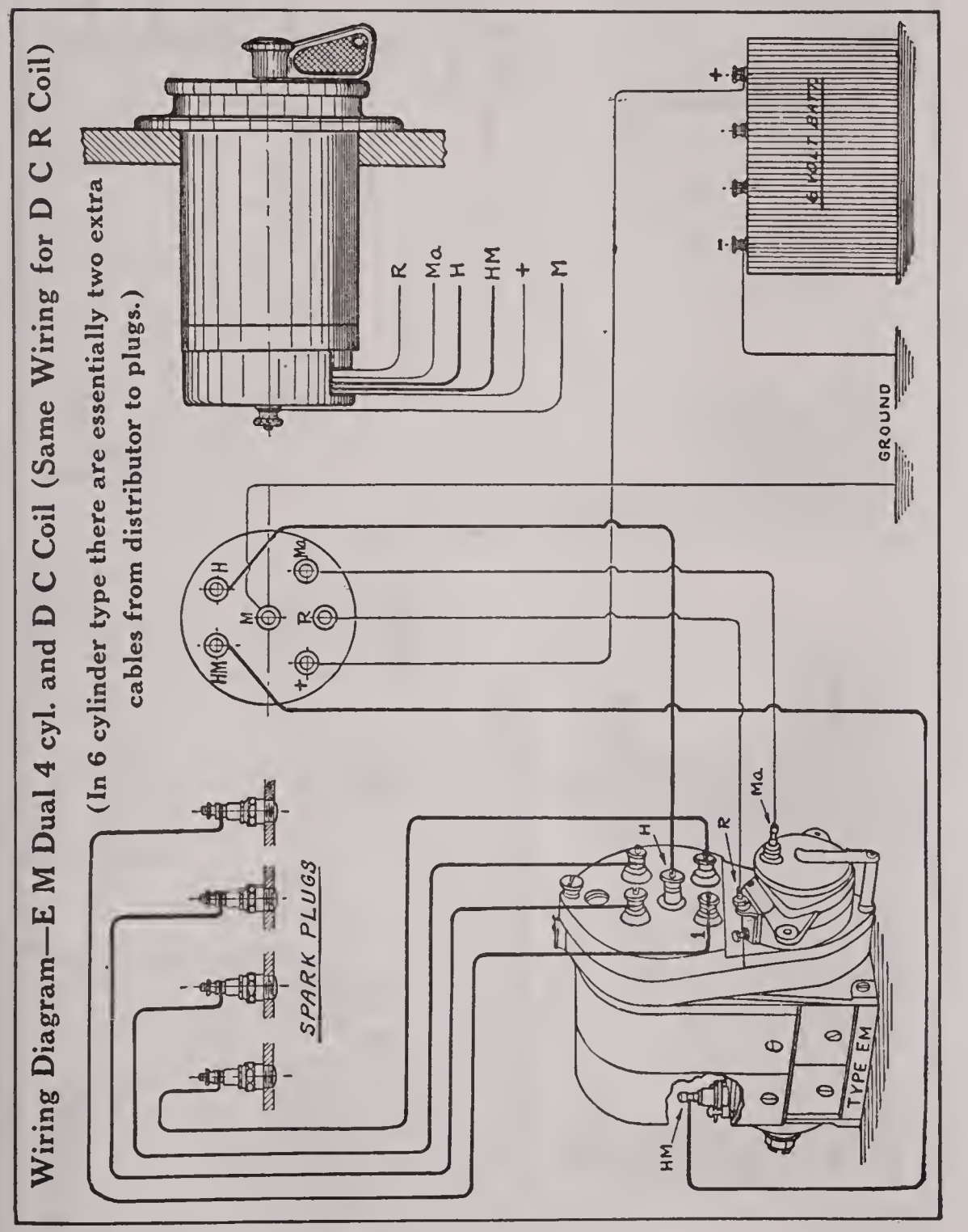


PLATE NO. 152

Eisemann Magneto

TYPE EM DUAL

The Type EM Eisemann magnetos provide for dual ignition.

The magneto breaker is operated from the end of the armature shaft. The battery breaker is at one side of the magneto breaker. It is operated from the distributor gears. Connections are plainly shown in the diagram. Contacts should open 1/64 in. When the platinum-tipped screw is adjusted, care must be taken to tighten the lock nut properly. Contacts should be cleaned thoroughly with gasoline whenever necessary. If contacts are badly burned or pitted, they may be resurfaced by the careful use of a fine, flat, jeweler's file or a piece of worn No. 00 sandpaper. Carefully blow all dust and filings out of the timer after resurfacing. To remove the breaker, the lock spring holding the screw in the center of breaker from turning, must be lifted up and turned aside to free the screw. The screw may then be taken out, and the entire breaker mechanism removed. When replacing, be sure that the lock spring is turned back, to hold the center screw in the proper position.

Spark gap should be 1/64 in. to 1/32 in.

Clean distributor and collector ring and brush with a soft cloth moistened with gasoline once or twice a year, or oftener if car is used enough to necessitate it.

If magneto windings are suspected of being at fault, disconnect the wires leading from the distributor to the plugs and crank the engine vigorously. If a spark jumps across the safety gap the magneto is all right. If not, the magneto is at fault. The safety gap is under cover at rear of the coil.

If it is desired to operate the car with coil and switch removed, connect the terminal H (diagram) to the terminal HM with a piece of cable similar to that used in the high tension circuit. A wire may be led from MA to the dash, and when it is desired to stop the engine the base end of the wire may be connected to the metal part of the car, thus grounding the magneto. The car may be operated on magneto with above arrangement until the coil or switch is repaired.

The cables in the high tension circuit should be 5/16 in. in diameter. The low tension cable should be 7/32 in, both dimensions without the insulation being referred to.

A few drops of light oil should be injected into the two oilers provided, every 1,000 miles. These two oilers are located, one at the driving end and one at the top of the distributor gear housing. The latter one also lubricates the timing lever bearing, also the fiber part of the magneto and battery contact levers, through the medium of two wicks placed in the timing lever bearing.

To time magneto to motor, turn the motor so that No. 1 cylinder is on upper dead center, power stroke, place the timing lever of the magneto in the fully retarded position and turn the magneto armature until No. 1 appears at the glass dial of the distributor plate, and make sure that the contacts are just opening.

Connect the magneto to motor in that position. The spark is fully retarded when the timing lever is pushed as far as possible in the direction of rotation of the armature.

A condenser is built between the T-shaped end of the armature and the bearing.

Two types of device for starting on the spark are provided. One consists of an electric vibrator, which rapidly interrupts the primary circuits when switch is placed on battery side and the battery breaker contacts are closed. If battery contacts are open, the vibrator may be set in operation by pressing the button marked "start" on the ignition switch. On the other type, known as the mechanical vibrator type, there is a three-toothed ratchet which passes over a fiber roller, on a contact arm, when the start key on the front of switch is turned from side to side, ignition switch on battery side.

If there is a conbustible charge in the cylinder distributor is delivering current to, when vibrator is operating, the engine will start.

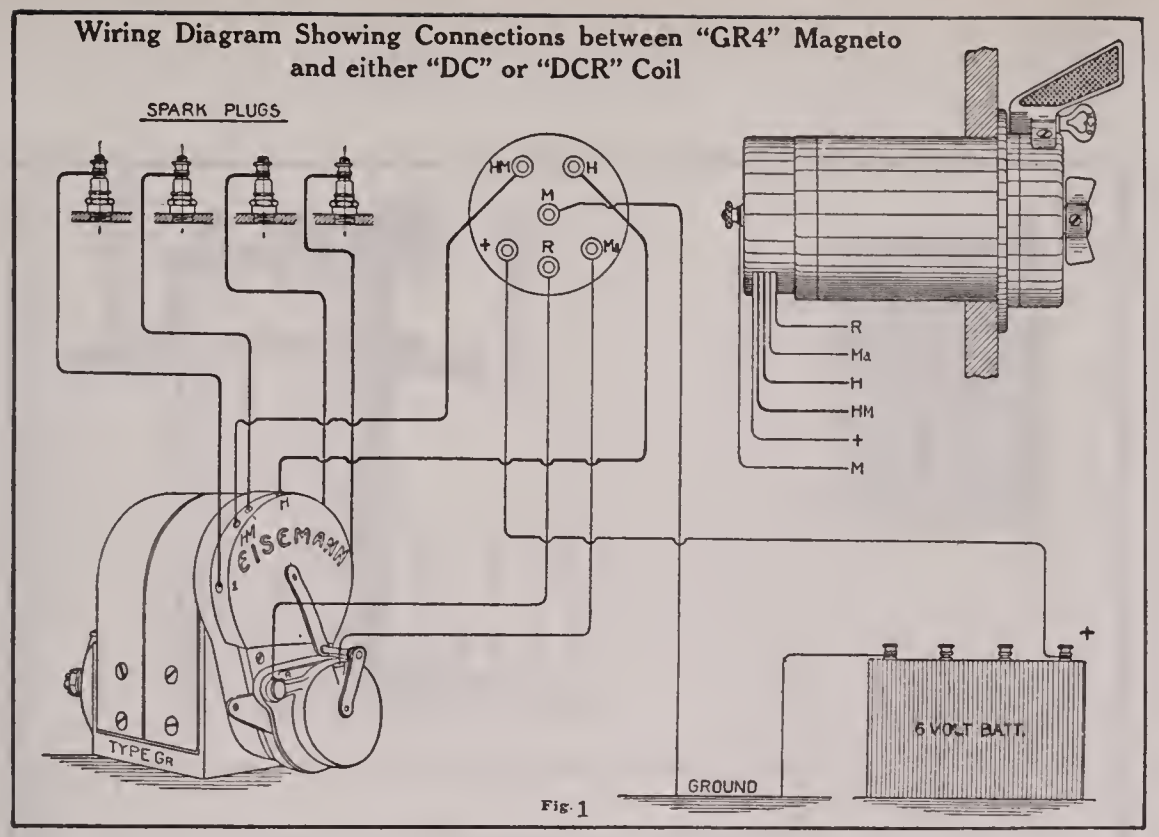


Fig. 1

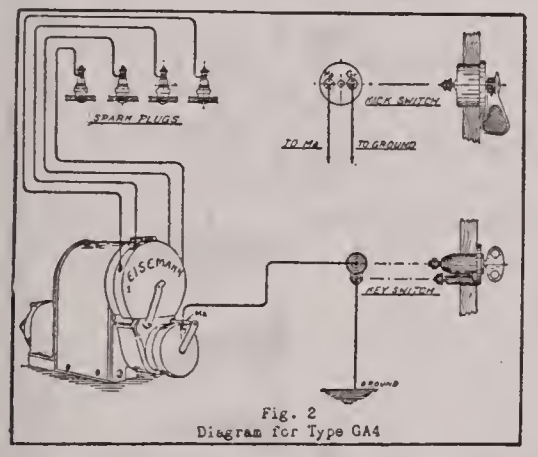


Fig. 2
Diagram for Type GA4

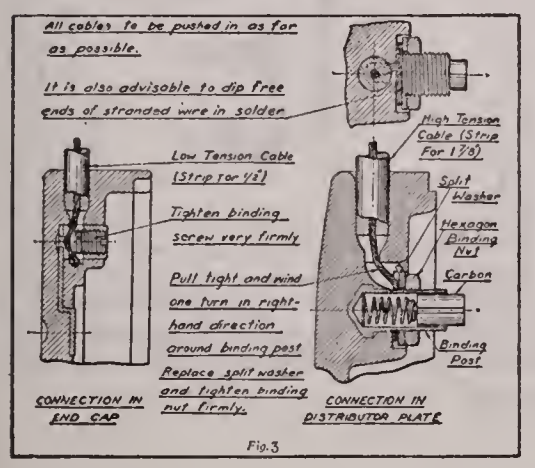


Fig. 3

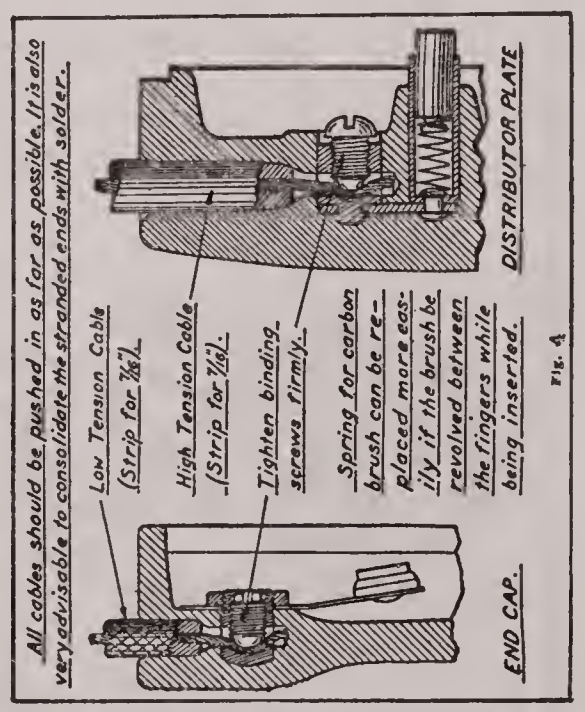


Fig. 4

PLATE No. 153

Eisemann Magnetos

TYPES GA4, G4, I EDIT., G4 II EDIT.

These magnetos provide for independent ignition. The Type GA4 has automatic spark control, while the other two models do not. The connections on all are the same.

To time the magneto to the engine, turn engine until the dead center mark on the flywheel is at proper position for spark to occur, No. 1 cylinder on power stroke. Then remove distributor plate from the magneto and turn the armature until the setting mark is in line with the setting screw. If magneto rotates in a clockwise direction, when viewed from the driving end, use the setting mark "R". The direction of rotation is indicated by an arrow on the driving end. If magneto rotates in counter-clockwise direction use the setting mark "L". With the armature in this position the contacts are just opening and the distributor rotor is making connection with wire leading to No. 1 cylinder. The driving medium must now be fixed to the armature axle without disturbing the relative position of magneto to motor.

Breaker contacts should open .010 in. to .020 in. Clean them with gasoline whenever necessary. If the contacts are badly burned or pitted, they may be resurfaced by careful use of a fine, flat, jeweler's file or a piece of worn No. 00 sand paper.

Thoroughly clean distributor and collector ring and brush, with a cloth moistened with gasoline once or twice a year, or oftener should it become necessary.

All cables must be properly connected to their respective terminals to insure a good mechanical, electrical and water proof joint. The method of connecting is shown in Figures 3 and 4.

On the G4 II Edition magnetos, there are two oilers on the breaker end. Both of these lead to the same bearing, so that only the one most accessible need be lubricated. One drop of clean, light machine oil every 1,000 miles is positively all that it should receive. At the driving end, two wells will be found. The larger one leads to the plain bearing. It should receive 15 drops every 1,000 miles. The smaller hole leads to the ball bearing. It should receive four or five drops every 1,000 miles. Use good, clean, light cylinder oil in these oilers.

On the Types GA4 and G4 I Edition magnetos, one or two drops of light machine oil in each of the oilers every 1,000 miles is sufficient.

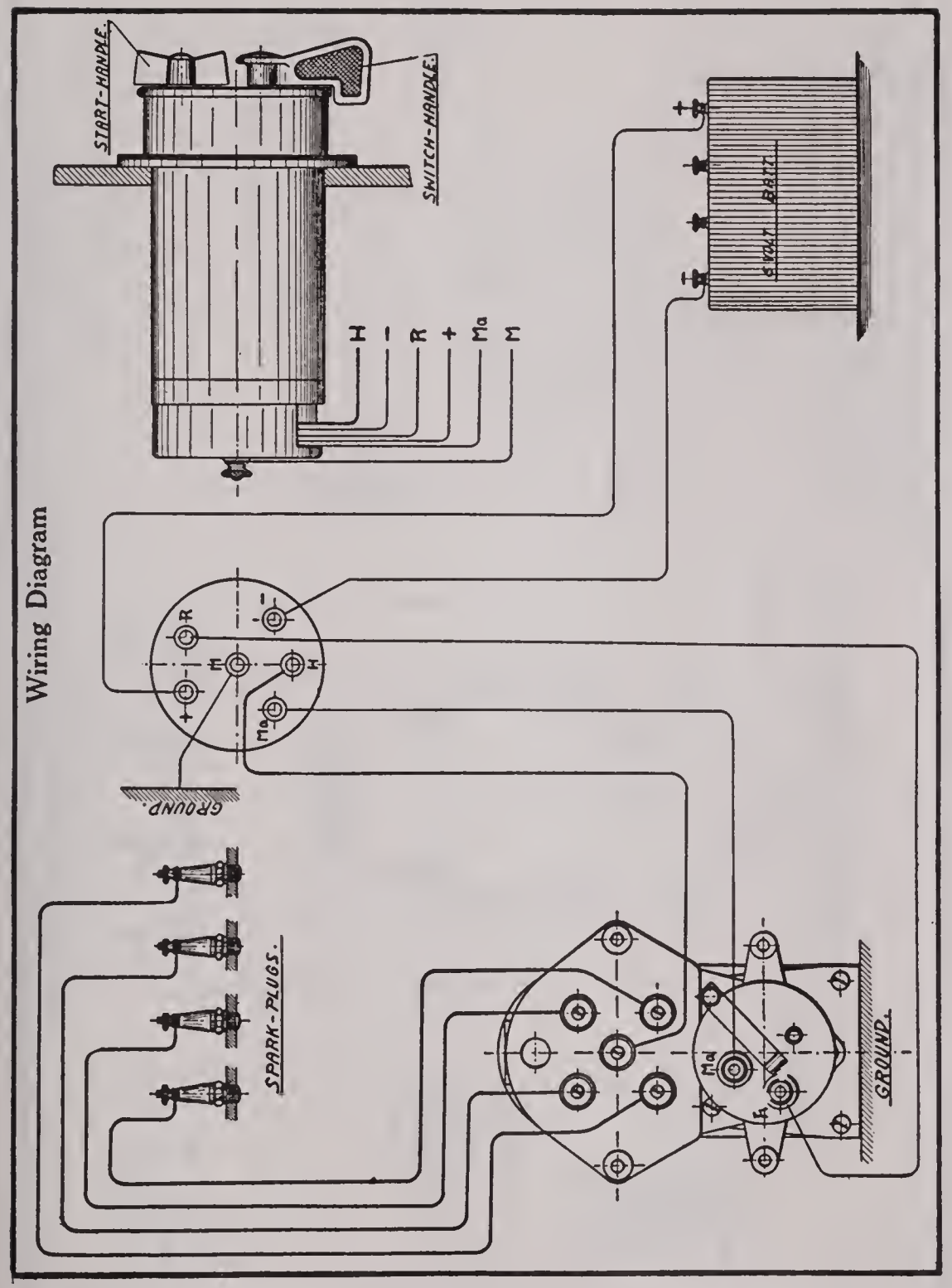


PLATE No. 154

Eisemann Magneto

TYPE EB

This type of Eisemann magneto provides a dual ignition system.

The wires in the high tension circuit should not be less than 5/16 in. in diameter. The wire in the primary circuit should not be less than 7/32 in. in diameter. In each case, the diameter of wire itself, without the insulation, is referred to.

Spark gap should be about 1/32 in.

The breaker contacts should open 1/64 in. to 1/32 in. Clean thoroughly with gasoline whenever necessary. If the contacts are badly burned or pitted they may be resurfaced with a fine, flat, jeweler's file or a piece of No. 00 sandpaper. The whole make-and-break mechanism can be removed if the connection between the timing lever body of the magneto and the spark control lever of the steering gear is removed. Clean distributor plate and collector ring and brush thoroughly with a cloth, moistened with gasoline at least twice a year, more often, if necessary.

To time magneto to motor, turn engine to point where spark should occur, No. 1 cylinder on power stroke. Then place spark at full retard and turn magneto armature in the direction magneto is driven, until No. 1 appears below the glass dial on distributor head. Magneto must be connected to engine in this position.

There is a device on the ignition switch known as a mechanical vibrator. In consists of a ratchet with three teeth, operated by a key on the ignition switch. When the ratchet is moved the teeth move over a fiber roller on a contact arm, thus oscillating the arm and making and breaking the circuit. When ignition switch is on battery position, and the "Start" key is rapidly moved from side to side, a shower of sparks is sent across the spark plug gap in the cylinder to which the distributor is delivering current. If there is a combustible charge in the cylinder, the engine will start.

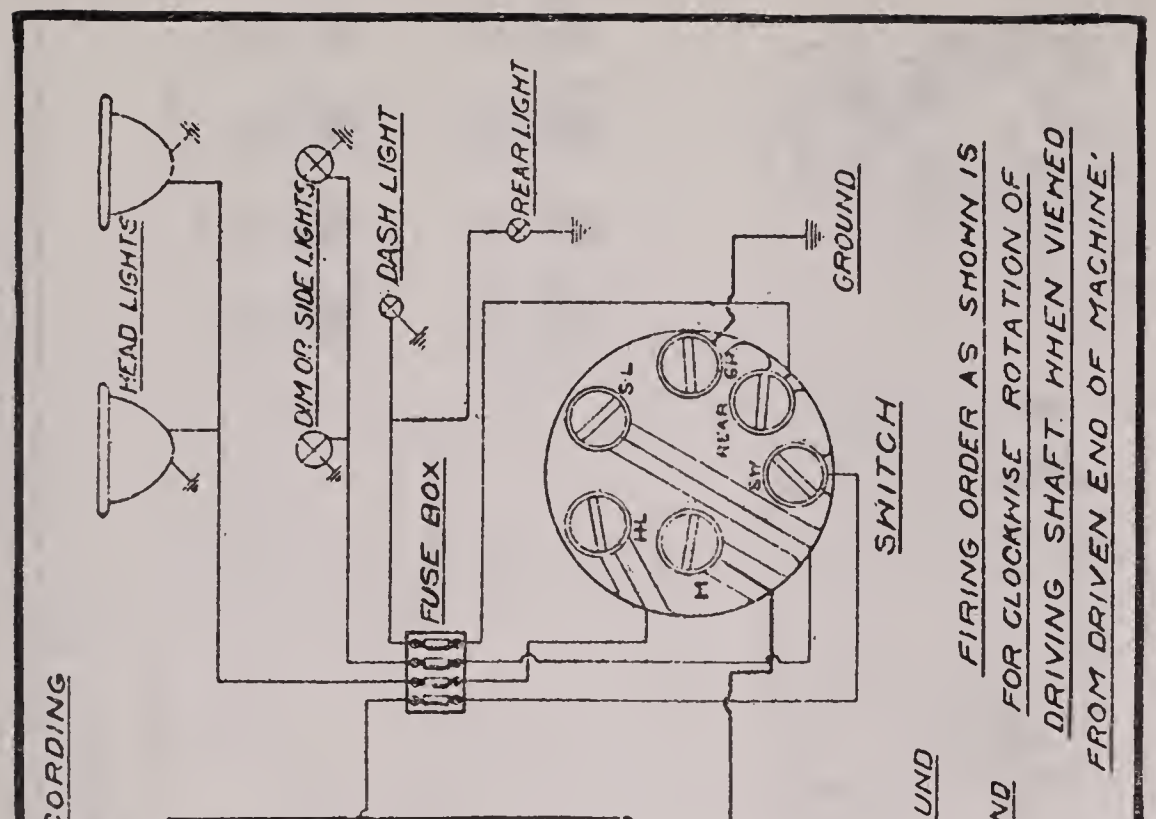


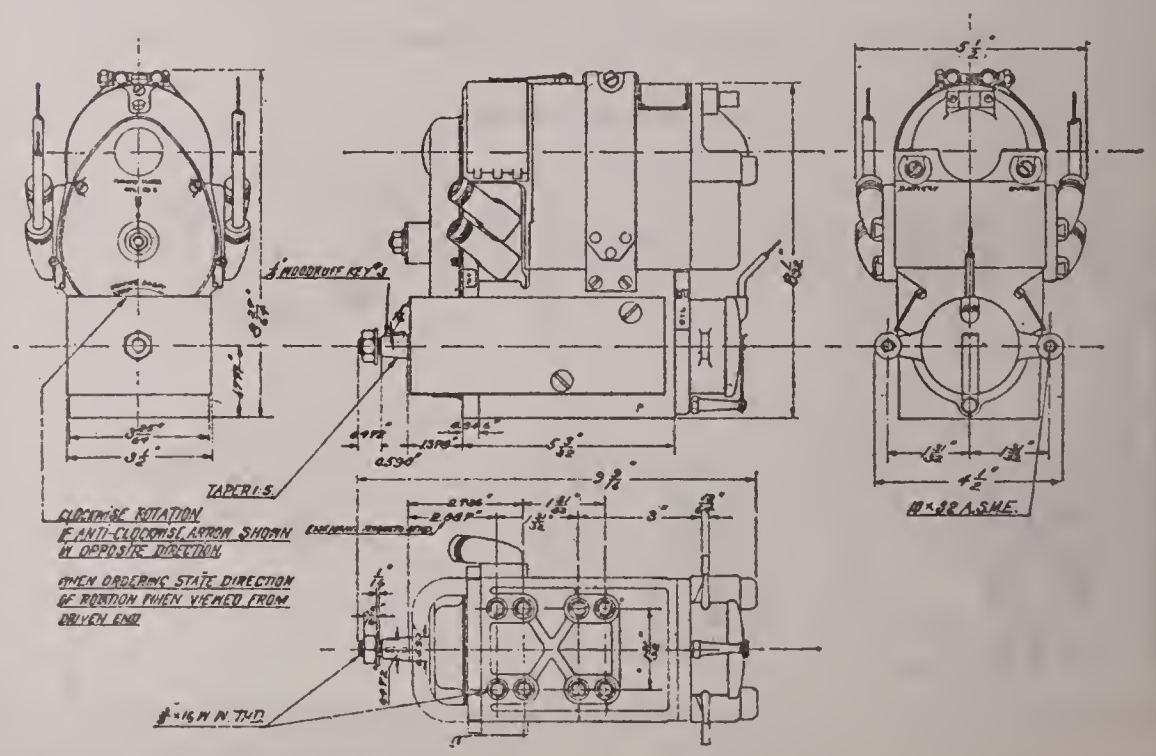
PLATE NO. 155

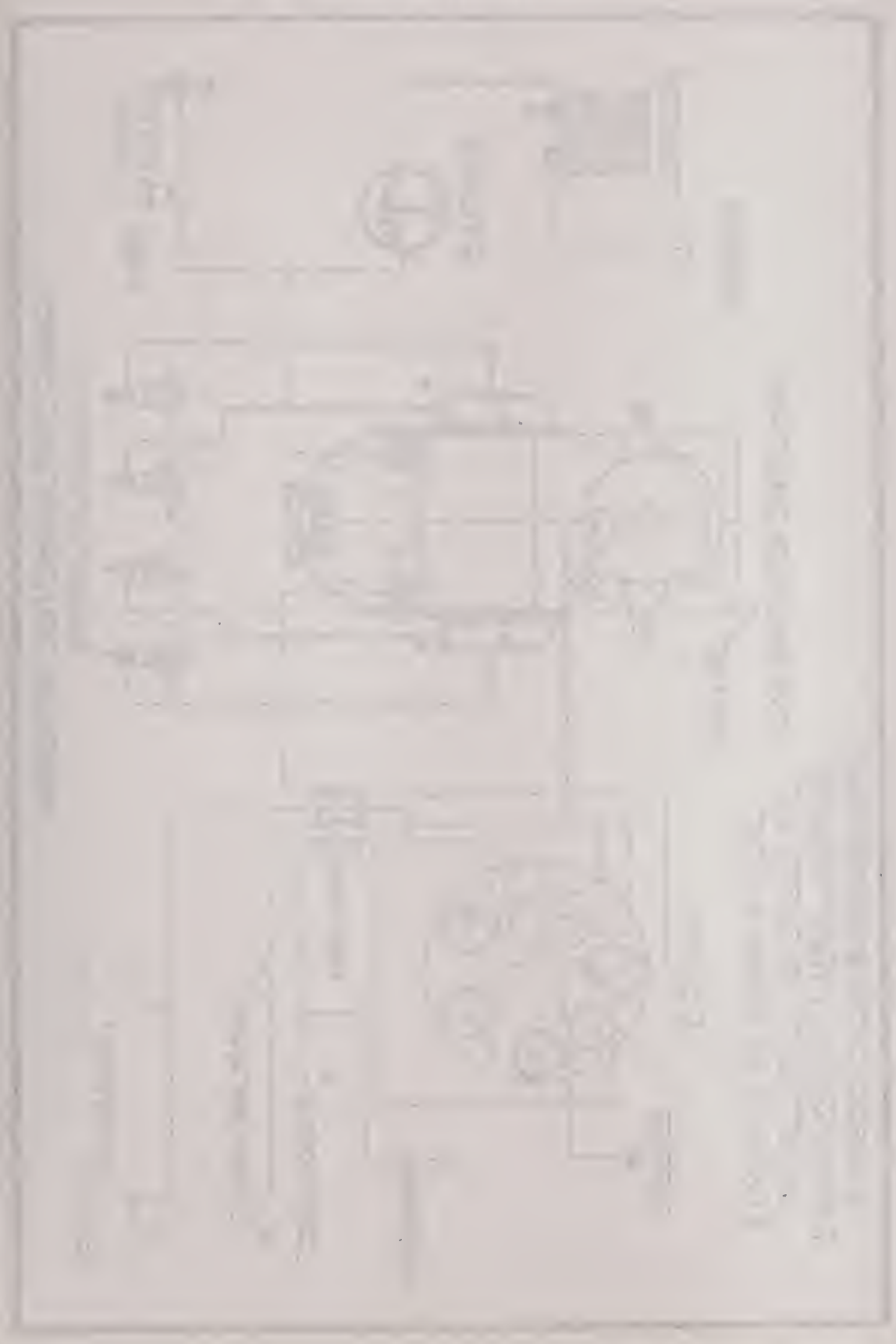
Eisemann Magneto Generator

TYPES M4G6 AND M4G12

This is a generator and high-tension magneto combined in one unit. It is intended to take the place of the high-tension magneto in use on any truck, tractor, motor boat, etc. It may be mounted on and driven by the same shaft as the former magneto was. It is made in 6 and 12 volt sizes for four-cylinder engines. The grounded system is used. The generator armature is carried above the magneto. The magneto field is produced by permanent magnets as in the ordinary magneto, and the generator field by electro-magnets as in the ordinary generator.

The normal output of the generator is 80 watts at 1200 R. P. M. The maximum output of the 12 volt machine is 6 amperes, and of the 6 volt machine is 12 amperes. The generator may be removed without disturbing the magneto. The generator is held down by a strap and six dowel pins. It may be easily removed by prying with a small screw driver in the slots provided for this purpose. The generator is compound wound. When lights are off, only the shunt field is exciting. When lights are on, both the series and the shunt field are exciting.





Remy Magnetos

Models P, 30, 31, 32

These magnetos are of the shuttle wound type. The Models P and 32 provide for single point, dual ignition. The Models 30 and 31 supply two point, dual ignition. Dual ignition is obtained at both sets of plugs.

When magneto is driven clockwise, the wire leading to No. 1 cylinder is connected to the lower left hand terminal of the distributor. If magneto is driven counter-clockwise the wire leading to No. 1 cylinder is connected to the lower right hand terminal of the distributor.

Spark gap should be .020 in. to .030 in.

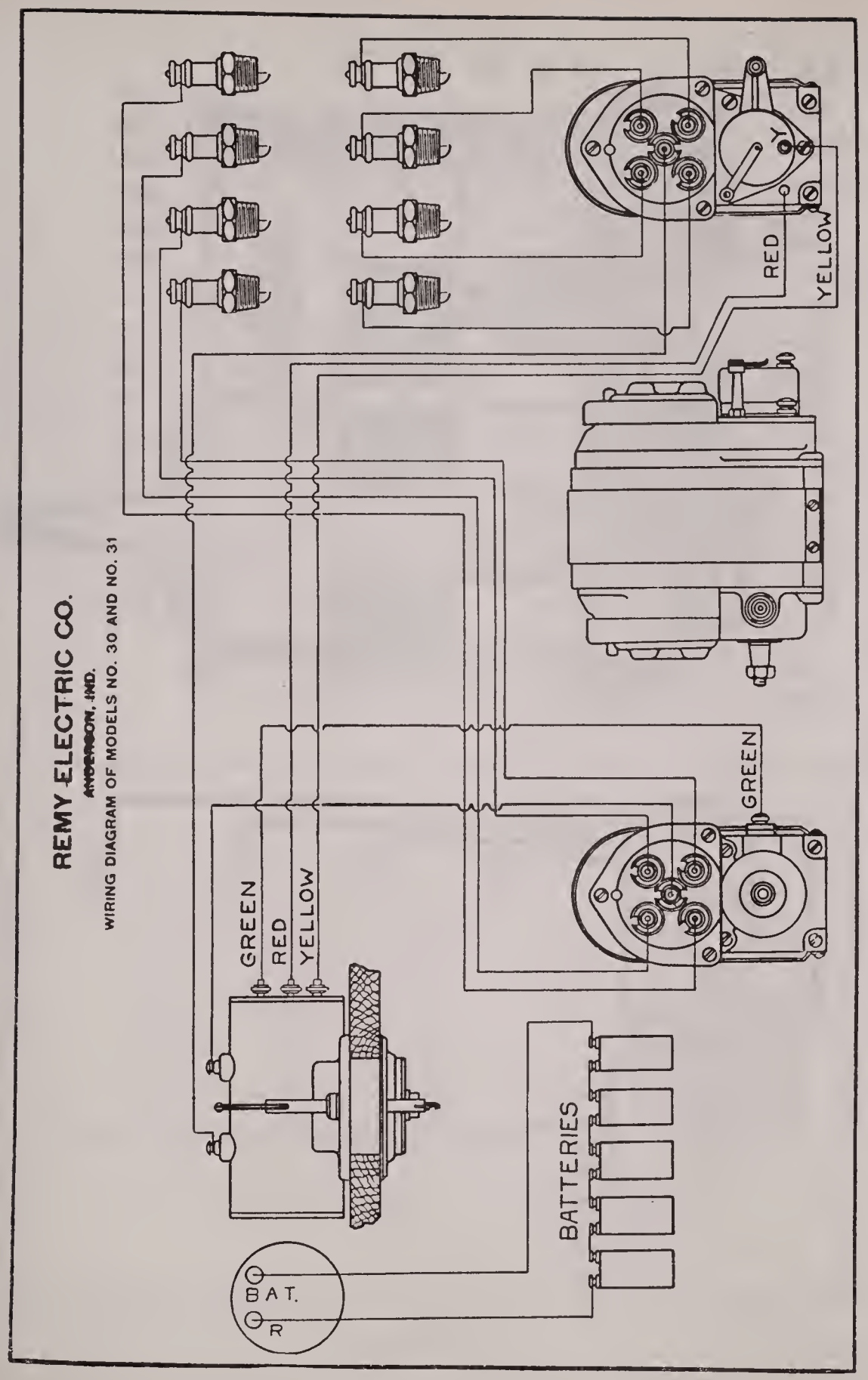
Magneto should be mounted on an aluminum or bronze bracket, as a steel or iron bracket will somewhat reduce the efficiency.

To time the magneto to the engine, turn No. 1 cylinder to the position at which spark should occur, spark fully retarded. This position of the piston is usually top dead center, but may vary in some motors. With engine in proper position, press in the timing button on the distributor and hold it there, while the magneto armature is turned slowly by hand, until the plunger of the button is felt to drop into the recess in the timing gear. Connect the magneto to motor without disturbing the relative angular position of either.

Breaker contacts should open .010 in. to .020 in. Clean with gasoline whenever necessary. If badly burned or pitted they may be resurfaced with a fine, flat, jeweler's file. This procedure should not be required often, as the contacts are of a special iridium-platinum composition. If contacts burn too rapidly see that the magneto is not over oiled and that the condenser makes good electrical connection.

Two oilers are provided, one at the rear of the magneto and one just back of the top of the distributor. Put three or four drops of good, light oil in each of these oilers every 1,000 miles.

If no other electrical apparatus is used on the car, either terminal of the battery may be connected to either terminal on the coil. If, however, other electrical equipment is used on the car, requiring a ground connection, the positive terminal of the battery must be connected to the terminal on coil marked "R".



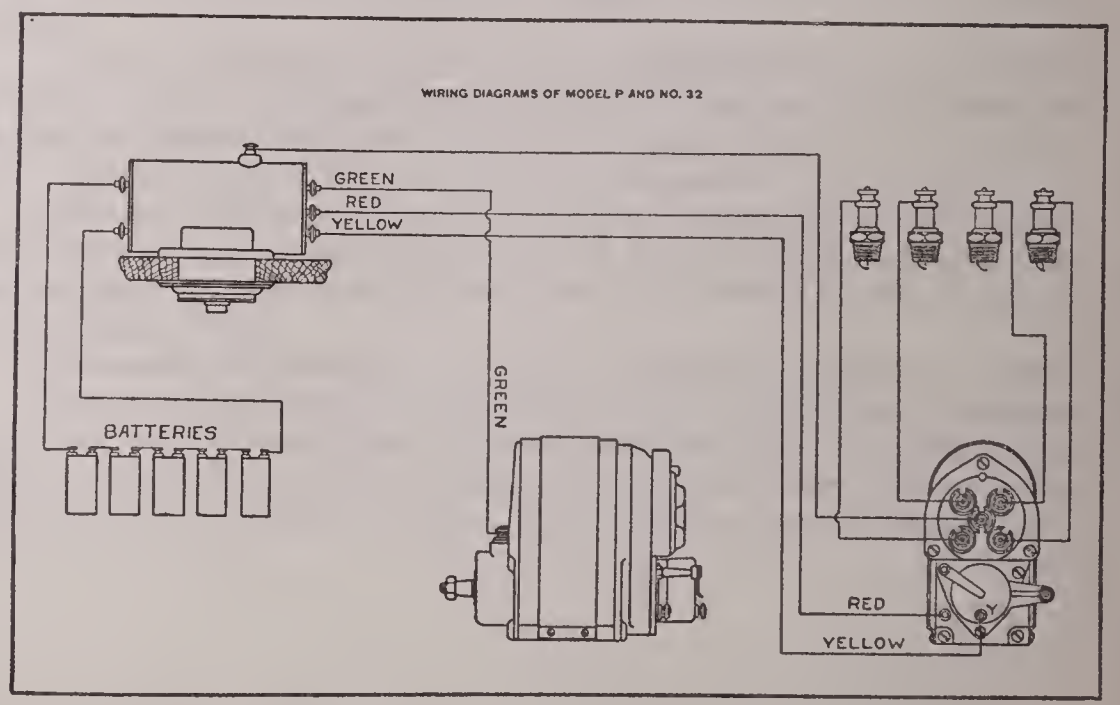
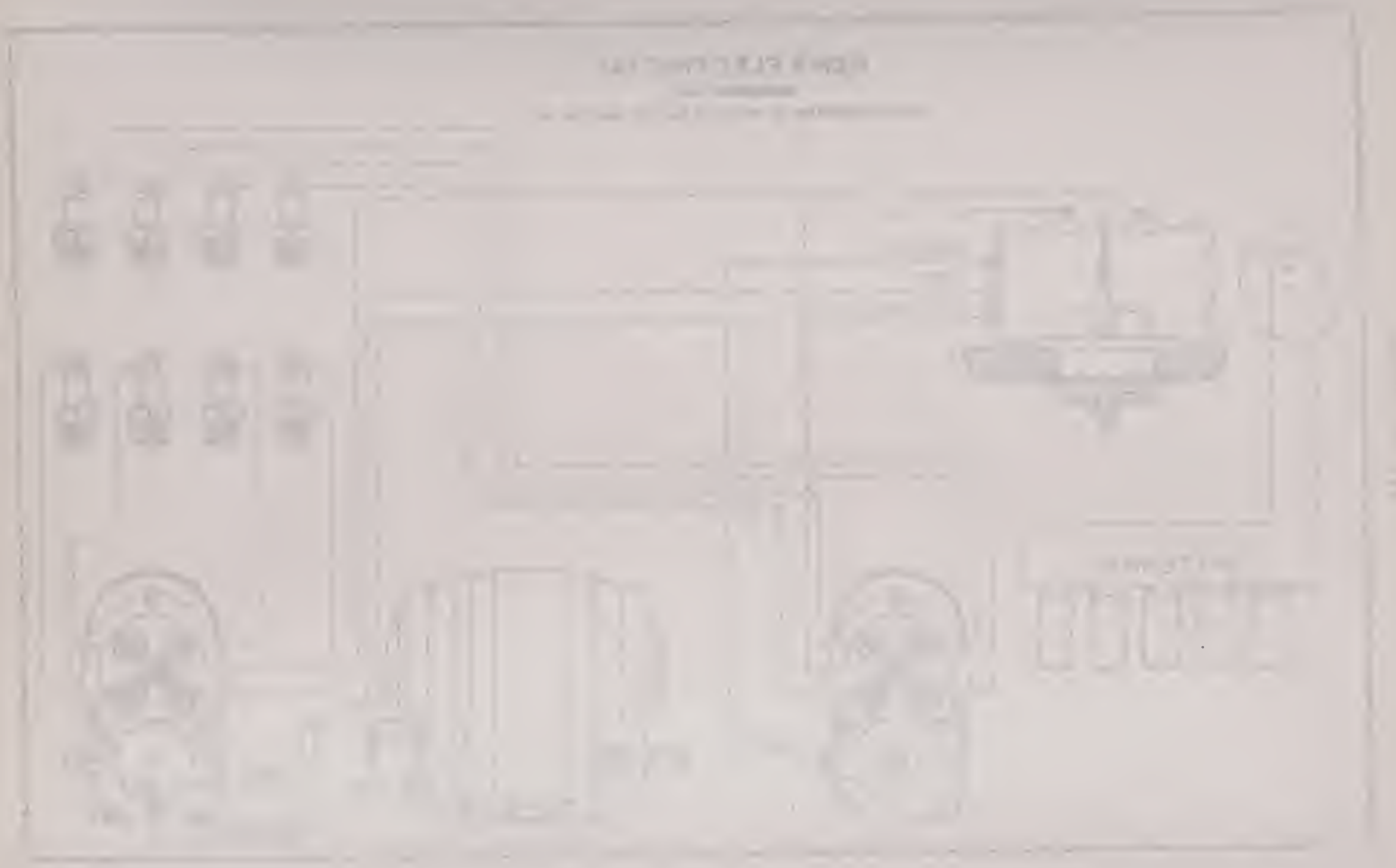
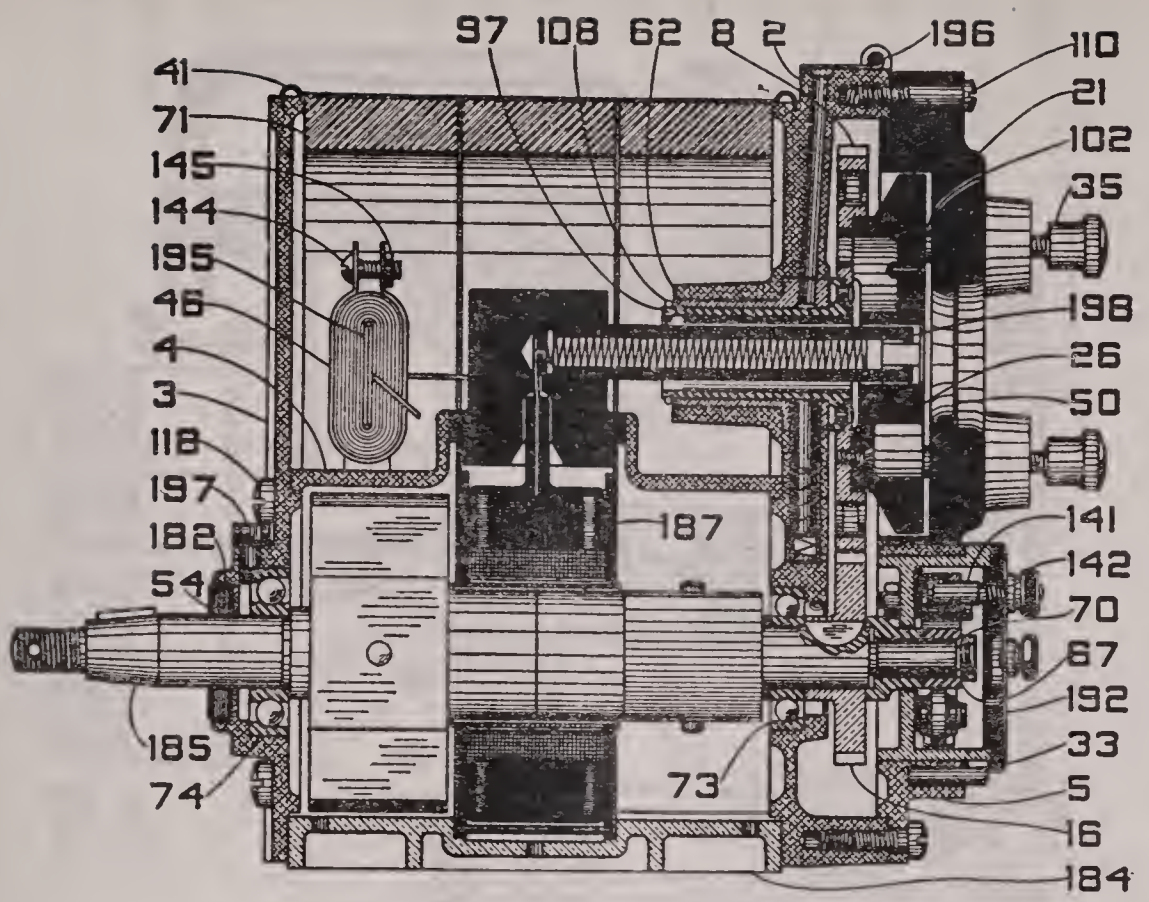


Plate No. 156





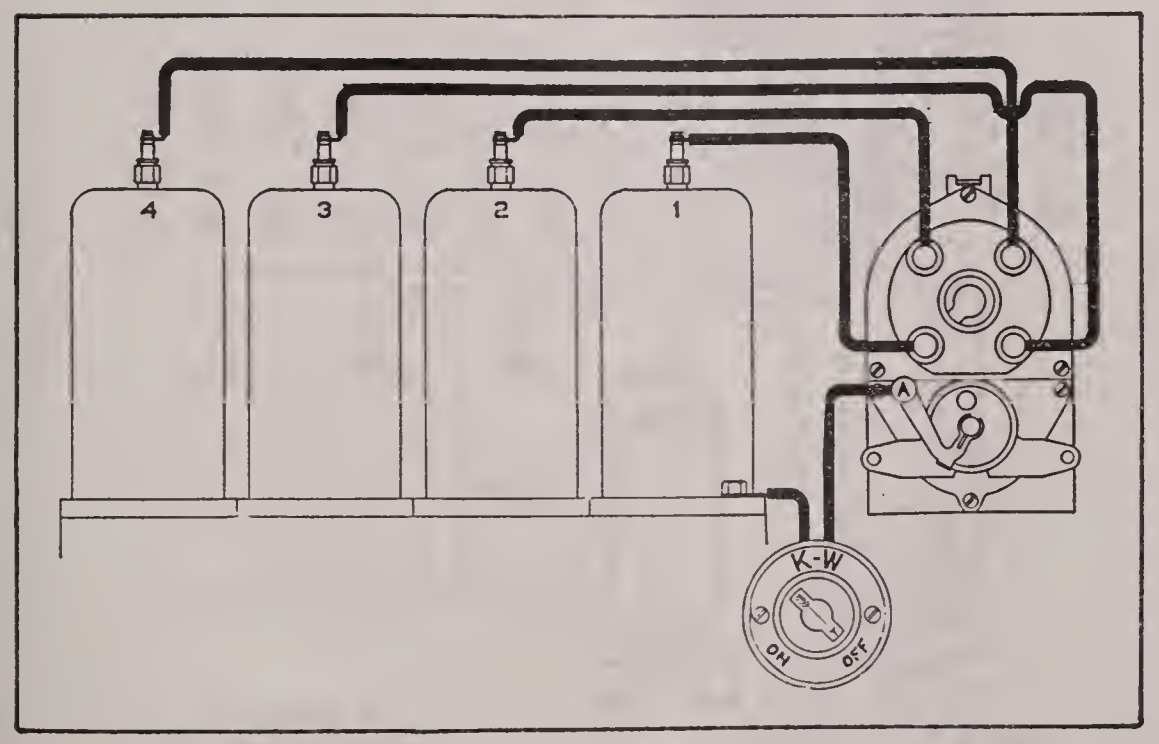


PLATE NO. 157

K-W Magnetos

TYPES T AND TK

These magnetos are of the inductor type. They will deliver four sparks per revolution, but can be set to deliver one, two or four sparks per revolution by changing the cam.

The entire circuit breaker is removable for inspection and adjustment. To remove breaker, push the contact spring aside and breaker can easily be removed. Contacts should open 1/64 in. The contact screw may be adjusted by inserting a screw driver through the hole provided for this purpose, on the side of the breaker box. Clean contacts thoroughly with gasoline whenever necessary. If contacts are badly burned or pitted they may be resurfaced with a fine, flat jeweler's file or a piece of No. 00 sandpaper.

The direction in which magneto must rotate is indicated by the arrow stamped on bearing cap. To change the direction of rotation, take cam off and turn it end for end. Then remove distributor cover, which will expose distributor moulding and segment. Remove the screws and set over to the other set of holes provided. This does not apply to the magneto equipped with the impulse starter.

Model T magnetos must be mounted on a non-magnetic base. If held down by a strap, the strap must be of non-magnetic substance. When bolts are used to hold magneto down, they must not be too long. They must not go into the magneto base more than 5/16 in., otherwise they will break through the base and strike the rotor.

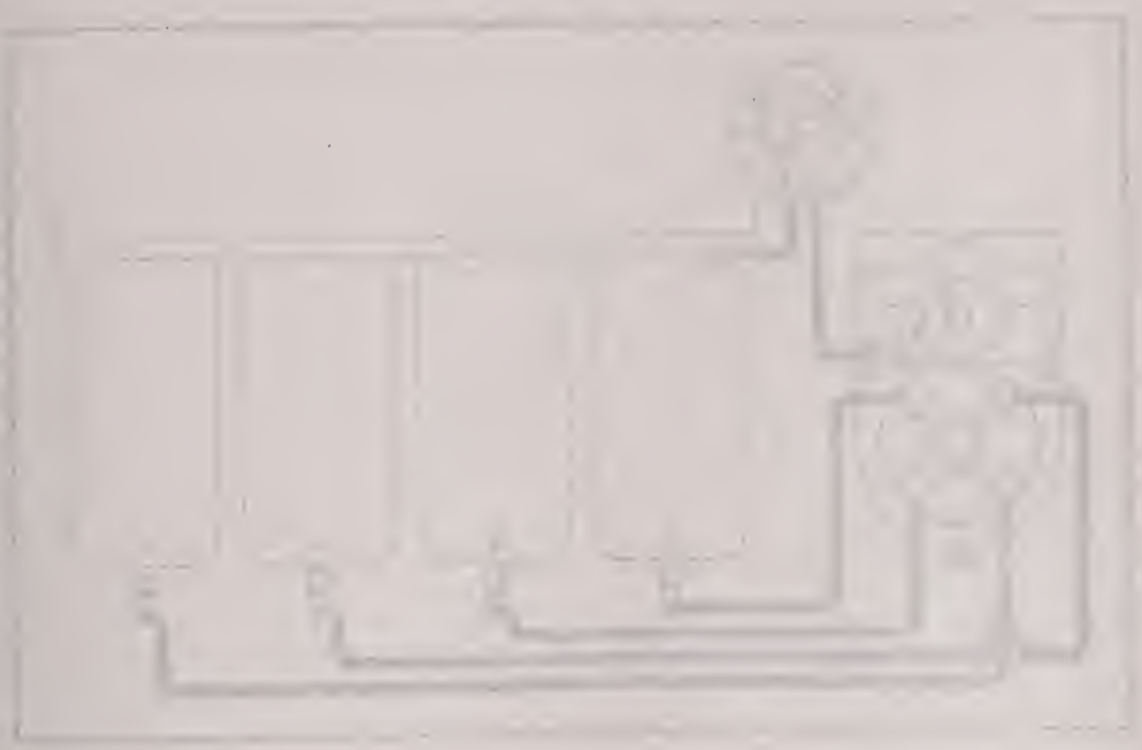
To time magneto, turn engine until No. 1 piston is on top dead center, power stroke. Then turn magneto armature shaft until the distributor segment is making connection with plug leading to No. 1 cylinder. (The segment can be seen through the window in center of distributor block.) Continue turning armature until the contacts just begin to open, and then connect magneto to engine in this position. Spark must be at full retard during above operation.

To time the TK magneto, equipped with the impulse starter, to engine, turn engine until No. 1 piston is on top dead center, power stroke. Then trip the dog into engagement and turn impulse starter until cam on case is starting to move dog out of engagement. Magneto should be connected to engine in this position.

Spark gap should be 1/64 in. Spark plug points should extend down into the cylinder far enough to reach a good mixture. If the plug does not extend down far enough, due to too short a barrel, the engine may pocket some of the exhaust gas, thus causing irregular firing.

Once a month clean the distributor with a soft cloth slightly moistened with gasoline.

There is an oil hole on top of the distributor housing. This oils both the distributor bearing and the front main bearing. There is another oil hole in the rear bearing cap. This is to provide a means of lubricating the rear magneto bearing. Put one or two drops of clean, light machine oil in each of the two magneto oilers every month or every 500 miles.



K-W Magneto

Type H

The instructions on this sheet apply to Models H, HK, HT, HTK, HTS, O and OK. K indicates impulse starter. T indicates five magnets. O indicates single cylinder.

The whole breaker unit can be removed by pushing the contact spring aside. Contacts should open 1/64 in. There is a hole provided in the side of breaker box to facilitate adjusting contacts. The contact screw may easily be turned by inserting the screw driver through this hole. Clean contacts with gasoline whenever necessary. If contacts are badly burned or pitted they may be resurfaced with a fine, flat, jeweler's file or a piece of No. 00 sand paper. Once a month clean out the distributor with a cloth moistened with gasoline.

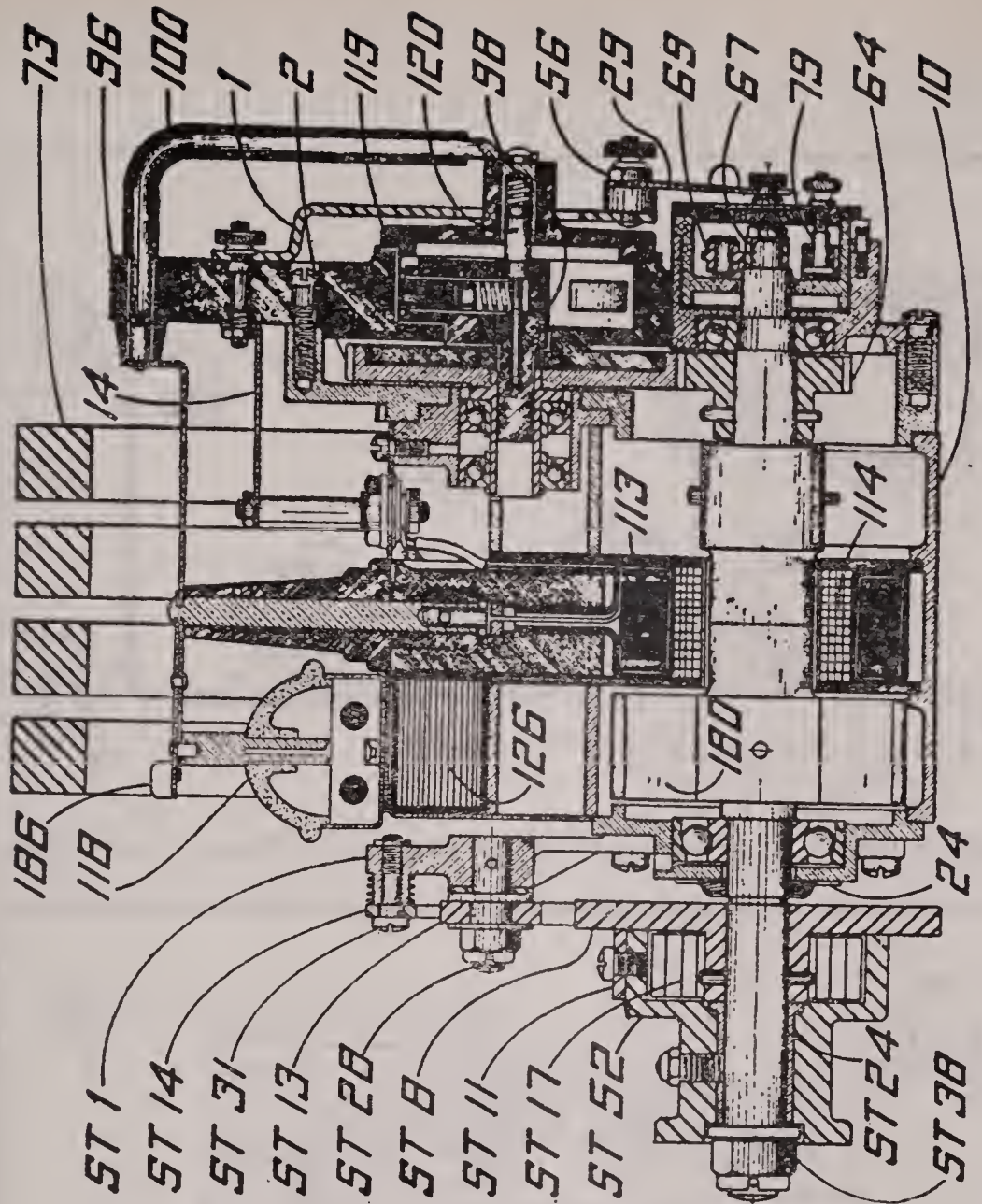
To reverse the direction of magnetos not equipped with the impulse starter, remove the cam and turn it end for end. Then remove distributor plate, exposing distributor moulding and segment. Loosen screws and shift to the other set of holes provided for the screws.

The screws which hold magneto to mounting should not extend into the base more than 5/16 in. If they extend in further than this they are apt to break through the base and strike the rotor.

To time the magneto not having an impulse starter, to engine, turn No. 1 cylinder to firing point, spark retarded. Then turn magneto by hand until contacts just begin to open, segment making connection with wire leading to No. 1 cylinder and spark retarded. Magneto must now be connected to engine in this position. Magneto shaft must be fastened to driving medium with a taper pin, as a set screw will soon work loose.

To time the magnetos having the impulse starter to engine, turn engine to 3 to 5 degrees past top dead center, No. 1 cylinder on power stroke and mount the magneto so that the tripping device is just beginning to release the impulse starting device. The magneto must then be connected to engine in this position.

Once a month put two or three drops of clean, light machine oil in each of the three bearings. One bearing is at each end of the rotor shaft and one bearing is on the distributor shaft.



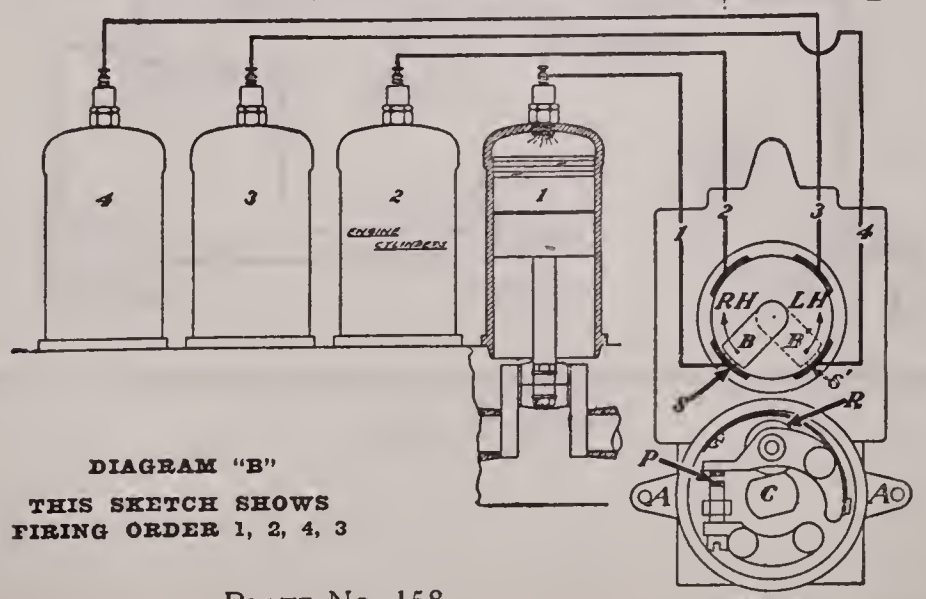


DIAGRAM "B"
THIS SKETCH SHOWS FIRING ORDER 1, 2, 4, 3

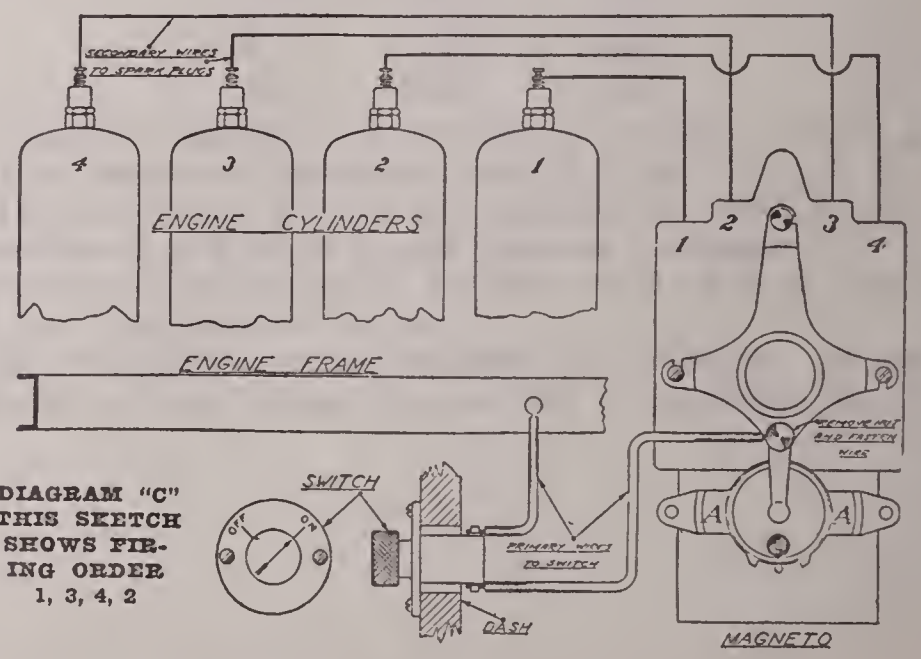
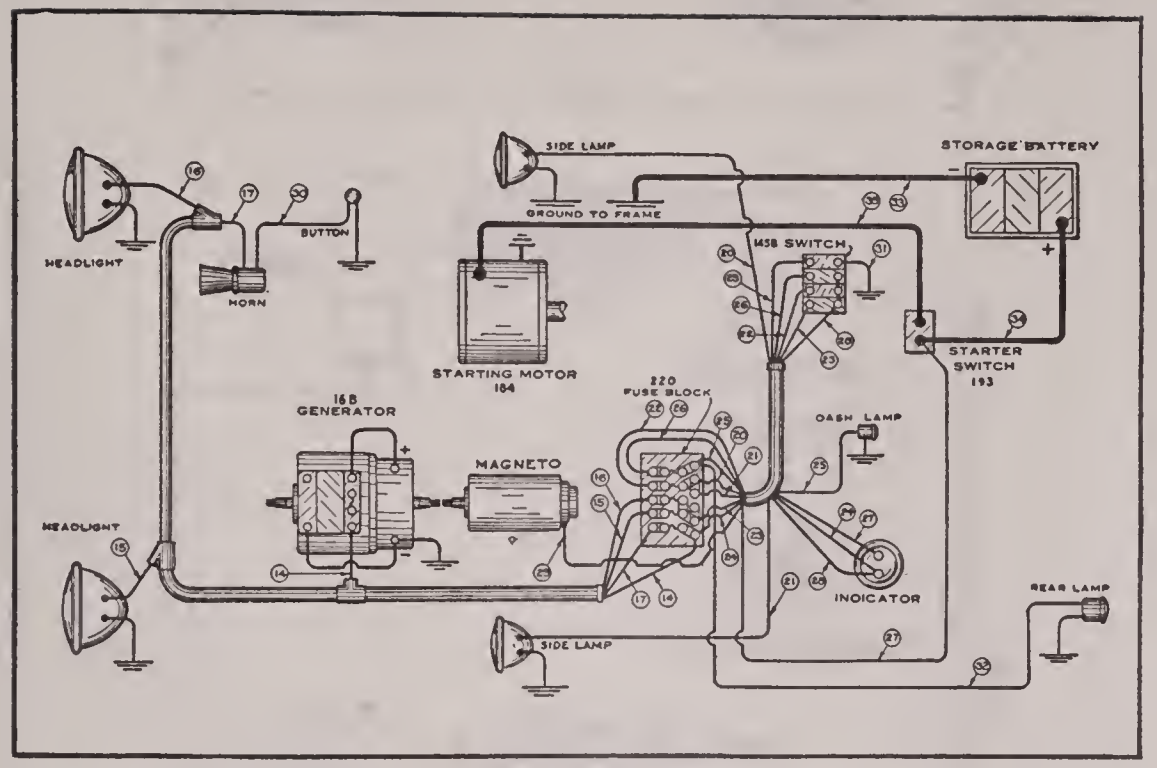


DIAGRAM "C"
THIS SKETCH SHOWS FIRING ORDER 1, 3, 4, 2

PLATE No. 158



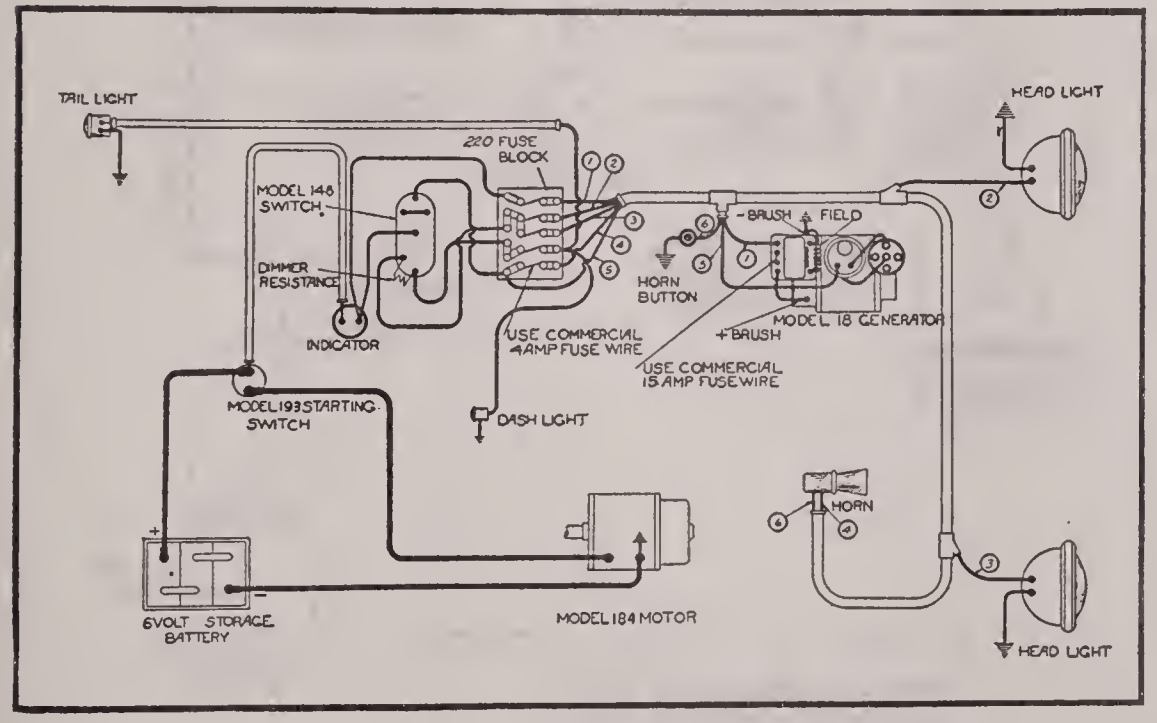


PLATE NO. 159

Interstate

MODEL TF

REMY 6-VOLT STARTING AND LIGHTING SYSTEM. MEA TYPE BK6 MAGNETO IGNITION

Battery is 6 volt, 86 ampere-hour. The negative terminal of the battery is grounded.

Breaker contacts should open .014 in. to .016 in. Break should occur when the dead center mark on flywheel is at indicator, spark fully retarded. Firing order is 1, 2, 4, 3. Put two or three drops of light, clean oil in each of the magneto oilers every 300 miles.

Starting motor is connected to engine by a Bendix gear. The following data applies to the starting motor:

Torque (with 6-in. pulley)	R. P. M.	Amperes	Volts
0 lbs.....	3600-4200	56-64	6.0
16 lbs.....	1150-1250	200-230	4.7-4.8
24 lbs.....	850-950	290-310	4.5-4.6
40 lbs.....	300-400	450-500	3.5-3.6
14 ft. lbs.....	Lock Torque	570-600	3.0

Voltage regulation is by vibrating regulator. Relay is combined with regulator.

There is a 15-ampere fuse on the relay-regulator base. This fuse is to protect the generator fields. Use commercial 15-ampere fuse wire. The following data applies to the generator:

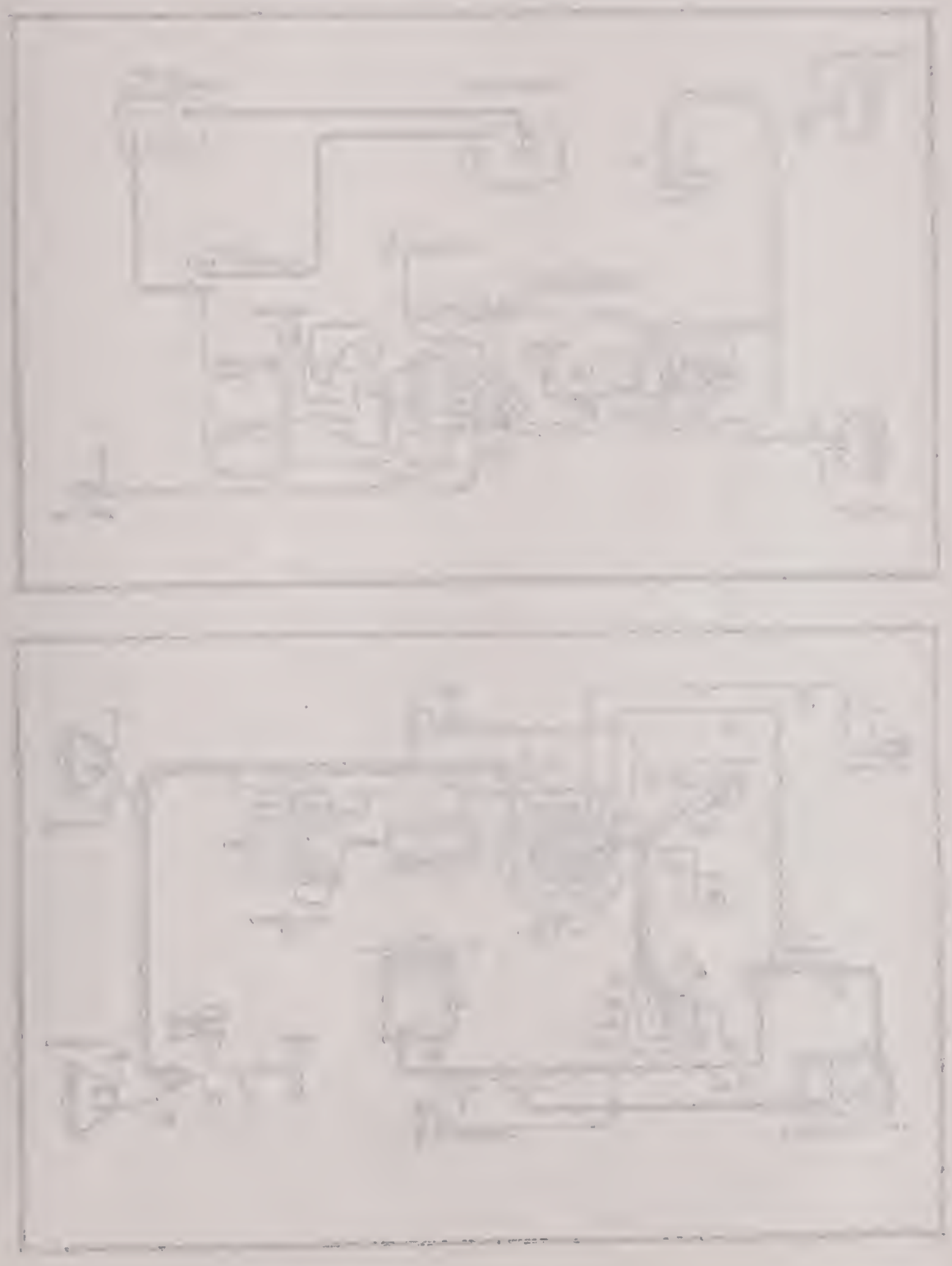
Amperes	R. P. M.	Volts
0.	370	6.0
7.	490	6.5
14.2	2200	6.9

On battery test field draws 3 to 3.5 amperes at 5.9 volts. Generator motoring draws 4 to 4.5 amperes at 5.8 volts and runs at 430 R. P. M.

Put five or six drops of oil in each of the generator oilers every 1,000 miles. Put four or five drops of oil in each of the motor oilers every 1,000 miles.

Head lights are 6-8 volts, 15 cp. Side lights are 6-8 volt, 6 cp. Dash light is 6-8 volt, 2 cp. Tail light is 6-8 volt, 2 cp.

Fuses in the large head and the horn circuits are 8-10 amperes. All other fuses in the lighting circuits are 4 ampere. Use commercial fuse wire of the proper size.



Splitdorf

Two-Unit Starting and Lighting System

Motor is connected to engine by a Bendix gear. Every 500 miles a few drops of medium weight oil should be put in each of the motor oilers. Clean Bendix drive with kerosene.

Voltage regulation is by a vibrating regulator. Should regulator contacts become badly burned or pitted they may be resurfaced with a piece of worn No. 00 sand paper. This should not be done unless necessary, as it is apt to change the output slightly. The output may be increased by increasing the spring tension. Cutout relay is combined with regulator.

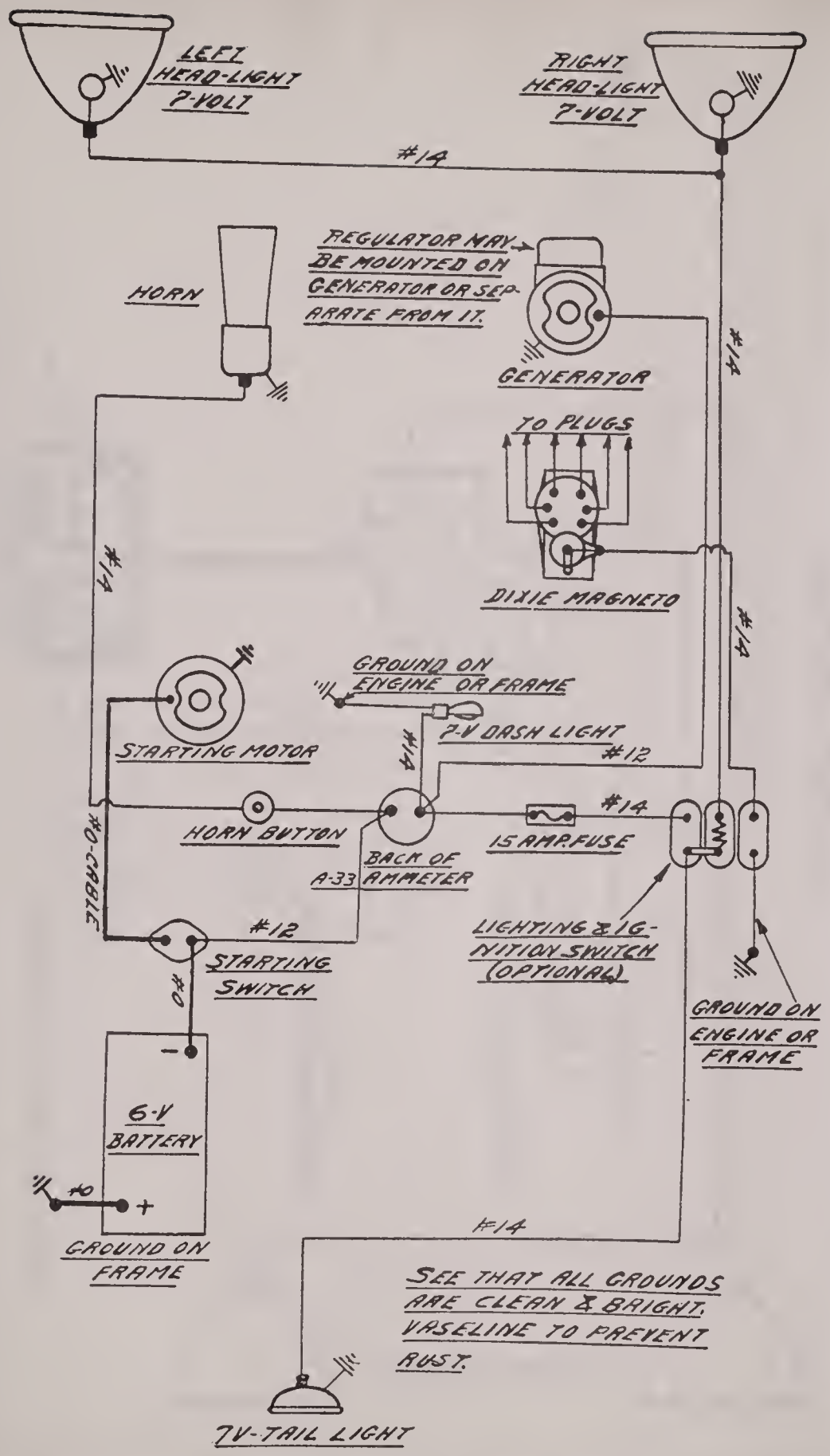
To remove the generator brushes remove the cover strap and the two screws holding the rocker disk in place, disconnect the brush leads, and withdraw the brush from brush holder. It is important that brushes slide freely in their holders and that the brush lead holders are clean and bright before replacing the terminal screws. See that the springs rest fairly on the end of the brushes with a firm, yet light tension.

When generator is held to the engine by the head, the drive end bearing is lubricated by the oil in the gear case. When generator is held to engine by a strap, or by bolts in body, an oiler is provided. Another oiler is provided at the commutator end. A few drops of medium weight machine oil should be put in each of the oilers provided, every 500 miles.

Do not flood the bearing with oil.

There is a 15 ampere fuse in the main circuit supplying current to head and tail lights. This fuse is located between the ammeter and lighting switch.

All lamps are 7 volt. Dash and tail lights are 2-4 cp. Head lights may vary in size between 15 and 21 cp., according to the car system is used on, and the desires of the operator.



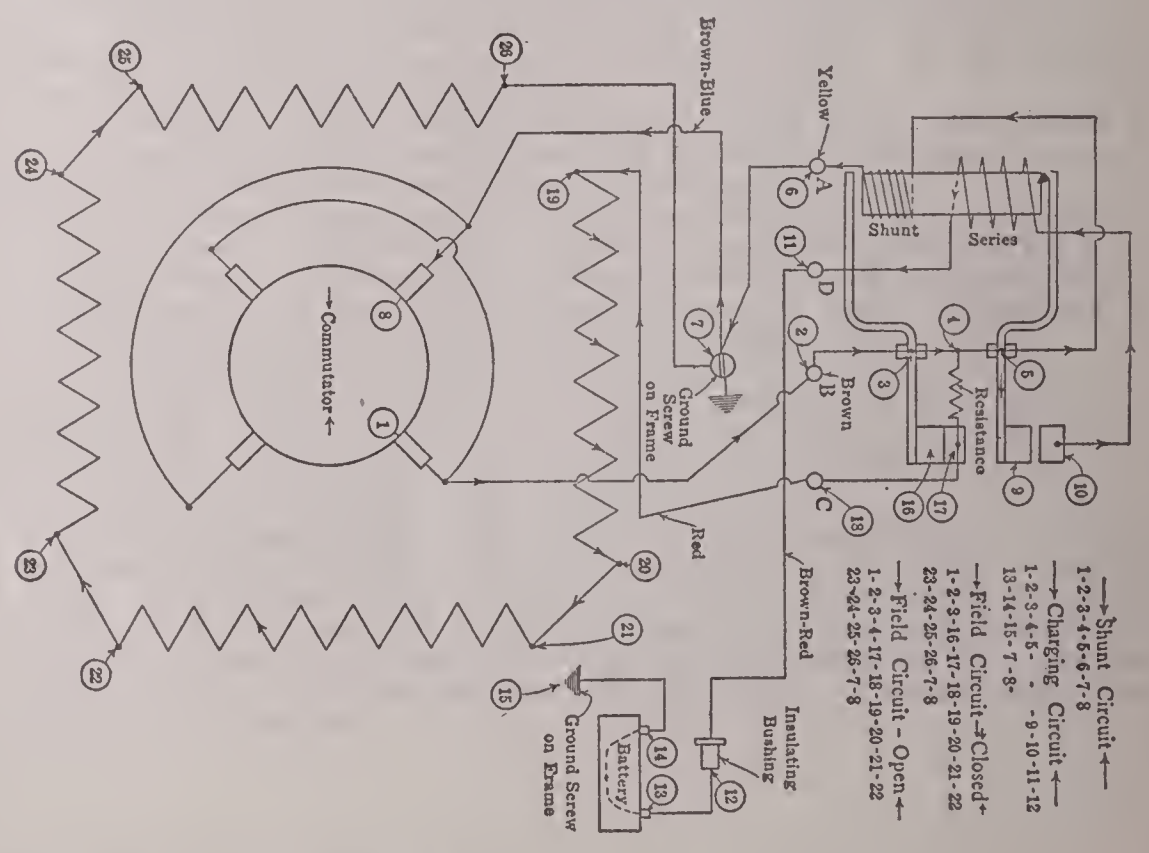
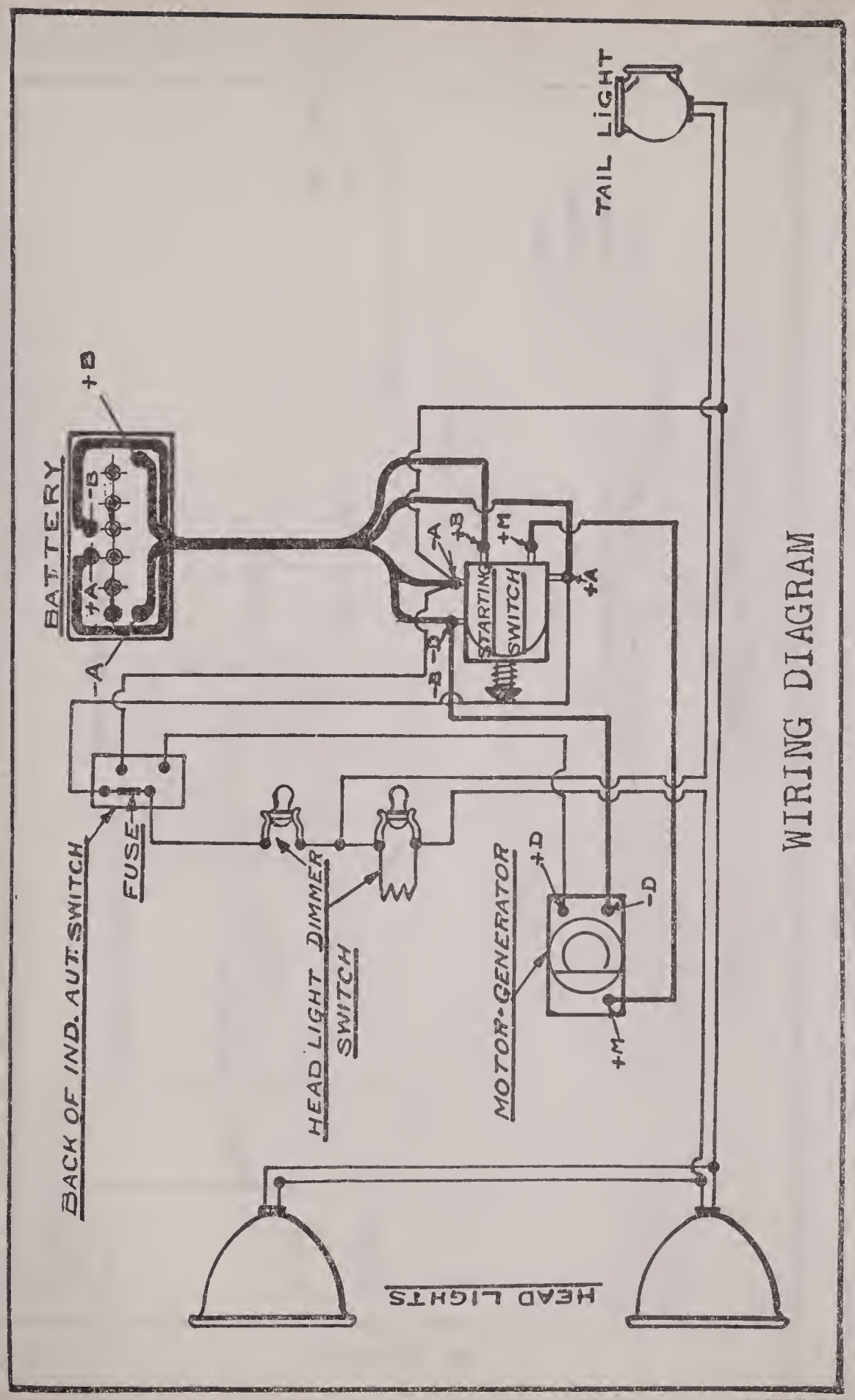


Plate No. 160



Splitdorf-Apelco

Single-Unit Starting and Lighting System

This is a single-unit 6-12 volt system. The lighting circuit and the generator operate at 6 volts and the starter operates at 12 volts. The battery consists of two 6-volt batteries enclosed in the same case.

Depressing the starting switch connects the two 6-volt batteries in series and completes the cranking circuit. This arrangement allows a lower battery ouput and allows the generator to begin to charge at a lower speed. Connecting the two 6-volt batteries in series to supply 12 volts for cranking, does not place 12 volts on lighting circuit. Lights always operate at 6 volts.

The motor-generator is chain connected to the engine. Chain must be kept clean and well lubricated. During the first 100 miles of running, take up any excess slack that may develop, or as often as required, until chain properly seats itself.

If the brushes of the starting switch wear abnormally, see that the foot pedal of the switch is not stuck in the floor board. The hole in which pedal operates should be large enough to prevent spring rubbing against the floor board. When starting switch pedal sticks down, the brushes in the switch and motor-generator wear and burn. See that the starting switch returns to its normal position and that good contacts are made. This can be ascertained by removing the cover of the staring switch.

Oil holes are provided at each end of the motor-generator to provide a means of lubricating the bearings. Put five or six drops of medium weight machine oil in each of the oilers every 1,000 miles. See that the motor-generator is properly lined up at all times. If it is out of line, the chain will be noisy and will wear abnormally on one side and eventually break. A poorly aligned chain will also cause the sprockets to wear.

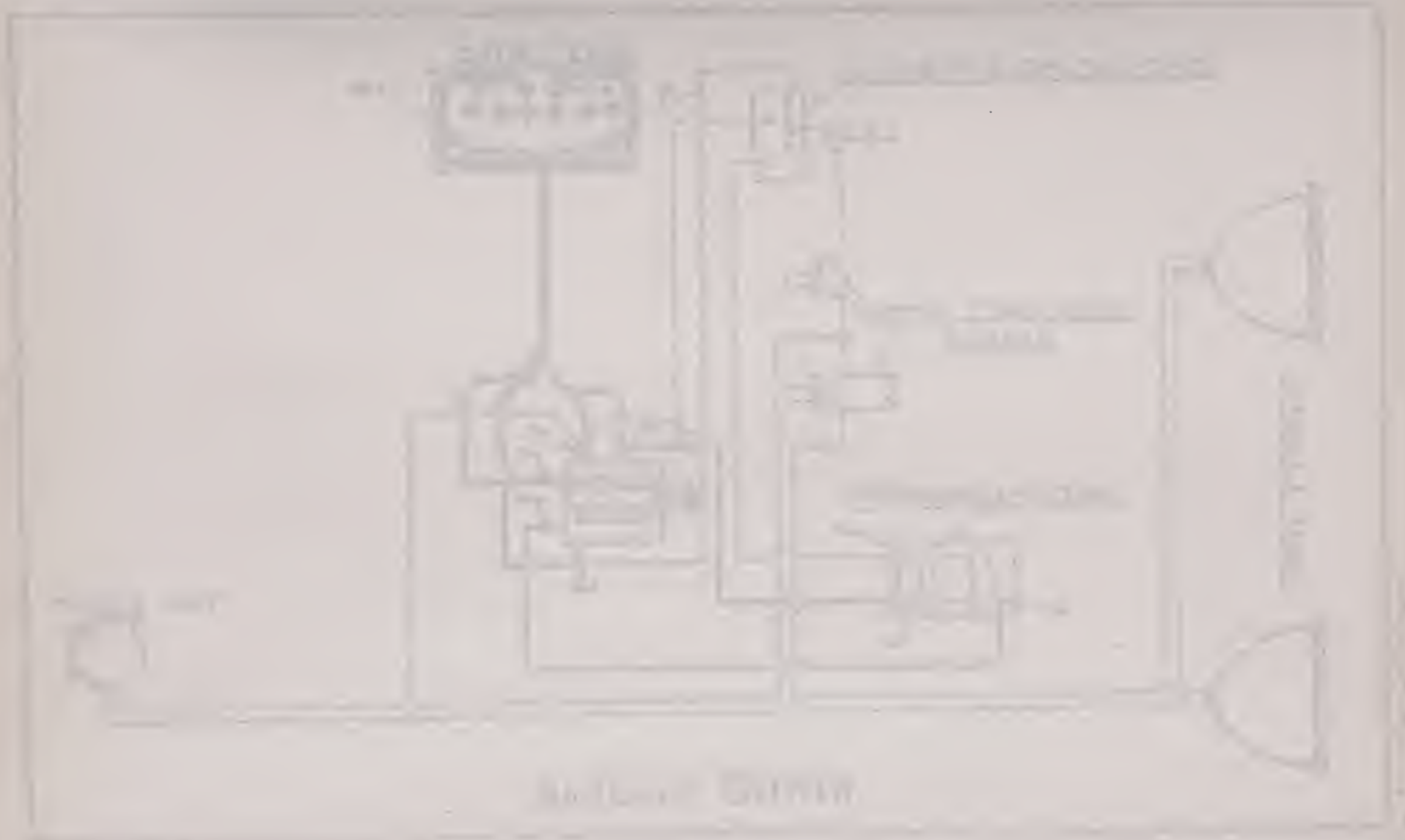
Keep commutator clean with a cloth moistened with gasoline. Do not change the position of the brushes or change the tension of the spring on them. See that the brush leads do not rub against the commutator.

The indicator indicates whether battery is being charged or not. When battery is being charged, the words "Charge On" are shown on the dial. When relay is open and battery is not charging, the words "Charge Off" are shown on the dial.

When engine is running slowly the indicator may flutter and show "On" and "Off" in rapid succession. If this takes place at medium or high engine speeds there is a loose connection, in line between battery and generator, either in the starting circuit or in the line between generator and relay. This loose connection must be located and connected at once, as the relay contacts will be badly burned if this condition is allowed to exist.

When starting switch is depressed, the current flows from A+ at battery to A+ on starting switch, through switch to M+ on switch, through to switch to M+ on motor-generator, through motor-generator to B— D— on starting switch, through to B— on battery, through battery to B+ on battery, then to B+ in starting switch to A+ on switch to A— on battery, through battery to A+ completing the circuit.

When charging, the current flows from D+ (diagram) on generator to D+ on indicating switch, through winding of the coil, coming out at B+, then to A+ on starting switch, where it divides, one side leading to A+ on battery, through battery to A— on starting switch. The other part of the current flows through the jumper in the switch to B+ on starting switch, through to B+ in battery, through battery to B— on starting switch. B— D— are the common return points of the current on starting switch, from there to D— on generator.



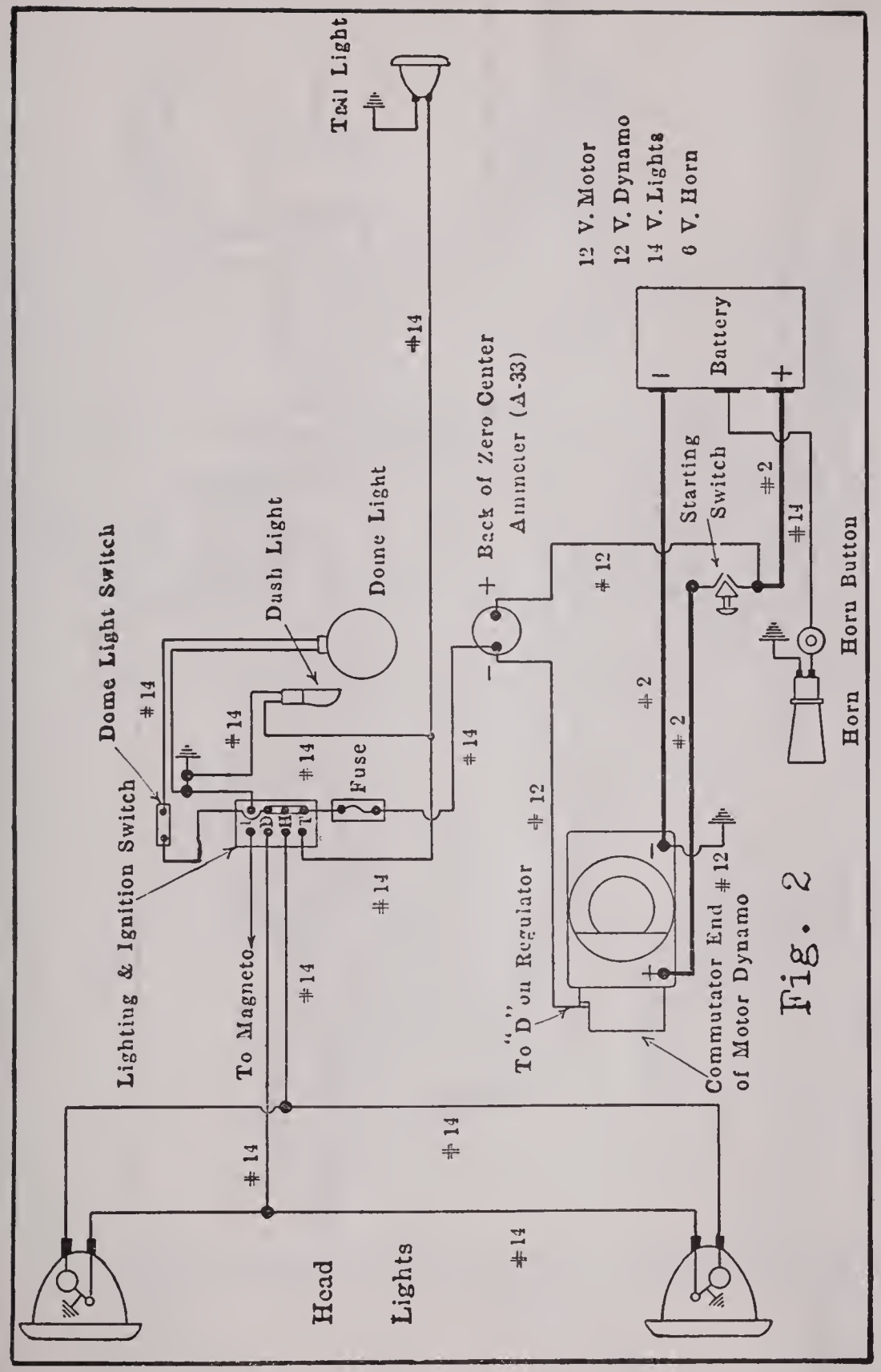


Fig. 2

PLATE No. 162

Pullman

MODEL A-25 (1916)

SPLITDORF SIX-TWELVE VOLT STARTING AND LIGHTING SYSTEM

Battery is 12 volt, 50 ampere-hour. The negative terminal is grounded at the starting switch on the 6-12 volt systems and at the motor-generator on the 12 volt system.

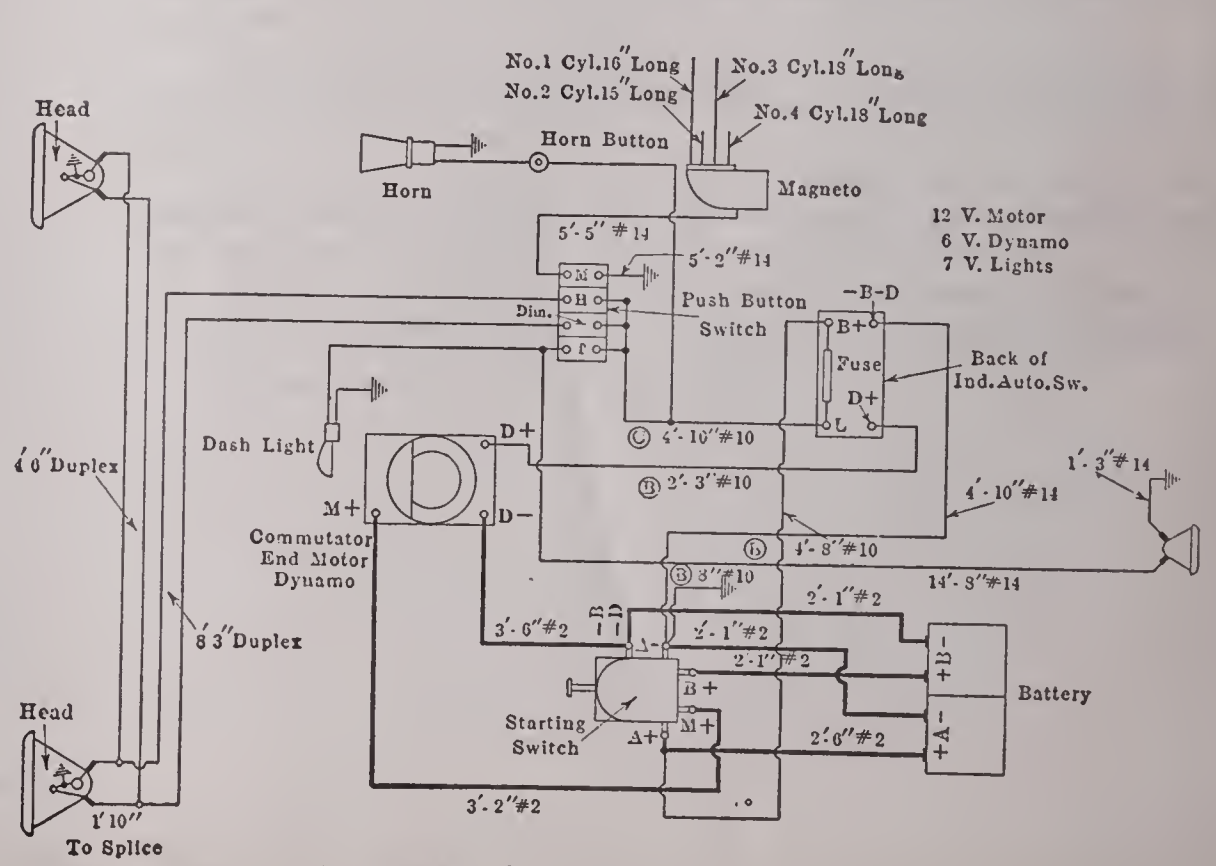
The early models used the 6-12 volt system described on Plate No. 161. The wiring diagram of the system, as it is applied to this car, is shown in Figure 1.

The later models used the Splitdorf 12 volt system. On this system the complicated starting switch used with the 6-12 volt system is not required. The starting switch is a simple switch whose sole function is to open or close the cranking switch.

The lighting circuit operates at 12 volts. Large head lights are 14 volt, 16-21 cp. Small head lights are 14 volt, 6 cp. Tail light is 14 volt, 2-4 cp. Dash light is 14 volt, 2-4 cp. Dome light is 13-14 volt, 6 cp.

Ammeter indicates rate battery is charging or discharging. There is a 15-20 ampere fuse in the main circuit between the ammeter and lighting switch.

There is a tap taken off the cells of the battery to supply 6 volts to the horn.



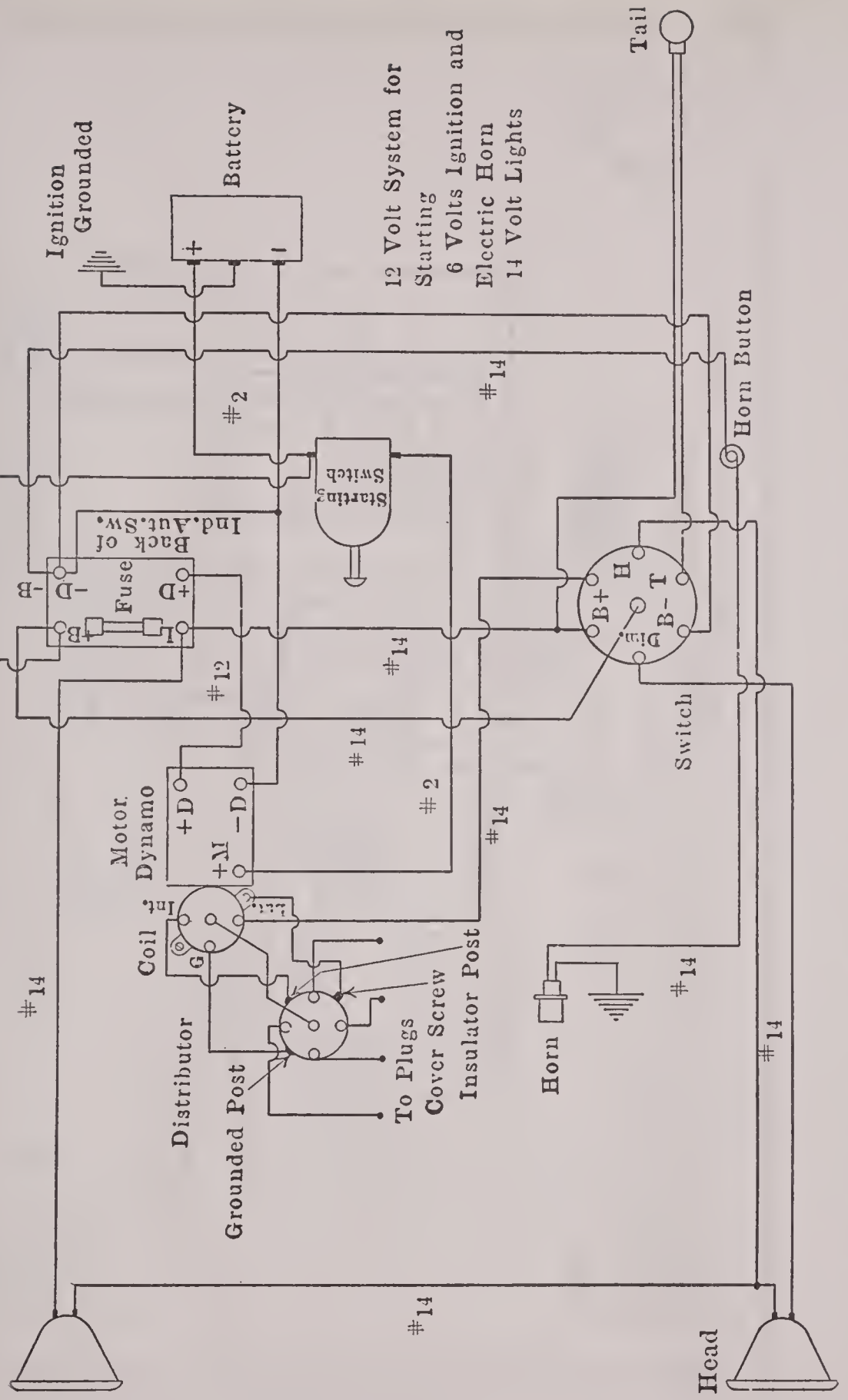


PLATE NO. 163

Pullmann

1915 MODEL

SPLITDORF-APELCO SINGLE-UNIT, 12-VOLT, TWO-WIRE SYSTEM

Ignition and horn operate on 6 volts. The positive terminal of the third cell, counting from the negative side of the battery, is grounded to supply the 6 volts for ignition and horn.

Head lights are 14 volt, 16-21 cp. Tail light is 14 volt, 2-4 cp. Head lights are in series on the dim position.

There is a 15 ampere fuse on the back of indicator. This fuse is in the main lighting circuit.

Generator should begin to charge battery at about 8 miles per hour. Maximum charging rate is reached at 14-16 miles per hour.

There are oilers at each end of the motor-generator, providing a means of lubricating the bearings. Put five or six drops of medium weight machine oil in each of the oilers every 500 miles or every two weeks.

Driving medium of motor-generator is connected to engine by a silent chain. Chain must be kept free from grit or dirt and well lubricated at all times. It should have ¼ in. to ½ in. up-and-down play.

Motor-generator must be properly lined up. If it is not, chain will be noisy and will wear excessively on one side, which will soon cause it to break. Improper alignment will also cause the sprockets and bearings to wear excessively.

When indicator shows "Charge Off" on the dial, the generator is disconnected from the battery. When the indicator shows "Charge On", the battery is being charged.

Voltage regulation is by reverse-series field.

Hollier

Eight Cylinder, 1916

Splitdorf-Apelco, 6-12 Volt, Single Unit Starting and Lighting System Atwater-Kent Ignition

Battery is 12 volt, 50 ampere-hour. Starting motor operates at 12 volts. Lights and ignition operate at 6 volts.

Condenser is mounted in the extension at one side of breaker. Breaker contacts should open .006 in. Contacts are of tungsten metal. Do not resurface unless they are burned or pitted badly enough to cause the engine to miss. The system will operate properly when these contacts are quite rough. The natural color of the contacts is a dark gray. Break should occur on upper dead center, spark lever within ½ in. of full retard. Firing order is 1, 8, 2, 7, 4, 5, 3, 6.

When starting switch is depressed the current flows from the battery at A+ (diagram) to A+ on starting switch, through switch to M+ on switch, then to M+ on motor-generator, through motor-generator to —B —D on starting switch, then to B— on battery, through battery to B+ on battery, then to B+ in the starting switch, through switch to A— on switch to A— on battery and through battery to A+, thus completing the circuit.

During the cranking operation the lights and ignition are supplied with 6 volts.

If brush in starting switch wear abnormally see that the foot pedal switch is not stuck in the floor board, due to smallness of hole, its wrong position, or to any other reason, such as a weak spring, etc. Starting switch sticking causes the brushes in the switch and motor-generator to wear and burn. See that switch returns to its normal position when released, and that good electrical contact is made. This can be easily ascertained by removing the starting switch cover.

Oil holes are provided at each end of motor-generator. Put five or six drops of medium weight machine oil in each of the oilers every 500 miles or every two weeks.

See that motor generator is properly lined up as, if out of alignment, the chain will be noisy, sprockets will wear, and chain will wear excessively on one side and soon break.

Clean commutator thoroughly with a cloth moistened with gasoline. Do not change the position of or the tension on brushes. See that brush leads do not rub on commutator.

Head lights are 7½ volt, 16 cp. (2½ amperes). Dash and tail lights are in series. They are 3½ volt, 4 cp. (.84 amperes). Head lights are in series on the dim position. There is a 15 ampere fuse on back of indicator. This fuse is in the main lighting circuit and horn circuit.

When charging, the current flows from D+ (diagram) on generator to D+ on indicating switch, through winding of the coil, coming out at B+, then to A+ on starting switch, where it divides, one side leading to A+ on battery, through battery to A— on starting switch. The other part of the current flows through the jumper in the switch to B+ on starting switch, through to B+ in battery, through Battery to B— on starting switch. B— D— are the common return points of the current on starting switch, from there to D— on generator.

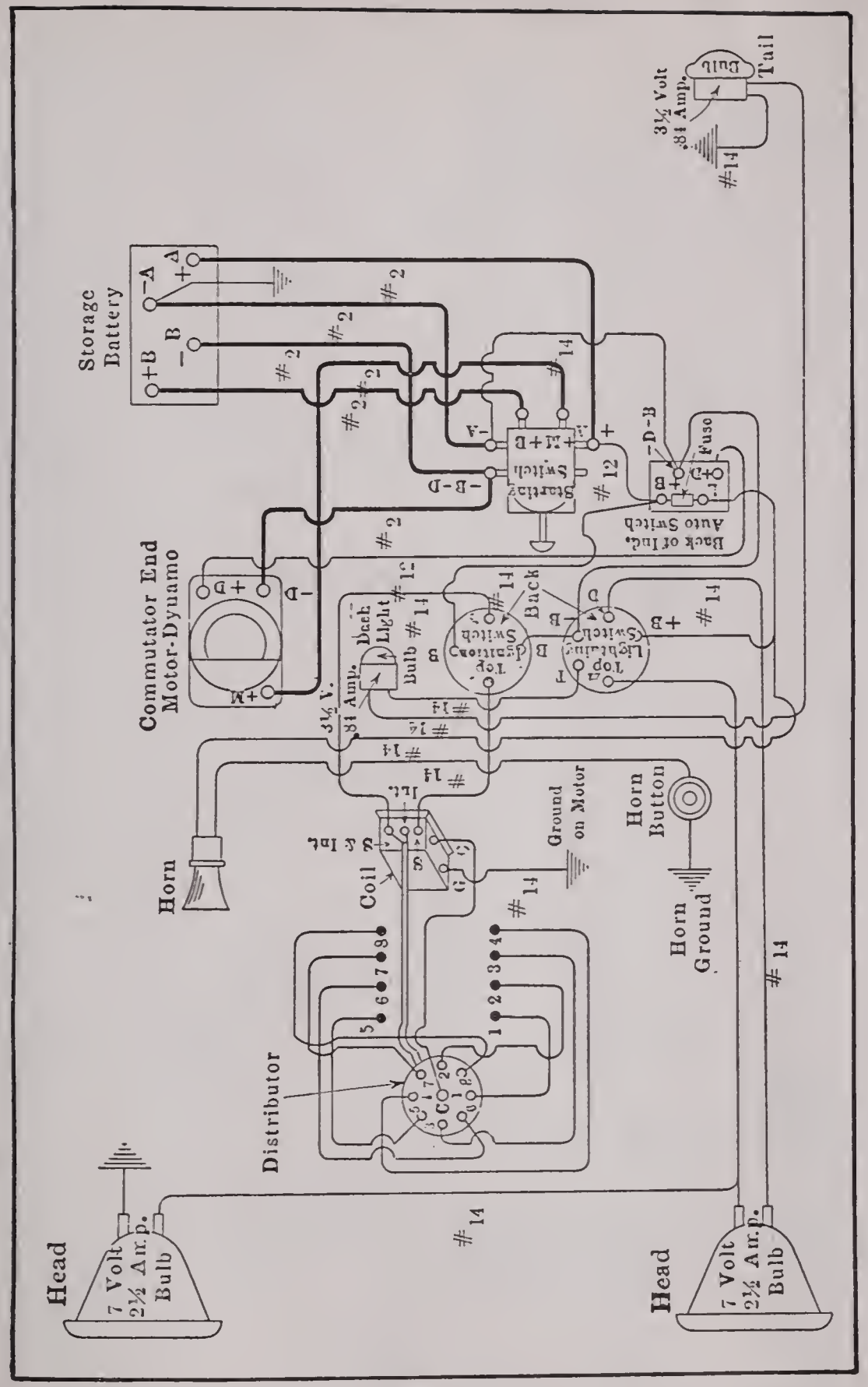
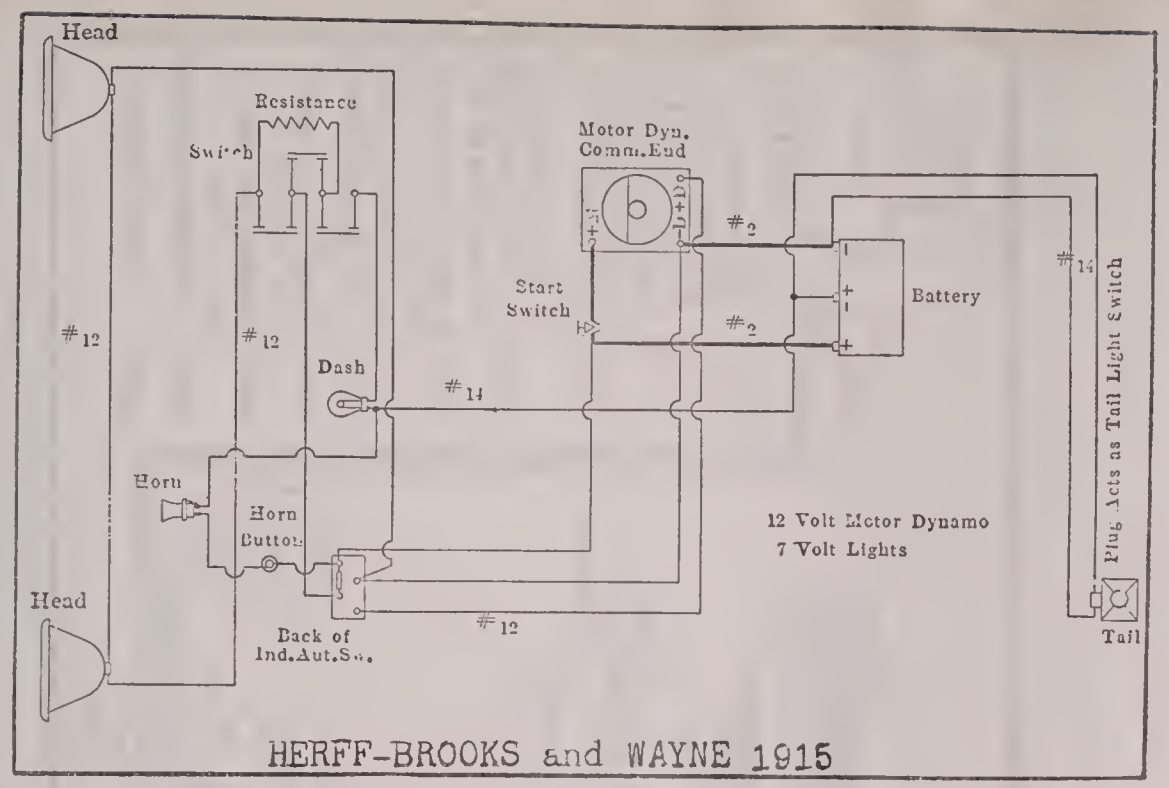
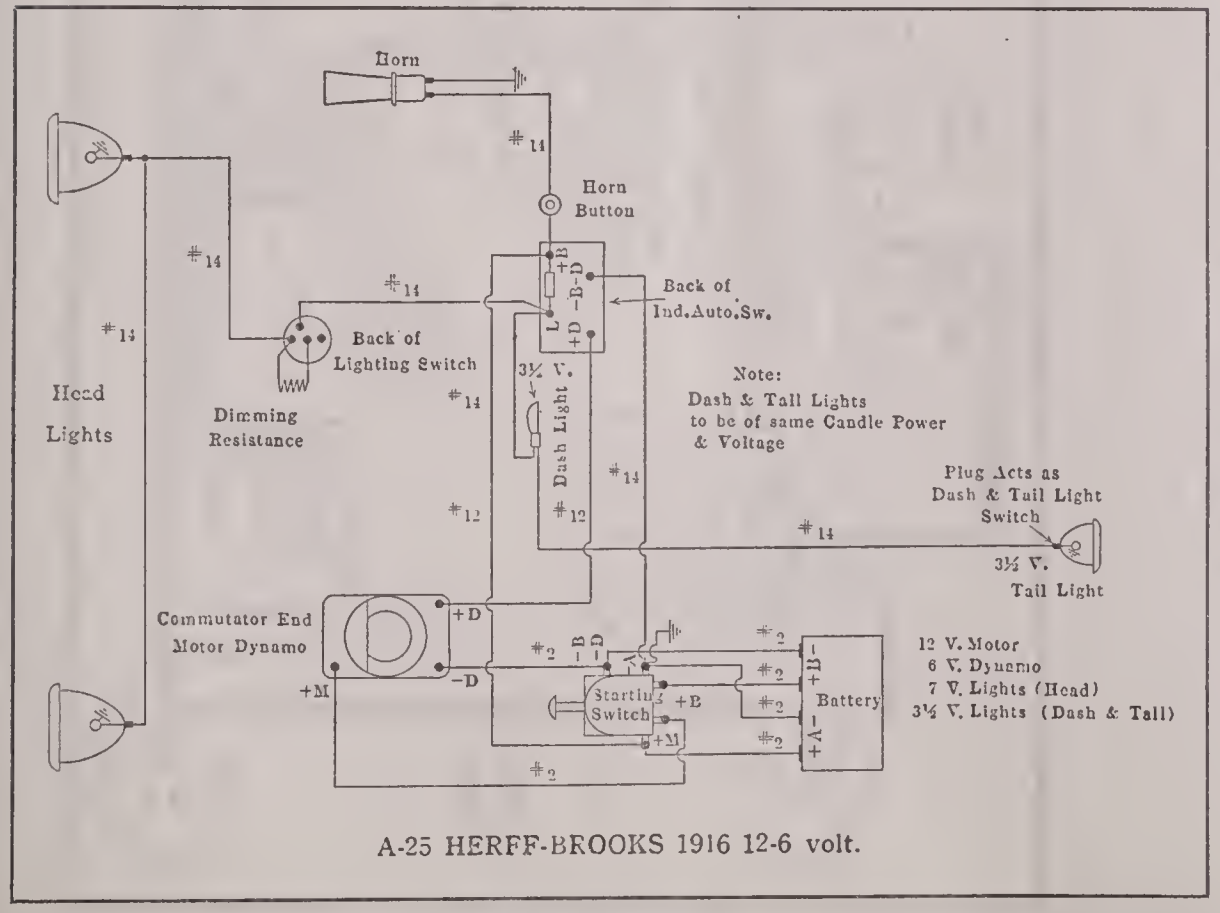


Plate No. 164



HERFF-BROOKS and WAYNE 1915



A-25 HERFF-BROOKS 1916 12-6 volt.

Herff-Brooks

1915-16

Wayne 1915

SPLITDORF STARTING AND LIGHTING SYSTEM

The 1915 Herff-Brooks and the 1915 Wayne were equipped with the Splitdorf-Apelco 12-volt starting and lighting system. The 1916 Herff-Brooks cars were equipped with the Splitdorf-Apelco 6-12-volt starting and lighting system.

On the 1915 models using the 12-volt system, the generator and motor both operate on 12 volts pressure. There is a 6-volt tap taken from battery to supply 6 volts to each the dash and tail lights. Head lights are in series. They operate at full battery pressure. Head lights are 7 volt, 16 cp. Dash and tail lights are each 7 volt, 2-4 cp. Horn also operates at 6 volts. The plug at tail light acts as the tail light switch.

There is a 15 ampere fuse on the back of the indicator. This fuse is in the main line supplying current for the lights.

There are oilers provided at each end of the motor-generator. Put four or five drops of medium weight machine oil in each of these oilers every 500 miles or every two weeks.

Keep the driving chain well lubricated and free from dirt at all times.

On the 1916 Herff-Brooks the starter operates at 12 volts. The generator, lights and horn operate at 6 volts.

The charging and cranking circuits are explained very fully on Plates No. 161 and 162.

Head lights are 7 volt, 16-21 cp. Dash and tail lights are in series. They are 3.5 volt, 2-4 cp. The plug at the tail light serves as the switch in this current.

The 15 ampere fuse on the back of the indicator is in the lighting circuit.

If brushes wear too rapidly, see that the starting switch pedal is not sticking down, due to the hole in the floor boards being too small or in the wrong place or the spring weak, switch stuck, etc. If the switch does not return to its normal position when released, the motor-generator brushes and the brushes in the switch wear and burn rapidly. See that the switch returns to normal position easily and that good electrical contact is made. This may be determined by removing the starting switch cover.

Keep driving chain free from dirt or grit and well lubricated at all times. There are oilers provided at each end of the motor-generator. Put four or five drops of medium weight machine oil in each of the oilers every 500 miles or every two weeks.

See that motor-generator is properly lined up. If it is not sprockets will wear, chain will be noisy and chain will wear excessively on one side, soon breaking.

Mitchell-Lewis

1916 Model

Splitdorf-Apelco Single-Unit, 12-Volt Starting and Lighting System
Connecticut Ignition

Battery is 12 volt, 65 ampere-hour.

Breaker contacts should open .018 in. to .020 in. Break should occur when the dead center mark on flywheel is 1¼ in. past indicator, spark fully retarded. Firing order is 1, 5, 3, 6, 2, 4. Spark gap should be .030 to .035 in.

Motor operates at 12 volts. Generator, lights, ignition and horn operate at 6 volts pressure. The supplying of 12 volts to starter does not place 12 volts on lights or other 6-volt apparatus.

The cranking and charging circuits are very fully explained on Plates 161 and 162.

Head lights are 7 volt, 16 cp. Dash light is 7 volt, 2-4 cp. Tail light is 7 volt, 2-4 cp.

Each circuit is covered with a different colored braid to facilitate tracing. The 15-ampere fuse on the back of the indicator is in the circuit supplying the lights with current.

Keep driving chain free from grit or dirt and well lubricated at all times. See that motor-generator is properly lined up. Should it be out of alignment the chain will be noisy, sprockets will wear, and chain will wear excessively on one side, soon breaking.

There is an oiler provided at each end of the motor-generator. Put four or five drops of medium weight machine oil in each of the oilers every 500 miles, or every two weeks.

Clean commutator with a cloth moistened with gasoline. Do not change position of brushes or change the tension on them. Should brushes wear too rapidly see that starting switch pedal is returning to its normal position when released. Should the starting switch fail to return to its normal position when released, due to the hole in floor board being too small or in the wrong place, weakness of spring, or rough contacts, etc., the brushes in starting switch and motor-generator will wear rapidly and burn. See that starting switch easily returns to its proper position when released and that good electrical connections are made.

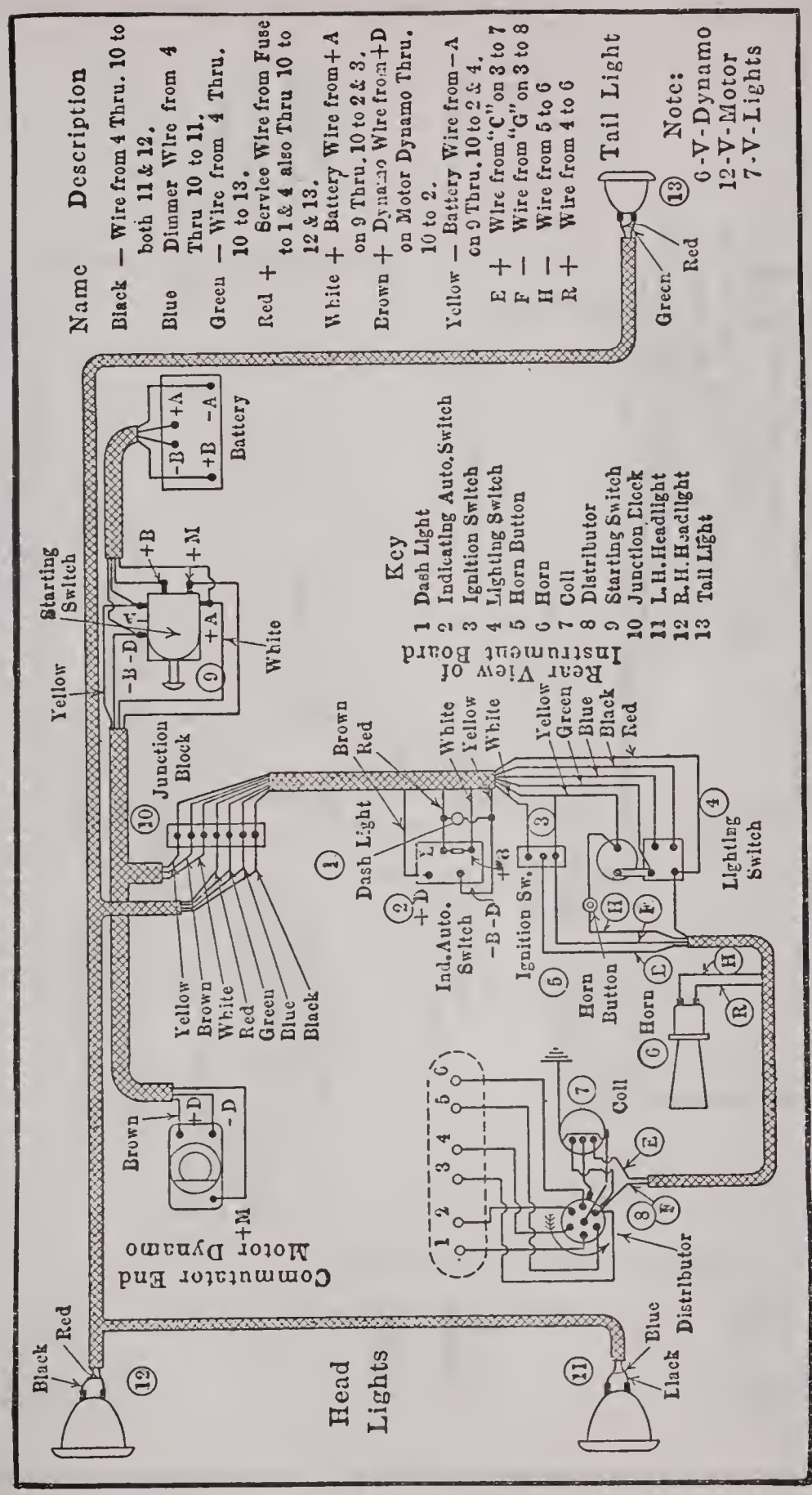


Plate No. 166

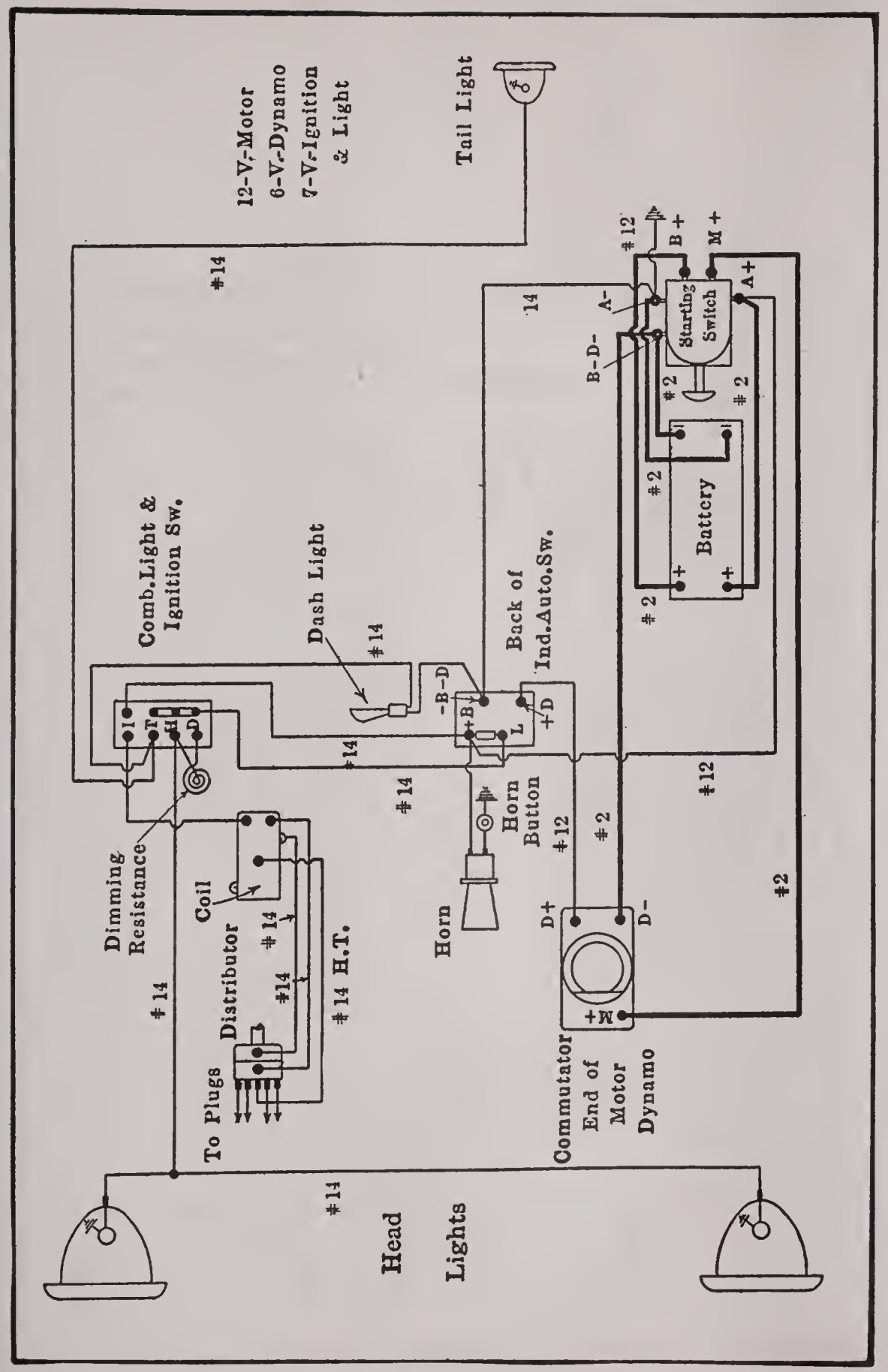


PLATE No. 167

Elkhart

1916 MODEL

SPLITDORF-APELCO, SINGLE UNIT, STARTING AND LIGHTING SYSTEM
CONNECTICUT IGNITION

Battery is 12 volt, 35 ampere-hour. The single wire system is used in the lighting and horn circuits. All other circuits are of the two wire type.

Breaker contacts should open .025 in. They are of tungsten metal. If contacts become so badly burned as to impair the operation of the motor, the entire inner mechanism of the breaker must be renewed. Break should occur when upper dead center mark is just past indicator, spark fully retarded. Firing order is 1, 3, 4, 2. Spark gap should be .025 in. to .030 in.

Motor operates at 12 volts. Generator operates at 6 volts. Cranking and charging circuits are fully explained in Plates 161 and 164.

Lights, horn and ignition operate on 6 volts. Head lights are 7 volt, 16 cp. Tail and dash lights are in series. They are 3.5 volt, 2-4 cp. The 15 ampere fuse on the back of the indicator is in the line which supplies the current to the lighting system.

There is an oiler provided at each end of the motor-generator. Put four or five drops of medium weight machine oil in each of these oilers every 500 miles or every two weeks.

Clean commutator with a cloth moistened with gasoline. Do not change the position of, or the tension on, the brushes. If brushes wear too rapidly see that the starting switch returns to its normal position readily, when released.

If switch does not return to its normal position, due to weakness of spring, or to hole in floor boards being too small or in the wrong place, etc., the brushes in the motor-generator and in the starting switch will burn and wear rapidly. See that good electrical connections are made in the switch. This can be determined by removing the starting switch cover.

Briscoe

Model 14-38

Splitdorf-Apelco, Single Unit, 6-12 Volt, Starting and Lighting System
Connecticut Ignition

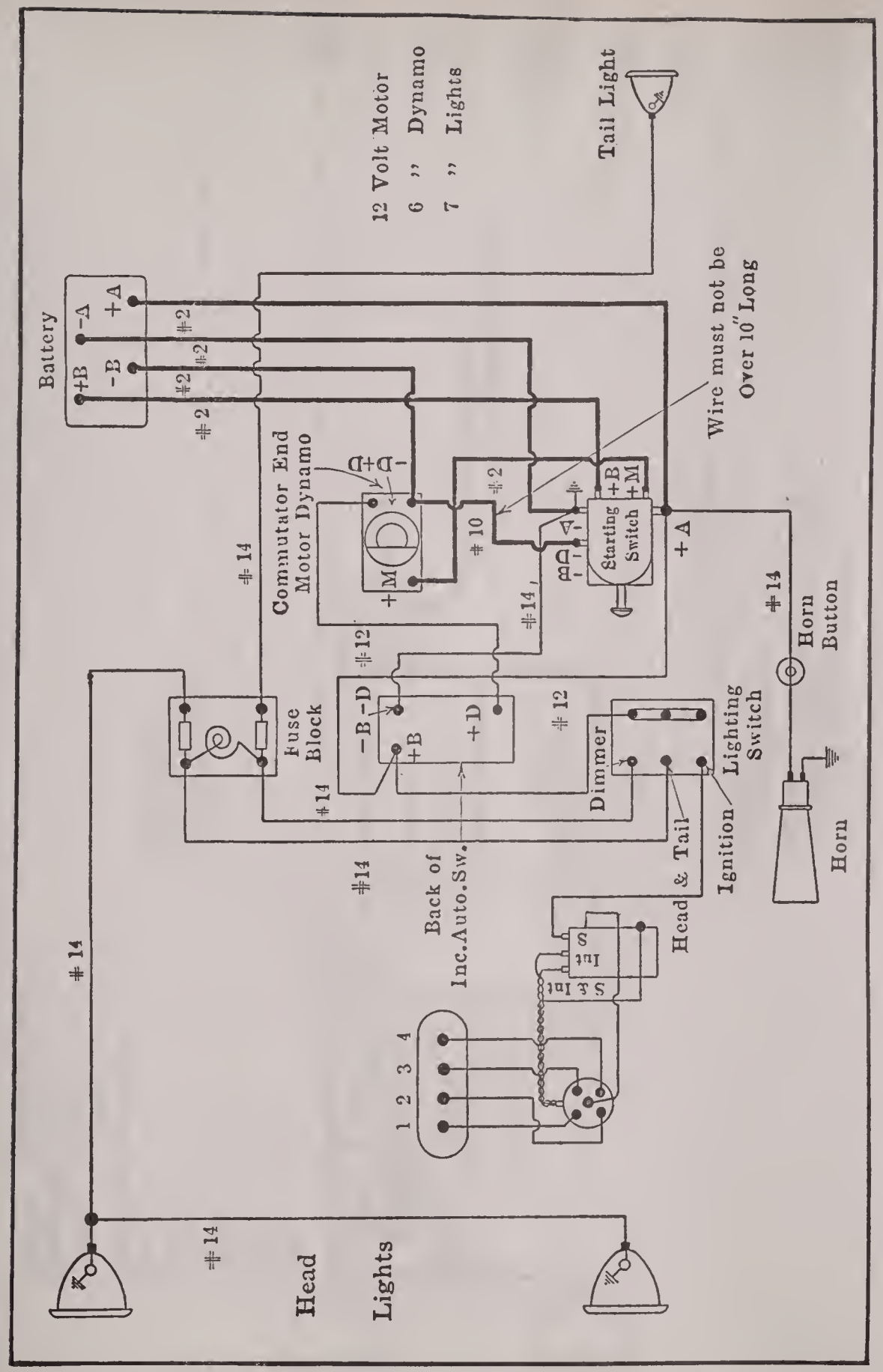


Plate No. 168

Battery is 12 volt, 60 ampere-hour. The positive terminal is grounded at the starting switch. The light and horn circuits are single wire. All other circuits are two wire.

Breaker contacts are made of tungsten metal. They should open .018 in. to .020 in. Break should occur when the mark "1-4" on the flywheel is at indicator, spark fully retarded. A simple way to test the breaker setting is to turn engine until the mark 1-4 on flywheel is at indicator. With spark fully retarded, the ammeter will indicate discharge, but the slightest advance of the spark lever will cause the indicator to return to zero. Lights must all be turned off and no unintentional ground or short circuits in the wiring. Firing order is 1, 3, 4, 2. If contacts become badly burned or pitted, the breaker must be renewed. The cost of a new breaker is no more than the cost of a new set of contacts. Spark gap should be a little less than 1/32 in., or the thickness of a smooth dime.

The starter operates at 12 volts and the ignition, lights and horn operate at 6 volts. The charging and cranking circuits are two-wire and the lighting, ignition and horn circuits are single wire.

The cranking and the charging circuits are fully explained in Plates No. 161 and 164.

Head lights are 7 volt, 12 cp., Tail light is 7 volt, 2 cp. Dash lamp is 7 volt, 2 cp. (when used).

With engine running slowly ignition should take an intermittent current of 4½ amperes. Battery should charge at a rate of about 15 amperes with car running 15 miles per hour, all lights turned off.

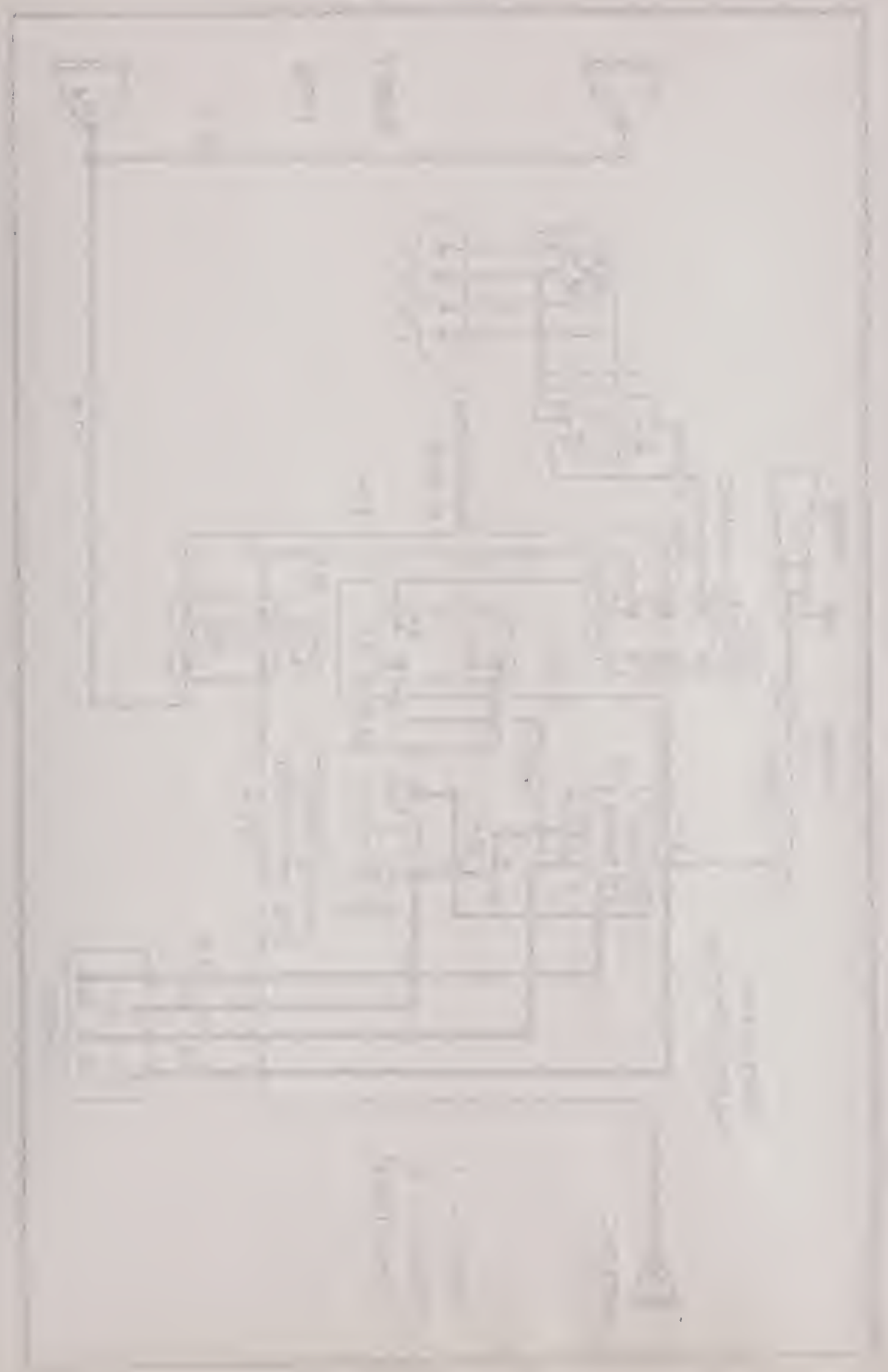
Driving chain must be kept well lubricated and free from dirt at all times. It should have ¼ in. to ½ in. up and down play.

If motor-generator is not properly lined up sprockets will wear, chain will be noisy and chain will wear excessively on one side and soon break.

Clean commutator and brushes with a cloth moistened with gasoline at least twice a year. Do not change the position of, or the tension on brushes. If brushes wear excessively, see that starting switch is operating properly.

If starting switch does not easily return to its normal position when pedal is released, due to weak spring, or to hole in floor boards being too small or in wrong place, etc., the brushes in the starting switch and in the motor-generator will wear excessively and burn. See that good electrical contacts are made in switch and that it returns fully and freely to its normal position when released. This can easily be determined by removing the starting switch cover.

There is an oiler provided at each end of the motor-generator. Put four or five drops of medium weight machine oil in each of these oilers every 500 miles or every two weeks.



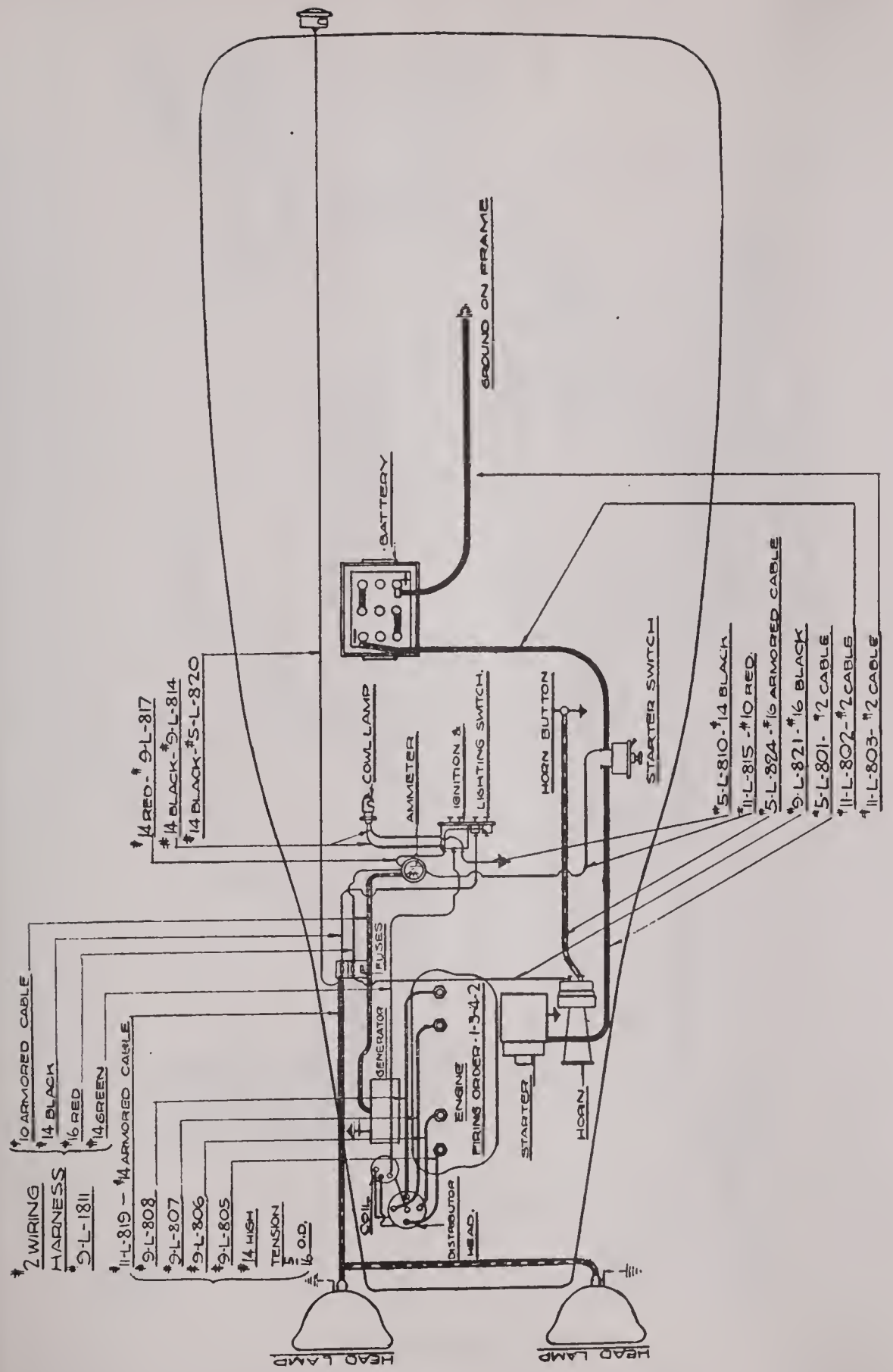


PLATE NO. 169

Dort

1918-19 MODELS

WESTINGHOUSE TWO-UNIT STARTING AND LIGHTING SYSTEM
CONNECTICUT IGNITION

Battery is 6 volt, 80 ampere-hour. The positive terminal of the battery is grounded.

Breaker contacts should open .025 in. to .027 in. To adjust contacts, remove distributor cap and after drawing out the pin, take off the breaker box cover. Then loosen lock nut holding contact screw and turn screw from the outside of the case by means of a small screw driver. Break should occur when the mark "1-4 DC" on the flywheel is at indicator, spark lever on the steering wheel advanced one inch on the quadrant. Firing order is 1, 3, 4, 2. Spark gap should be .025 in. Thread on spark plugs is S. A. E. Type, 7/8 in.-18. Every 1,000 miles remove breaker box cover and put three or four drops of light machine oil around breaker shaft. This will run down and lubricate the bearing. Care must be taken to see that no oil reaches the contact points. Contacts are of tungsten metal, so should not be filed. If so badly burned or pitted as to impair the proper operation of the motor, a new breaker should be installed. The engine will operate properly with the contacts quite irregular.

Starting motor is connected to the engine by a Bendix gear. Put three or four drops of good machine oil in each of the oilers on the starter every month.

Voltage regulation is by third brush. Relay closes at 8-9 miles per hour and opens at about 7 miles per hour. Maximum charging rate of 12-14 amperes is reached at 16-18 miles per hour. Rate decreases at higher speeds. Twice a month put three or four drops of cylinder oil in the oil well at the rear of the generator. The drain hole under the front part of the generator must be kept open at all times to allow free passage of any excess oil.

Ammeter indicates rate of charge or discharge of battery.

Head lamps are 6-8 volt, 16 cp. The dash lamp is 6-8 volt, 2 cp. Tail lamp is 6-8 volt, 4 cp. To remove the lens on the head lamps press the button at the side and turn slightly to the left, then pull forward.

Fuses are 7 volt, 10 ampere. The style used is No. 1, 1/4 in. diameter, 5/8 in. glass tube.

Dort

1915 Models

Splitdorf-Apelco 6-12 Volt Starting and Lighting System
Connecticut Ignition

Battery is 12 volt, 50 ampere-hour. The negative terminal of one set of three cells is grounded at the starting switch to supply six volts to lights and ignition.

Breaker contacts should open .025 in. to .027 in. To adjust contacts remove distributor cap, draw out other pin and remove breaker box cover. Then loosen lock nut and adjust by turning contact screw from the outside by means of a small screw driver. Break should occur when the mark "1-4 DC" on the flywheel is at indicator, spark lever on the steering wheel advance one inch on the quadrant. Firing order is 1, 3, 4, 2. Spark gap should be .025 in. Every 1,000 miles remove breaker box cover and put three or four drops of light machine oil around the breaker shaft. This oil will run down and lubricate the bearing. See that none of the oil gets on the contacts. Contacts are of tungsten metal. Do not file. If contacts become so badly burned or pitted as to impair the proper operation of the engine, renew the breaker mechanism. The contacts will function properly, even though they become quite rough.

Figure 1 is the wiring diagram showing correct connections when motor-generator is used for both starting and generating. The other diagram applies when only the Apple lighting system is used, there being no starter furnished except on request.

Both the cranking and the charging circuits are explained fully on Plates Nos. 161 and 164.

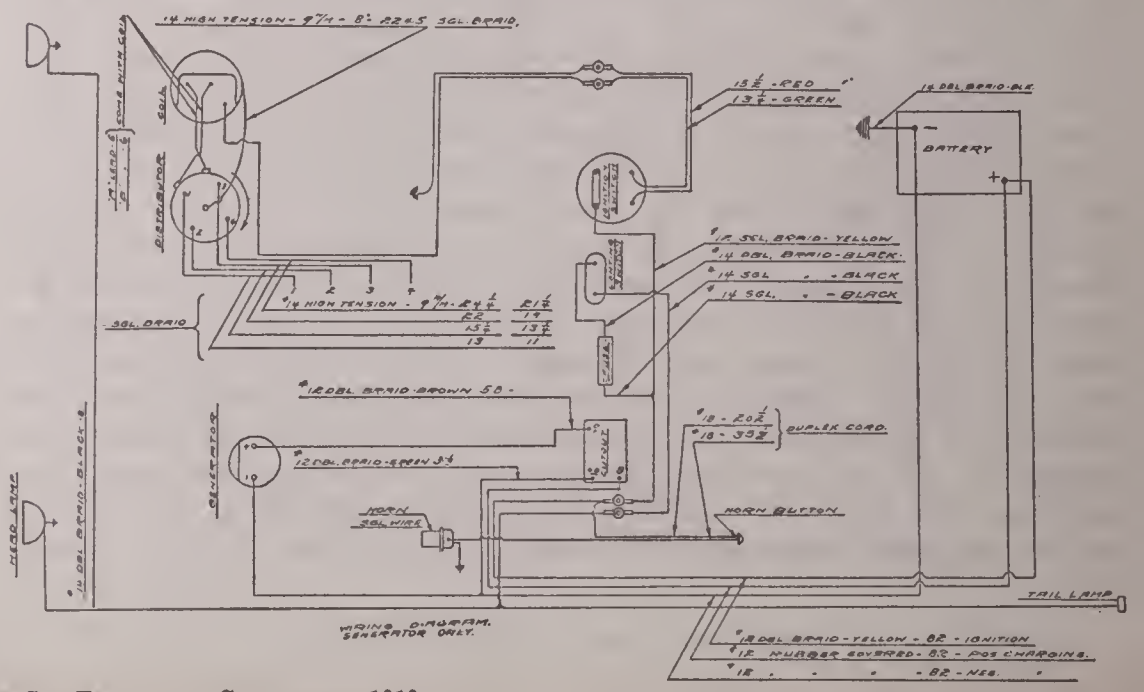
Should brushes wear abnormally, see that the starting switch is operating properly.

If starting switch does not return to its normal position easily when starting pedal is released, due to weak spring, etc., the brushes in both the switch and the motor-generator will wear rapidly and burn. See that good electrical connections are made in switch. This can easily be determined by removing the starting switch cover.

There is an oiler provided at each end of motor-generator. Put four or five drops of medium weight machine oil in each of the oilers every 500 miles, or every two weeks.

Keep driving chain well lubricated and free from dirt at all times. If motor-generator is out of line, chain will be noisy, sprockets will wear, and chain will wear excessively on one side and soon break.

Head lamps are 7 volt, 16 cp. Tail lamp is 7 volt, 4 cp. Fuse is 15 ampere.



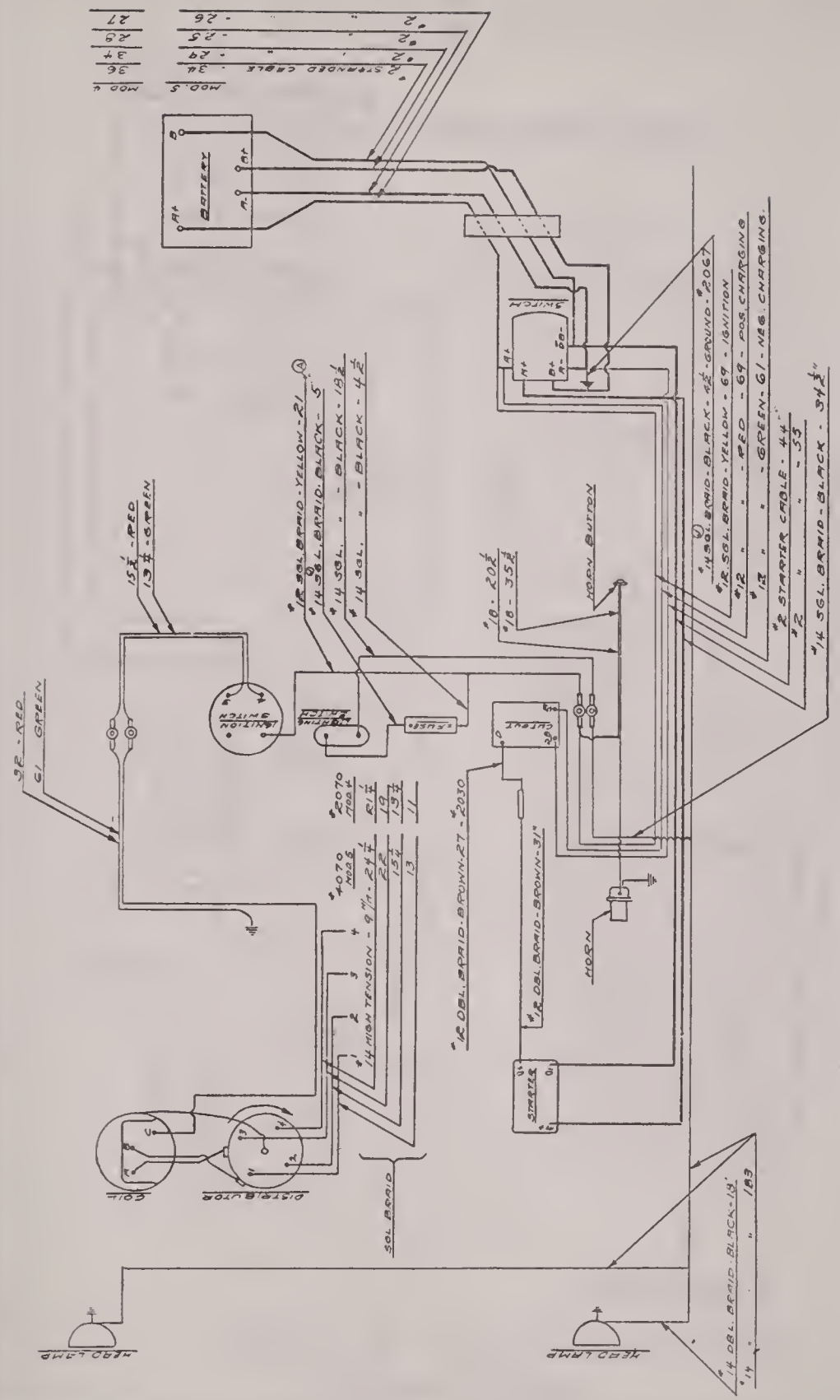


PLATE No. 170

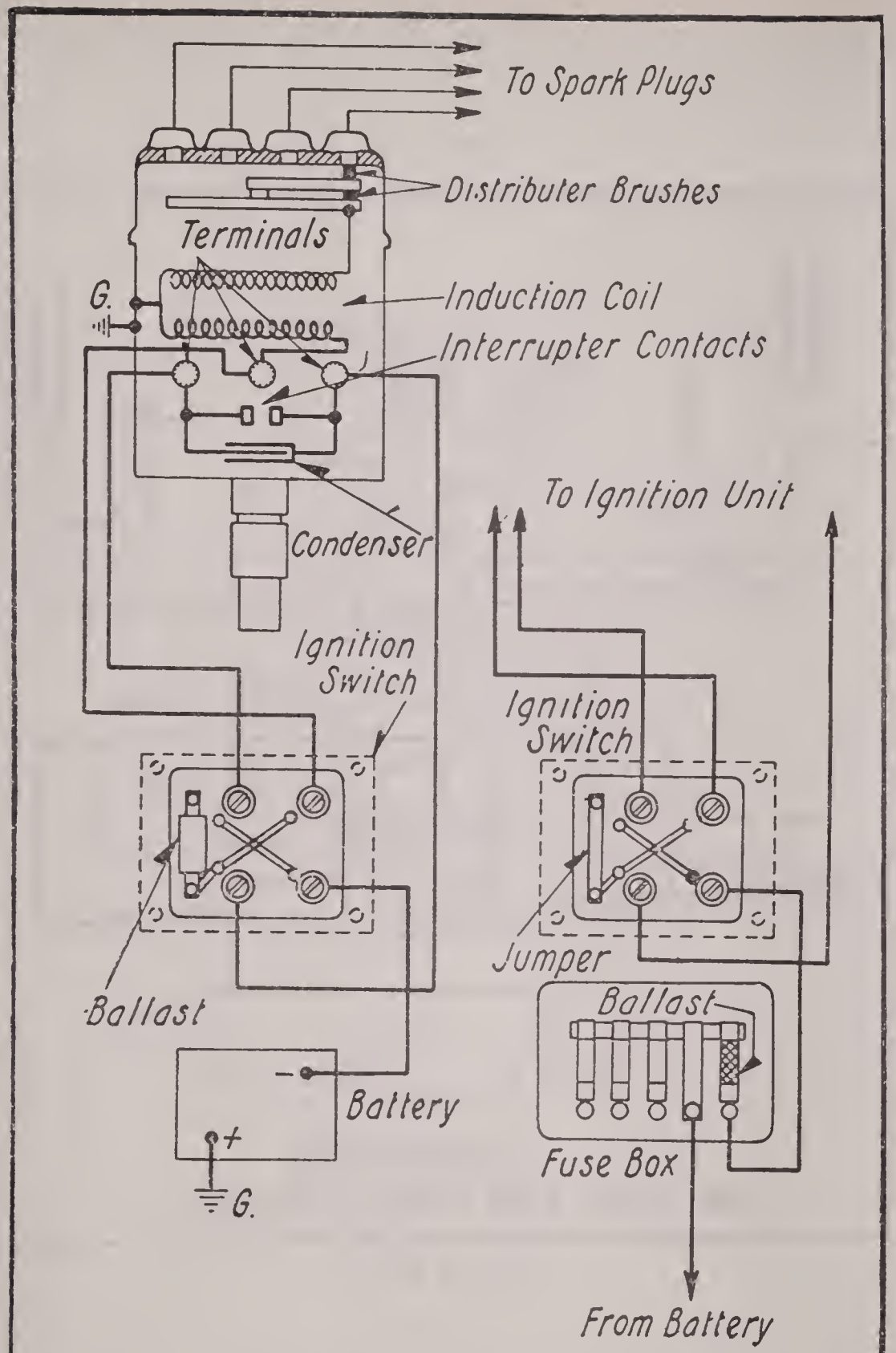


DIAGRAM OF CONNECTIONS VERTICAL IGNITION SYSTEM

PLATE NO. 171

Cunningham

WESTINGHOUSE TWO-UNIT, STARTING AND LIGHTING SYSTEM. WESTINGHOUSE OR DELCO IGNITION

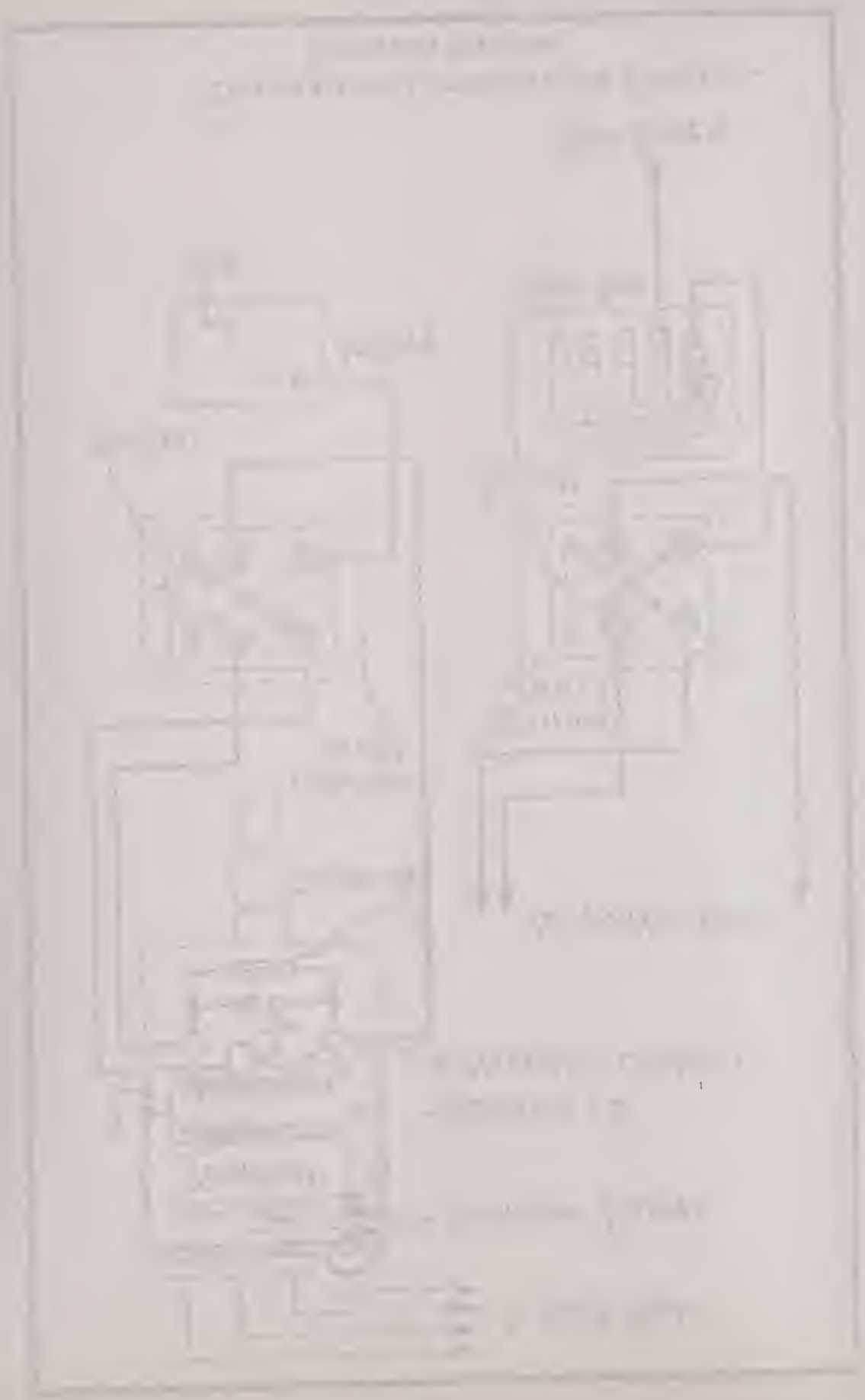
Battery is 6 volt, 120 ampere-hour. The positive terminal is grounded.

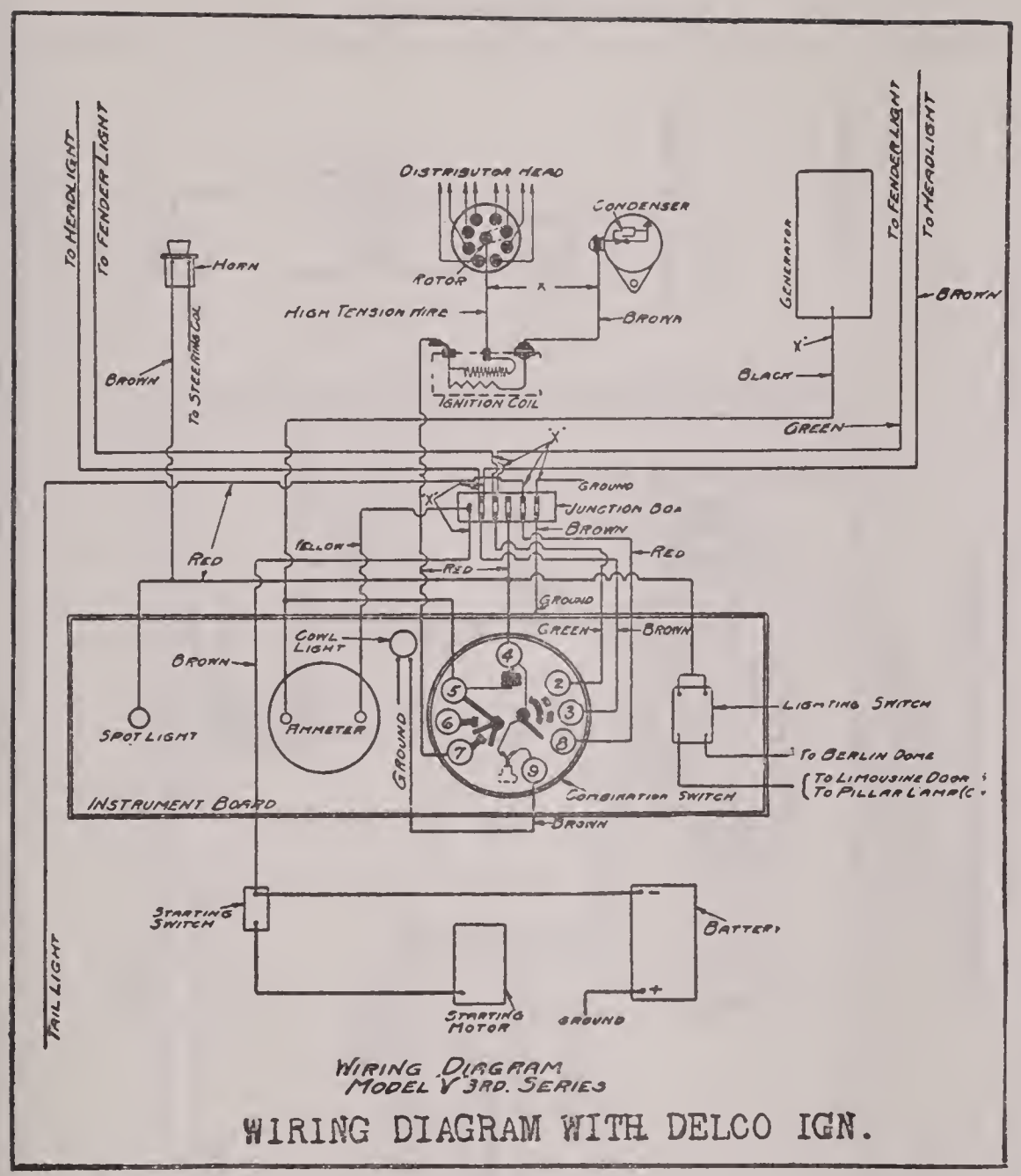
On cars using the Delco igniter, spark control is by combined automatic and manual controllers. Breaker contacts open .018 in. Contacts are made of tungsten metal. Spark gap should be .030 in. The distributor is supplied with two oilers. The upper one is to provide lubrication for the upper ball bearing. It should receive four or five drops of light engine oil every two weeks. The lower oiler is provided with a wick to feed the oil to the bearing. This oiler should be filled with engine oil every two weeks.

To time the ignition, place the spark lever 2 in. from full retard. Turn the engine so that No. 1 piston in the right-hand block is on top dead center, just entering power stroke. Loosen the screw in center of breaker shaft and turn the cam so that the segment will be making connection with wire leading to No. 1 cylinder when breaker is properly set. Set breaker so that the contacts will open when breaker is rocked forward as far as slack in gears will allow and close when rocked back again. The firing order is 1R, 3L, 2R, 1L, 4R, 2L, 3R, 4L.

The Westinghouse igniter contains the coil, breaker and distributor, all in one unit. The ignition coil is in the case, between the breaker and distributor. Contacts should open .008 in. If burned or pitted, contacts may be resurfaced with a fine, flat, jeweler's file or a piece of worn No. 00 sandpaper. Put two or three drops of light machine oil in the oil cup on the side of the distributor marked "Oil", every three months. Spark plug gap should be about .025 in. Distributor brushes should slide freely in their holders and spring should push the top brush out so that it will extend ¼ in. from the holder when distributor plate is removed. The brushes should, however, be retained firmly by their springs, so that they never tend to fall completely out of the tube. Be sure that both brushes in the distributor are in place. To time this unit to engine, place spark lever on steering wheel at 2 in. from the fully retarded position on the quadrant, No. 1 piston on upper dead center, just entering power stroke. Then remove the distributor plate and turn the shaft of the ignition unit until the V notch on the top edge of the outer casing is in line with the brush end of the distributor segment. The ballast coil is in the fuse box. It is the same shape and size of the fuses used and fits in the same kind of clip. Should ballast coil be burned out the engine may be operated if a 5 ampere fuse is put in place of the coil. The ignition must not be left on with engine idle, as the fuse will blow. The ballast must be renewed as soon as possible, as excessive sparking results at the contacts when a fuse or piece of wire is used in its place.

For care of the starting and lighting system see Plate No. 172.





WIRING DIAGRAM WITH DELCO IGN.

PLATE NO. 172

Cunningham

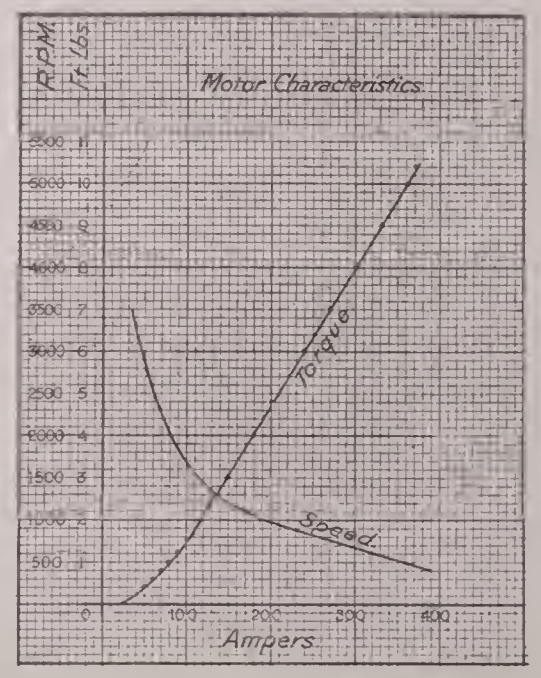
WESTINGHOUSE STARTING AND LIGHTING SYSTEM. DELCO IGNITION

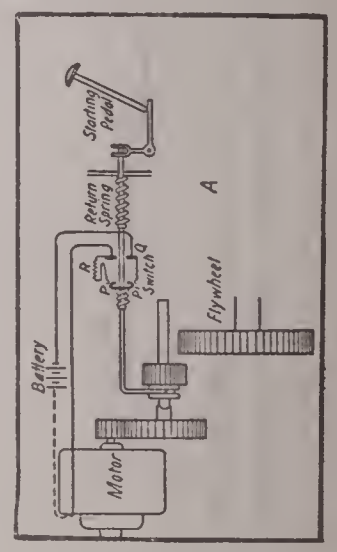
(Continued from Plate No. 171)

Starter is connected to flywheel by non-automatic mechanical shift. The action of this device is clearly shown in Figure 3. The diagram is only to show the working principle, not as it actually is on the car. When the starting pedal is depressed, the switch rod is moved forward, making the proper connections in turning the motor slowly, and drawing the pinion into mesh. Starting from the clear open position, when the switch rod travels 3/16 in., the auxiliary contacts (PP) are closed, thus completing the circuit through the motor and the resistance (R). This turns the motor slowly to facilitate the meshing of the gears. Upon 1/2 in. travel the contacts open, when the rod has traveled 9/16 in. the gears start to mesh. Upon 1 1/4 in. travel the main contacts begin to close and upon 1 3/8 in travel main contacts are compressed. Upon releasing the starting pedal the return spring reverses the above operation. Current consumption at various speeds and torque of the starting motor is shown by the curve. Put three or four drops of machine oil in each of the motor oilers once every month.

Voltage regulation of the generator is by third brush. There is a fuse on or in the relay case. This fuse is in the shunt field circuit and must be removed if generator is run with battery disconnected. Put three or four drops of machine oil in each of the generator oilers every 500 miles or every two weeks.

Head lights are 7 volt, 16-21 cp., 2.6-3 ampere. Fender lights are 7 volt, 6 cp., 1.25 ampere. Tail light is 7 volt, 2 cp., .42 ampere. Dash and meter lights (when used) 7 volt, 3 cp., .42 ampere. Dome and pillar lights (when used) 7 volt, 4 cp., .83 ampere.

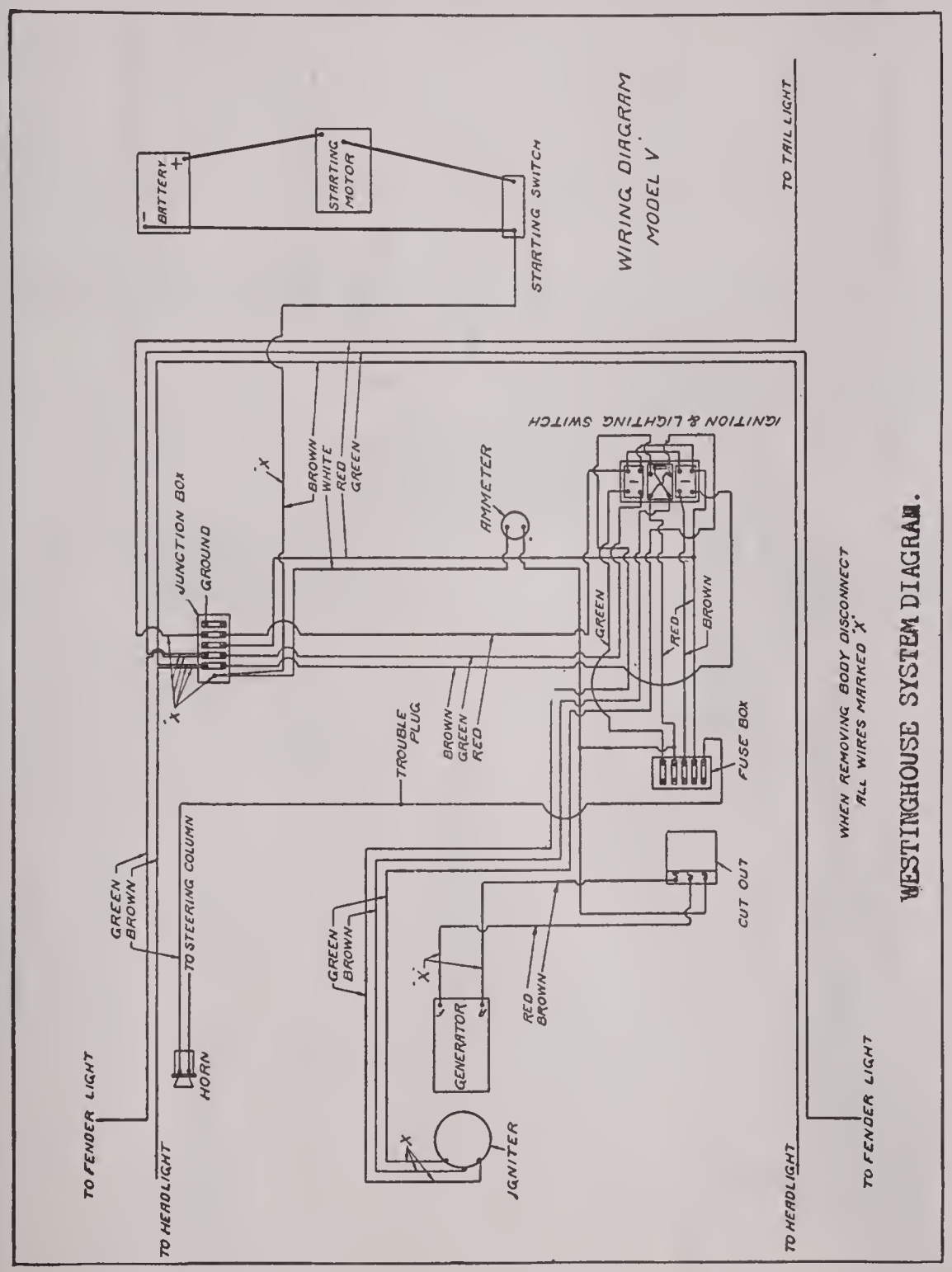




(Continued from Plates No. 171-2)

Cunningham

Models V and V 2nd Series



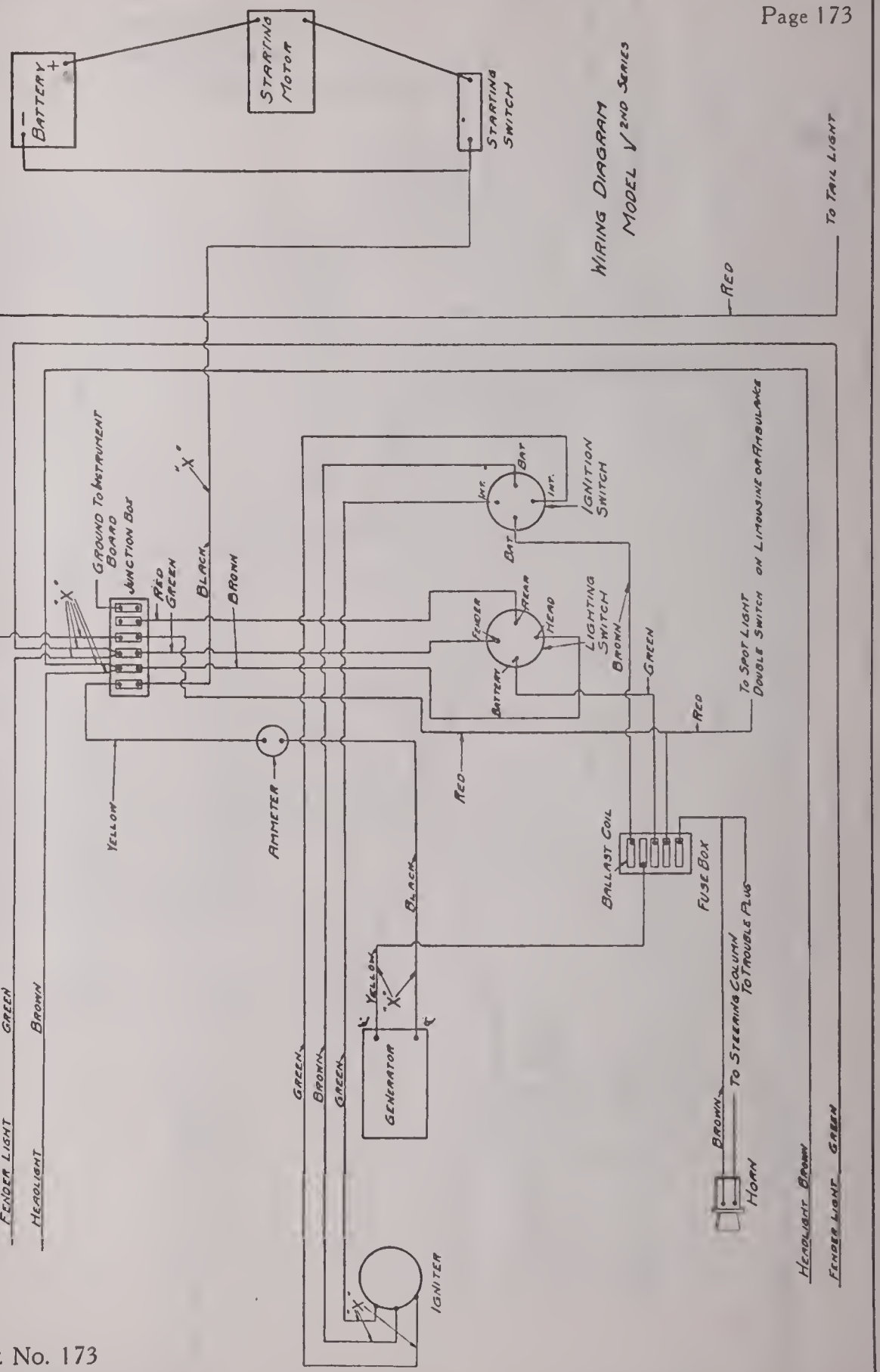


Plate No. 173

BATTERY
FEED FOR INSIDE LIGHTS
FEED FOR INSIDE LIGHTS
GREEN
BROWN
TO SMALL HEADLIGHT
TO LARGE HEADLIGHT
JUNCTION BOX
GROUND
STARTER
GROUND
HORN
BROWN
GREEN
RED
X
STARTING SWITCH
BLACK
COIL
AMMETER
TROUBLE PLUG
RED
LIGHTING SWITCH
RED
FUSE BOX
RED
GENERATOR
"X"
WHITE
BROWN
YELLOW
BROWN
SPEEDOMETER
TO LARGE HEADLIGHT
TO SMALL HEADLIGHT
GREEN
TO TAILLIGHT

WIRING DIAGRAM MODEL "S"

GROUND-GREEN
RED
BROWN
CONNECTING PLUG BREAK CONNECTION HERE WHEN REMOVING BODY
BATTERY
GROUND-YELLOW
WHITE
TO HEADLIGHT
BLACK
HORN
TROUBLE PLUG
BROWN
SPEEDOMETER & SWITCH
TAIL LIGHT CAN BE CONNECTED HERE IF DESIRED
TO STEERING COLUMN
COIL
AMMETER
YELLOW
BLACK
WHITE
RED
BROWN
STARTING SWITCH
SMALL HEAD LIGHT
LARGE HEAD LIGHT
LIGHTING GENERATOR
WHITE
BLACK
YELLOW
CUT OUT
FUSE BOX
DYNAMO
RED
GROUND
FEED FOR INSIDE LIGHTS
STARTING MOTOR
GROUND FOR INSIDE LIGHTS
BLACK
WHITE
BROWN
CABLE JUNCTION BOX
TO HEADLIGHT
BLACK
WHITE
RED
TO TAIL LIGHT
PLUG SWITCH IN REAR

WIRING DIAGRAM MODEL "R"

Cunningham

MODELS S & R

(For text see Plate Nos. 171 & 172.)

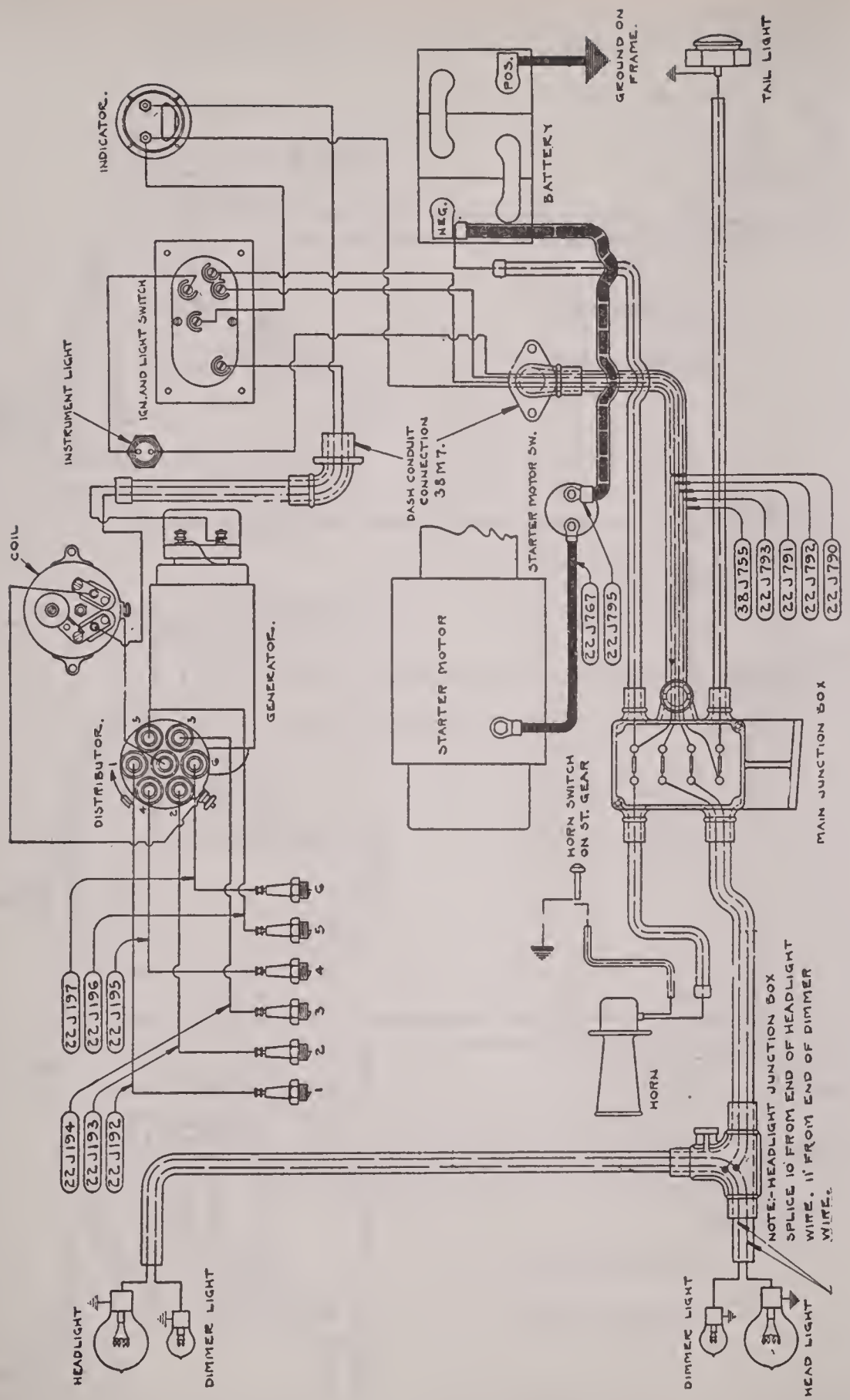


PLATE NO. 175

Velie

MODELS 38, 39-7, 39 SPORT

REMY TWO-UNIT STARTING AND LIGHTING SYSTEM. REMY IGNITION

Battery is 6 volt, 80 ampere hour. The positive terminal is grounded.

Break should occur when the dead center mark on the flywheel is ½ in. past indicator, spark fully retarded. Firing order is 1, 5, 3, 6, 2, 4. Breaker contacts should open .015 in. to .018 in. If contacts are badly burned or pitted, they should be resurfaced with a fine, flat, jeweler's file or a piece of worn No. 00 sandpaper. Spark gap should be .025 in.

Starter is connected to engine by a Bendix gear.

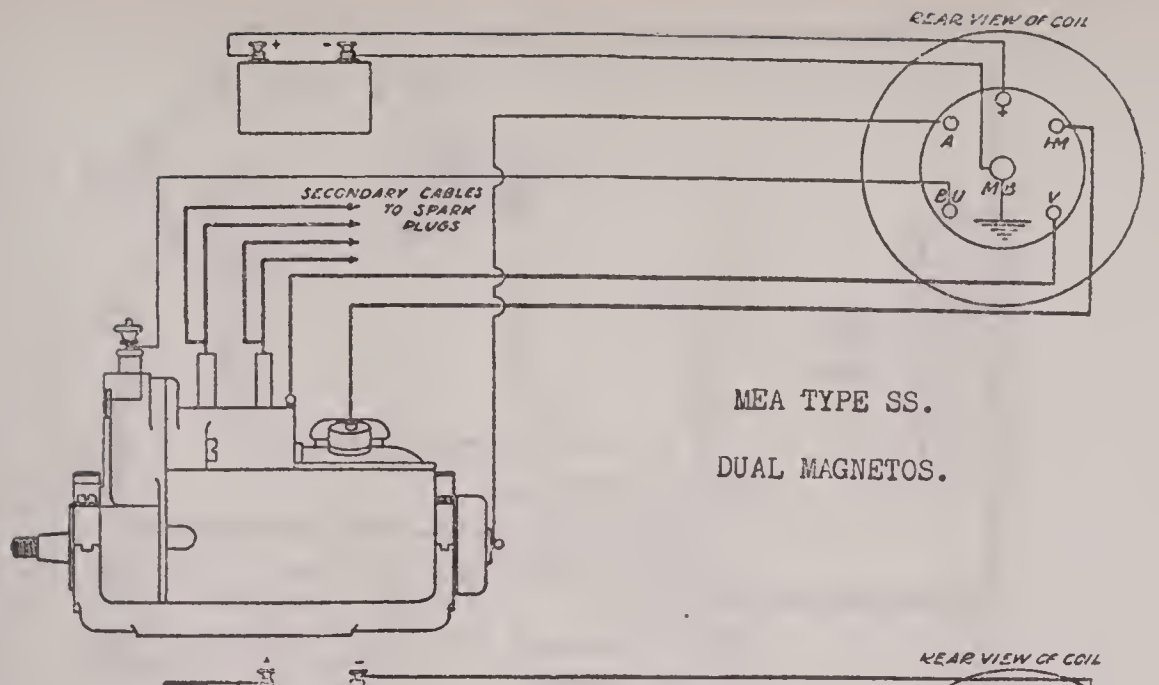
The following data applies to the motor:

Torque (with 6 in. pulley)	R. P. M.	Amperes	Volts
4 lbs.	1850	110-115	5.3-5.5
8 lbs.	1400	158-165	5.1-5.3
12 lbs.	1150	200-210	4.9-5.1
16 lbs.	850	238-250	4.6-4.8
20 lbs.	700	275-285	4.4-4.6
15 ft lbs.	Lock Torque	550-575	3.3-3.4

Voltage regulation is by third brush. Relay should close at 7 miles per hour and open at 6 miles per hour. Spring tension on main brushes is 17 to 20 oz. Spring tension on the third brush is 13 to 17 oz. Field draws 5 amperes at 6.4 volts. There is a thermostat to protect the battery from being overheated by too rapid a charging rate. When the high initial charging rate has been flowing long enough to heat the battery the thermostat opens and throws a resistance into the shunt field, thus reducing the generator output. The following data applies to the generator, all tests to be made with the relay in circuit and the thermostat contacts closed.

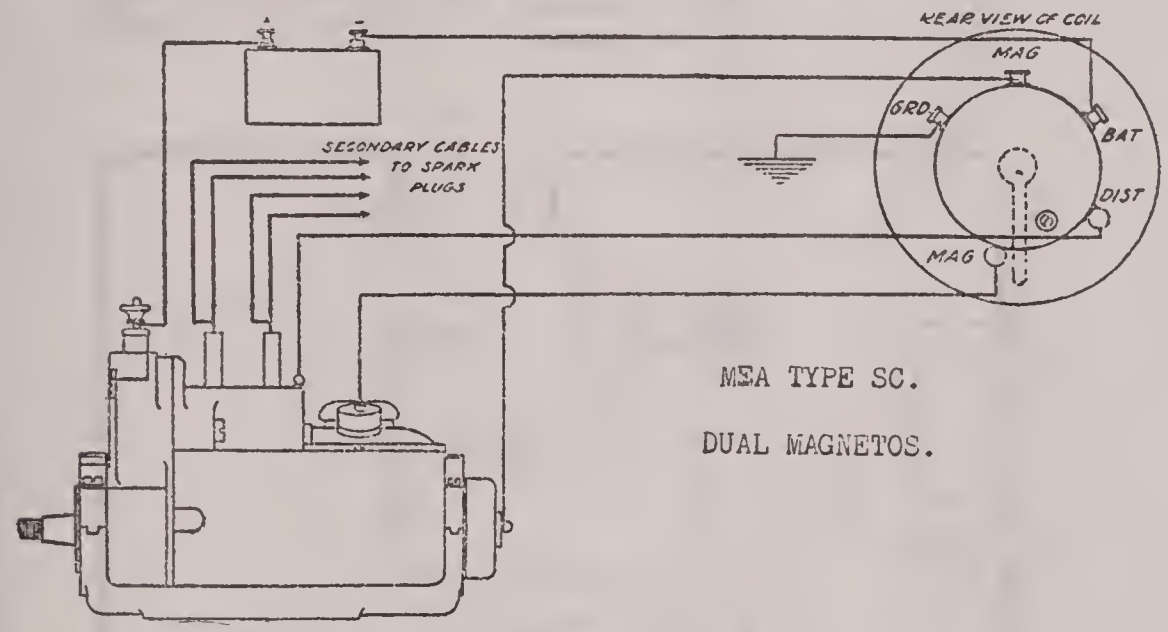
Amperes	R. P. M.	Volts
0.	442	6.4
7.	630	7.1
14.	870	7.8
22.	1700	8.6
17.	2500	7.45
12.25	3500	7.2

Large head lights are 6-8 volt, 15 cp. Small head lights are 6-8 volt, 4 cp. Dash and tail lights are in series. They are 3-4 volt, 2 cp. Fuses are 5 ampere.



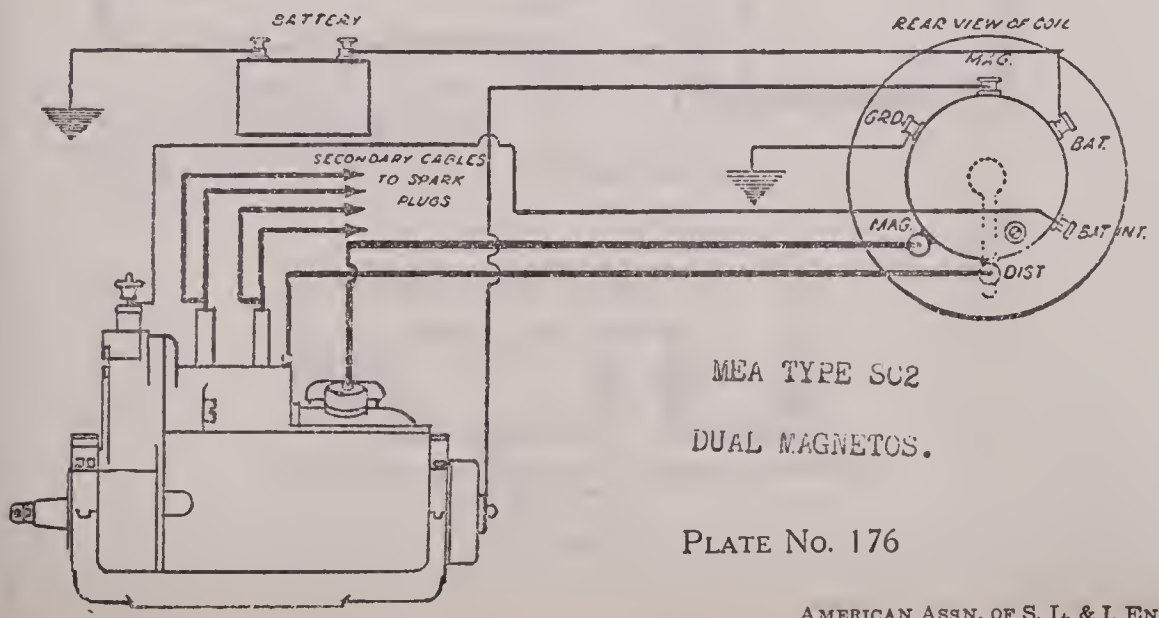
MEA TYPE SS.

DUAL MAGNETOS.



MEA TYPE SC.

DUAL MAGNETOS.



MEA TYPE SC2

DUAL MAGNETOS.

PLATE No. 176

Mea Magnetos

TYPES SC, SC2, SS

The Mea magneto is so constructed that when the spark is retarded or advanced, the magnets are also moved, thus always producing the spark at the time when the magnetism is moving across the windings at the fastest rate, producing the hottest spark. The magneto operates best when the break occurs while the edge of the armature is 1/16 in. from the pole tips. Contacts should open 1/64 in.

Clean contacts with gasoline whenever necessary. If contacts are badly burned or pitted they may be resurfaced with a fine, flat, jeweler's file or a worn piece of No. 00 sandpaper. Spark gap should be 1/64 in. If magneto is to be removed for repairs or for cleaning, in order to facilitate replacing, before magneto is disconnected from driving medium, turn engine until a number appears in the indicator. Then remove the magneto, and do not change the position of the engine. When replacing, turn magneto shaft until the same number again appears at the distributor and reconnect to engine. When timing this magneto to the engine, turn engine to position at which No. 1 cylinder should fire, with spark fully retarded (usually when the upper dead center mark on flywheel is 1¼ in. to 1¾ in. past indicator). Then, turn magneto frame as far as it will go, in the opposite direction to that in which the armature rotates. Remove breaker cover and turn armature, in the direction in which it rotates when running, until the contacts just begin to open. Next, connect to driving medium, without changing position of engine or magneto, and connect the proper wires to the proper sockets.

Put two or three drops of light machine oil in each of the magneto oilers every two weeks.

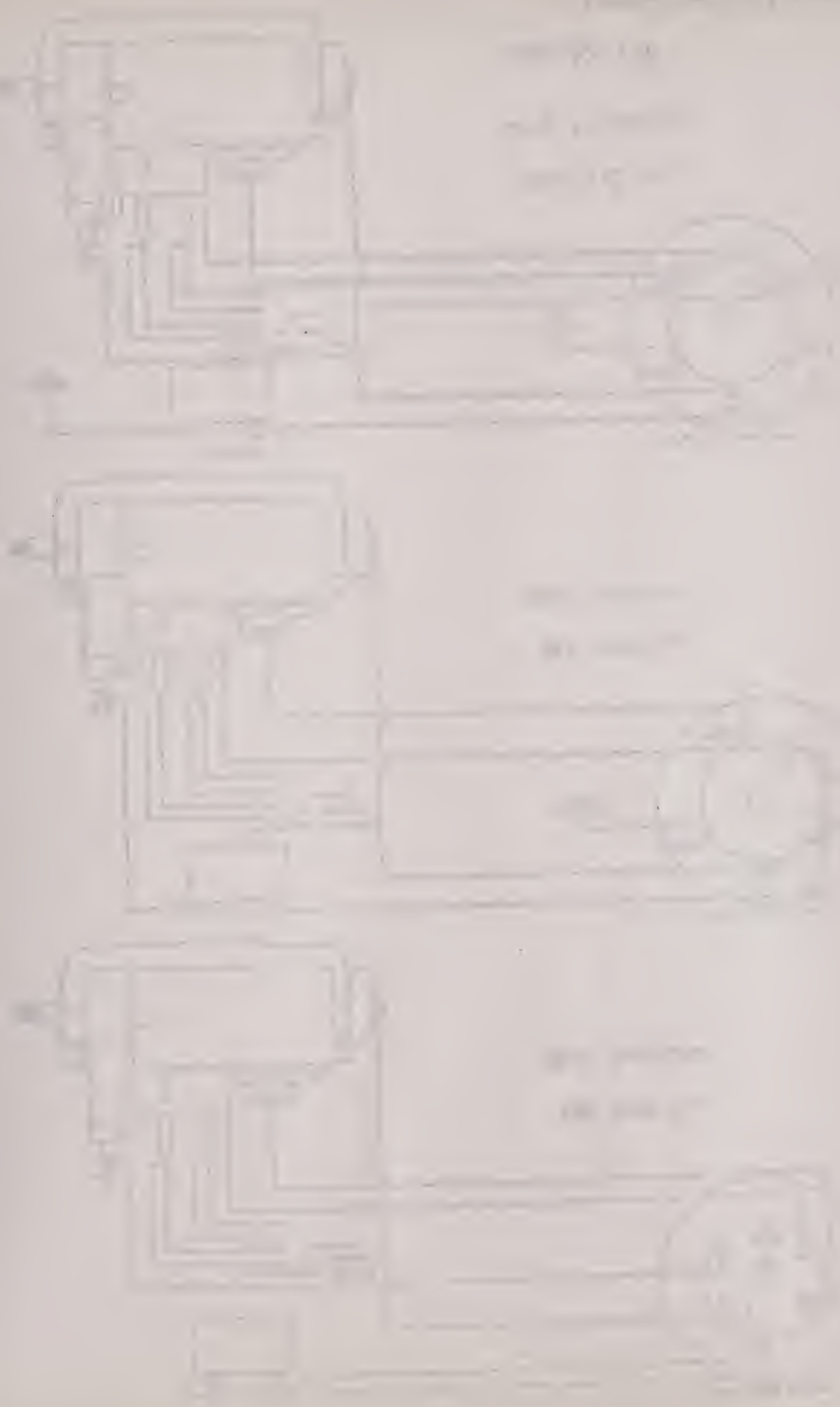
Never remove the top cover supporting the high tension carbon while magneto is running, as this cover contains the safety gap, and the windings are apt to be punctured if magneto is run while it is off.

Remove the magneto from base when bolting latter to frame, and see that the bolts do not project across the inside surface of the base, otherwise they may injure the magneto housing.

In tightening the nut at the front end of the armature shaft on the coupling, do not try to prevent it from turning by holding it on the breaker. Be sure to have the low tension wire well fastened at the terminal so that no stray strands will touch on uninsulated parts of the breaker.

The breaker may be easily removed from the case by removing the long center screw holding the breaker to armature, and screwing it into the small tapped hole provided in the breaker, so that it may be used as a handle to lift the breaker out. In replacing the breaker the small pin at its back must be introduced into the slot provided on the armature. Care must be taken not to tighten the screw before this pin is properly in place.

If magneto has been taken down, it is important that the armature and the distributor gears be placed in the proper relative position to each other. To facilitate so placing them, three holes are drilled in the end shield, the distributor gear and the end plate of the armature, in such a position, that if the three parts in question are in line, the relation between armature, breaker and distributor is correct. In assembling, all that is necessary is to insert a pin into the hole in the end shield and set gears so that pin will pass through all three holes.



Bosch, or Rushmore, Starter

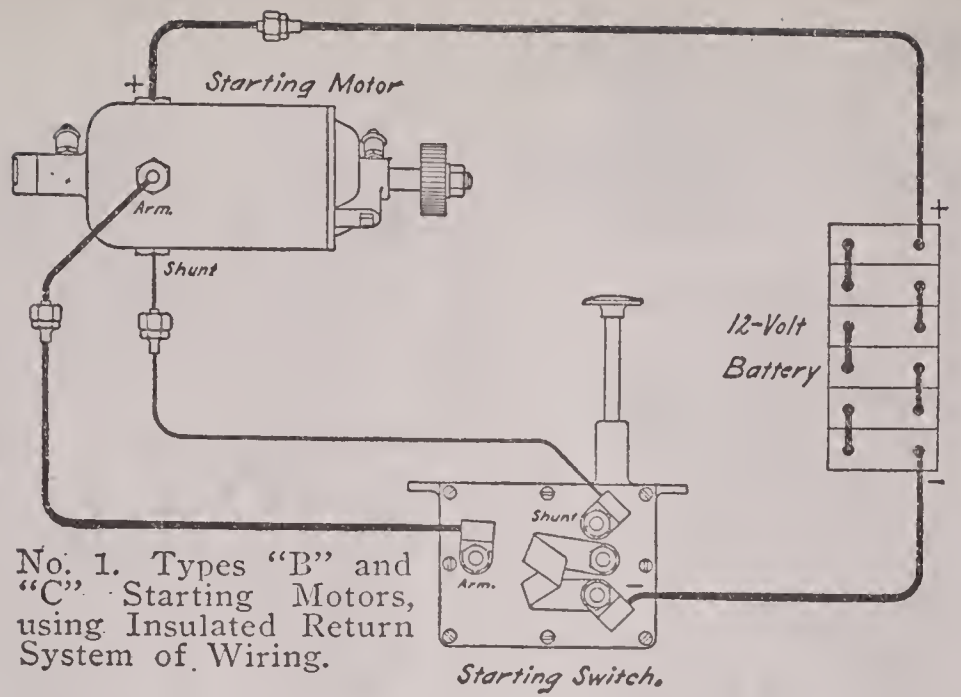
The Bosch, or Rushmore, starter as it is sometimes called, is made in nine sizes, as given below, with the size battery and cables used with each.

Motor Type	Voltage	Ampere Capacity	Main Cable Gauge	Shunt Cable Gauge
A8,813	6	160	00	4
A8,913	12	80 to 100	00	4
B2, B5	6	120 to 150	00	4
B2, B5	12	80	0	4
C3	6	100 to 120	0	6
C3	12	50 to 60	1	6
C18	12	50 to 60	3	6
C41	12	35 to 50	2	6
C42	6	80 to 100	1	6

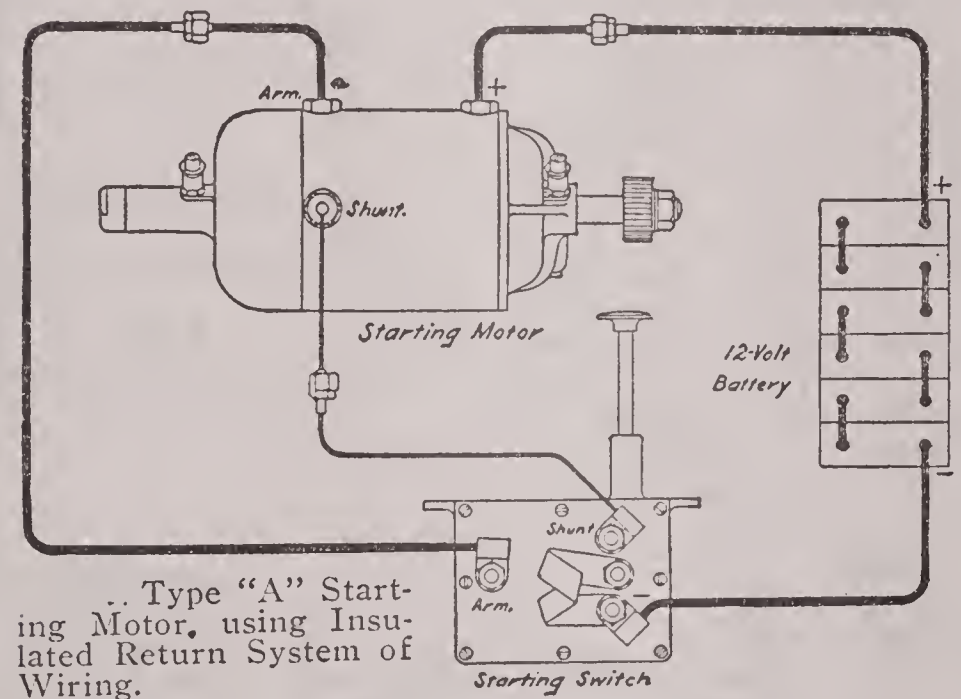
When very long cables are used, as is sometimes the case in motor boats, the size next largest to that tabulated should be used for the main cable, the shunt cable remaining the same size as tabulated.

When the starting pedal is depressed, the moving contact in the starting switch is moved along the three stationary contacts in the switch. The armature is so constructed as to have considerable end play. There is a spring at the commutator end, which holds the armature in position so that the pinion is clear of the flywheel gear when current is off. When connection is made between the movable contact and the first, or shunt, and the second contact in the switch, a large current is allowed to flow through the shunt field. This acts as a powerful electro-magnet and draws the armature into the working position in the motor. As the pinion is fastened to the end of the motor shaft, it is drawn into mesh with the flywheel gear. A small current also flows through the resistance and the armature, causing the latter to turn slowly. This is to facilitate meshing of the gears. When connection is made between the moving contact and the last stationary contact in the switch, the full battery pressure is applied to the motor, turning it with full power, cranking the engine. As the engine begins to run on its own power and the speed of the motor increases, the attraction between the armature and the field poles decreases, due to the decreased current caused by the greater back pressure and the demeshing of the gears results. No harm can come of keeping the starting switch closed after gears are demeshed, as the motor will be running at full speed, thus not consuming enough current for the attraction between the field poles and the armature to overcome the spring pressure. When the foot is removed from the starting pedal, the switch is returned to its normal position by a spring. The foot should always be removed entirely from the pedal, so as not to hinder the quick action of the spring. Should the starting pedal be depressed so rapidly that the gears do not have time to mesh, the motor will rotate freely. In this case the pedal must be released and the motor allowed to come to rest before switch is closed again.

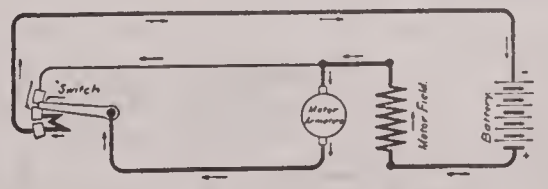
Each end of the motor is provided with an oiler feeding oil to the bearing and shaft by means of a wick. If starter is used only normally, three or four drops of oil should be put in each of the oilers every 1,000 miles. If starter is used frequently, four or fire drops of oil must be put in each oiler every 500 or 600 miles. In cases where starter is on a marine engine, it should be oiled every three weeks. Use good, clean, light machine oil.



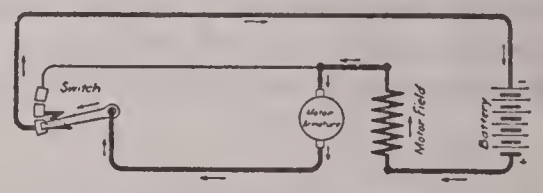
No. 1. Types "B" and "C" Starting Motors, using Insulated Return System of Wiring.



.. Type "A" Starting Motor, using Insulated Return System of Wiring.

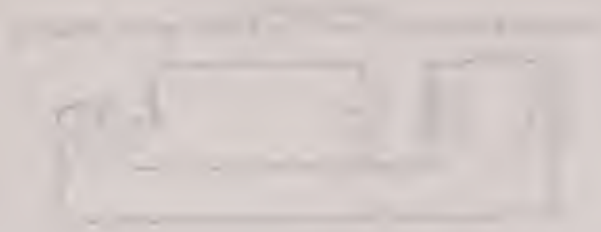


Electrical circuit during first part of downward movement of switch pedal.



Electrical circuit established when switch pedal has completed its downward movement.

PLATE NO. 177



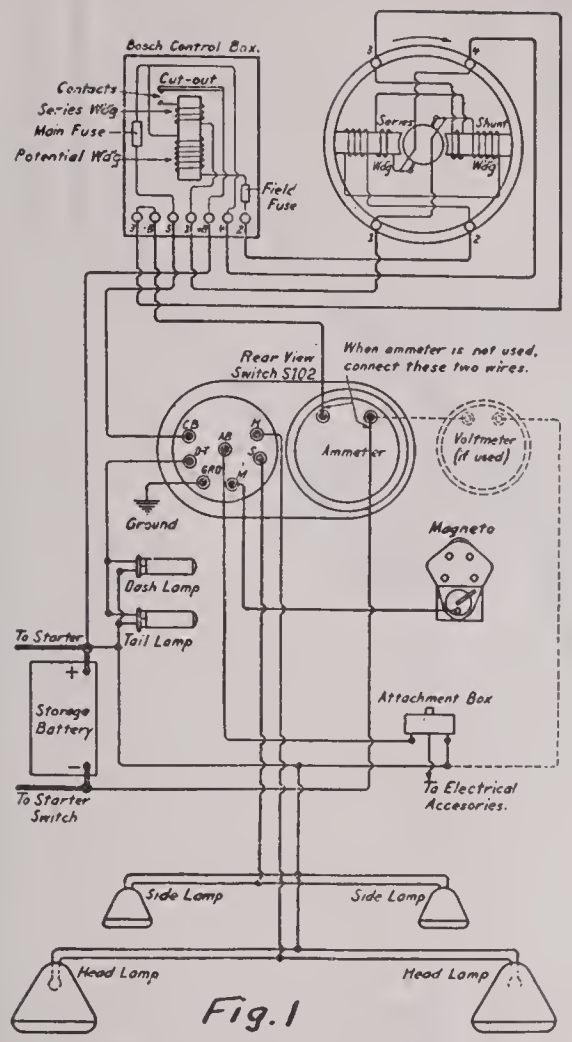


Fig. 1

Wiring Diagram for Bosch Standard Lighting System, using any DSG Dynamo, CBG Control Box and S102 Switch.

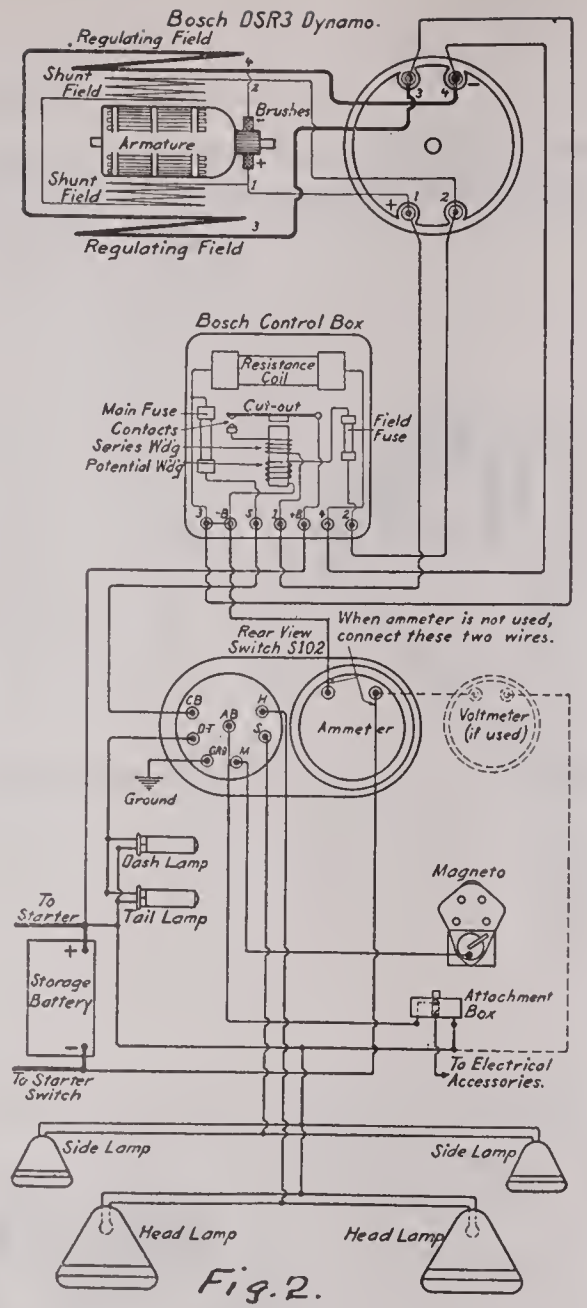


Fig. 2.

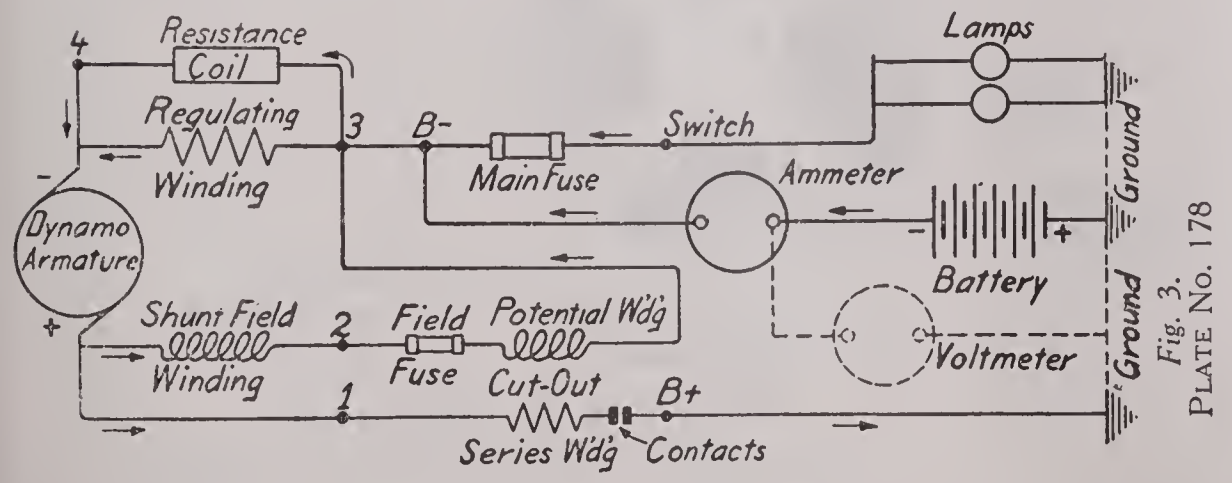


Fig. 3.
PLATE No. 178

Complete Circuit Diagram of Bosch Standard Lighting System, using DSR3 Dynamo and Ground Return System of Wiring.

Bosch Lighting Systems

TYPES DSG AND DSR GENERATORS

The type DSR dynamo is made in 100, 80, 70 and 60 watt sizes for both 6 or 12 volt systems. Voltage regulation is by reverse series field.

To facilitate wiring, the generator terminals are numbered 1, 2, 3, 4. These terminals are connected to the terminals on the relay, bearing corresponding numbers. The terminal B on the relay is connected to the ammeter. Terminal S is connected to the terminal marked CB on the light and ignition switch. Terminal marked B is connected to the positive terminal of the battery, or when a single-wire system is used, it is grounded. Terminal D-T on the switch is connected to the dash and tail light circuit. Terminal GRD is grounded. Terminal AB is connected to the attachment box. Terminal M is connected to the grounding terminal on magneto. Terminal S is connected to the side of dimmer lights, and terminal H to the head light circuits.

There are two fuses on the relay base. The small one is in the shunt field circuit. The large one is in the main circuit, supplying the lights.

On the 12-volt system the battery is 12 volt, 50 ampere-hour. On the 6-volt system 6-volt, 100 ampere-hour battery is used. When a single-wire system is used the positive terminal of battery is grounded and all terminals connected to the common return must be grounded. If battery is connected up wrong, the relay will vibrate rapidly.

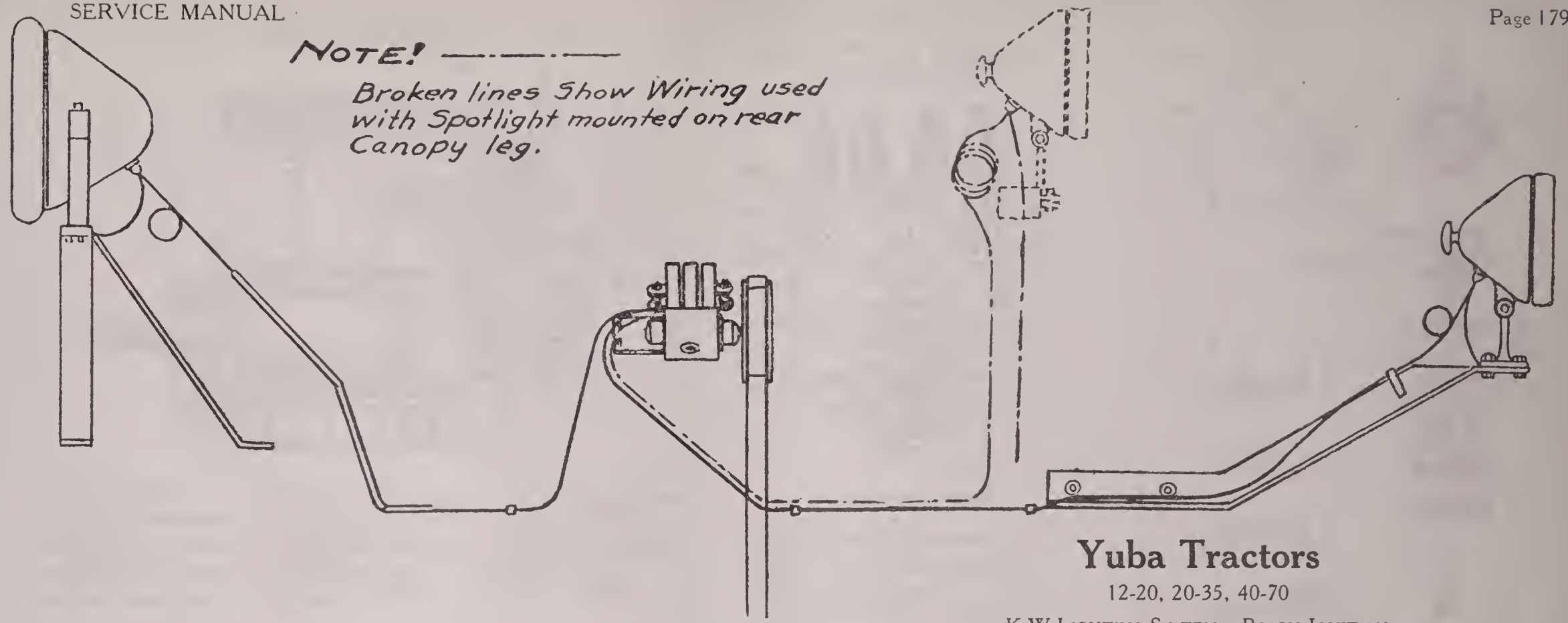
The generator is provided with ball bearings. Put two or three drops of oil in each oiler every 500 miles. If the generator is on a marine engine oil every week. Use light machine oil; never use cylinder oil.

Generator should begin to charge battery when running about 500 R. P. M.

Figure 1 is the wiring diagram when this system is used.

The DSR generator is 12 volts, 100 watts. Voltage regulation is by a reverse winding, operating in conjunction with a regulating resistance. The regulating resistance is connected in shunt with the terminals of the reverse winding. When the voltage is normal the current flowing through the resistance is not large enough to heat it enough to cause any effect, hence it acts practically as a short circuit across the terminals of the reverse field. As the speed rises, increasing the voltage above normal, more current is forced through the regulating resistance. This heats it, causing its resistance to increase, thus sending more current through the reverse shunt winding, cutting down the voltage. The resistance of the regulating coil increases in proportion to the current through it, thus keeping the voltage practically constant above a speed sufficient to produce the maximum desired. The output may be regulated by changing the size of the regulating resistance.

These same directions apply to the DSG type. The wiring diagram for this system is shown in Figure 2. Figure 3 is a conventional diagram using a single-wire system.



Yuba Tractors

12-20, 20-35, 40-70

K-W Lighting System. Bosch Ignition

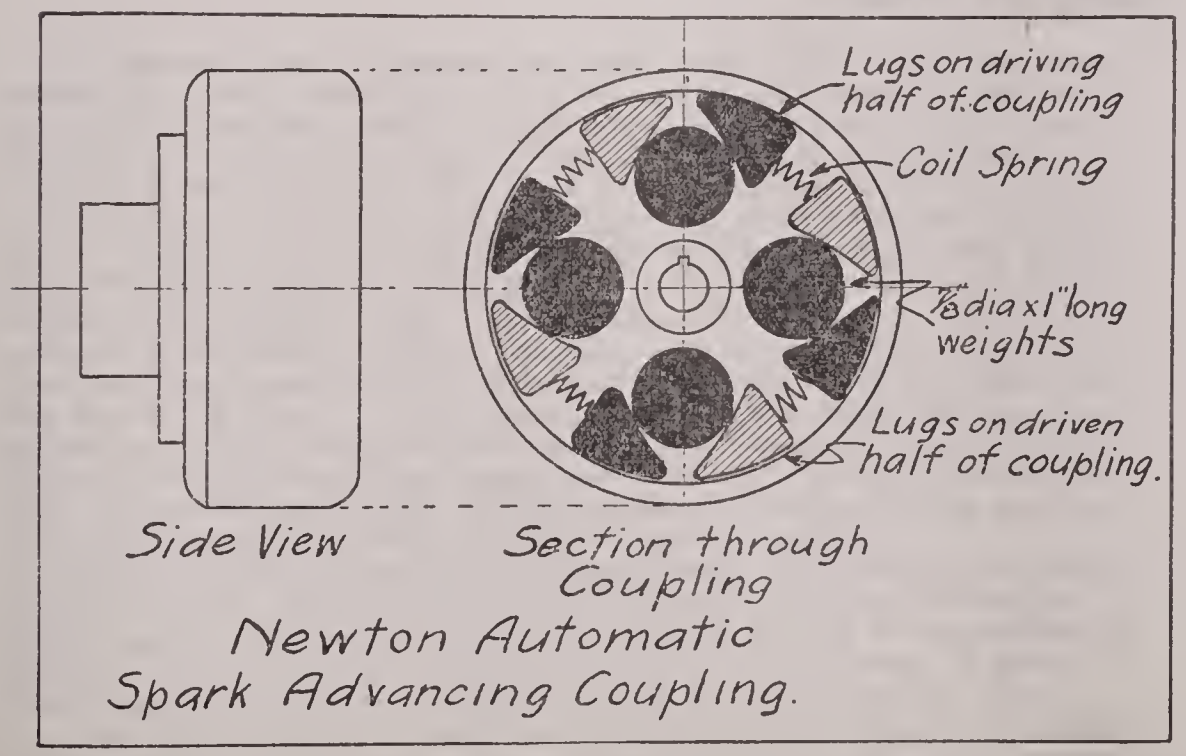


PLATE No. 179

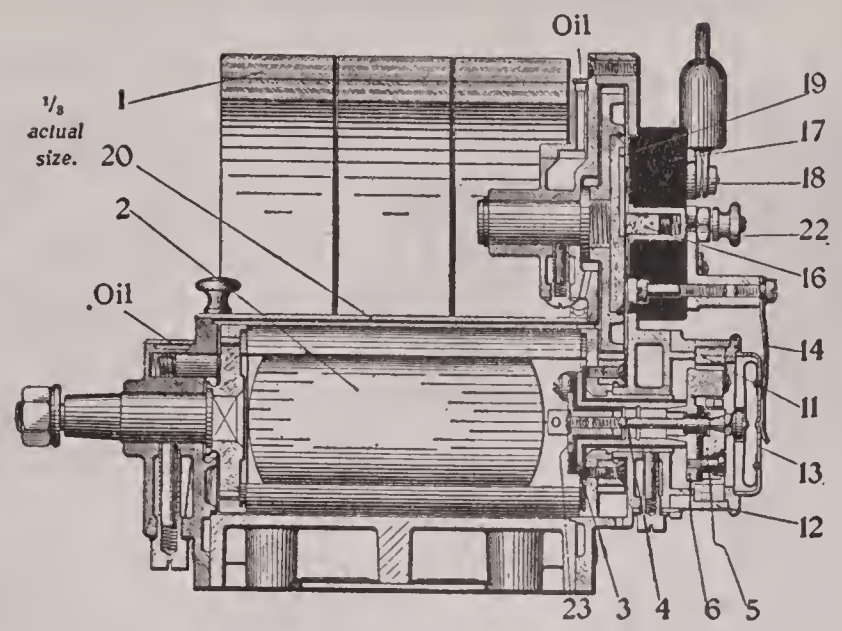
These tractors are equipped with a Bosch magneto and a K-W Type L. S. lighting generator as optional equipment.

Magneto should be set so that, with the engine being turned slowly by hand, magneto grounded, the breaker contacts will open when the upper dead center mark on the flywheel is 3½ in. past the center line of the engine. The firing order of the 12-20 tractor is 1, 2, 4, 3. The firing order of the 20-35 and the 40-70 tractor is 1, 3, 4, 2. Spark gap should be .018 in. to .020 in. Clean breaker with gasoline whenever necessary. If contacts are badly burned or pitted, they may be resurfaced with a fine, flat, jeweler's file or a piece of worn No. 00 sandpaper. Contacts should open 1/64 in. Spark control is by a Newton Automatic Spark Advance Coupling shown in Fig. 2. This coupling is composed of two main parts, one part being connected to the magneto and the other part to the driving shaft. On the inside of each of these two main parts are cast four wedge-shaped lugs. Between these lugs a weight in the form of a small roller is placed. As the coupling revolves the centrifugal force tends to throw these weights away from the center, thus forcing the wedge-shaped parts apart and advancing the spark by forcing the piece attached to the magneto slightly ahead of the driver. This action will be clearly understood by an inspection of the diagram. The thrust of these weights is resisted by the small coil springs between the lugs. These springs tend to keep the coupling in a retarded position. Before being put into use this coupling should be filled with 600 W oil; it should be refilled with the same grade of oil once every month.

No starting motor is supplied with these tractors.

The K-W generator is belt driven from the flywheel. It runs at about 2,000 R. P. M. It is of the inductor type, delivering alternating current and not being suitable for charging a storage battery. The capacity of this generator is 4½ amperes. Lamps used are 16 cp. Put several drops of light machine oil in each of the oilers every two weeks.

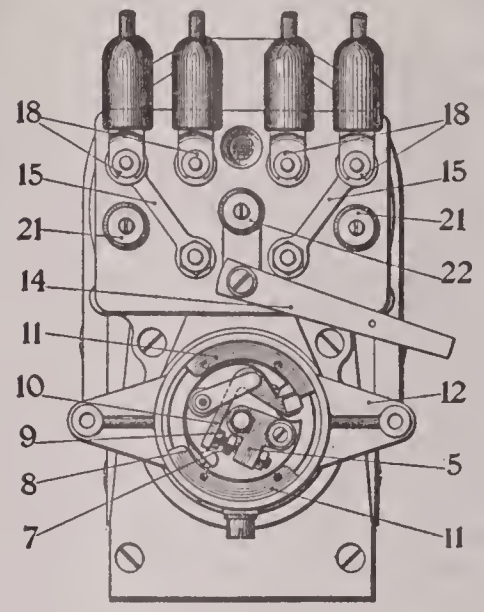
Longitudinal Section. Fig. 1.



1. Double magnet.
2. Armature.
3. Contact piece for common contact.
4. Fastening screw for contact breaker.
5. Contact piece on contact breaker.
6. Contact breaker disc.
7. Long platinum-screw.
8. Bell crank lever spring.
9. Short platinum screw.
10. Bell crank lever.
11. Segments in interrupter housing.
12. Interrupter housing.
13. Cover for interrupter housing.
14. Flat spring for holding cover for interrupter housing.
15. Connecting piece on terminal studs on distributor plate.
16. Distributor carbon.
17. Distributor plate.

Rear View of Magneto.

(End cap taken off)



18. Connection terminal.
19. Rotating distributor segment.
20. Dust cover.
21. Nut for fastening distributor plate.
22. Closed circuit terminal.
23. Connection piece for the end of auxiliary winding.

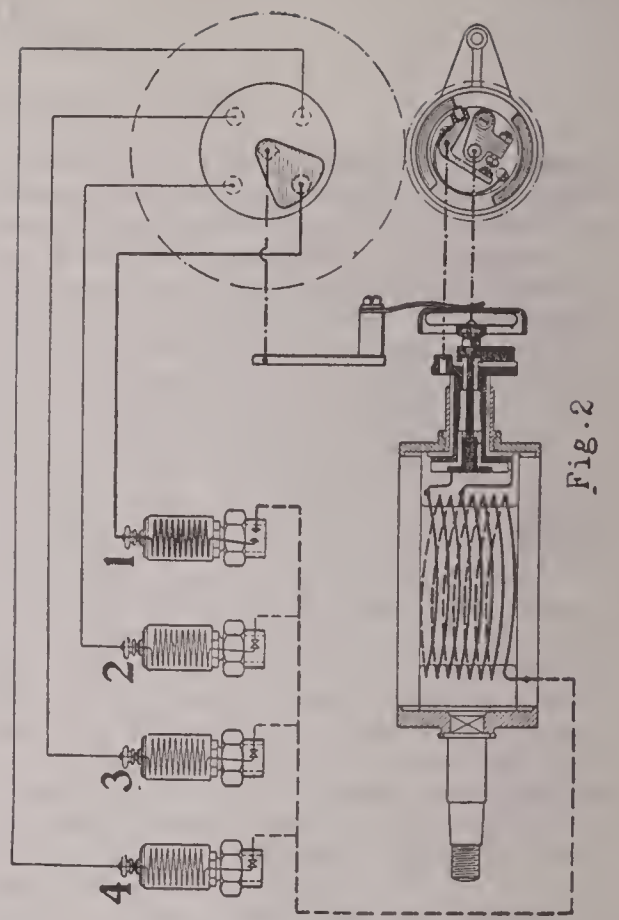


Fig. 2

PLATE No. 180

Bosch Magnetic Plug Ignition

This system consists of a magneto, very much similar to the ordinary high tension magneto and a set of special plugs. The armature of the magneto is of the shuttle wound type. The construction of the magneto is shown in the cross section, Figure 1. The electrical connections are shown in Figure 2. As can be seen on Figure 2, the winding is in two sections, both producing a pressure tending to send a current in the same direction. The smaller or primary section is short circuited when the contacts are closed. This allows a current to flow through this winding, producing a strong magnetic field. When the contacts are opened, the circuit is broken and the magnetism suddenly collapses across the entire winding of the armature, producing a pressure in the same direction as that developed by moving the wires across the permanent field of the magneto. These two pressures, acting together, force a current through the armature winding and plug as shown in Figure 2. The contacts in the plugs are normally held in a closed position by a spring. When this current produced by the magneto flows through the coil in the plug it produces enough magnetism to move the armature and open the contacts. This sudden opening of the contacts produces a hot spark much in the same manner as spark is produced by the mechanical make and break system.

The part of the engine into which the magnetic plug is screwed must be well cooled. The coil body must never come in contact with the frame of the car or the engine. If for any reason it is necessary to remove the coil body, this may be accomplished by turning the latter to the left. Should it be necessary, a small amount of gasoline or kerosene may be injected into the hollow portion of the plug to loosen the thread.

Every four weeks the plug should be dismantled, thoroughly cleaned with gasoline and then well greased before reassembling. To do this the whole plug must be removed from the socket. After plug is removed from the socket, first remove the spring or withdraw it sufficiently to allow the breaker to be taken out. The knife edge of the spring is pressed into the groove on the breaker arm and can easily be removed with a small screw driver or a pocket knife. After the removable brass piece is removed the breaker may be easily drawn out.

Every 500 miles each of the oil wells of the magneto should be filled with light machine oil, until the oil overflows through the overflow duct or drain. The oil is fed to the bearings by felt wicks. Whenever necessary the wicks should be removed and washed in gasoline. While the wicks are out the oil well and breaker should be thoroughly cleaned with gasoline, after which the wicks must be replaced and the wells filled with oil. Magneto breaker contacts should open about 1/64 in. If badly burned or pitted they may be resurfaced with a very fine, flat, jeweler's file or a small piece of worn No. 00 sand paper.

To time the magneto to the engine, loosen the driving medium and then turn the engine by hand until No. 1 cylinder is on top dead center, then remove distributor cap and turn the magneto armature until No. 1 appears at the dial on distributor. Then turn the armature, in the direction it should rotate when operating, until the edge of the armature is the proper distance as given below, past the pole tip. On the Type "K3" magneto this distance should be 16 to 17½ mm. On Type "K4" it should be 21 to 24 mm., on Type "K6" 31 to 36 mm. and on Type "K8" 40 mm. After magneto is in the correct position, as given above, it must be connected to the driving medium without disturbing the relative position of either.

Bosch

Two Independent System

By this system the engine may be operated on either magneto, battery or both magneto and battery. Two sets of plugs must be used. Any independent, single spark magneto may be used with this system. The battery system consists of the timer-distributor and the combined switch and coil. Battery system is entirely independent of the magneto.

The construction and the electrical connections of the coil are shown in Figure 1. Coil is built to operate on 6 volts. A 6 volt, 70 ampere-hour battery is recommended. If it is necessary to use dry cells, 10 cells must be used for a four cylinder motor and 12 cells for a six cylinder motor. Cells must be connected in series multiple, five cells in each row on the four cylinder and six cells in each row on a six cylinder motor. The cells in each row must be connected in series, and the two rows connected in parallel.

Construction of the timer-distributor is shown in Figure 2. It is driven at cam shaft speed and is fastened to the driving shaft by means of the sleeve "1" and the taper pin "2". To adjust the contacts, the side springs 12 must be turned back from the holding pins which will permit the removal of the distributor plate 7 and the brass ring 13.

In order that the system may be successfully operated on both battery and magneto at the same time, the two systems must operate simultaneously, that is, both breakers must open at exactly the same time. In order to set them to so operate it is only necessary to first time the magneto to the motor and then set the battery to operate with the magneto.

To do this, turn the magneto to the point at which break occurs, spark fully advanced, timer loose on shaft and magneto grounded to eliminate any danger of engine back firing. Then remove the distributor cover and revolve the sleeve of the battery timer until the contacts just begin to open, distributor segment delivering current to same cylinder as magneto. Connect the breaker to its driving medium in this position, replace distributor cover and connect wires leading to the plugs in their proper firing order.

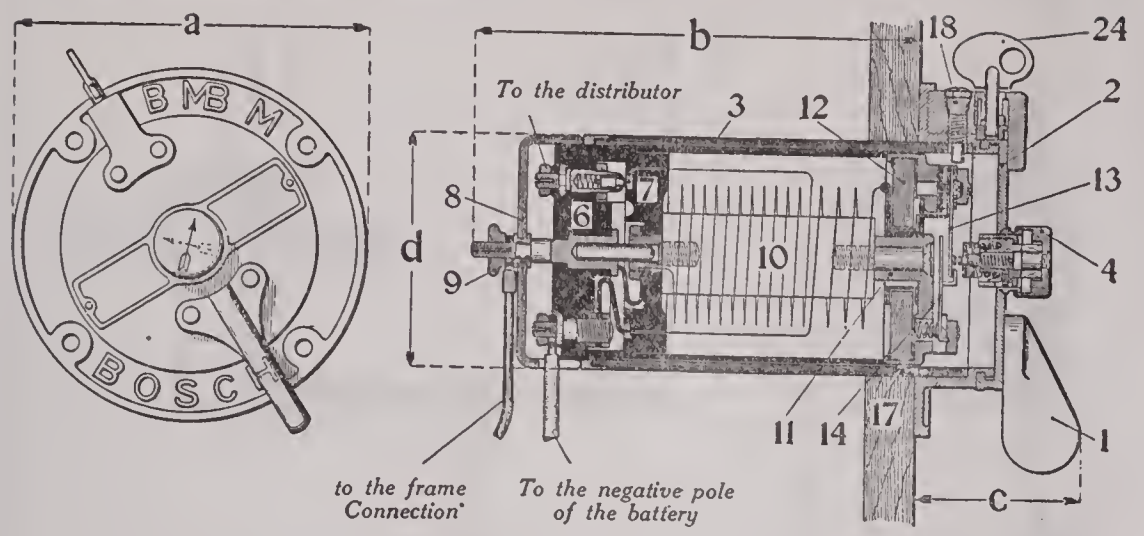
Proper connections are shown in Figure 3. The middle terminal of the battery is not grounded as it appears on the diagram. Two batteries are represented in the one box in diagram.

When switch is on the "M" position, the battery circuit is open and magneto is in operation. When in the "Off" position, battery circuit is open and magneto is grounded. When on "B" side, battery is operating and magneto is grounded. When on the "MB" position, both the magneto and the battery ignition operate.

Battery breaker contacts should open .018 in. to .020 in. If badly burned or pitted, they may be resurfaced with a fine, flat, jeweler's file or a small strip of worn No. 00 sand paper.

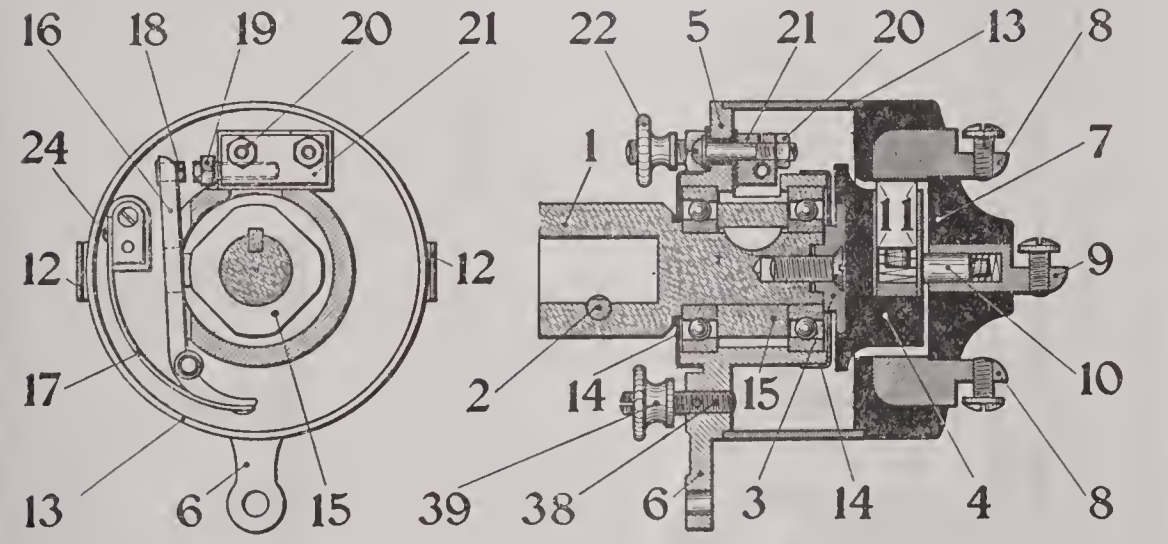
Dimensions { *a = 105 mm, b = 135 ", c = 50 ", d = 71 "*

Horizontal Coil Type "C".



1. *Switch handle.*
2. *Movable cover.*
3. *Coil housing.*
4. *Starting press button.*
6. *Fixed connection plate.*
7. *Movable switch plate.*
8. *Cable cover.*
9. *Milled edged nut.*
10. *Iron core.*
11. *Plate carrying the starting arrangemcnt and the condenser.*
12. *Condenser.*
13. *Contact spring.*
14. *Vibrator.*
15. } *Auxiliary contact breaker.*
16. }
17. *Vibrator spring.*
18. *Stop screw for switch handle.*
24. *Locking key.*

Fig. 1.



1. *Sleeve shaft*
2. *Key.*
3. *Catch plate.*
4. *Rotating distributor piece.*
5. *Base plate.*
6. *Timing arm.*
7. *Distributor disk.*
8. *Binding post for spark plug cable.*
9. *Binding post for current conducting cable.*
10. *Fixed carbon brush.*
11. *Rotating carbon brush.*
12. *Flat fastening spring.*
13. *Distributor housing.*
14. *Protecting cap.*
15. *Steel cam.*
16. *Contact breakcr lever.*
17. *Contact breaker spring.*
18. *Short platinum rivet.*
19. *Long platinum screw*
20. *Lock nut for screw 19.*
21. *Insulated contact piece.*
22. *Binding nut for primary winding.*
38. *Threaded bolt.*
39. *Nut for threaded bolt.*

Fig. 2

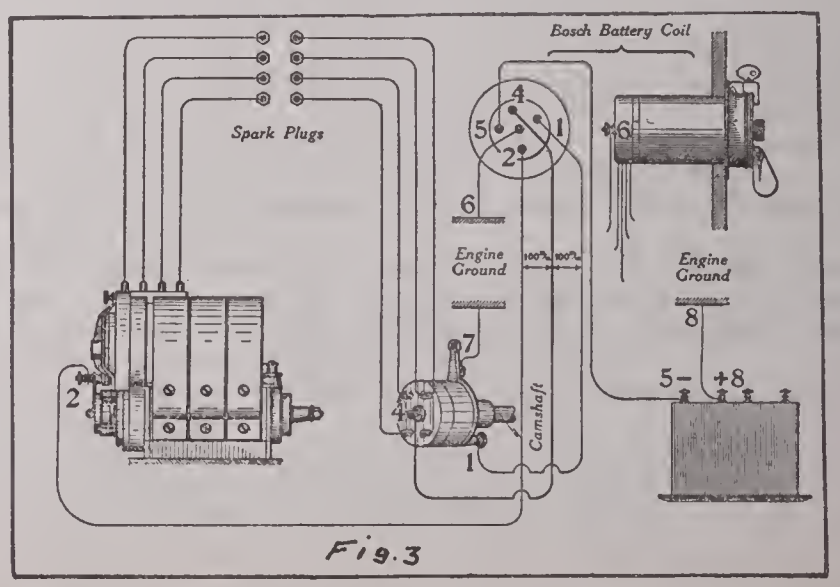


Fig. 3

PLATE No. 181

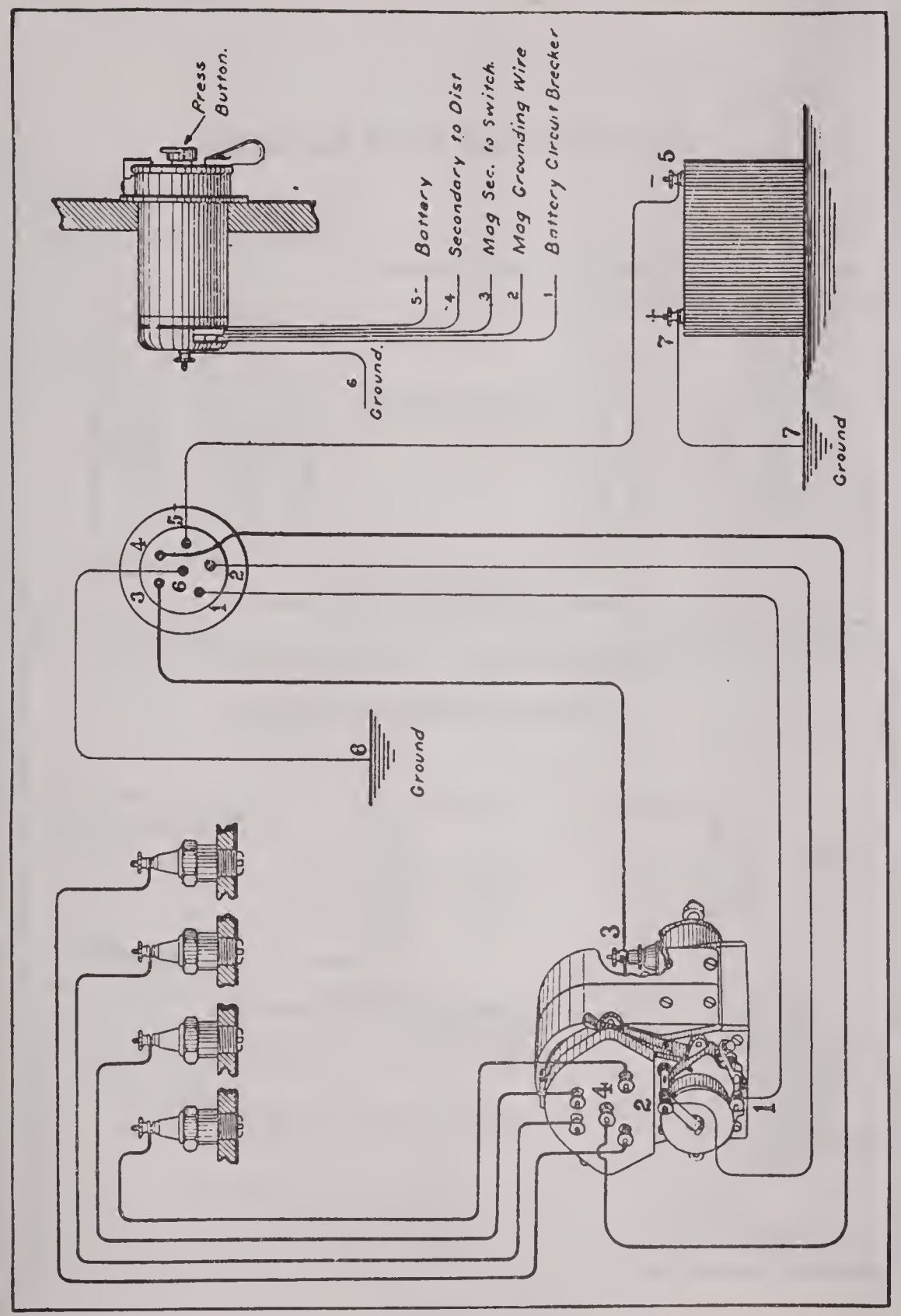


PLATE No. 182

Bosch Magneto

TYPES D, DR, DU

These three types of magnetos provide a dual ignition system. The same set of plugs and the same distributor are used for both battery and magneto ignition, otherwise the two systems are independent.

The ignition switch is mounted on the end of the case containing the battery ignition coil. For the purpose of starting on the spark, a vibrator may be cut into the circuit by pressing the button in the center of the switch. Normally this vibrator is out of the circuit, but pressing the button on the center on the switch brings the platinum contacts together, and a vibrator spark of high frequency results. If a gas mixture is in the cylinder to which distributor is delivering current the engine will start.

The timing of the dual magneto is identical with the independent type. The battery breaker is set to open at approximately 10 degrees later than the magneto.

To time magneto to engine, loosen magneto from driving clutch, turn engine until No. 1 cylinder is on top dead center, then turn magneto armature in the direction it should rotate when operating until the distributor segment is making connection with the wire leading to No. 1 cylinder. Then turn the magneto until the edge of the rotor is the distance given in the following table, from the edge of the pole piece:

FOR FOUR-CYCLE ENGINES		FOR TWO-CYCLE ENGINES	
DR3	11 to 13 mm.	D3	8 to 11 mm.
DR4	14 to 17 mm.	D4	11 to 14 mm.
DR6	18 to 22 mm.	D6	12 to 16 mm.
DR8	16 to 22 mm.	DR3	8 to 11 mm.
D3	11 to 13 mm.	DR4	11 to 14 mm.
D4	14 to 17 mm.	DR6	12 to 16 mm.
D6	18 to 22 mm.	DR8	10 to 14 mm.
DU3 Model 4	11 to 14 mm.	DU3 Model 4	8 to 11 mm.
DU4 Model 4	13 to 15 mm.	DU4 Model 4	10 to 13 mm.
DU6	16 to 20 mm.	DU6	12 to 16 mm.

The magneto must then be connected to engine without changing the position of either. It will be noticed that the above setting is not exact, the range being to cover all motors. If the firing point of an engine is known, the magneto driving shaft may be disconnected, engine turned to point where spark should occur, next turn the magneto armature by hand until contacts just begin to open, with the distributor making connection with proper plug. The magneto must then be connected to engine in this position. Spark should be fully retarded during all of the above operations.

The above directions do not apply to the "Model 5" magnetos. To time this model, place spark lever in the fully retarded position, remove distributor plate and turn engine to point where spark should occur, No. 1 piston on power stroke. (On a four-cycle engine this point is usually when the piston is 3 mm. from top dead center, power stroke and at top dead center on a two-cycle engine.) Then turn magneto, by means of the distributor gear, until the breaker contacts just begin to separate, distributor rotor making connection with wire leading to No. 1 cylinder. Magneto must then be connected to engine in this position.

Magneto breaker contacts should open about 1/64 in. Battery breaker contacts open .06 mm. Clean contacts with gasoline. If contacts are badly burned or pitted they may be resurfaced with a fine, flat jeweler's file or a small strip of worn No. 00 sandpaper. Spark gap should be about .018 in.

Every 1,000 miles or every four weeks put two or three drops of light machine oil in each of the magneto oilers.

Coil is made to operate on a 6 volt battery. A 6 volt, 60 ampere-hour battery is recommended. If for any reason the system must be operated on dry cells, use 10 cells for four-cylinder engine and 12 cells for six-cylinder engines. Connect them in series parallel, putting five or six in series, as the case may be, and connect the two rows in parallel.

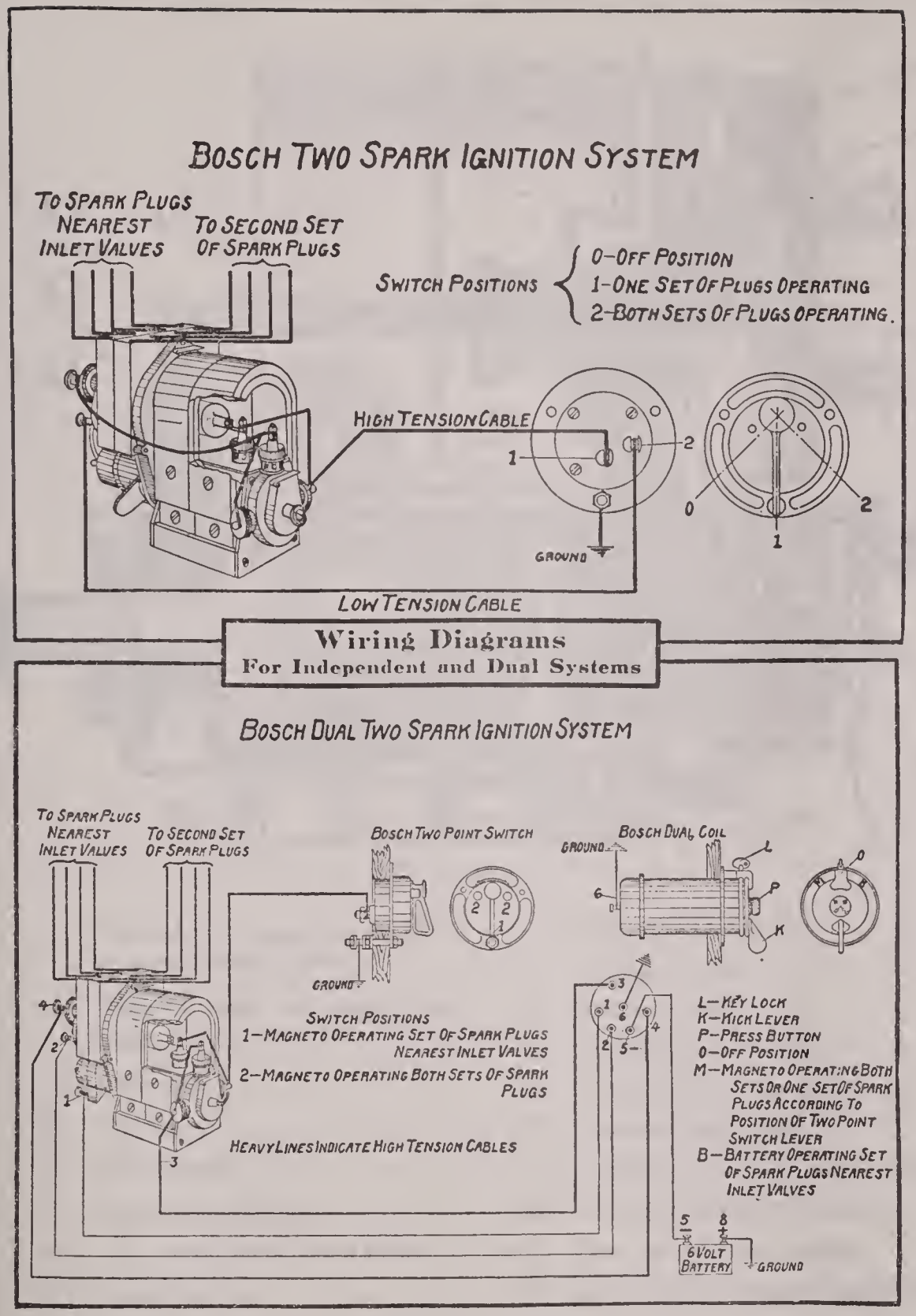


PLATE NO. 183

Bosch Two-Spark Magnetos

TYPES DU4/2 AND DR6

The purpose of a two-spark ignition system is to produce ignition at two points in the combustion chamber, thus cutting down the time interval between ignition and complete combustion, which in turn adds power and efficiency to the engine. Bosch two-spark magnetos are produced in either independent or dual types. In external appearance the two-spark magneto is very similar to the single-spark type, the chief difference being the distributor and the fact that there is an extra safety gap. On the single-spark type of magneto one end of the secondary is grounded, while on the two-spark type both ends are brought out to two segments diametrically opposite on a single slip ring. Two slip ring brushes are provided, which are horizontally located on opposite sides of the magneto end plate. During the portions of the armature rotation when the secondary is delivering current, each of the brushes will be in contact with a slip ring segment. One brush is connected to the inner distributor as in a single-spark magneto, while the other brush is connected to the outer distributor by means of a short cable passing around the magnets. The distributor rotor is of double length and carries two brushes, insulated from each other. The distributor has just double the number of plugs as the engine has cylinders.

To time magneto to engine, place spark control lever in the fully retarded position, disconnect magneto driving medium, turn engine until No. 1 cylinder is at firing point and turn magneto armature until breaker contacts just begin to open, distributor rotor making connection with No. 1 cylinder. Magneto must then be connected to engine without disturbing their relative position.

The use of two-spark ignition does not require the same amount of advance as the single-spark type, due to the much smaller time which elapses between ignition and complete combustion. The effect of retarding the spark results if one set of plugs is cut out of operation. The switch provided for the two-spark magneto has three positions. In the "Off" position the primary is grounded as in the ordinary single-spark magnetos. When switch is in the position marked "1," one set of plugs is cut out, and when switch is in the position marked "2," both sets of plugs are in operation.

On replacing a single-spark magneto with a two-spark magneto, the point on flywheel which is under indicator when break occurs, spark fully advanced, should be marked. The point at which break should occur with a two-spark magneto will be about halfway between this mark and the top dead center mark. A more exact setting may be obtained by experiment. Very little advantage will result from a two-spark system if the spark plugs are situated very near together. The two plugs should be separated at least one-half of the width of the compression chamber, valve pockets included. In T-head motors it is the usual practice to place one plug in the exhause valve cap and one in the intake valve cap.

For ordinary running, operation should be on both sets of plugs. For very slow running, for starting or when engine is idling, only one set of plugs should be used.

Spark gap should be between .015 in. and .030 in. About .018 in. is the average gap required.

Every 1,000 miles or every two weeks put two or three drops of light machine oil in each of the magneto oilers.

Longitudinal Section of DU4 Magneto

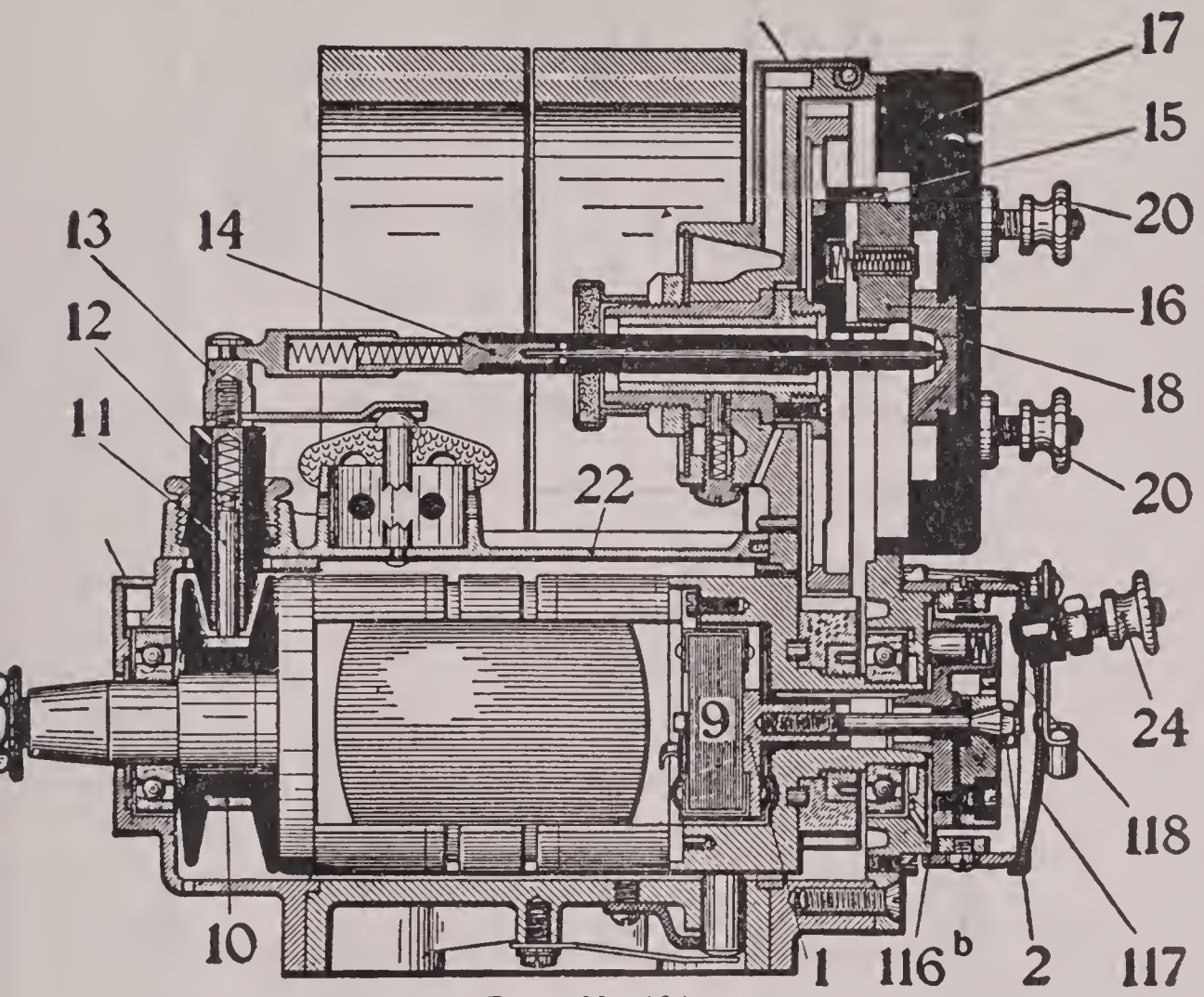


PLATE NO. 184

1. Brass plate for connecting the end of armature primary circuit.
2. Fastening screw for magneto interrupter.
9. Condenser.
10. Slipring.
11. Slipring brush.
12. Slipring brush holder.
13. Cap nut for slipring brush holder.
14. Connecting bar.
15. Distributor brush holder.
16. Distributor brush.
17. Distributor plate.
18. Central distributor contact.
20. Terminal nut for distributor plate.
22. Dust cover over armature.
24. Terminal nut for grounding terminal.
116b. Interrupter housing and timing arm.
117. Cover for interrupter housing.
118. Contact spring for grounding terminal.

Bosch Magneto

TYPES DU1, DU2, DU3, DU4, DU6

These models supply independent single spark, high tension ignition.

The electrical connections as shown in Figure 2 are of about the same as used in all standard magnetos. The secondary is a continuation of the primary. The primary is short circuited when contacts are closed. This allows a current to flow in this winding which produces a magnetic field about both the primary and secondary winding. When the contacts open, the circuit allowing current to flow through the primary circuit is broken. This allows the magnetism to collapse across the winding of the armature, producing a high pressure which tends to force a current in the same direction as the pressure produced by moving the winding of the armature across the magnetic field of the magnets. This high pressure causes a current to flow through the windings to the slip ring, the brush and distributor, to the plug where it jumps the spark gap, igniting the gas, and then returns to the magneto through the metal parts of the car.

The end of the secondary is connected to the slip ring or collector ring, mounted on the armature just inside the plate on the driving end of the magneto. This applies to all of the DU models except the DU1 two-spark magneto. The description given on Plate No. 182 applies to this magneto, the only exception is that there is no distributor on the DU1, as it is a one-cylinder magneto the current is lead direct to the plugs.

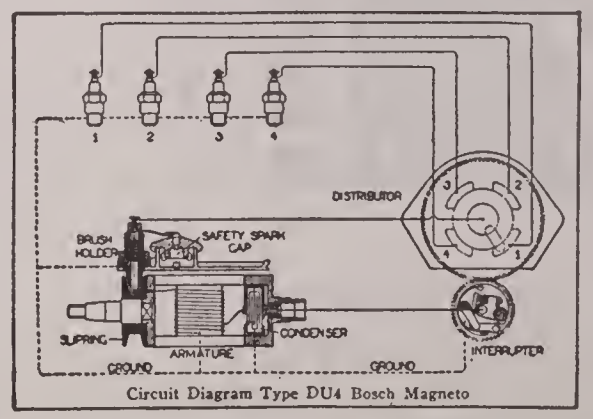
To time the magneto, turn the engine until the dead center mark on the flywheel is at the point at which break should occur, spark fully retarded. Then turn the armature shaft until the contacts just begin to open, the distributor rotor making connection with the plug leading to the proper cylinder. Magneto must now be connected to the driving medium in this position.

The ignition is cut out by grounding the primary circuit. There is a grounding terminal on the breaker box. A wire is run from this terminal to a switch on the dash and thence to the frame of the car. Should the ignition suddenly fail entirely, this circuit is the first which should be inspected.

Clean breaker contacts with gasoline whenever necessary. If contacts are badly burned or pitted they may be resurfaced with a fine, flat, jeweler's file or a small strip of worn No. 00 sandpaper, after which it should be carefully blown out to remove all filings or dirt.

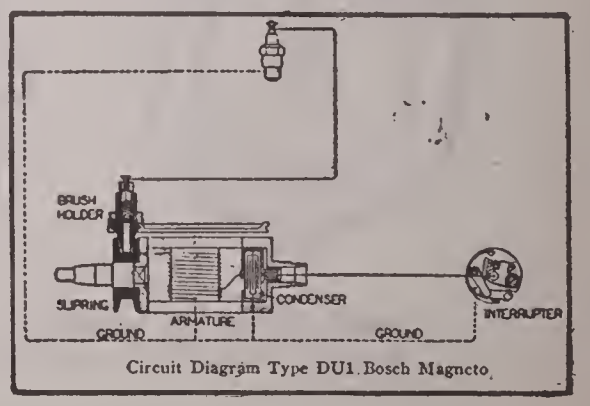
Every two weeks or every 500 miles put two or three drops of light machine oil in each of the magneto oilers. Contacts should open 0.4 mm. (1/64 in.). The interrupter may be removed by taking off the interrupter housing and withdrawing the hexagon-headed fastening screw. Should the interrupter stick in its seat after the screw is removed, it may be pried loose with two small screw drivers inserted back of the interrupter disk, one at each side. Do not pry hard enough to damage the unit.

Spark gap should be .018 in. to .020 in.



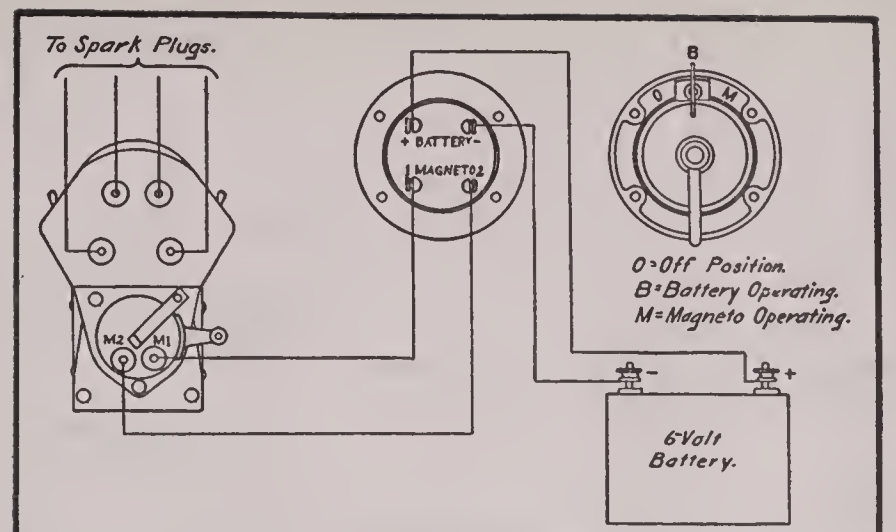
Circuit Diagram Type DU4 Bosch Magneto

Fig. 2

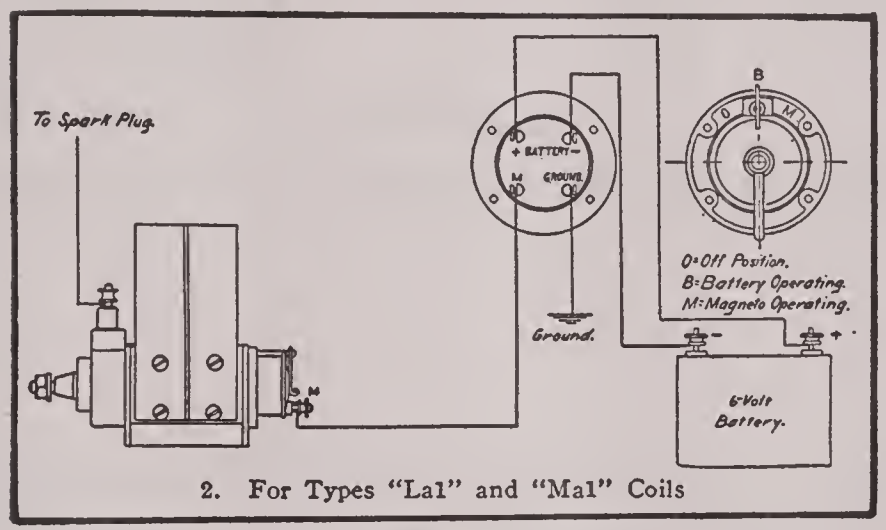


Circuit Diagram Type DU1 Bosch Magneto

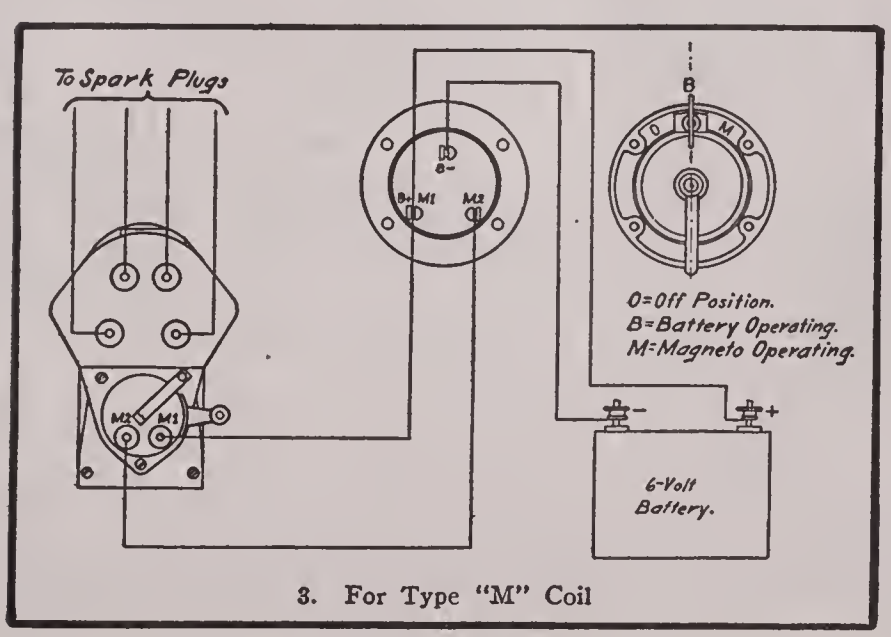
Fig. 3



1. For Types "La2" and "Ma" Coils



2. For Types "La1" and "Ma1" Coils



3. For Type "M" Coil

PLATE No. 185

Bosch Duplex Ignition

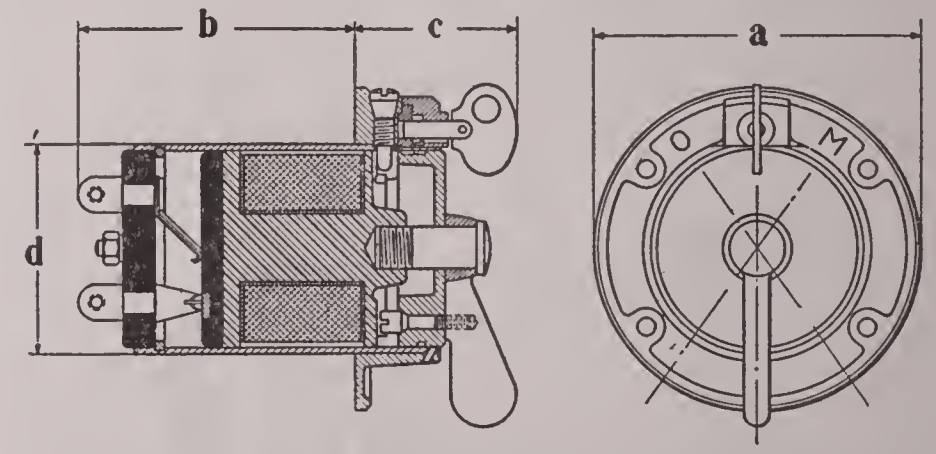
This system is intended to produce easy starting. The battery side is not intended to be used as a separate ignition system as is the case in dual systems, but to aid the magneto in producing a hot spark at low speeds. When switch is on the battery side, the magneto primary and the coil primary are both in the battery circuit. In order for the battery to aid the magneto, it must be tending to force current in the same direction as the magneto. If it is not, one pressure will buck out the other, with the result that no spark will be produced. As the magneto produces an alternating current, reversing its polarity twice during each revolution of the armature, a commutator is provided so as to deliver direct current from the magneto. This commutator consists of two metal segments on the breaker box cover. The interrupter is provided with two brushes which sweep the two metal segments, this giving the same effect as is produced in a D. C. generator, the only difference being that in the duplex magneto the commutator is stationary and the brushes move, while in the generator the commutator is moved and the brushes are stationary. As soon as the engine starts, there is no more need for the battery, as the magneto will produce sufficient spark at the lowest speed the engine will run. To avoid discharging the battery, the switch should be turned to the magneto side when engine is running. In this position, the magneto operates as an independent system.

Except for the commutator described above, the magneto is the same as the corresponding type of independent magneto, and the instructions given for them also apply when equipped for duplex ignition. The removal of either, or both, the battery or coil, will not affect the operation of the magneto as an independent system.

The coil is wound to operate on 6 volts. A 6-volt, 60-ampere-hour storage battery is recommended. If dry cells must be used, 10 cells should be used for the four-cylinder engine, and 12 cells for six-cylinder engines. The cells must be connected in series, multiple, five or six cells, as the case may be, in each row and the two rows connected in parallel.

The battery circuit must not be grounded. If the pasteboard cover over the battery becomes wet, it will act as a conductor. If this condition exists in two adjacent cells, a short circuit will result, or if the battery should come in contact with the metal parts of the car it will cause ignition to fail and batteries to run down. A ground in the battery circuit will cause both magneto and battery ignition to fail.

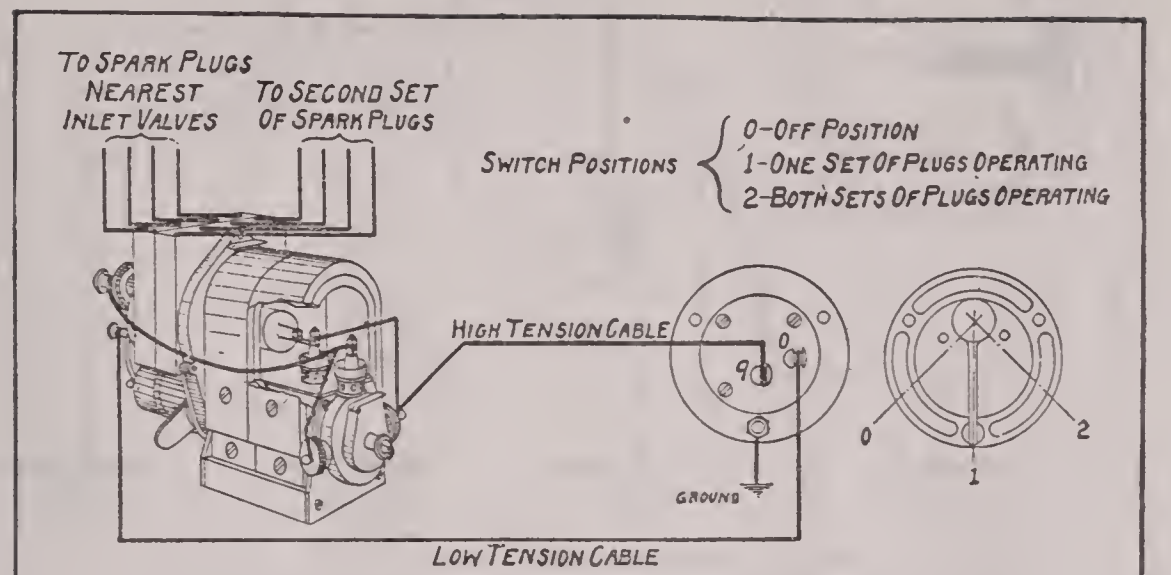
Coil may be drawn from its case by removing the screw in the flange at the position marked "B."



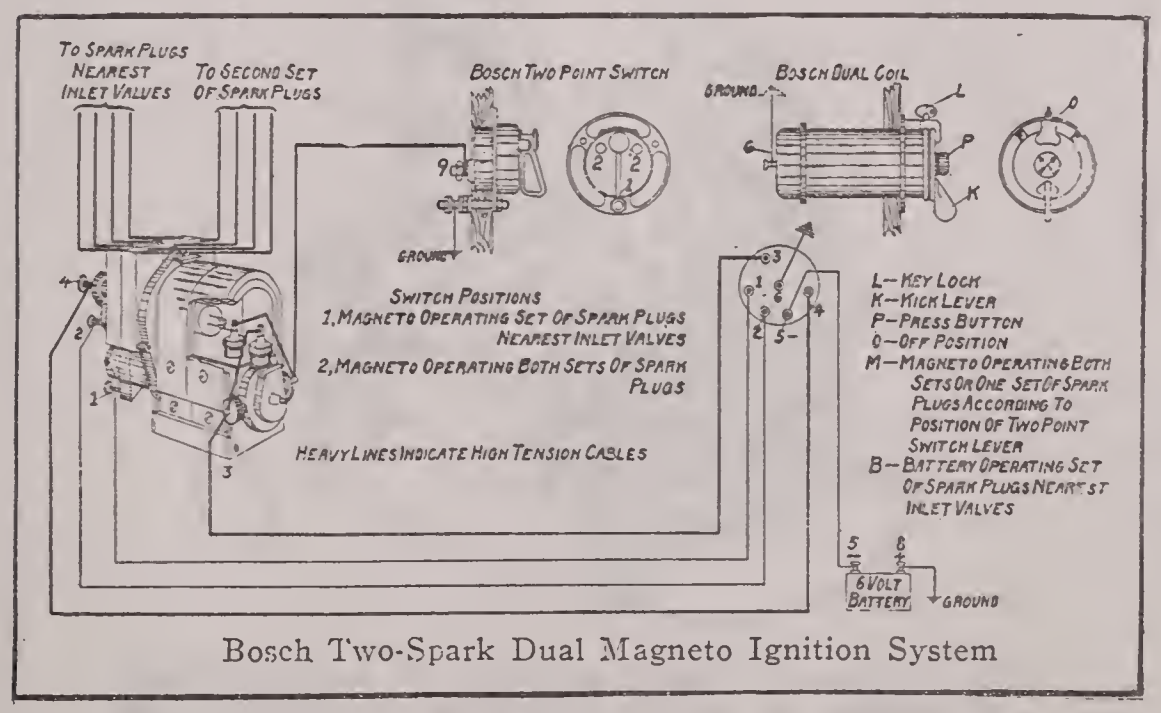
a	b	c	d
90	73	45	58.5

Dimensions are in millimeters. Calculate 25.4 mm to the inch.

Dimensions of Bosch Duplex Coils



Bosch Two-Spark Independent Magneto Ignition System



Bosch Two-Spark Dual Magneto Ignition System

PLATE No. 186

Bosch Magneto

TYPES ZR ED. 16

The Bosch Type ZR Ed. 16 magneto is made for single or two-spark ignition. The two-spark type is made for both independent and dual ignition. The single-spark type is sometimes installed with a separate battery system, two sets of plugs being used. Duplex battery ignition may also be installed with this system, no change being needed in the magneto.

The internal circuits of this magneto are very simple, being shown in the accompanying diagrams. The operating principle is fully described on Plates No. 182, 183 and 184.

The ignition is cut out by short circuiting or grounding the primary. There is a terminal provided for this purpose, located on the breaker cap. If ignition suddenly fails entirely, the first place to look for trouble is in this circuit.

Magneto breaker contacts should open 1/64 in. They should be cleaned with gasoline whenever necessary. If contacts are badly burned or pitted, they may be resurfaced with a fine, flat, jeweler's file or a small strip of worn No. 00 sandpaper.

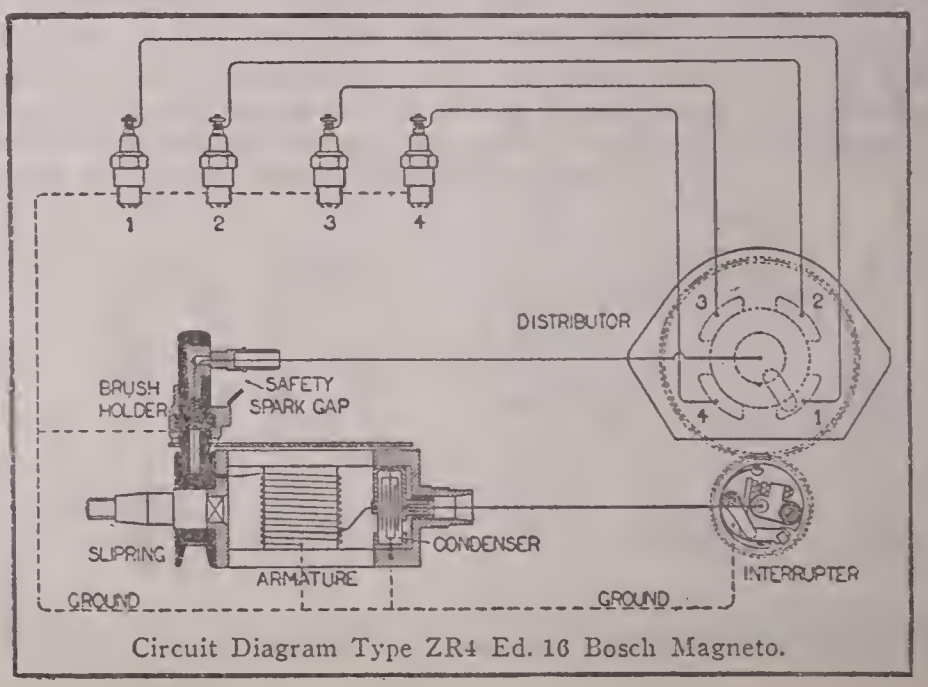
The interrupter may be removed by removing the breaker cap and taking out the hexagon-headed retaining screw.

Spark gap should never be more than .030 in. or less than .014 in. The gap giving the best service on most engines is .018 in. to .020 in.

To time the magneto, disconnect magneto driving medium and turn engine by hand until No. 1 cylinder is on firing point, spark fully advanced. Then turn magneto armature shaft by hand until the contacts just begin to open, distributor rotor making connection with wire leading to No. 1 cylinder. Magneto must now be connected to driving medium without disturbing its relative angular position to the engine. When timing a two-spark magneto it must be remembered that it will require only 1/2 to 2/3 the advance required by a single-spark system, so magneto must be set correspondingly.

Every 500 miles or every two weeks, two or three drops of light machine oil should be put in each of the magneto oilers.

If engine does not fire regularly and the plugs or wiring are not at fault and engine is in good mechanical condition otherwise, the breaker should be inspected. See that it is free from dirt and grease, that contacts are all right, that the hexagon retaining screw is tight and that the interruptor moves freely on its pivot. If the lever does not move freely, due to the tightness of bushings, as is sometimes the case in a new magneto, the hole may be carefully reamed out a trifle. Be careful not to enlarge it too much, as it will get loose with wear. Do not put any oil on this bearing. It is intended to operate without any lubrication.



Circuit Diagram Type ZR4 Ed. 16 Bosch Magneto.

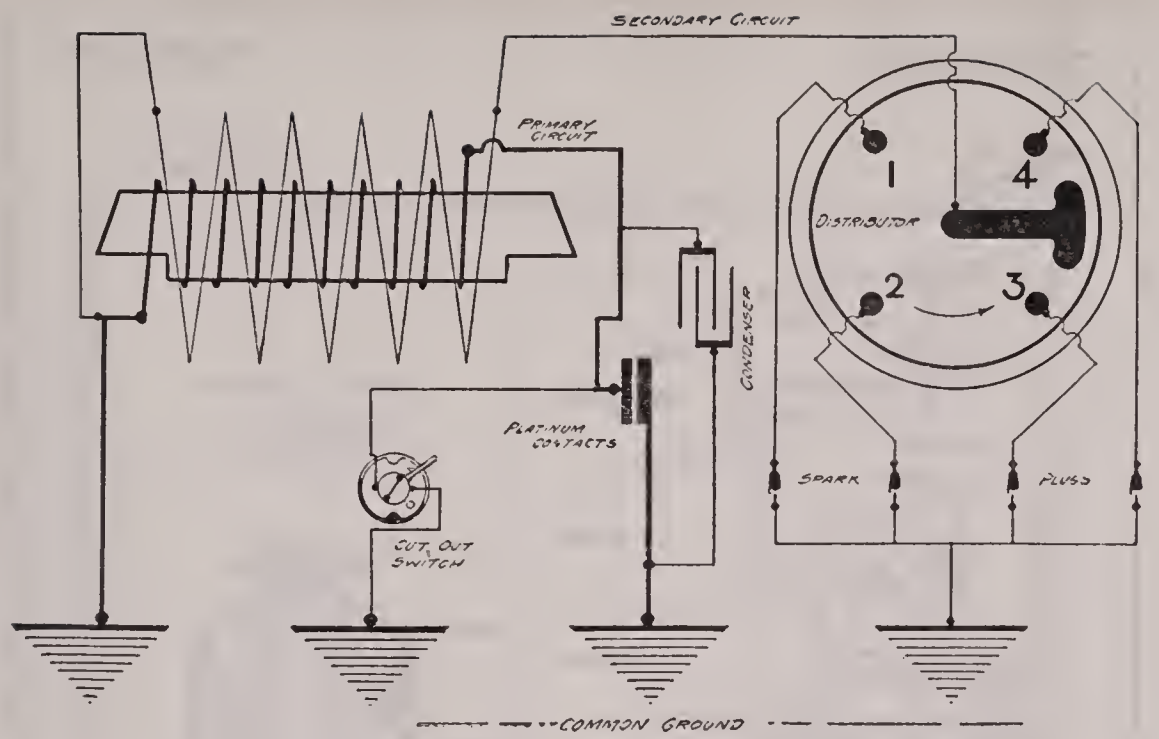


Fig. 1—Internal Wiring Diagram.

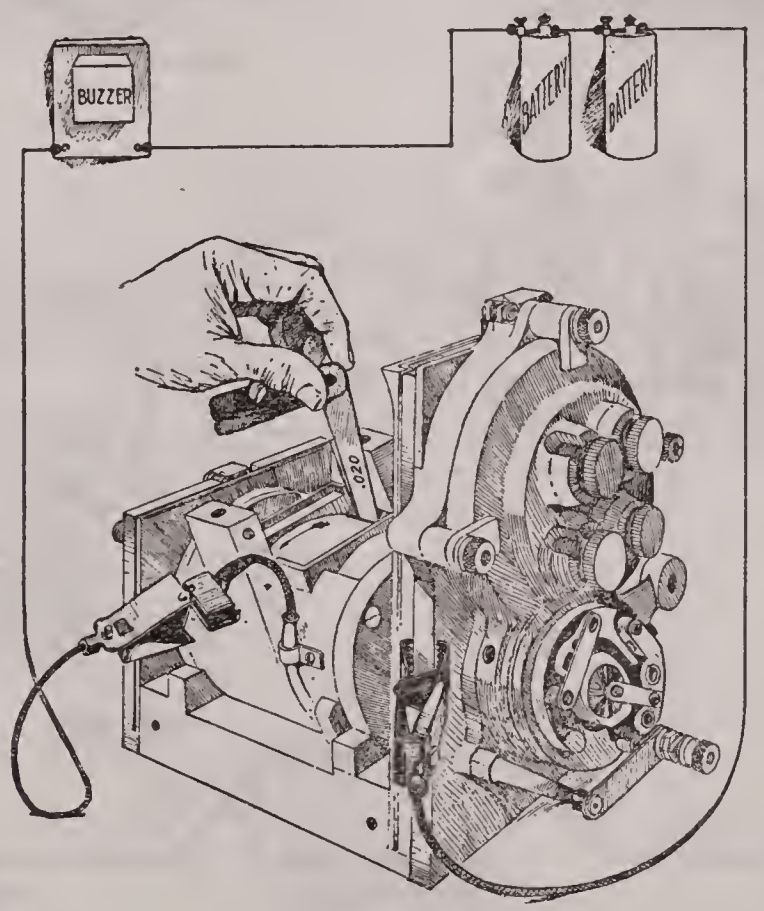


Fig. 2—Method of connecting buzzer to magneto primary circuit, for accurately setting the relation of contact opening, to rotor position.

PLATE No. 189

Dixie Magneto

This is a form of the inductor type magneto. The coil is wound around a stationary core. The field has two movable pole pieces which rotate past the ends of this core, thus reversing the direction of magnetism and producing a high tension current by the same elementary process as in the ordinary shuttle wound armatures.

Breaker contacts should open .018 in. to .020 in. Clean contacts with gasoline whenever necessary. If contacts are badly burned or pitted, resurface them with a fine, flat, jeweler's file or a piece of worn No. 00 sandpaper. To remove breaker, first take off breaker cover, remove screw fastening primary cable to magneto, take out the four screws holding breaker to magneto, then remove breaker. Spark gap should be .020 in. to .025 in. Breaker contacts should open when the rotating pole piece is .015 in. to .035 in. past the tip of the stationary pole piece, measured in the direction of rotation of the armature. This setting may be determined with a buzzer connected as shown in Figure 2. The entire coil structure is moved with the breaker mechanism each time the spark is retarded, thus the above position is maintained at all degrees of advance or retard, producing a spark of equal intensity at all positions.

The bearings of magneto are provided with oil cups. These cups should each be filled twice before the magneto is run the first time, and similarly oiled thereafter as follows: On pleasure cars, every 1,000 miles; on trucks, every 500 miles; on aeroplanes, every 25 hours of operation; on tractors, motors boats, and stationary engines, every 20 hours of actual operation. The oil cup on top of the distributor should be filled twice and two drops of oil put in the oil cup at the driving end. Use good light machine oil.

For use on large aeroplane engines, where starting with ordinary ignition system would be difficult, a special starting magneto, known as the Dixie 11-S, is provided. The external wiring diagram of this system is shown in Figure 3 and the internal diagram in Figure 4. The starting magneto is arranged to be turned by hand, or by a gear engagement, to run several times as fast as the service magnetos. It has no high tension winding, but has a primary winding and breaker similar to the ordinary Dixie magneto. When the contacts of the service magneto are closed, the starting magneto has no effect, but when the service magneto contacts open, the starting magneto winding is in series with the primary of the service magneto, thus a vibrating spark is produced in the spark gap.

A simple dual starting system is described on Plate No. 51.

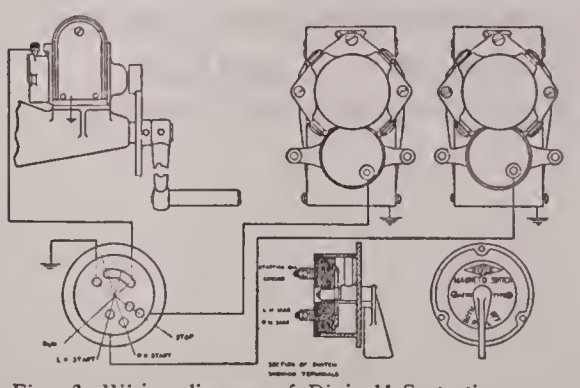


Fig. 3—Wiring diagram of Dixie 11-S starting magneto, with control switch and two service magnetos.

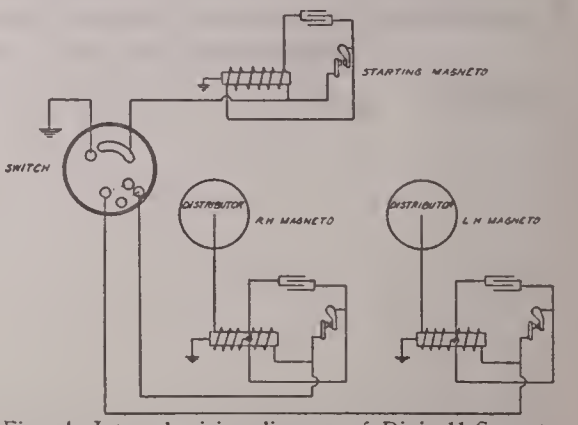
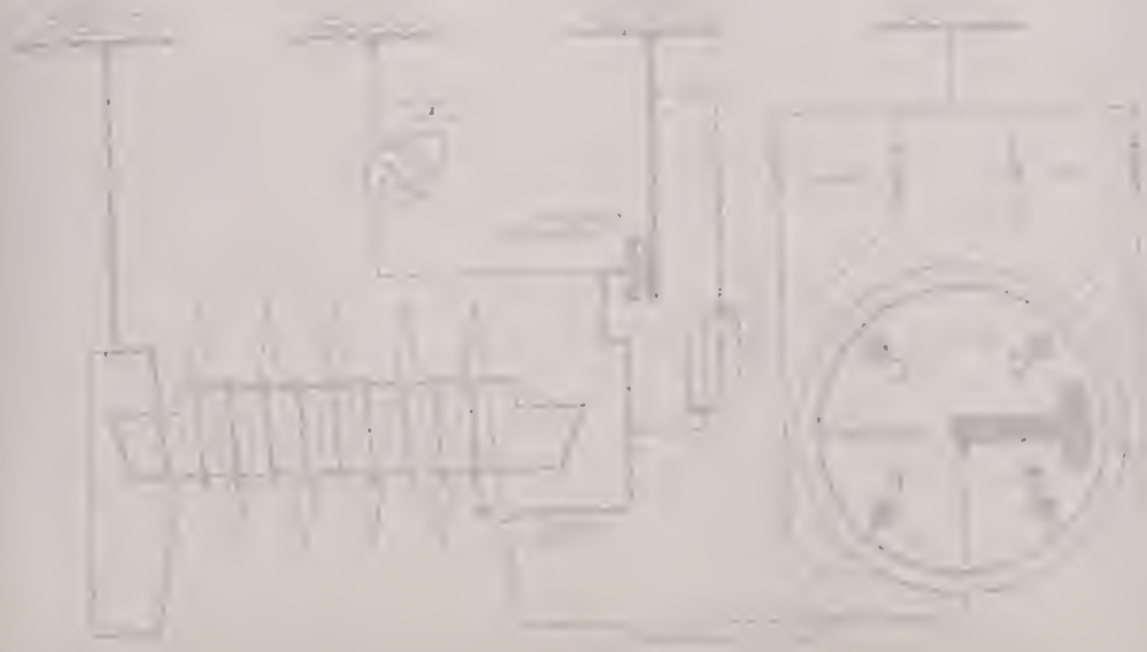


Fig. 4—Internal wiring diagram of Dixie 11-S starting magneto, control switch and two service magnetos.



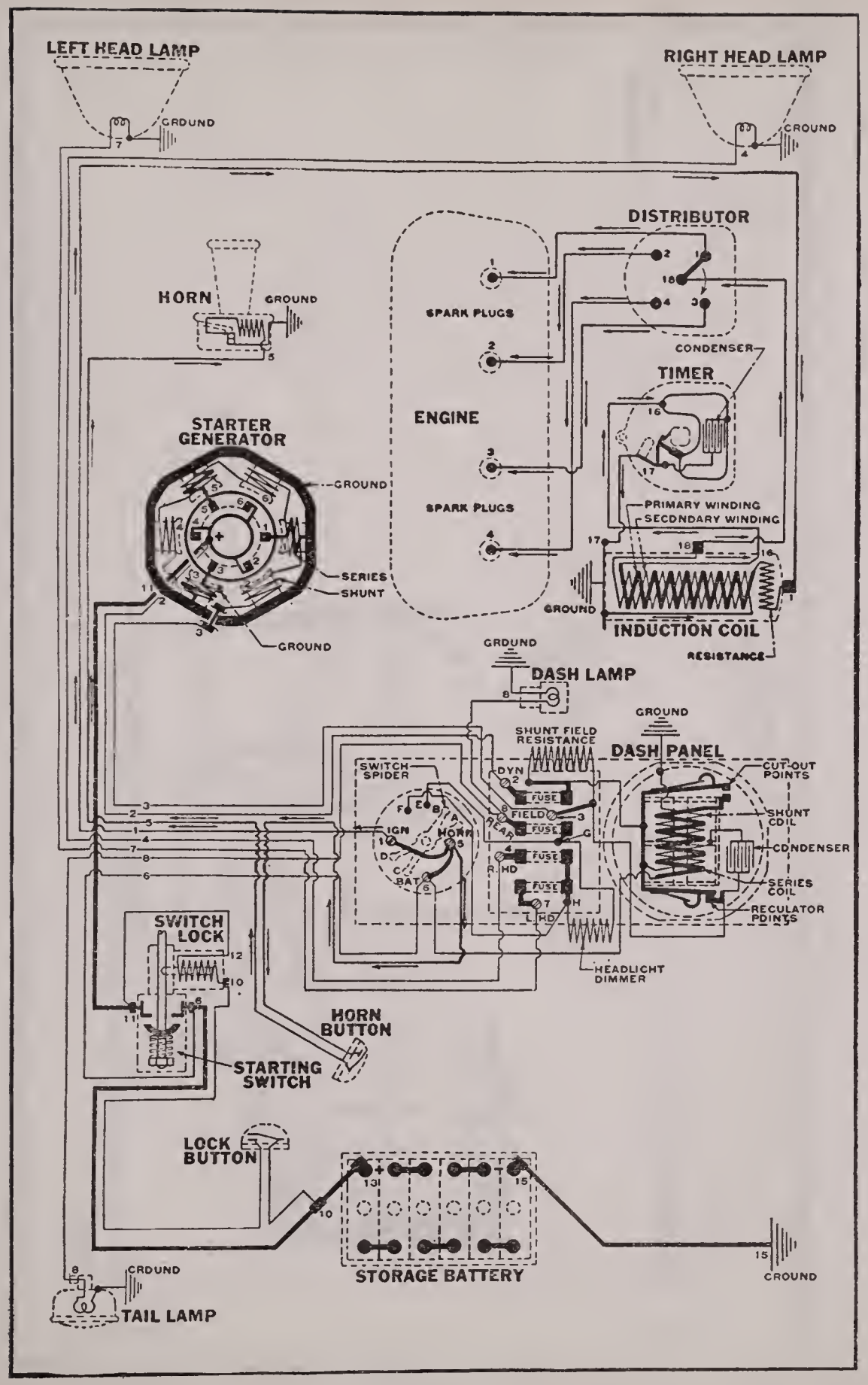


PLATE No. 190

Maxwell

1918

SIMMS-HUFF 12-VOLT, SINGLE UNIT STARTING AND LIGHTING SYSTEM.
ATWATER-KENT IGNITION

Battery is 12 volt, 35 ampere-hour.

Breaker contacts should open .012 in. Break should occur when the upper dead center mark on flywheel is 1¼ in. past indicator, spark fully retarded. Firing order is 1, 3, 4, 2. Spark gap should be .020 in. to .023 in.

Starting motor should develop 24 ft. lbs. lock torque.

Voltage regulation is by a reverse series field and vibrating regulator, located on the dash panel. Relay closes when generator voltage reaches 14 volts. Charging rate should be 12 amperes when generator is running at 1200 R. P. M. Maximum charging rate should be about 15 amperes. On generators below No. 27,700 the resistance of the shunt field should be 6.5 ohms. On machines above 27,700 the shunt field resistance should be 4.8 ohms, providing there are no grounds or short circuits in the windings.

To test for a ground in the brush holder, raise all brushes and test between the main terminal and frame. To determine if there is a short in the armature, connect shunt field and run generator idle as a motor. If there are no grounds it will take 7 amperes at 6 volts. To test generator, remove all wires, connect a wire from the field terminal on side to main terminal post on front. Then connect another wire from the main terminal through an ammeter or lamp, to ground. Ammeter should show 12 amperes charge when generator is running at 1200 R. P. M.

If charging rate is too low, see that belt is tight, commutator and brushes are clean, brushes are not sticking in their holders and that regulator contacts are clean and properly adjusted. Clean contacts by drawing a piece of soft paper between them.

Head lights are 12-16 volt, 24 cp. Tail light is 12-16 volt, 2 cp. Dash light is 12-16 volt, 2 cp. Fuses are 20 ampere.

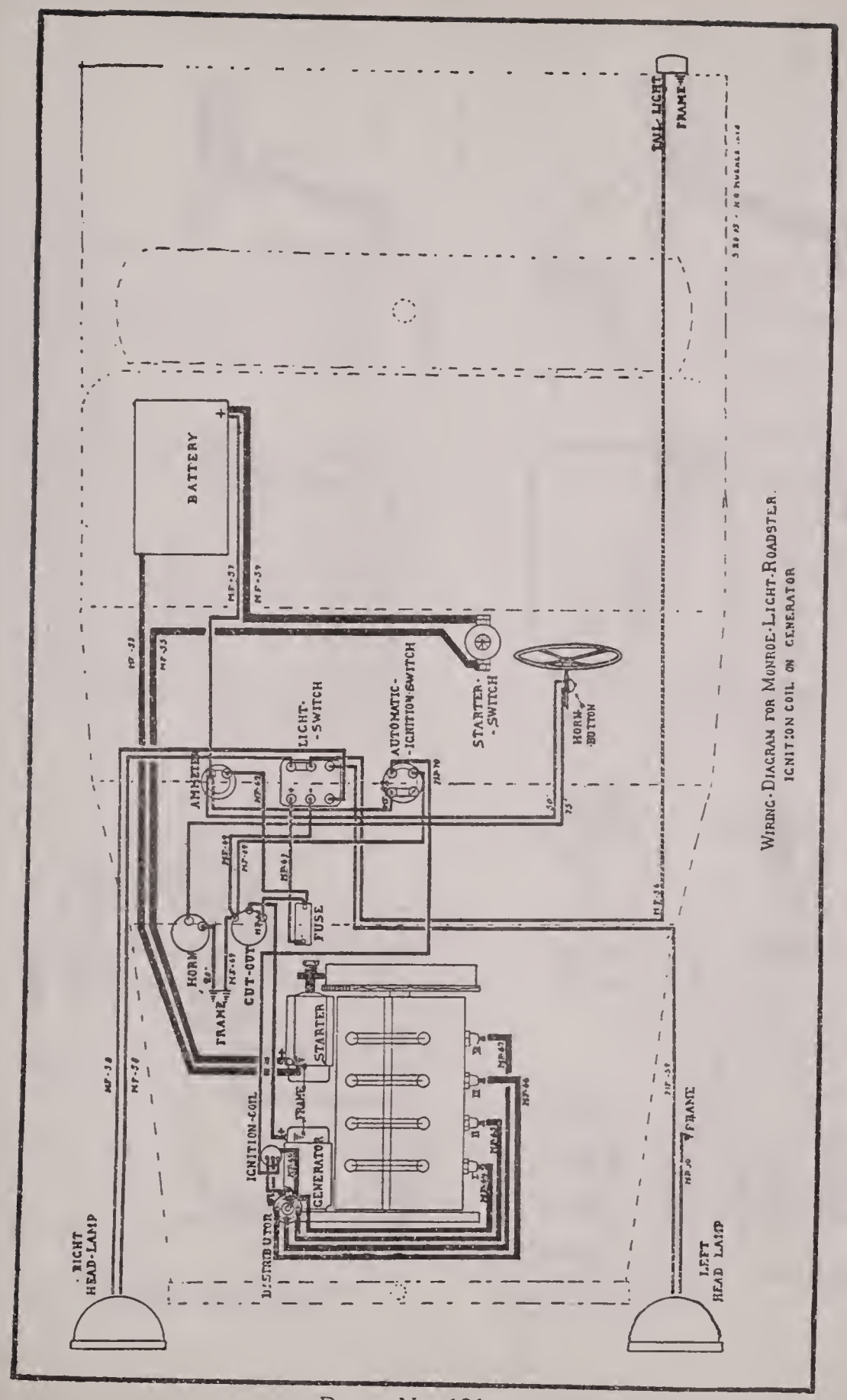


PLATE NO. 191

Monroe

MODEL N-2 (1916)

AUTO-LITE TWO-UNIT, STARTING AND LIGHTING SYSTEM
CONNECTICUT IGNITION

Battery is 6 volt, 80 ampere-hour. The positive terminal is grounded through the motor and the generator frames.

Breaker contacts should open .018 in. to .020 in. Break should occur when the upper dead center mark is at indicator, spark fully retarded. Firing order is 1, 2, 4, 3.

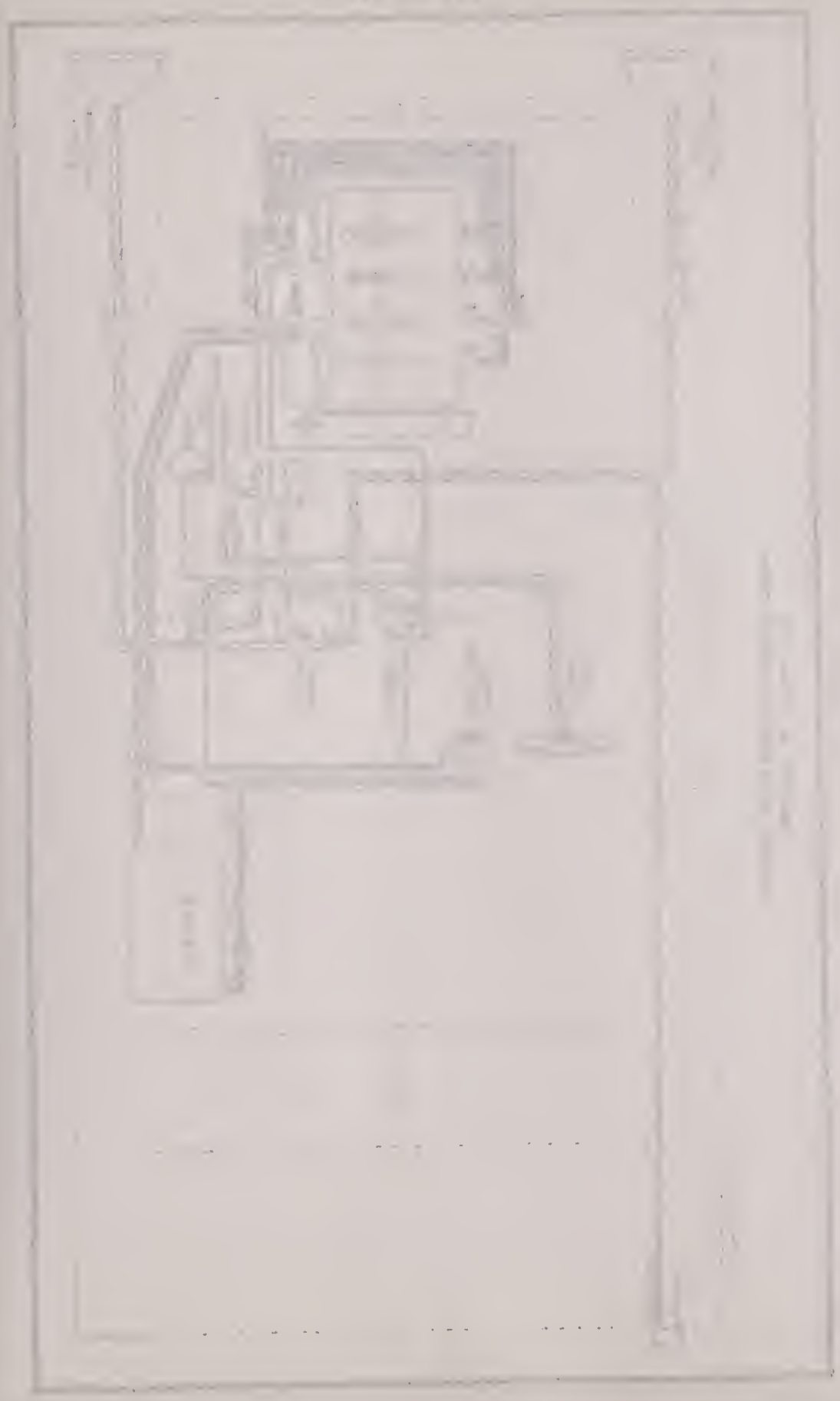
Motor is connected to flywheel by Bendix gear. Put three or four drops of light machine oil in each of the motor oilers every 1,000 miles. Motor allows 130 to 150 amperes to flow while cranking the engine.

Voltage regulation is by bucking field. Relay should close at 7 miles per hour. Maximum charging rate of 10 amperes is reached at 25 miles per hour. Use medium cup grease in the grease cup at front end of generator. Tighten this grease cup one turn every three or four days. Every 1,000 miles remove the band at commutator end and clean commutator and brushes. At the same time, put three or four drops of light machine oil in the bearing.

There is a 20-ampere fuse under the cowl, on the dash board. This fuse is in the main line supplying the lighting circuit with current.

Ammeter indicates rate battery is charging or discharging.

The ignition switch is arranged to cut off the ignition about one minute after the engine is stopped, providing the ignition is not turned off by the operator. Head lamps are 6-8 volt, 16 cp. Tail lamp is 6-8 volt, 2 cp.



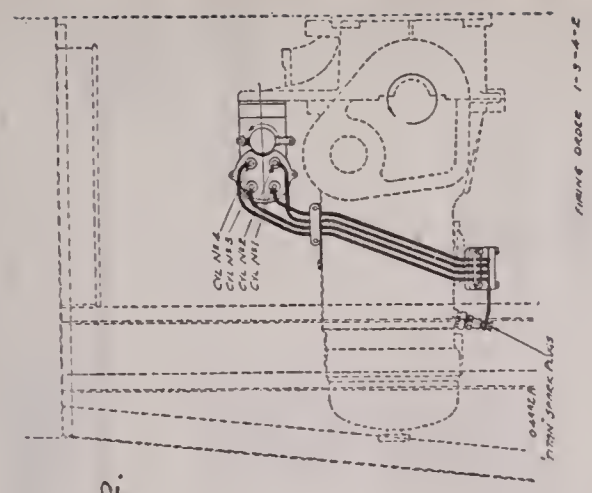


Fig. 2.

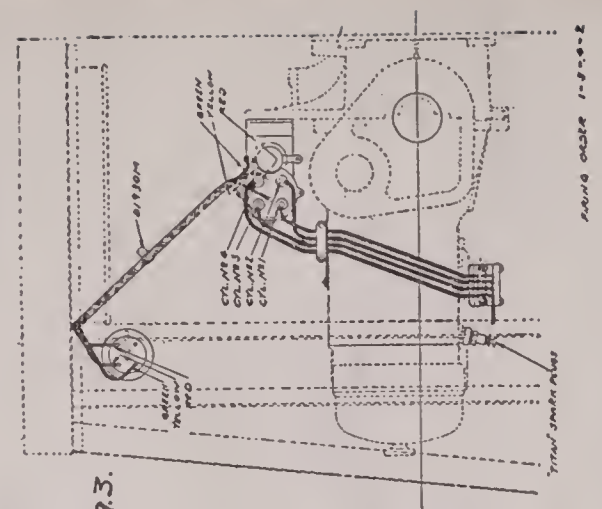


Fig. 3.

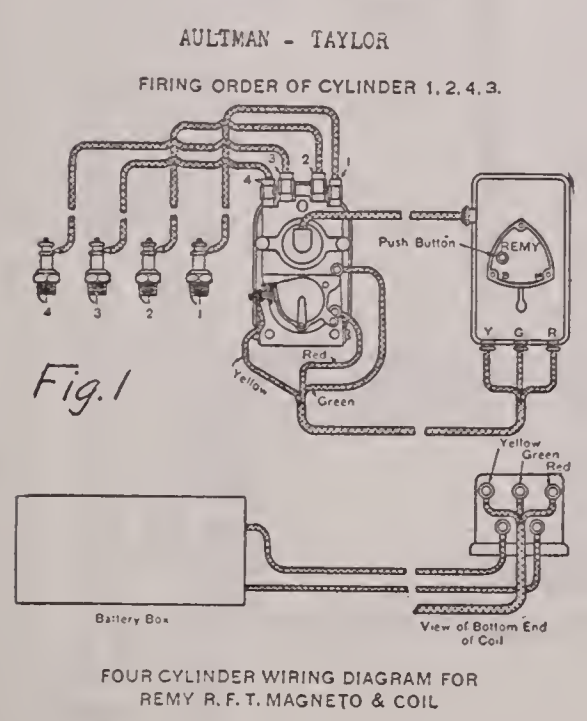


Fig. 1

FOUR CYLINDER WIRING DIAGRAM FOR REMY R. F. T. MAGNETO & COIL

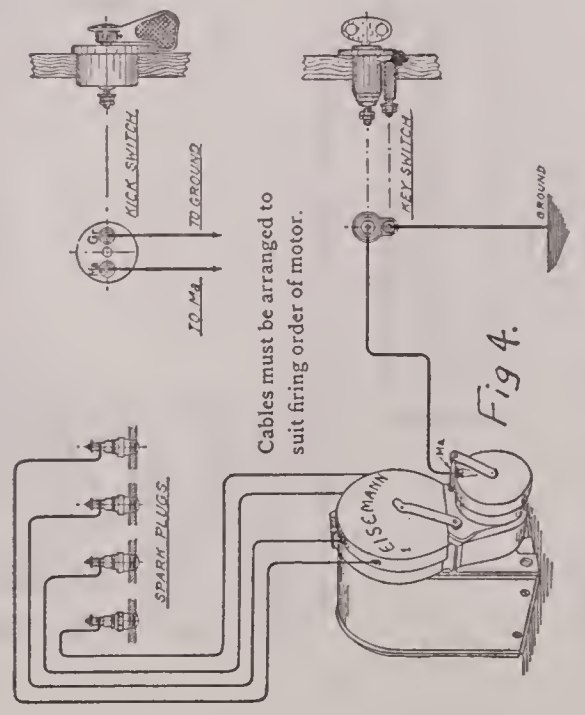


Fig 4.

Parrett Tractor Case Tractor Aultman-Taylor Tractor

Dixie or Eisemann Magneto Ignition

The Parrett tractor is not equipped with a starting and lighting system as standard equipment. Ignition is by Model 40 or 46 Dixie Magneto or Eisemann Type G-4-II Edit. magneto. A complete description of each of these magnetos is given on a separate sheet. Fig. 4 is the wiring diagram.

Magneto should be set so that break will occur when the mark DC 1 and 4 on the flywheel is ¾ in. past the indicator, spark fully retarded. This setting will give a spark when the crank shaft is five degrees past dead center, spark retarded, or when crank shaft is 25 degrees before dead center, spark fully advanced. Spark gap should be .028 in. to .032 in. Firing order is 1, 2, 4, 3.

The Aultman-Taylor tractor uses Remy R. F. T. magneto. Spark should occur when the mark 1 and 4 DC on the flywheel is at indicator and the "1111" lines on the cam shaft sprocket are at extreme top position.

Firing order is 1, 2, 4, 3. Spark gap should be .028 in. to .030 in.

The Case tractor uses Kingston magneto equipped with an impulse starter. Break should occur when piston on power stroke is just over top dead center, spark fully retarded. Firing order is 1, 3, 4, 2. Spark gap should be from .030 in. to .035 in. Breaker contacts should open .018 in. Clean them with gasoline whenever necessary. If contacts are badly burned or pitted they may be resurfaced with a fine, flat, jeweler's file or a small strip of worn No. 00 sand paper. Every two weeks or every 500 miles put three drops of light machine oil in each of the magneto oilers.

Once every month put a very small amount of vaseline on the fiber bumper. This should be applied with a toothpick or a similar instrument. Distributor segment does not touch the terminal points. It is advisable to put a few drops of oil on the impulse coupling occasionally to prevent rust. The dogs should work freely enough on their pivots so that they fall to their outer position by their own weight.

The magneto is provided with a short circuiting device, which acts as a grounding switch. This device consists of two strips of brass. One is fastened to the outside of the breaker box and the other to the magneto proper. When the control lever is in the fully retarded position the two pieces make contact and short circuit the primary winding. On some of the 9-18 tractors a grounding switch is provided instead of the above described device.

The diagram in Figure 3 applies to the engine not equipped with the switch and Figure 4 applies to the ones equipped with a switch.

PLATE No. 192

Mercer
Series 22-72

U. S. L., 12-Volt, Single-Unit, Starting and Lighting System.
Bosch Ignition

Battery is 12 volt, 100 ampere-hour.

The Type DU4 magneto is used. Instructions for the care of this magneto are given on Plate No. 184. The magneto should be set so that with the piston entering power stroke, the highest point on the breaker cam will be resting on the fiber bumper of the contact arm, spark lever in the fully retarded position. Firing order is 1, 3, 4, 2. Breaker contacts should open .014 in. to .016 in. Clean with gasoline whenever necessary. If badly burned or pitted, contacts may be resurfaced with a fine, flat, jeweler's file or with a small strip of worn No. 00 sandpaper.

The motor-generator is located at the rear end of the engine, the armature being fastened direct to the crank shaft, taking the place of the flywheel. An electro magnetic starting switch is provided. When the button marked "Start", on the dash, is pressed in, the circuit through a solenoid is closed. The solenoid draws in an iron core which closes a sliding starting switch, thus completing the main motor circuit. The core of the solenoid is forced out by a spring when the "Start" button is released. All of the brushes except the three lower ones are used for the starter. The three lower ones are used when operating as a generator. The touring button must be pulled out to start. The spring tension on the starting brushes should be 1¼ pounds. This pressure can easily be measured with a spring scale. When sanding in brushes, always draw the sandpaper in the direction opposite to that in which the commutator rotates when operating. Should starter fail, see that the touring button is pulled out, that all connections are in good order, that battery is fully charged, that commutator and brushes are clean and that spring is exerting proper tension on brushes. If all of these are found to be O. K., connect terminals C+ and B+ on back of switch block with a piece of wire. If starter then operates the "Start" button is at fault. If it does not, remove cover of solenoid and see if it is operating. If the core is pulled in, but motor does not start, examine the contacts.

Only the three lower brushes are used when the unit is operating as a generator. The spring tension on each of them should be 1¾ pounds. There are two fuses on the relay base. The large, 30-ampere fuse is in the main line leading from the generator to the battery and lights. The small fuse is in the shunt field. It is of 5 ampere capacity. To remove generator fuse block, first unlock the knob, then press inward and turn one-quarter turn to the left or right. There are three extra fuses in the light fuse block. The two large fuses on the right side of this fuse block are 30 amperes each. The back one is in the ground return wire of the horn and light circuits. The small 10-ampere fuse, above these two, and the 30-ampere fuse, nearest the front, are for spare use. On the left side of the block, the top 10 ampere fuse is in the horn circuit, the next, 5 ampere fuse, is for spare use. The next, 10 ampere fuse, is in the head light circuit. The lower 10 ampere fuse is in the dash, tail and dimmer light circuit.

The generator is disconnected from the battery and the shunt field circuit is opened when the "Touring" button is pressed in. This is to provide a means of cutting out the battery when it is fully charged.

Ammeter registers the rate of charge or discharge. Relay should close at about 10 miles per hour. The maximum charging rate should never exceed 18-20 amperes at highest engine speed.

Head lights are 12 volt, 24 cp. Dimmer lights are 12 volt, 4 cp. Dash light is 12 volt, 4 cp. Tail light is 12 volt, 4 cp.

Plate No. 193

Oldsmobile

Model 45-A (1918)

Delco Two-Unit, Starting and Lighting System. Delco Ignition

Battery is 6 volt, 80 ampere-hour. The negative terminal is grounded.

Distributor is mounted on rear of generator. Contacts should open .020 in. They are made of tungsten metal. See Plate No. 20 for care of these contacts. Breaker should be set so that when the spark control lever is two inches from the top of the sector, and piston is on top dead center, the contacts will just open when the breaker is rocked forward as far as the slack in the gears will permit, and close when the breaker is rocked back. The firing order is 1, 8, 3, 6, 4, 5, 2, 7. Spark control is by combined automatic and manual controllers. Every 1,000 miles fill the oil cup on side of the distributor. Once a month, wipe the distributor cap out with a soft cloth and if the track of the rotor is not yet polished from wear, put a very small amount of vaseline on it. Spark gap should be about .030 in. Condenser is in the breaker housing. There is a resistance unit on top of the coil.

Motor is connected to engine by a Bendix gear. Put several drops of light machine oil in each of the motor oilers every 5,000 miles.

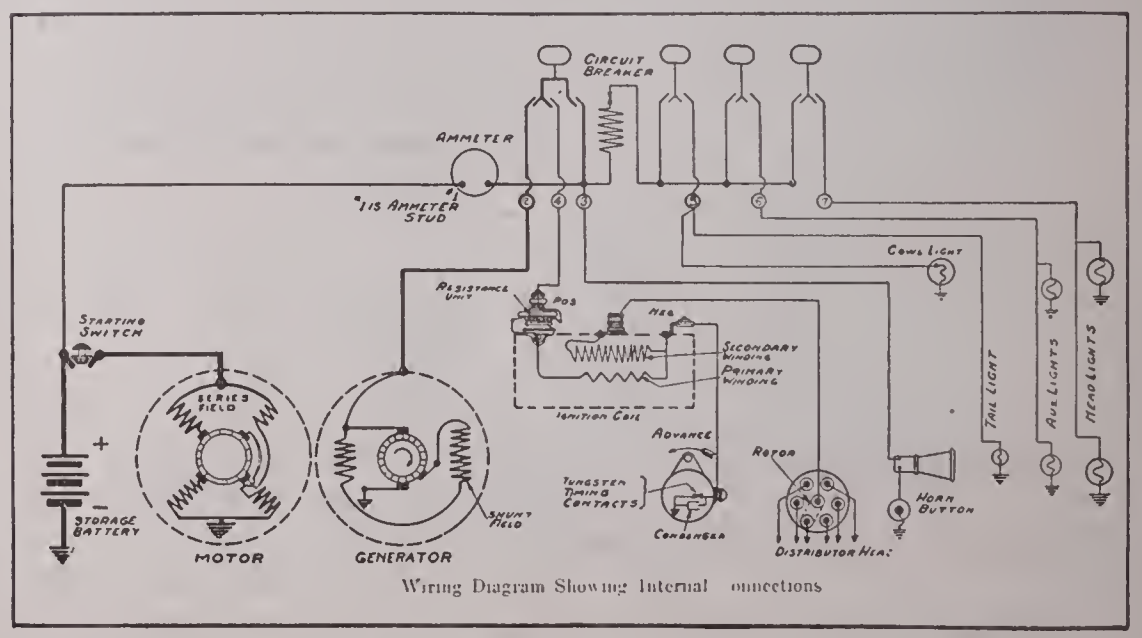
Generator is driven by the same belt that drives the fan. If loose, this belt may be tightened by raising the generator. Voltage regulation is by third brush. Charging rate should never exceed 20 amperes, with all lights out. Relay should close at about 8 miles per hour. Every 500 miles lubricate the generator bearings with ordinary engine oil. The rear bearing should not have as much oil as the front bearing.

Ammeter indicates the rate of charge or discharge.

Large head lights are 6-8 volt, 15 cp. Small head lights are 6-8 volt, 4 cp. Tail light is 6-8 volt, 2 cp. Dash light is 6-8 volt, 2 cp.

There is a circuit breaker to take the place of fuses in the lighting circuit.

Every 500 miles oil the horn with several drops of light machine oil.



Wiring Diagram Showing Internal Connections

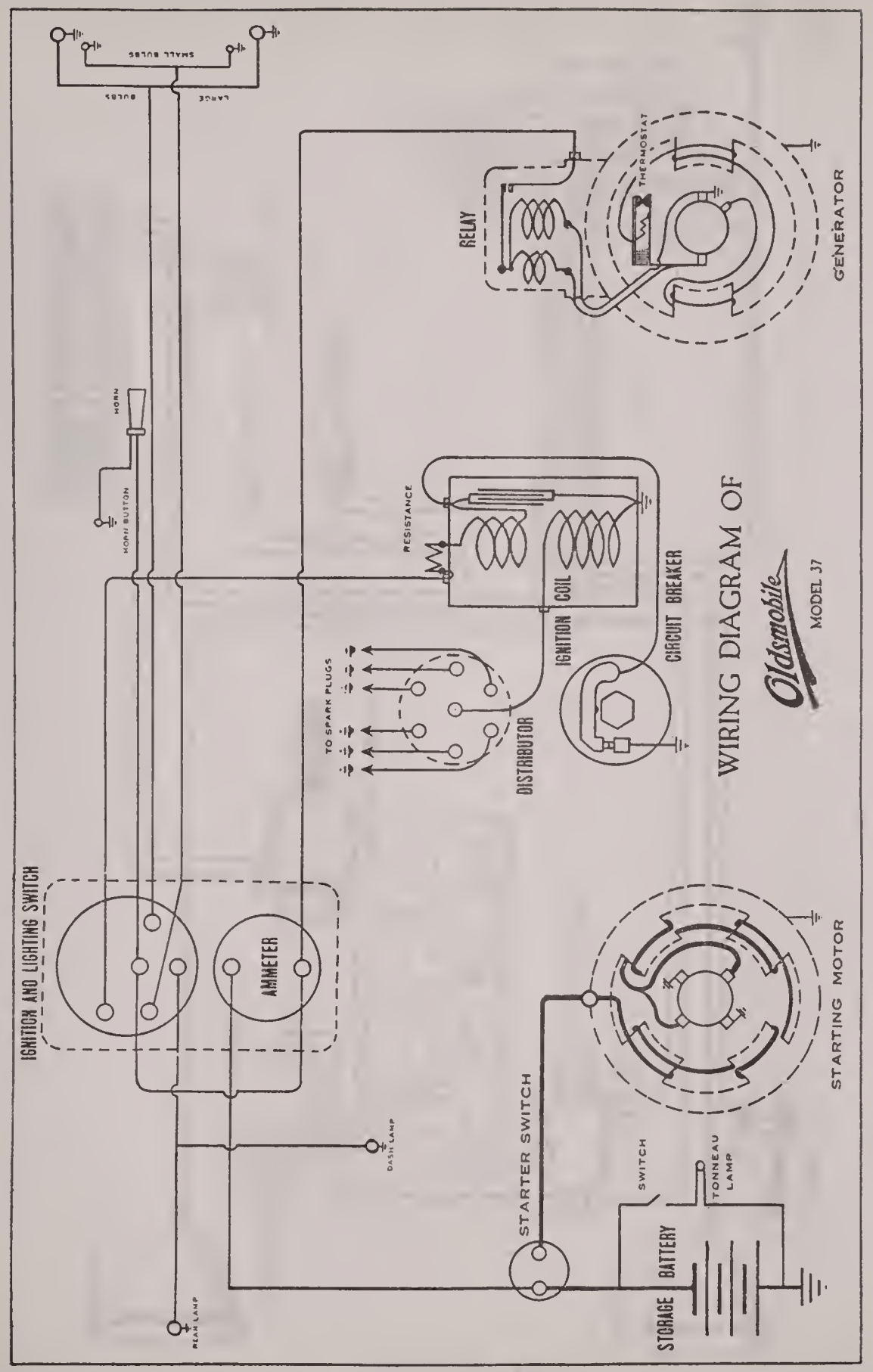


PLATE No. 195

Oldsmobile

MODEL 37 (1918-1919)

REMY TWO-UNIT, STARTING AND LIGHTING SYSTEM. REMY IGNITION

Battery is 6 volt, 80 ampere-hour. The positive terminal is grounded.

Breaker contacts should open .020 in. to .025 in. If contacts are badly burned or pitted they may be resurfaced with a fine, flat, jeweler's file or a piece of worn No. 00 sandpaper. Every 1,000 miles put a small amount of vaseline on the fiber block or on the cam. Use medium cup grease in the grease cup under the breaker head. Tighten this cup two turns every 1,000 miles. Break should occur on top dead center, spark fully retarded. Firing order is 1, 5, 3, 6, 2, 4. Spark gap should be .030 in.

Starting motor is connected to engine by a Bendix gear. Put three or four drops of light machine oil in each of the motor oilers every 5,000 miles.

Voltage regulation of the generator is by a third brush and the Remy Thermostat control. Every 1,000 miles fill the oil well at the rear of the generator with light machine oil. The front generator bearing is lubricated by oil in the timing gear case. Relay contacts should open .020 in. to .025 in. Clean contacts by drawing a piece of soft paper between them. If badly burned or pitted they may be resurfaced with a fine, flat, jeweler's file or a worn piece of No. 00 sandpaper. Do not use this method unless necessary, as it is apt to affect the operation. Blow out all dust or filings after cleaning. The maximum charging rate with thermostat contacts closed should be 18-20 amperes. This rate will be reduced to 13-14 amperes when the thermostat has been heated enough to cause the points to separate. Should generator be run with battery disconnected, the resistance in the thermostat will act as a fuse, burning out if the voltage rises too high. If the resistance unit burns out it should be renewed at once, as the battery is not properly charged with the equipment in this condition. If ammeter registers charge for a short time while engine is run at sufficient speed to charge the battery and then registers discharge, with engine speed the same, the thermostat resistance is burned out and must be renewed.

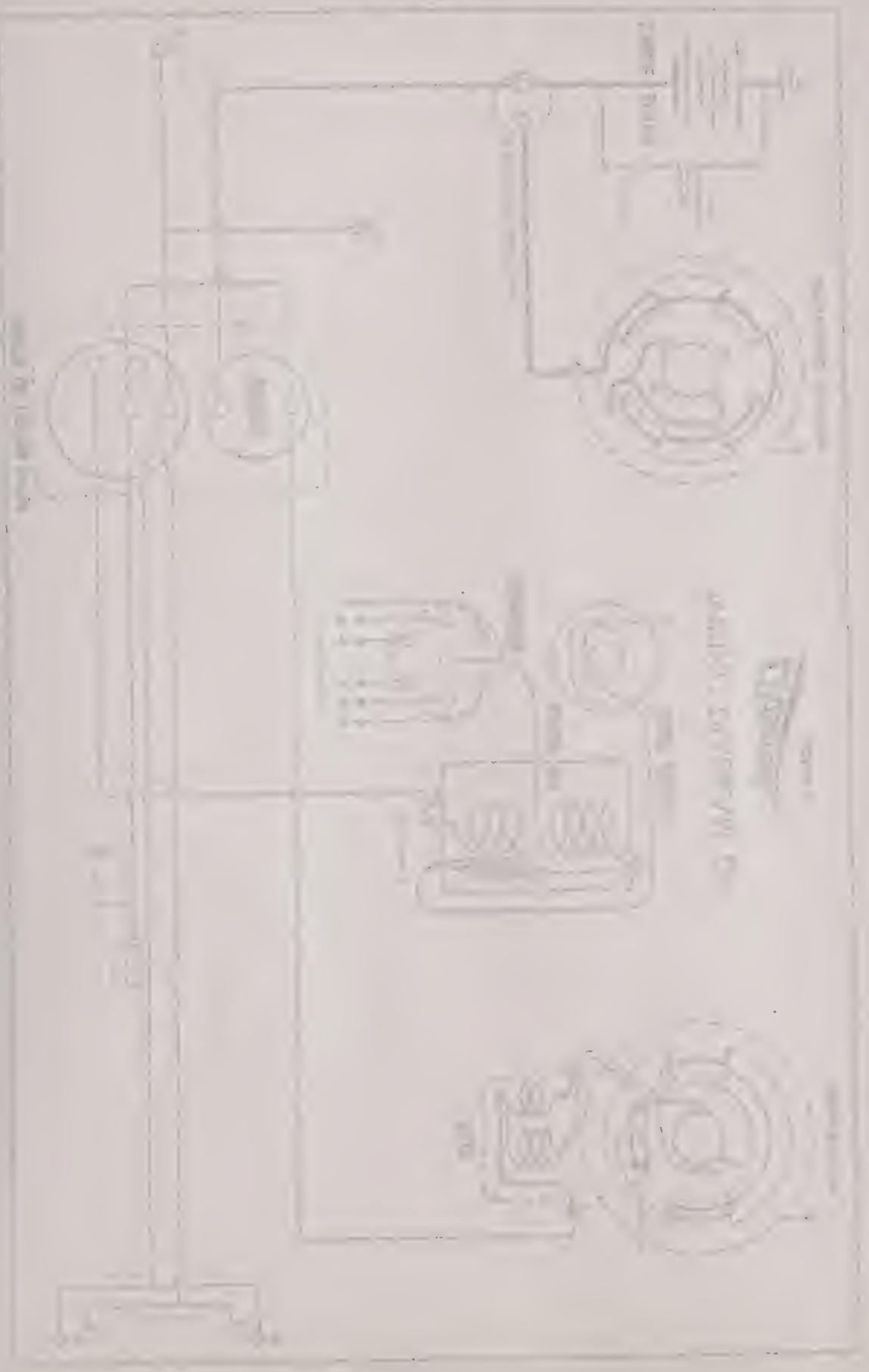
The following data applies to the generator, all tests to be made with the relay in circuit and the thermostat contacts closed.

Amperes	R. P. M.	Volts
0.	525	6.4
7.	780	7.1-7.2
14.	1100	7.8
19.5-20.5	1680	8.6
19-20	2000	8.6
13-15	3000	8.

Brush tension on main brushes 17 to 20 oz. Brush tension on third brush 13 to 17 oz. Field draws 5 amperes on 6.4 volts.

Head lights are 6-8 volt, 15 cp. Dimmer lights are 6-8 volt, 4 cp. Tail and dash lights are each 6-8 volt, 2 cp.

Every 500 miles put three or four drops of light machine oil in the horn oiler.



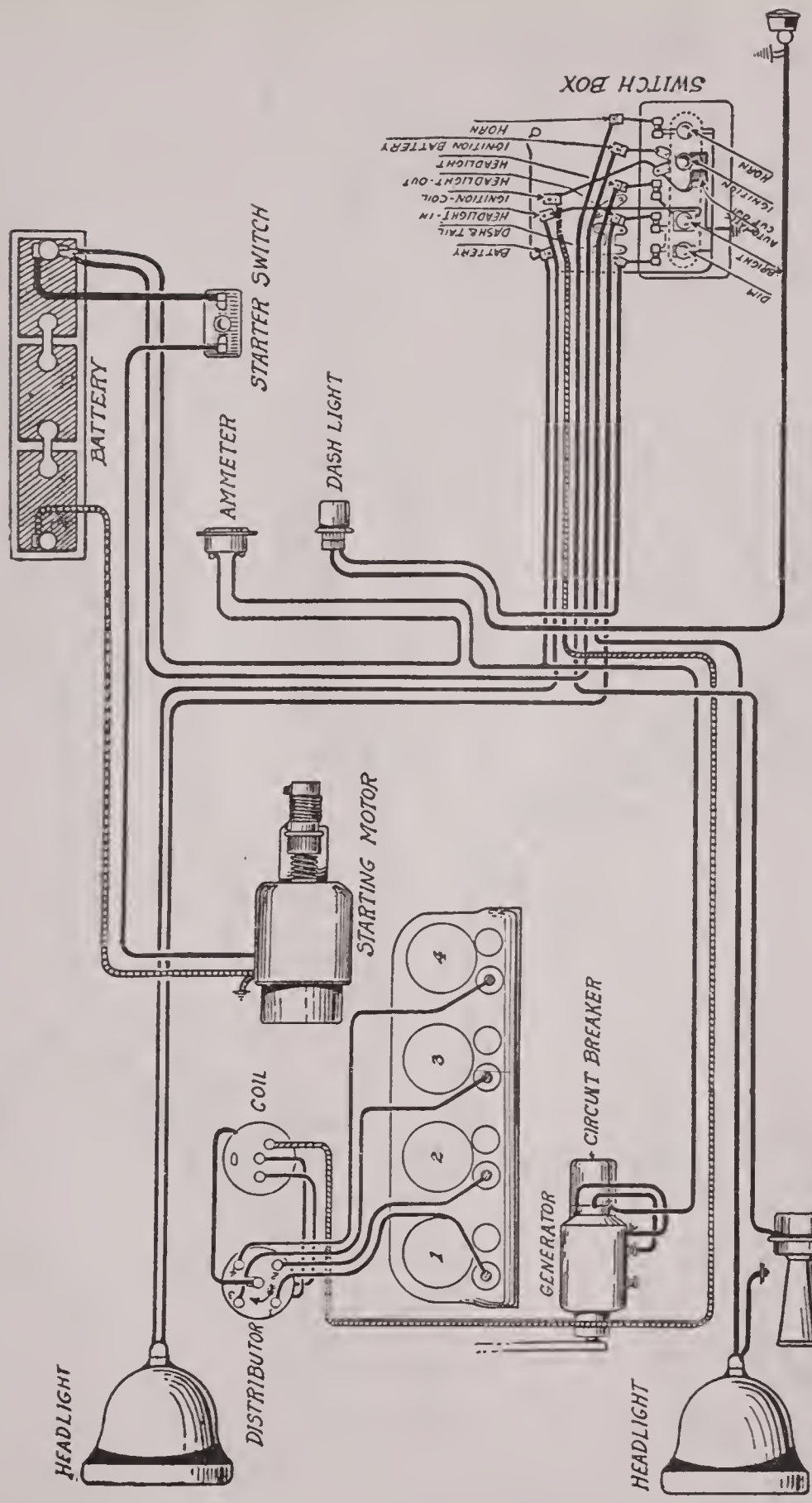


PLATE NO. 196

Overland

85B FOUR (1917-18-19)

AUTO-LITE TWO-UNIT STARTING AND LIGHTING SYSTEM

CONNECTICUT IGNITION

Battery is 6 volt, 80 ampere-hour. The positive terminal is grounded through the starting motor.

Breaker contacts should open .018 in. to .020 in. Contacts are made of tungsten metal. Should contacts be so badly worn as to impair the proper operation of the motor, the breaker mechanism must be renewed. See Plate No. 50. Refill the cup under the breaker head with vaseline every 2,000 miles. Break should occur when the mark $\frac{1\text{-}4}{UP}$ on the flywheel is 1½ in. past the indicator, spark fully retarded. The firing order is 1, 3, 4, 2. Spark gap should be .028 in. to .030 in. There is a thermostat in the switch case, to open the ignition current, if the switch is left on with the engine idle. See Plate No. 7.

Motor is connected to flywheel by a Bendix gear. Should the pinion stick in mesh with the flywheel gear, step on the starter for a second. Then insert the starting crank and turn the engine over quickly by hand. This method will usually loosen the pinion and is much simpler than using a punch or cold chisel and hammer. Quite often the holes, through which the bolts holding the motor in place are inserted, will wear from the constant vibration, putting the motor out of alignment with the flywheel. This will cause the teeth in the flywheel gear to be broken out and the pinion to stick. This may usually be corrected by putting shims under the motor, where they are required.

After the first 1,000 miles of running and every 10,000 miles thereafter, the generator driving chain may require adjustment. The chain may be adjusted by loosening the two screws holding the generator and moving the generator. The chain should be just tight enough that no strain is on the links when the engine is idle. Chain must be well lubricated. Use light engine oil. Put plenty of oil on the chain, wiping all excess oil from the surface with a clean cloth after it has penetrated to the inner bearing surface of the chain links.

Voltage regulation of the generator is by third brush. Relay should close at about 7½ miles per hour and open at about 6 miles per hour. Sometimes the relay cover will ground on the contact arm, causing the generator to fail and the battery to discharge. This should be immediately corrected. Maximum charging rate should be 14-16 amperes at about 20 miles per hour. Every 500 miles put four or five drops of light lubricating oil in each of the generator oilers.

Head lamps are 6-8 volt, 16 cp. Dash and tail lights are in series. They are 3-4 volt, 2 cp. Fuses are 20 ampere. The fuses are in the combination light and ignition switch on the steering column.

Hudson

SUPER SIX

DELCO DOUBLE-UNIT STARTING AND LIGHTING SYSTEM. DELCO IGNITION

Battery is 6 volt, 80 ampere-hour.

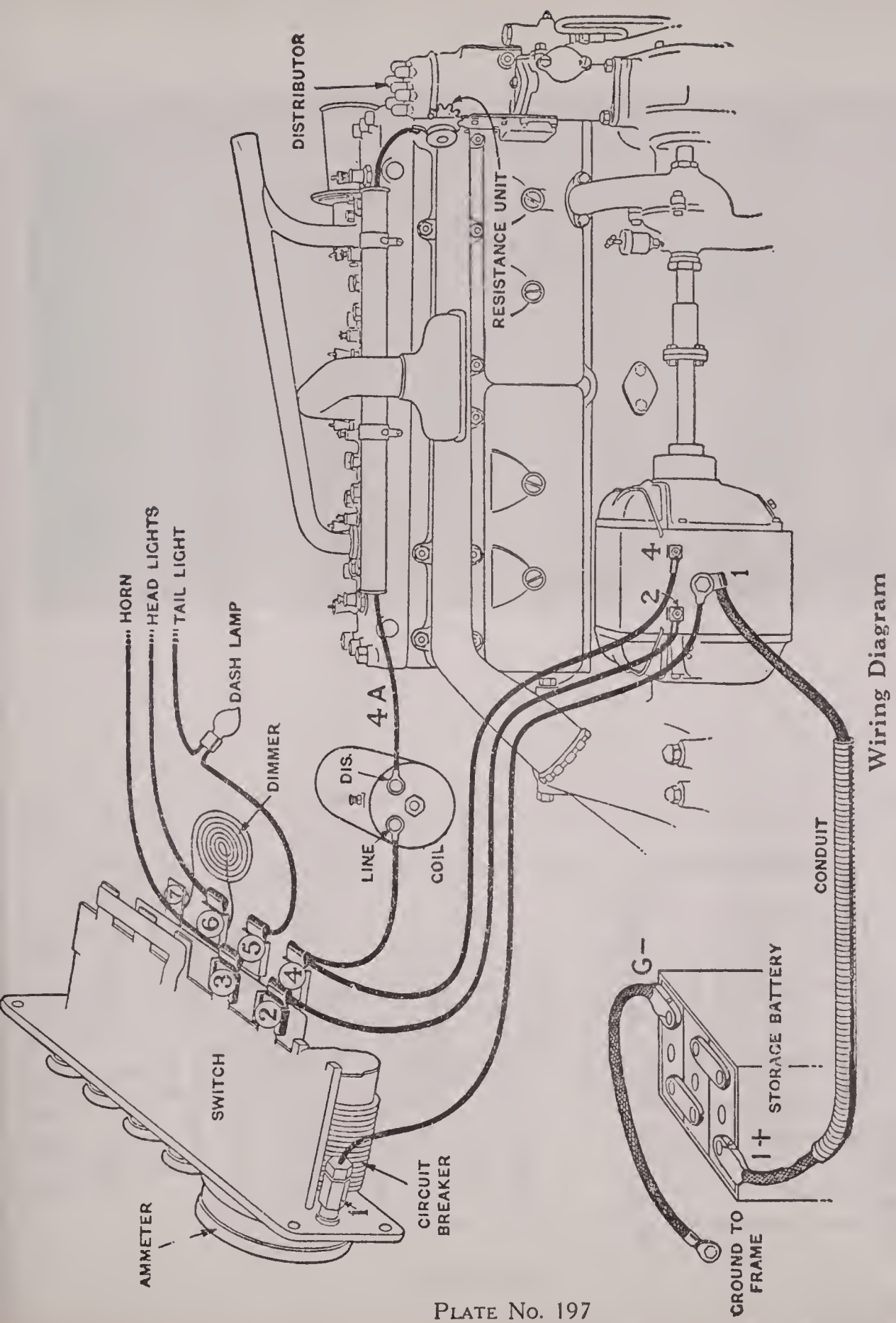
Breaker contacts should open .018 in. to .020 in. Spark should occur just over top dead center, spark lever fully retarded. The firing order is 1, 5, 3, 6, 2, 4. The spark gap should be .025 in. to .028 in.

Motor is connected to the flywheel by a non-automatic, mechanical pinion shift. One of the motor brushes is raised to open the motor circuit. When the ignition switch is closed, the generator operates as a motor to facilitate the meshing of the motor pinion with the flywheel gears. Depressing the starting pedal draws the pinion into mesh, opens the generator circuit and allows the motor brush to come into contact with the commutator, thus applying the full battery pressure to the motor, cranking the engine. There is an overrunning clutch to prevent the engine driving the motor. The pinion and flywheel gears are demeshed when the starting pedal is released.

Voltage regulation of the generator is by third brush. The generator should begin to supply current at 6 to 8 miles per hour. The maximum charging rate should not exceed 17-18 amperes at 20-24 miles per hour, all lights off. This rate decreases to 10-11 amperes at 40-45 miles per hour.

There is a vibrating circuit breaker on the light and ignition switch to take the place of fuses in the lighting circuits. It will only allow 5 to 7 amperes to flow through it when vibrating.

Head lamps are 6-8 volt, 15 cp. Dash and tail lights are in series. They are 3-4 volt, 2 cp.



Wiring Diagram

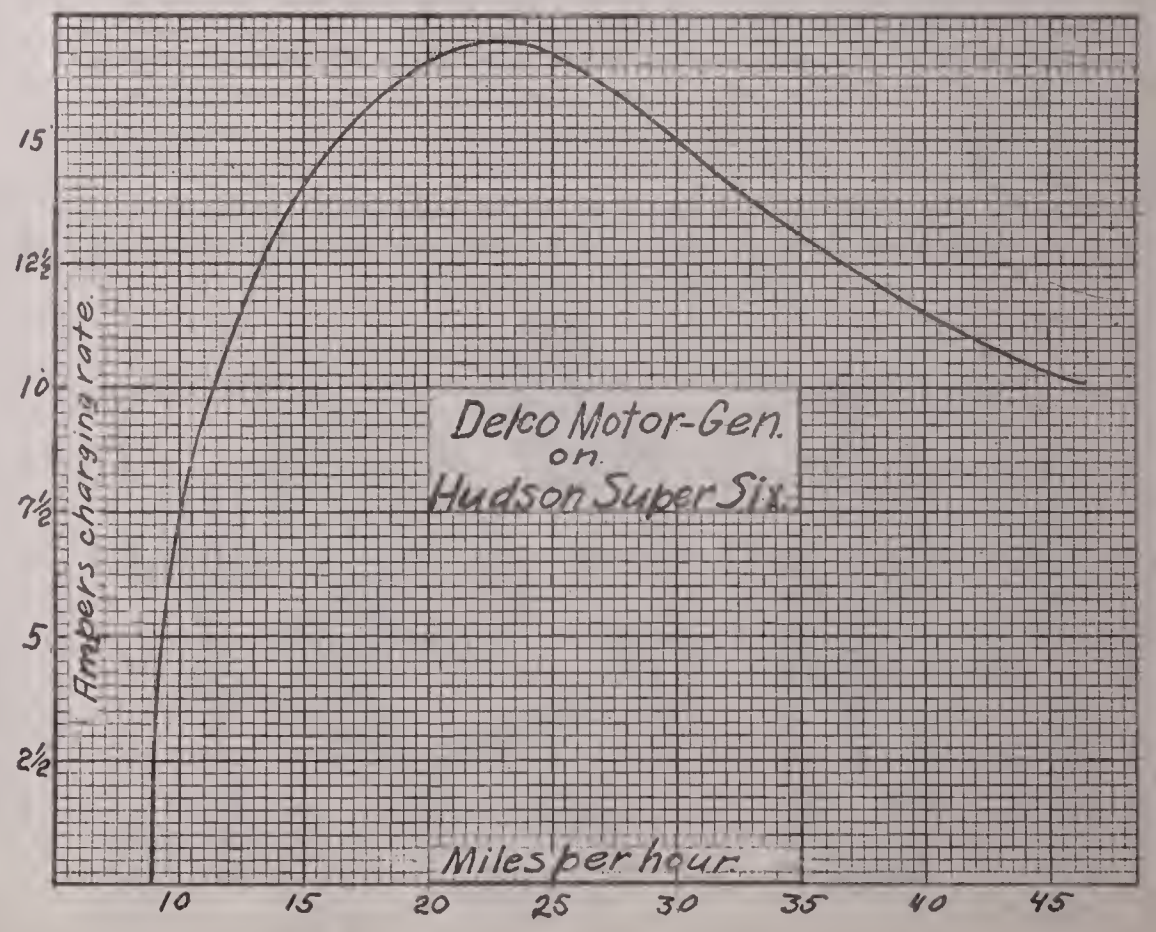
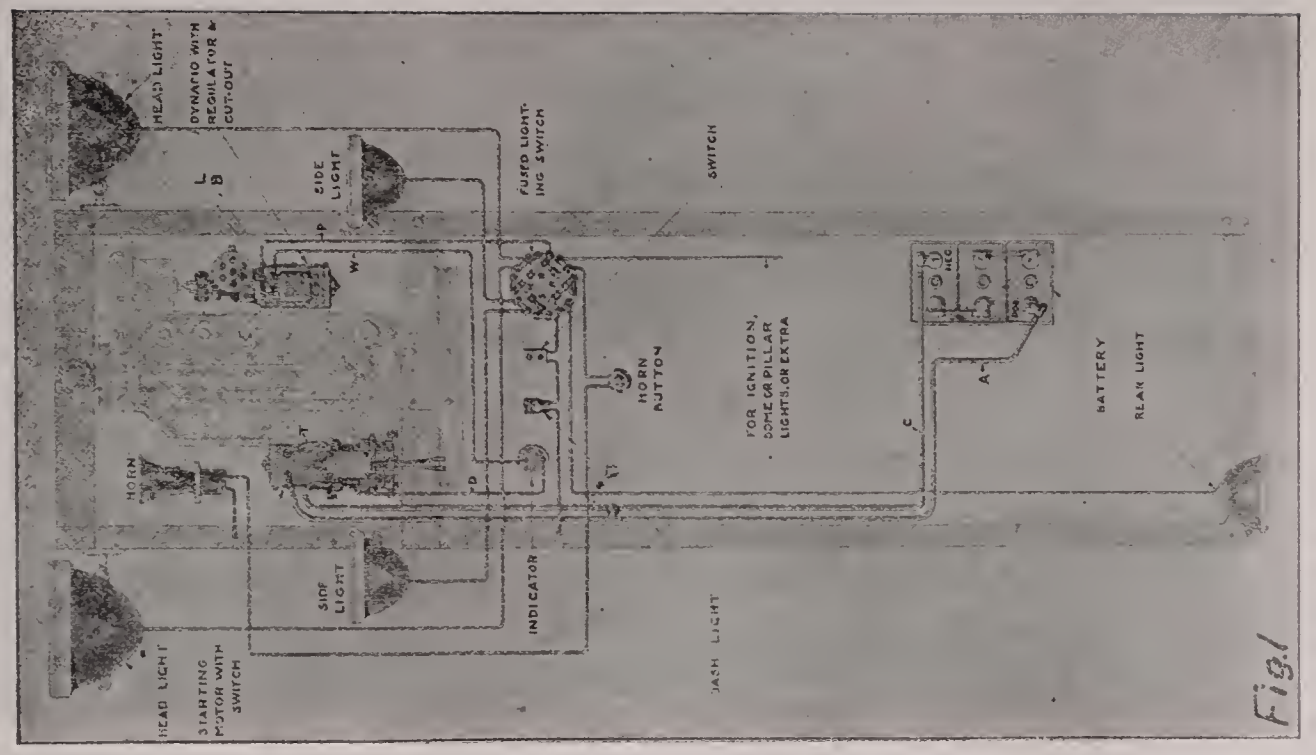


PLATE No. 197



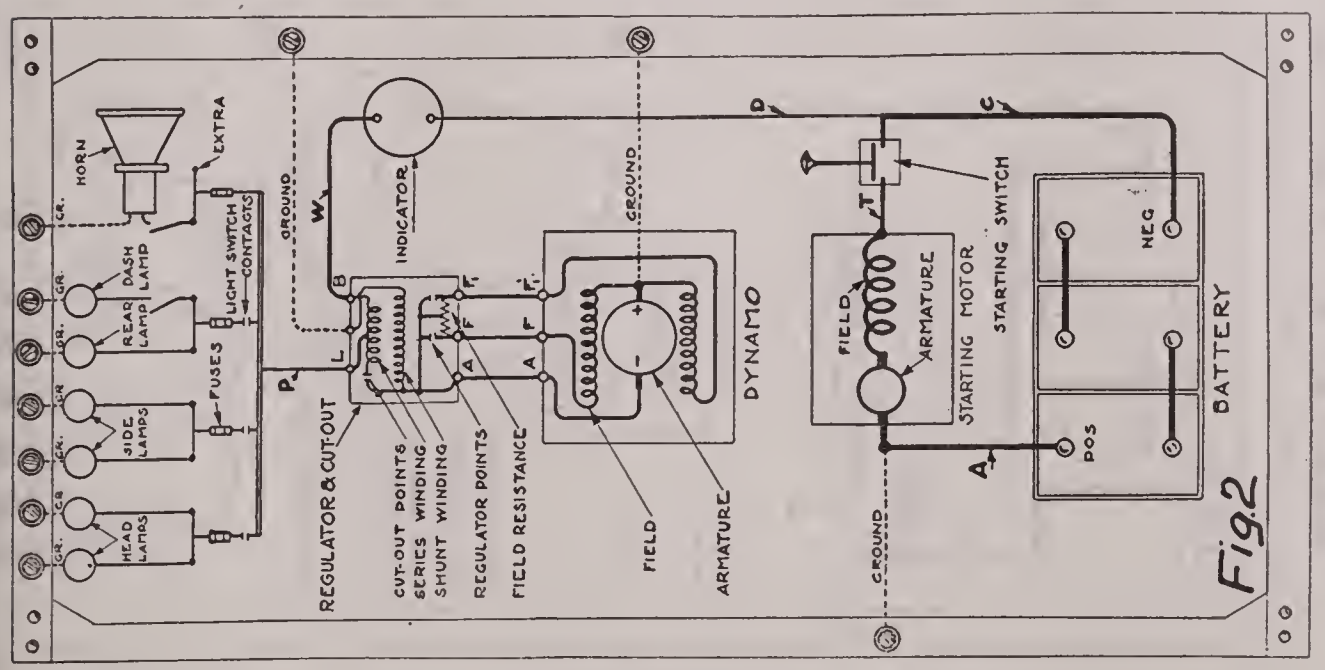


PLATE NO. 198

Gray & Davis

TWO-UNIT STARTING AND LIGHTING SYSTEM

MODELS T AND S GENERATOR. MODEL Y STARTING MOTOR

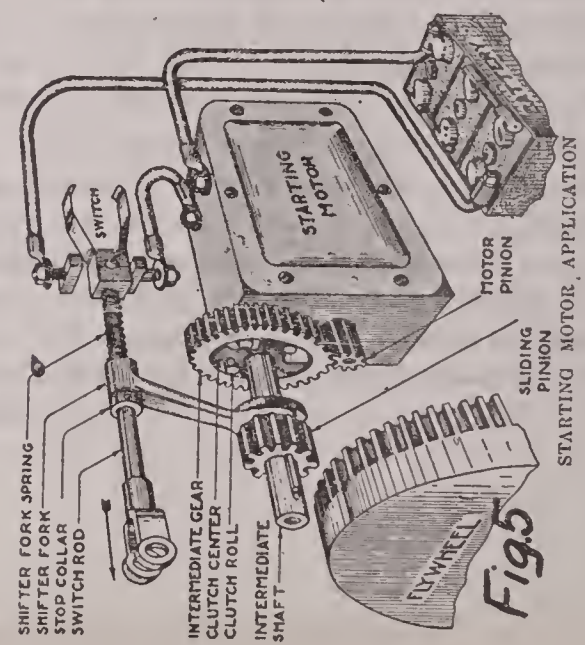
The following instructions apply to the Gray and Davis starting and lighting system as applied to the following cars:

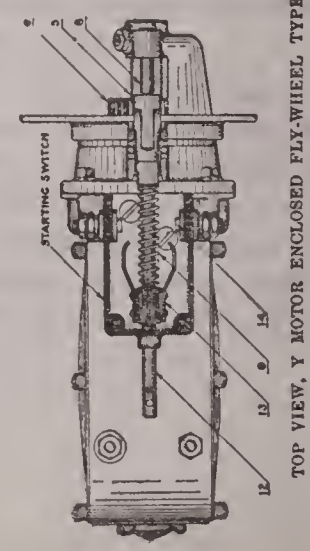
Peerless	Chandler	Metz	Elkhart
Velie	Partin Palmer	Stearns	Crow
Enger	Winton	Imperial	Jones
Meteor	Chalmers	Paige	Maxwell

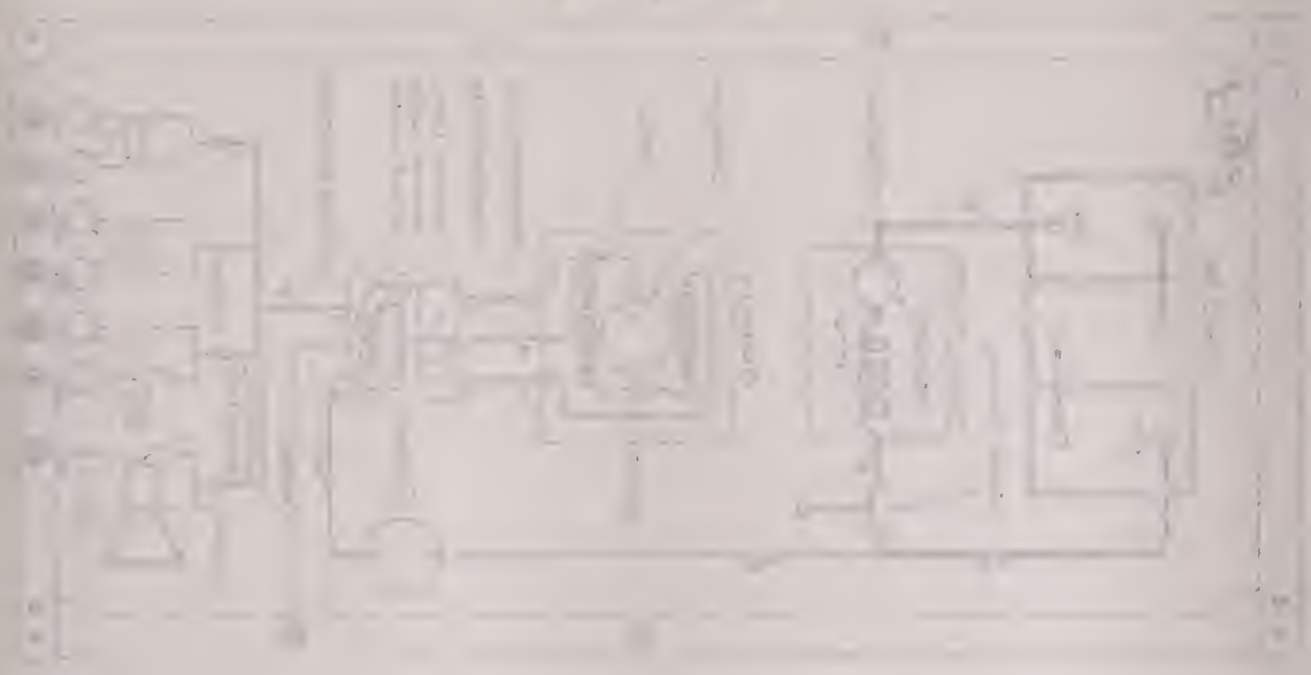
On the Chalmers, Paige and Maxwell, one terminal of the starting switch is grounded. The diagrams Fig. 3 and 4 apply to these cars. On all of the other cars named, the positive terminal of the motor is grounded. Figs. 1 and 2 is the general wiring diagram for these cars.

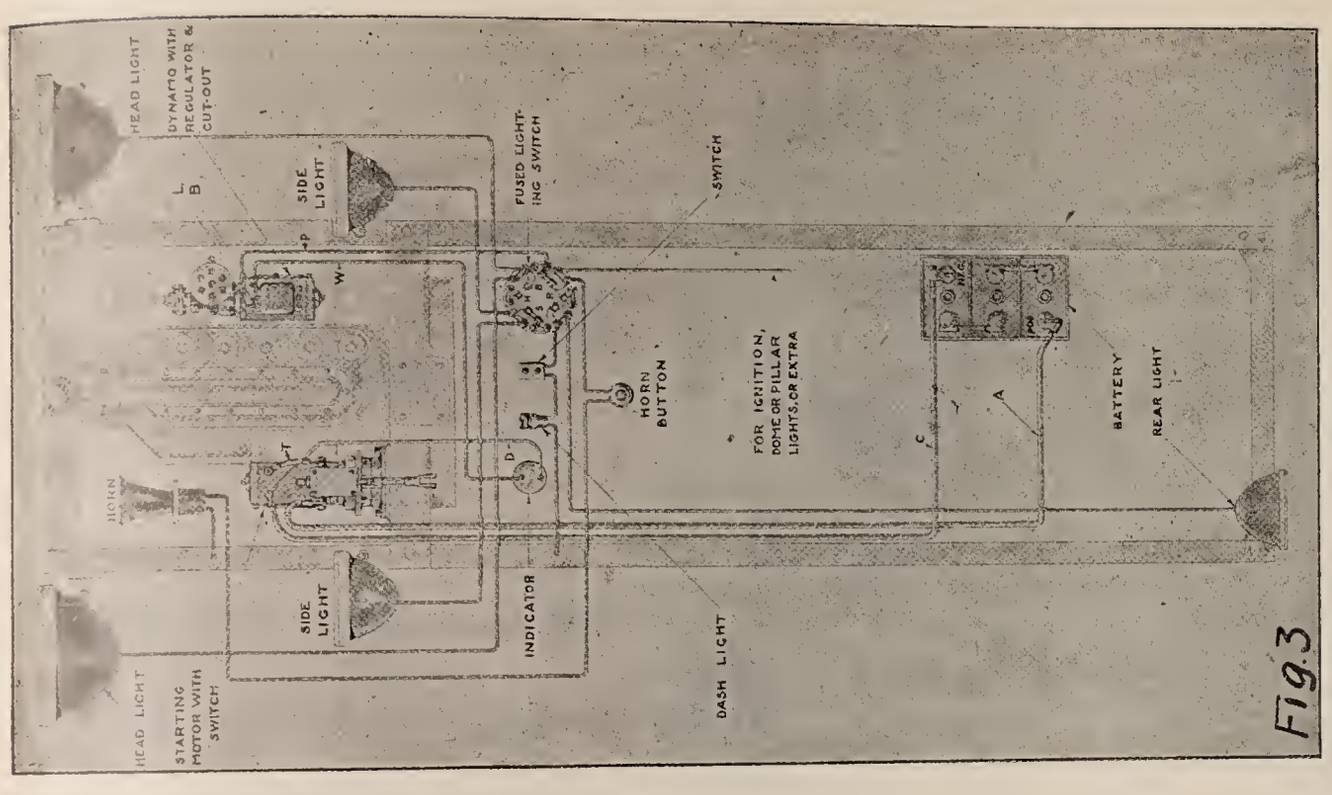
The starting motor is connected to the flywheel by a non-automatic mechanical pinion shift operated from the starting switch pedal. The sliding pinion (Fig. 5) is moved along the shaft when the starting pedal is depressed. If the pinion is in the proper position to mesh with the flywheel gear, it is meshed immediately. If it is not in such a position, the switch rod is moved on compressing the spring and closing the starting switch. As soon as the motor starts to turn, the compressed spring forces the pinion into mesh. There is an overrunning clutch to prevent the gas engine driving the motor. Every two weeks, put 8-10 drops of light engine oil in each of the motor oilers. Sliding surfaces and rods must be kept well oiled. The starter gear case should receive one tablespoonful of heavy engine oil every month.

(*Continued on Plate No. 199*)









(*Continued from Plate No.* 198)

Gray & Davis

Two-Unit Starting and Lighting Systems

Models T and S Generator. Model Y Starting Motor

Voltage regulation of the generator is by a vibrating regulator, which is combined with the relay. The output of the Type "T" generator is about 6½ volts, 10 amperes at 1,000 R. P. M. The output of the Type "S" generator is about 6½ volts, 10 amperes at 650 R. P. M. Should the output fall below normal it is probably due to dirty contacts. Clean the contacts by drawing a piece of soft paper between them. If contacts are badly burned or pitted they may be resurfaced with a piece of worn No. 00 sandpaper or a fine, flat, jeweler's file. This should not be resorted to unless necessary, as it will change the output. The generator should deliver a maximum output at 10-12 miles per hour. When the lamps are turned on the frequency at which the regulator contacts operate is reduced, thus increasing the output.

The generator terminals are marked "B" and "L". Terminal "B" is the negative It is the end of the series winding of the regulator and is connected to the battery, in series with the charging indicator. Terminal "L" is also negative, being connected to the series winding at a given distance from the end. It is connected to the lamps through the switch.

The positive brush holder is grounded to the frame; therefore, the frame is positive. Connections between the generator and regulator are as follows:

The three terminals at the end of the regulator opposite terminals marked "B" and "L" are connected to the generator windings as shown in the technical wiring diagrams Figs. 2 and 3, that is: "A" connects to the negative terminal of the generator, "F" connects to one field coil, and "F-1" connects to the other field coil.

Once every two weeks, or 500 miles, put 8 or 10 drops of light engine oil in each of the oil holes on the plain generator at the commutator end; the oil should be put in the upper oiler only, the lower one acting as an overflow. On the geared type of generator, lubricate the commutator end, upper bearing with 8-10 drops of oil, the lower hole acting as an overflow as on the plain type. The oiler on the side of the driving end should be filled until it overflows, allowing sufficient time for the oil to reach the gears. Should the ignition distributor be driven from the generator shaft, put 8-10 drops of oil in the ignition shaft oiler.

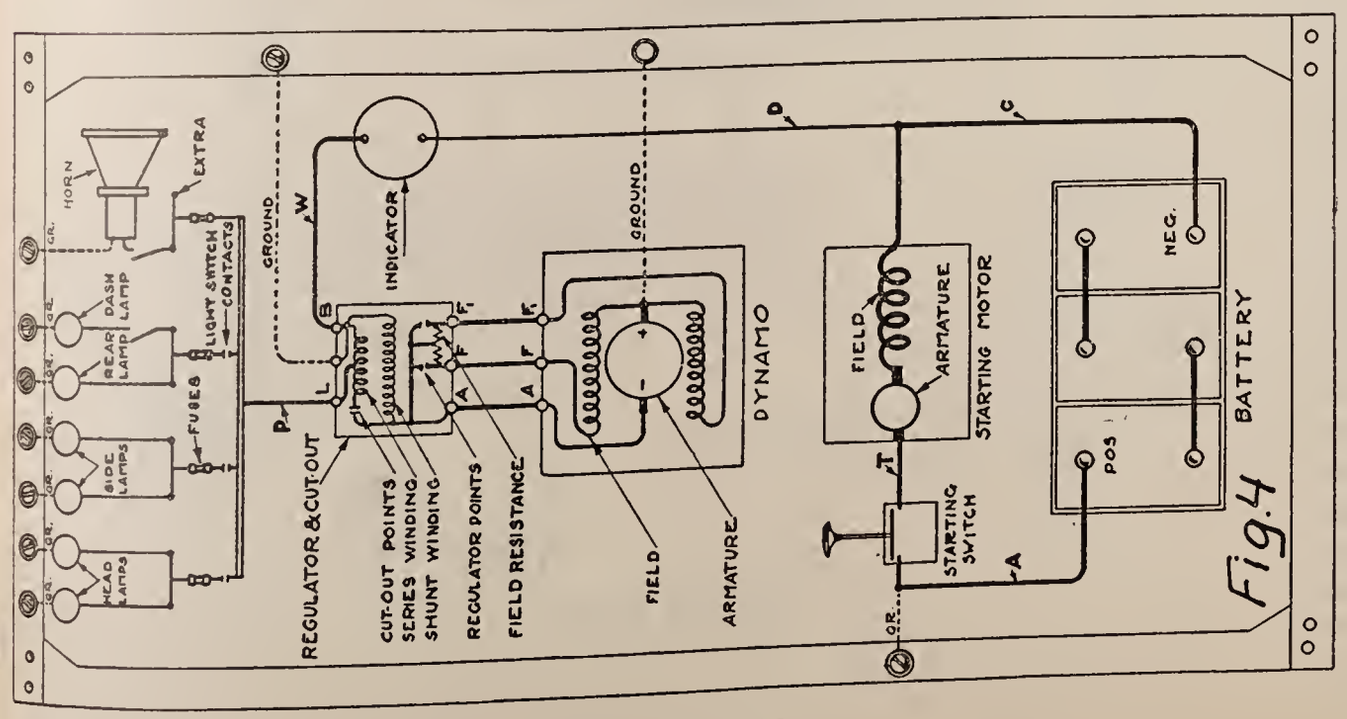


PLATE NO. 199

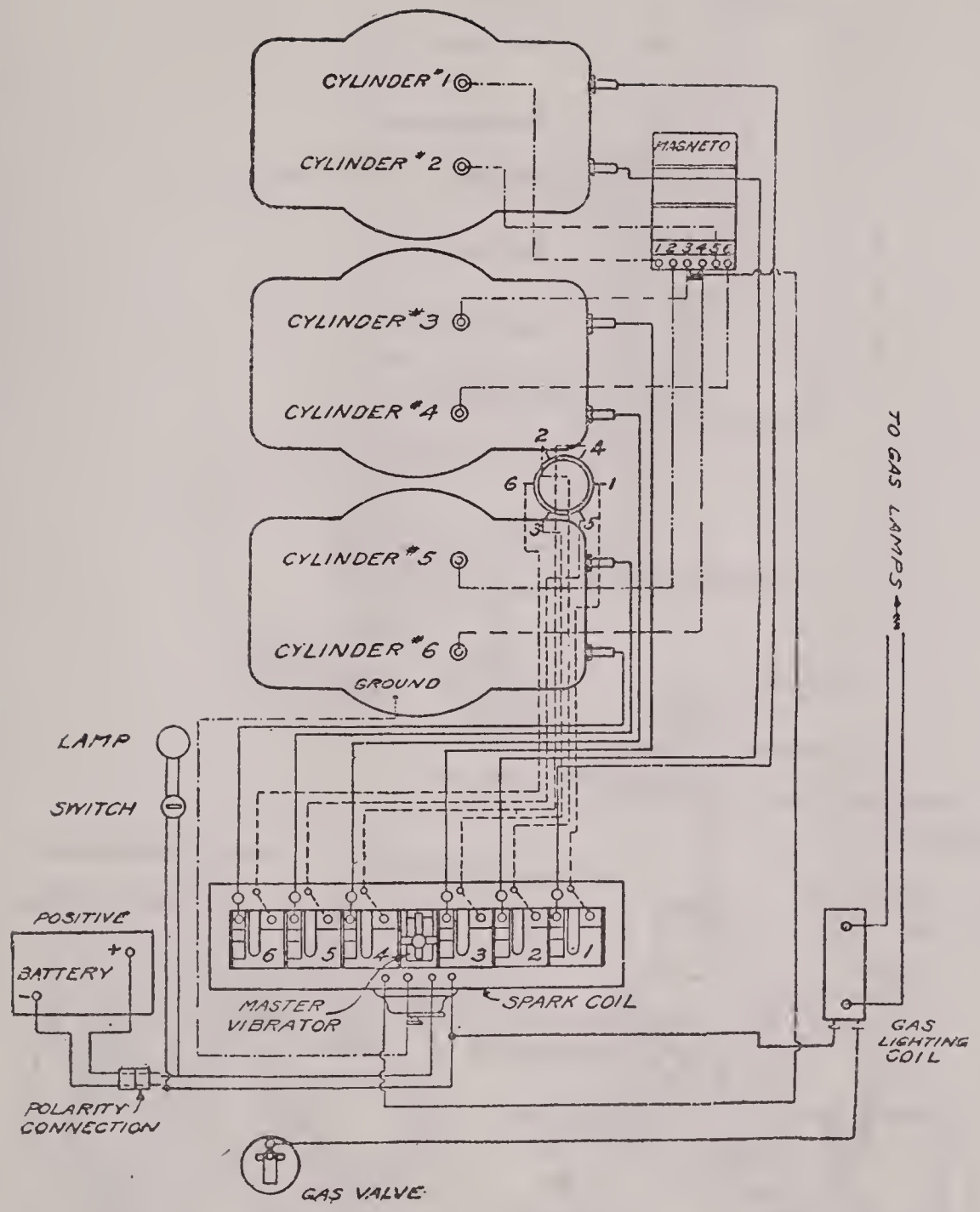


PLATE No. 200

Pierce-Arrow

1912 MODELS

BOSCH MAGNETO AND BATTERY IGNITION SYSTEMS

Battery is 6 volt, 75 ampere-hour. The two-wire system is used.

This model Pierce-Arrow car is equipped with a double ignition system. The Bosch Type D6 magneto is used for the magneto system. The breaker contacts should open .014 in. to .016 in. Clean contacts with gasoline whenever necessary. If badly burned or pitted, they should be resurfaced with a fine, flat, jeweler's file or a worn piece of No. 00 sandpaper. Put two or three drops of light machine oil in each of the magneto oilers every two weeks. The spark gap should be .020 in. The magneto spark should occur when the piston on power stroke is 1/2 in. before top dead center, spark lever in the fully advanced position. The piston is in this position when the top dead center mark on the flywheel is 4-13/16 in. (4.8125 in.) before the indicator. With the spark lever in the fully retarded position the spark should occur when the piston is 1/32 in. before top dead center. The firing order is 1, 5, 3, 6, 2, 4. For further care of this magneto see Plate No. 184.

The battery system consists mainly of a set of six coils, a master vibrator and the commutator for distributing the low tension current to the proper coil. The battery spark should occur when the piston has traveled 2 1/8 in. (2.125 in.) past top dead center, power stroke, spark lever fully retarded. The piston is at this point when the top center line on the flywheel is 10 1/2 in. past the indicator. To time the battery spark, turn the engine to the above position, spark lever fully retarded. Turn the ignition switch to the "Off" position and remove the high tension lead from the cylinder on power stroke and hold it about 1/8 in. from the cylinder. Then loosen the two set-screws holding the rotor in place on the shaft and turn it so that it is making connection with the coil for cylinder on power stroke. Turn the ignition switch to the "B" position. If the system is in order, a shower of sparks will pass across the gap between the high tension lead and the cylinder casting. Now turn the rotor so that if the spark lever is advanced the slightest bit or the rotor turned back, the spark will discontinue. Then tighten the set-screws, to hold the rotor firmly in place, and replace the spark plug lead. The center electrode of the spark plug should be exactly in the center of the hole in the disk electrode. The master vibrator should be so adjusted that it takes the least possible current that will produce a satisfactory spark at high speed. The commutator and rotor should be lubricated with light cylinder oil, applied in not too large quantities. Never use graphite or lubricant containing it in the commutator. Use soft cup grease in the grease cup on the commutator shaft. Tighten the grease cup one turn every 150 miles.

Pierce-Arrow

SERIES 1 (1913), 2 (1914), 3 (1915)

WESTINGHOUSE STARTING AND LIGHTING SYSTEM. BOSCH MAGNETO AND BATTERY IGNITION

The battery is Exide Type 3x15-1, 6 volt, 105 ampere-hour. The positive terminal is grounded.

These cars are provided with a double ignition system. The magneto used is the Type ZR6. Breaker contacts should open .016 in. Clean contacts with gasoline whenever necessary. If they are badly burned or pitted, resurface with a fine, flat, jeweler's file or a small strip of worn No. 00 sandpaper. Every 500 miles put not more than five drops of light machine oil in each of the magneto oilers. For further care of this magneto see Plate No. 186. The magneto spark should occur when the piston on compression stroke is ½ in. before top dead center, spark lever in the fully advanced position, or when the piston is 1/32 in. before top dead center, spark lever in the fully retarded position. The piston is in the first-named position when the 1 & 6 top center line on the flywheel is 4-13/16 in. (4.8125) before the indicator.

The battery ignition system consists mainly of a set of six coils, a master vibrator and a commutator, the function of which is to distribute the low tension current to the proper coil. A complete description and instructions for the care and timing of this system is given on Plate No. 200.

The driving power of the starting motor is transmitted to the flywheel through a magnetic pinion shift, controlled by a push button on the dash. When the starting button is pressed the current flows from the positive terminal of the battery to the frame, through the ignition switch, the push button to the starting controller (or magnetic switch) through the winding of this switch to terminal "S" on the generator, through the armature and the series winding of the generator to terminal "B" on the generator, then to No. 1 connector on the junction box, then to the negative main terminal of the magnetic control switch and to the negative terminal of the battery, through the large lead, thus completing the circuit through the magnetic control switch, closing the contacts. This completes the circuit through the motor and the solenoid pinion shifting coil. When this circuit is completed the current flows from the positive terminal of the battery to the ground, to the grounded terminal of the solenoid and to the positive terminal of the motor. The current through the solenoid attracts the iron plunger drawing the pinion into mesh. Before the plunger has been attracted the motor is in series with a resistance (R), Figure 2, in the starting switch. As soon as the current is turned on, the motor is turned slowly, to facilitate the meshing of the gears. As the solenoid draws in the armature the motor circuit is broken, the pinion is drawn into mesh and the motor circuit again completed, this time without the resistance in the circuit, thus applying the full battery pressure to the motor, cranking the engine. There is an overrunning clutch to prevent the engine driving the motor. The heavy winding shown in the solenoid, Fig. 2, is in series with the motor armature. As the speed of the motor increases, the current through the armature decreases, due to the back pressure produced by the motor increasing, thus cutting down the current in the heavy winding, reducing the magnetic pull of the solenoid and allowing the spring acting against the magnet to force the pinion out of mesh and opening the main cranking circuit. The starting button should be released as soon as the engine begins to run on its own power. One of the relay contacts is grounded, thus as soon as the generator produces sufficient pressure to close the contacts the terminal "S" of the generator is grounded. Should the starting button be pressed when the contacts are closed, the current flows from the grounded contact to the positive terminal of the battery, and tends to send current from terminal "S" of the generator to the battery through the starting switch push button and the ignition switch, hence if the button is pressed the battery will be tending to send current in one direction and the generator in the opposite direction, over the same wire, hence no current will flow, thus should the button be pressed with the generator running at or above cut-in speed no harm can come, as the magnetic control switch will not operate.

(*Continued on Plate No.* 202)

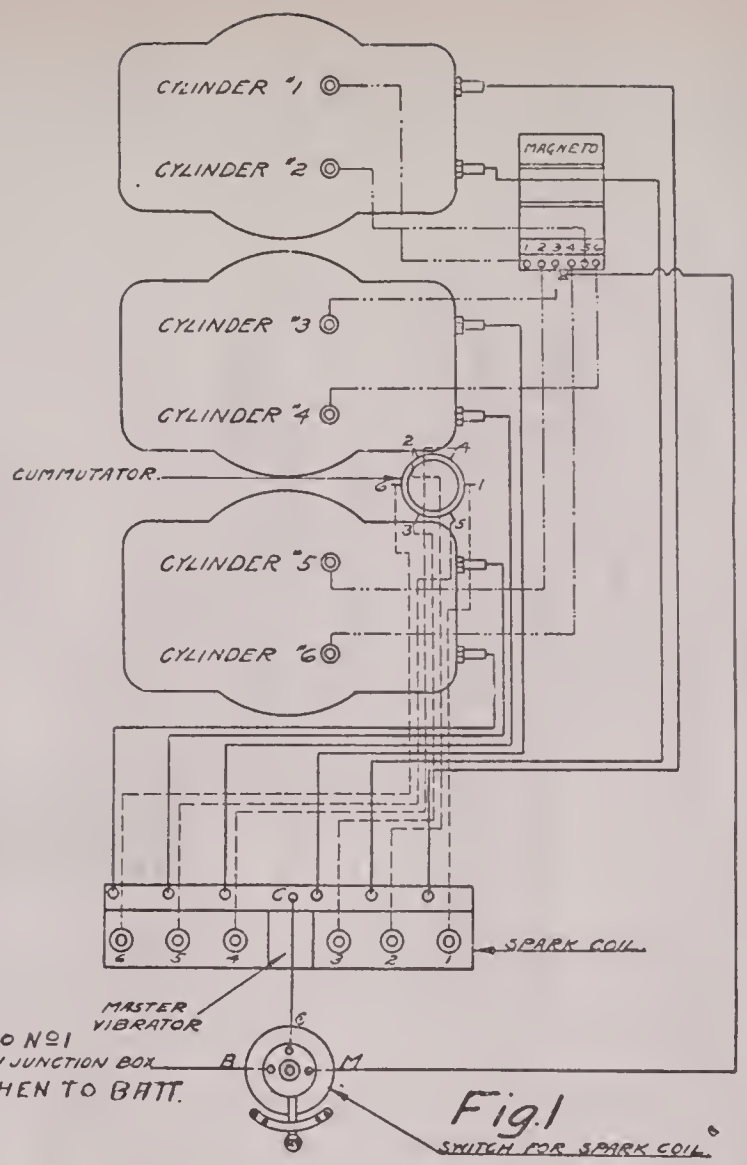
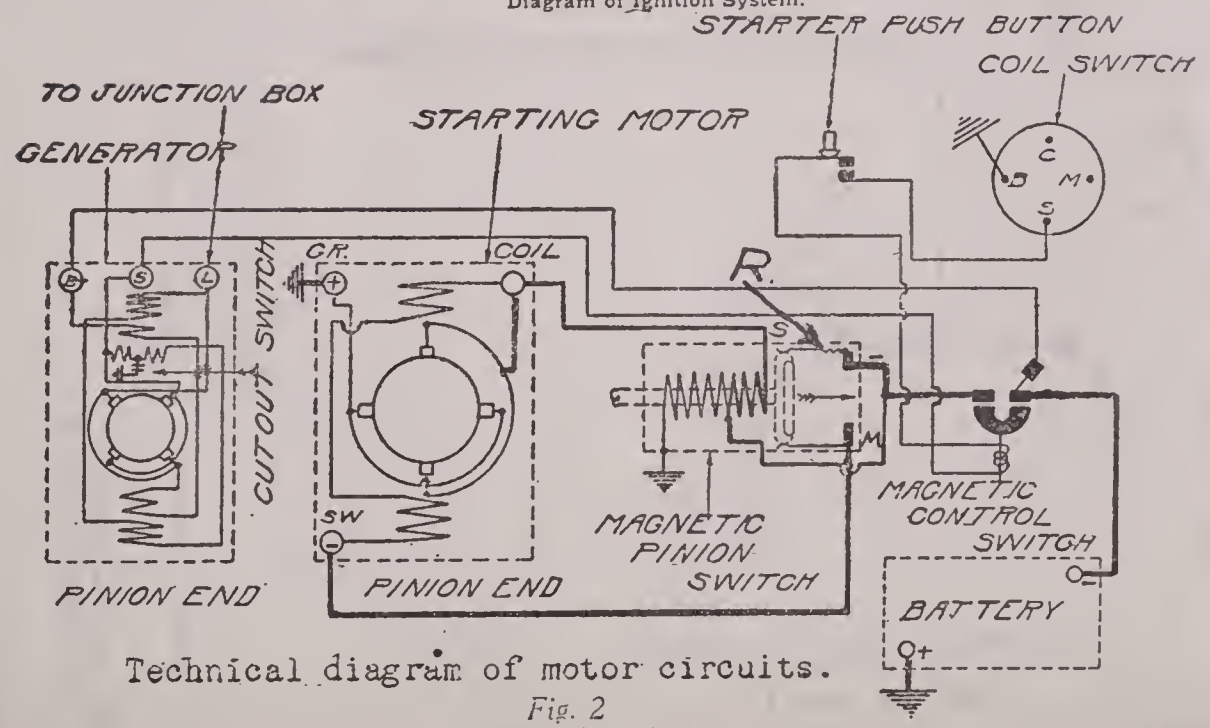


Diagram of Ignition System.



Technical diagram of motor circuits.

Fig. 2

PLATE No. 201

(*Continued from Plate No.* 201)

Pierce-Arrow

Series 1 (1913), 2 (1914), 3 (1915)

Westinghouse Starting and Lighting System
Bosch Magneto and Battery Ignition

Should the apparatus fail to work when the starting button is depressed, relay contacts closed, see that the ignition switch key is inserted and turned and that the switch lever is on the "M-B" or "B" position, as the device is inoperative otherwise. If the ear is placed near the magnetic control switch a sharp click will be heard when the starting button is pressed, if it is working properly. If no click is heard, test for current at the terminals, starting button pressed in. If the terminals test O. K., there is an open circuit in the windings or the switch is sticking. A sharp blow with a hammer on the side of the case will nearly always loosen it. Should there be any difficulty in meshing the gears, see that the distance between the pinion and the flywheel gear, when in the demeshed position, is correct. This distance should not vary any appreciable amount from 3/16 in. Should the magnetic control switch close when the starting button is pressed, but the motor fail to operate, there may be an open circuit in either the motor or the pinion shifting switch, or the wires leading to them. To test the motor, run an insulated wire (No. 10 or larger) from the negative terminal of the battery to the terminal marked "SW" on the motor, Fig. 2. Should the motor spin rapidly the pinion shift or switch is at fault. If the motor spins slowly, the battery is low, the terminals are defective, the commutator or brushes are defective, the bearings are tight or the armature winding may be grounded or short circuited.

Once every month put four or five drops of light machine oil in each of the motor bearing oilers, also in the oil cup on casing over the starting pinion. Figs. 3 and 4 are the characteristic curves of the motors.

(*Continued on Page* 203)

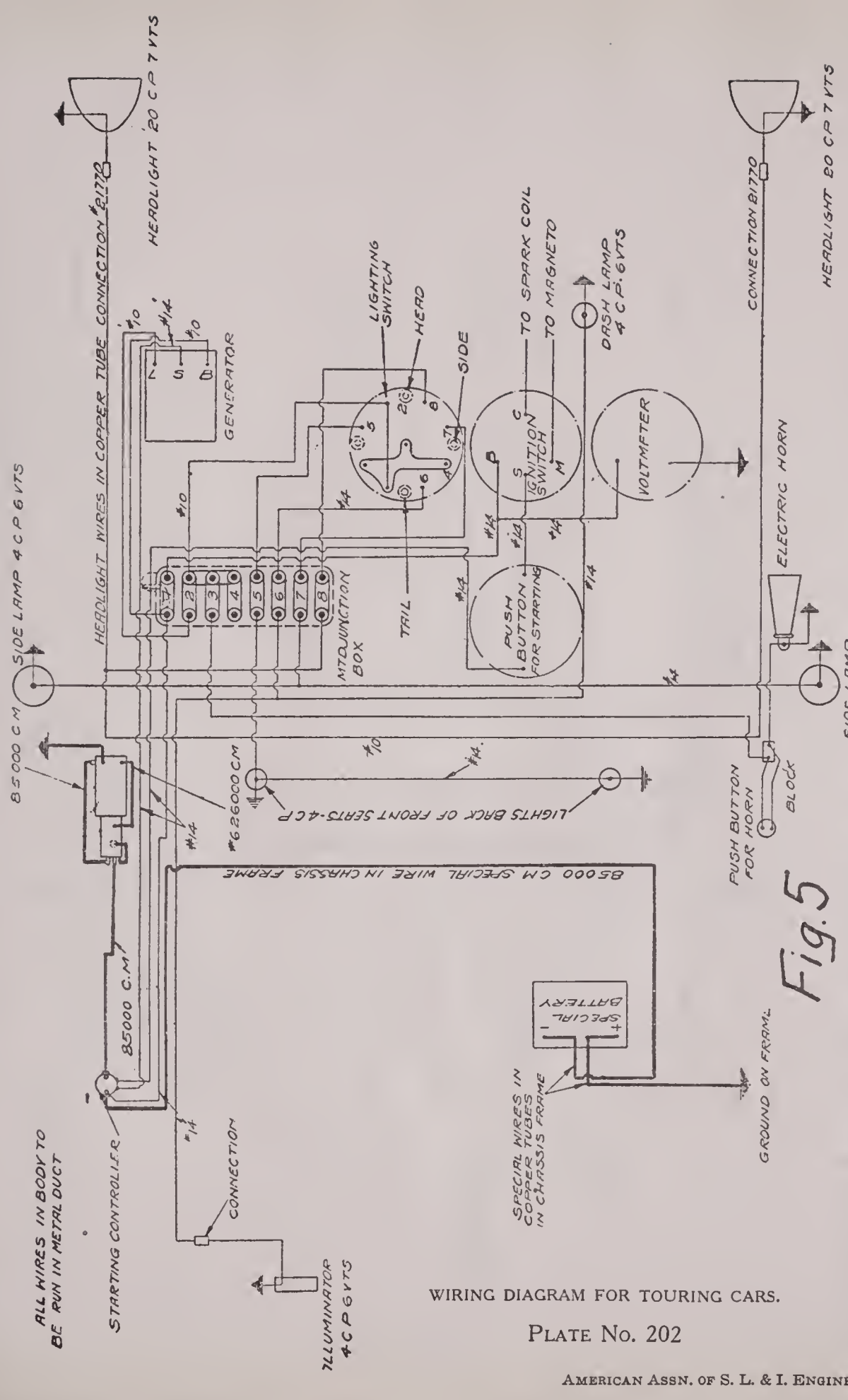
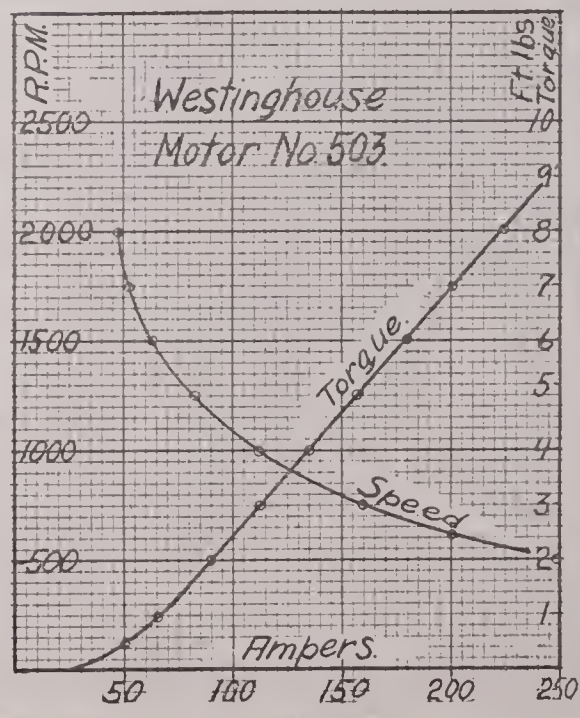
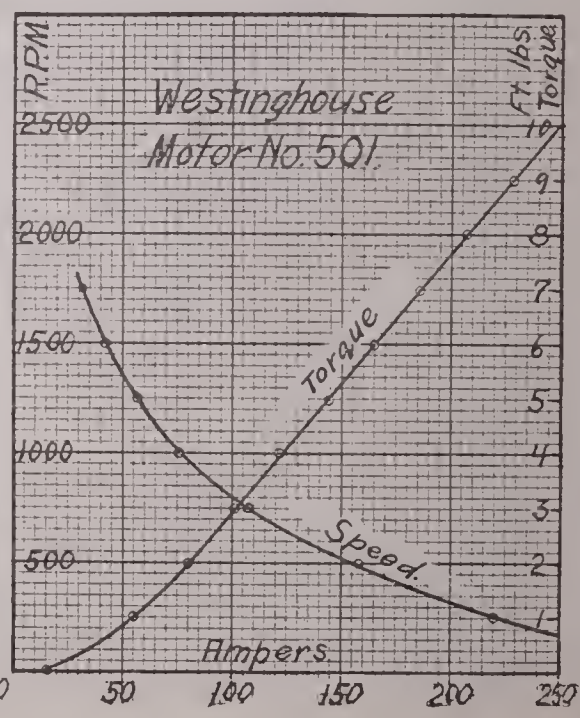


Fig. 5

WIRING DIAGRAM FOR TOURING CARS.

PLATE NO. 202





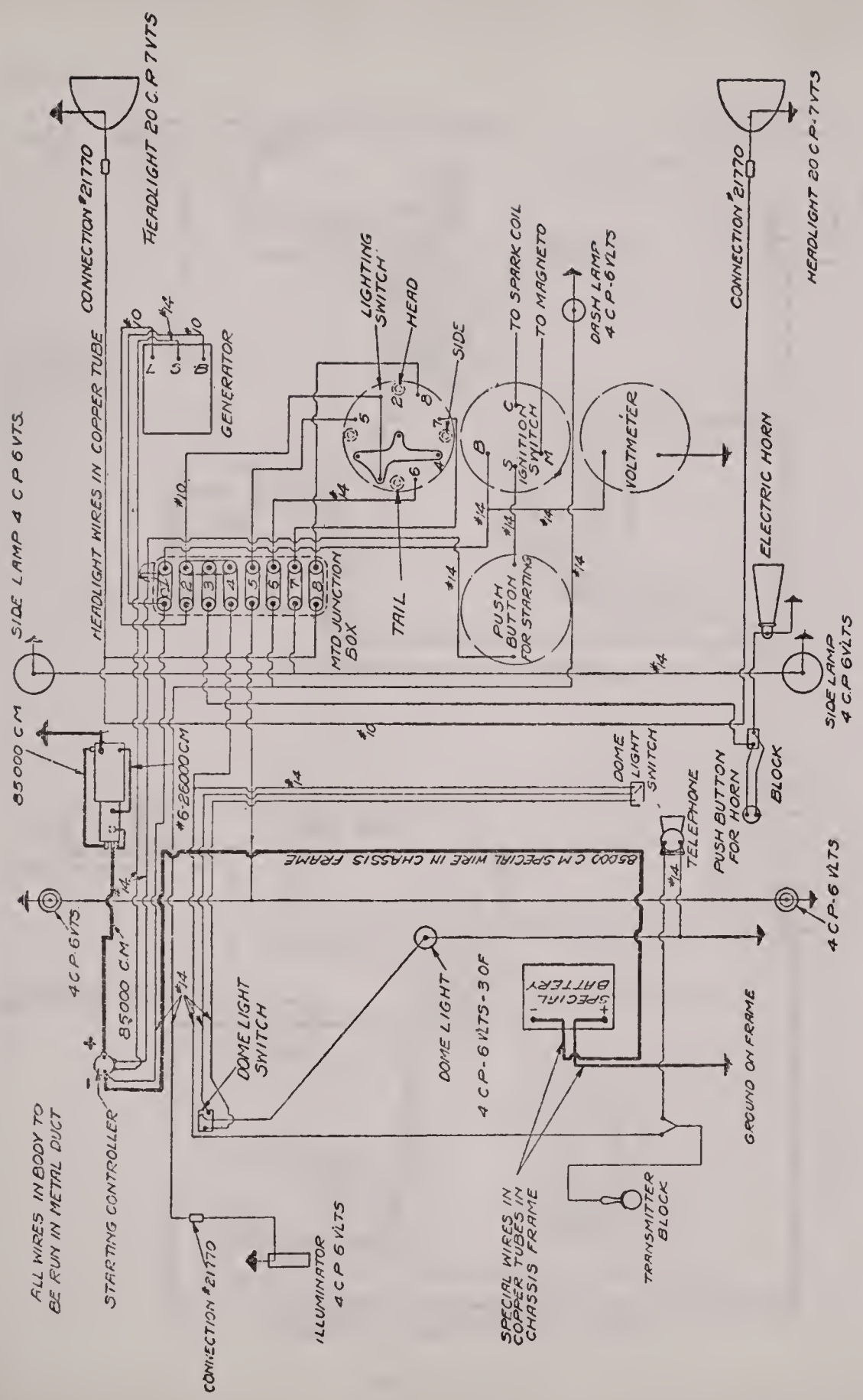


PLATE No. 203

(*Continued from Plate No. 202*)

Pierce-Arrow

SERIES 1, 2 AND 3

WESTINGHOUSE STARTING AND LIGHTING SYSTEM. BOSCH MAGNETO AND BATTERY IGNITION

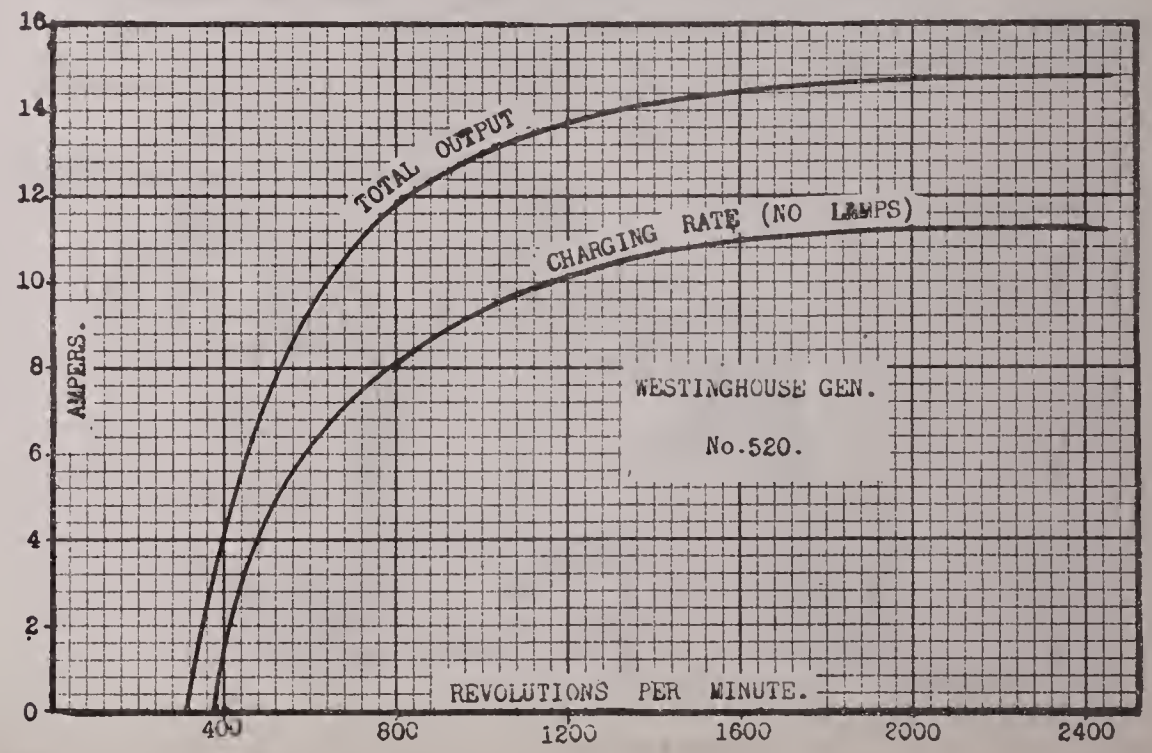
In the lighting circuits the single-wire system is used. Voltage regulation of the generator is by a series bucking field. Relay should close at about 360 R. P. M. and open at about 300 R. P. M. of the generator. These generator speeds are reached at about 12½ and 10½ miles per hour, respectively, high gear car speed. The charging rate rises rapidly after the relay closes, until 5 to 7 amperes is reached, after which it rises more slowly, all lights out, as shown in the accompanying curve. The current for the lights does not pass through the bucking field, so when they are turned on the output automatically increases to supply the extra current used, keeping the charging rate practically constant.

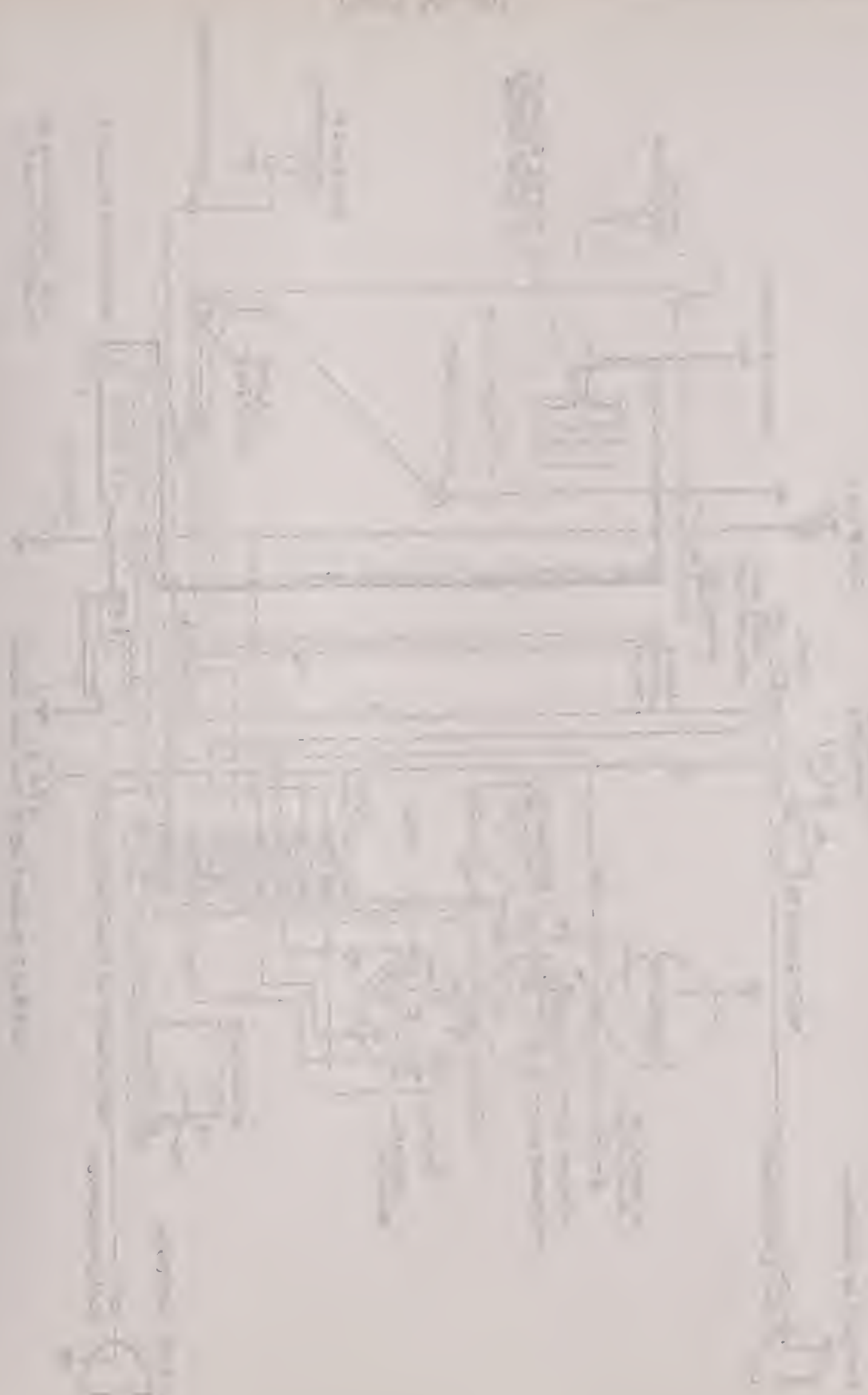
The brushes may be removed for inspection by unscrewing the black fiber caps and withdrawing with their connecting springs. When replacing, the brushes must be put back in the same holder from which they were taken, with the same side up. The current does not pass through the spring, but through the copper shunt.

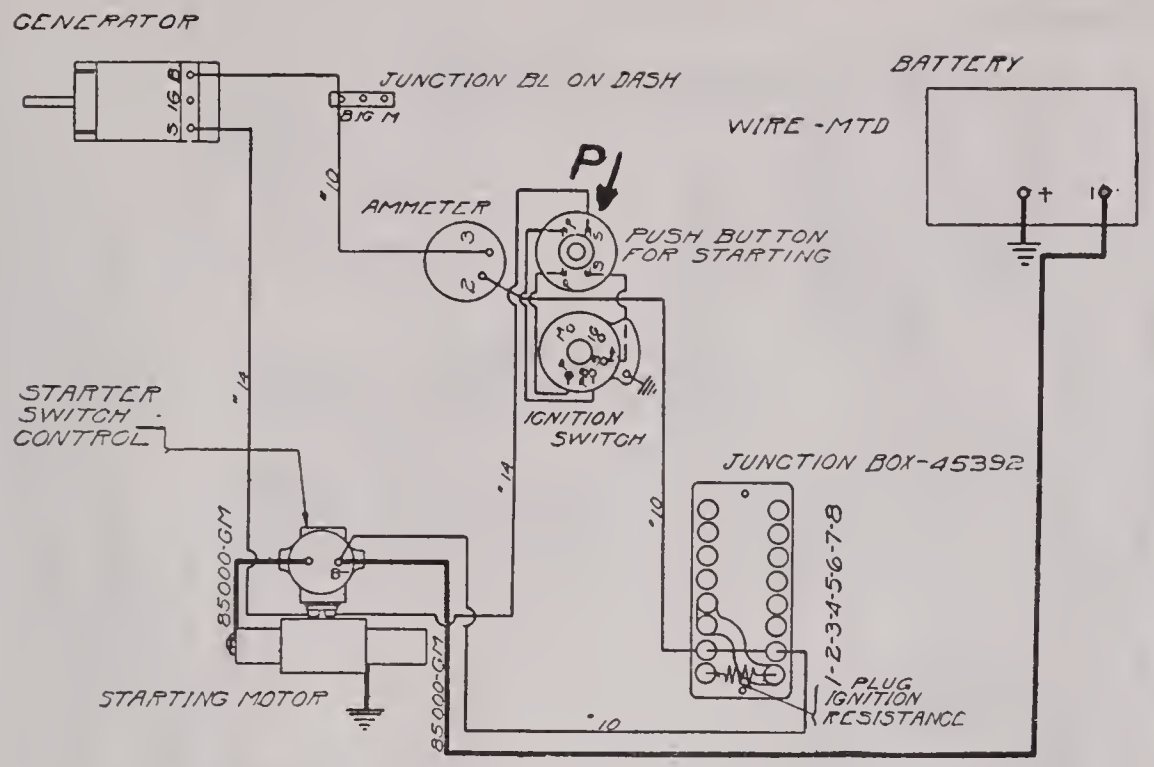
Once a month put four or five drops of light machine oil in each of the generator oilers.

There is a switch mounted on the back of the junction box, with "On" and "Off" positions. This switch should normally be in the "Off" position. If it is temporarily necessary to increase the charging rate, the switch may be placed in the "On" position.

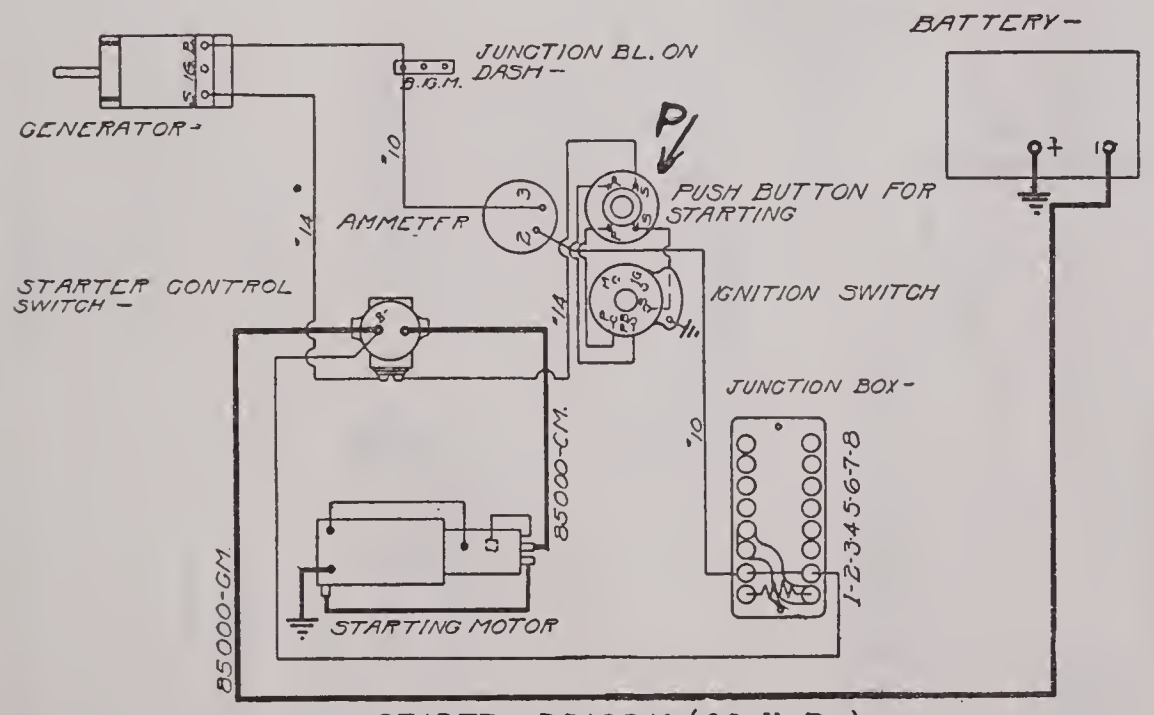
Head lights are 7 volt, 21 cp. Side lights are 6 volt, 4 cp. Dash and trouble lights are 6 volt, 4 cp. Tail light is 6 volt, 2 cp. Dome light is 6 volt, 6 cp. Pillar and tonneau lights are 6 volt, 4 cp. Fuses are 10 ampere capacity.







STARTING DIAGRAM (38 AND 48 H. P.)



STARTER DIAGRAM (66 H.P.)

PLATE No. 204

SERIES 4 (1916-17-18) AND SERIES 5 (1918)

WESTINGHOUSE STARTING AND LIGHTING SYSTEM. BOSCH MAGNETO AND WESTINGHOUSE BATTERY IGNITION

Battery is 6 volt, 105 ampere-hour. The positive terminal is grounded.

A double ignition system is used. The magneto is the Bosch, Type ZR6. Breaker contacts should open .012 in. to .016 in. Clean with gasoline whenever necessary. If contacts are badly burned or pitted, resurface them with a fine, flat, jeweler's file or a worn piece of No. 00 sandpaper. Every 500 miles put not more than five drops of light machine oil in each of the magneto oilers. On the "A4" cars the magneto spark should occur when upper dead center mark (1 & 6) on the flywheel is 1¾ in. past the indicator, spark lever fully retarded. On the "B4" cars, the magneto spark occurs when the upper dead center mark is 3/16 in. past the indicator. On the "C4" cars, the magneto spark occurs when the upper dead center mark on the flywheel is 1 in. past the indicator, spark lever in the fully retarded position. The firing order is 1, 5, 3, 6, 2, 4. For further directions applying to the magneto see Plate No. 186. The spark gap should be between 1/50 in. and 1/32 in.

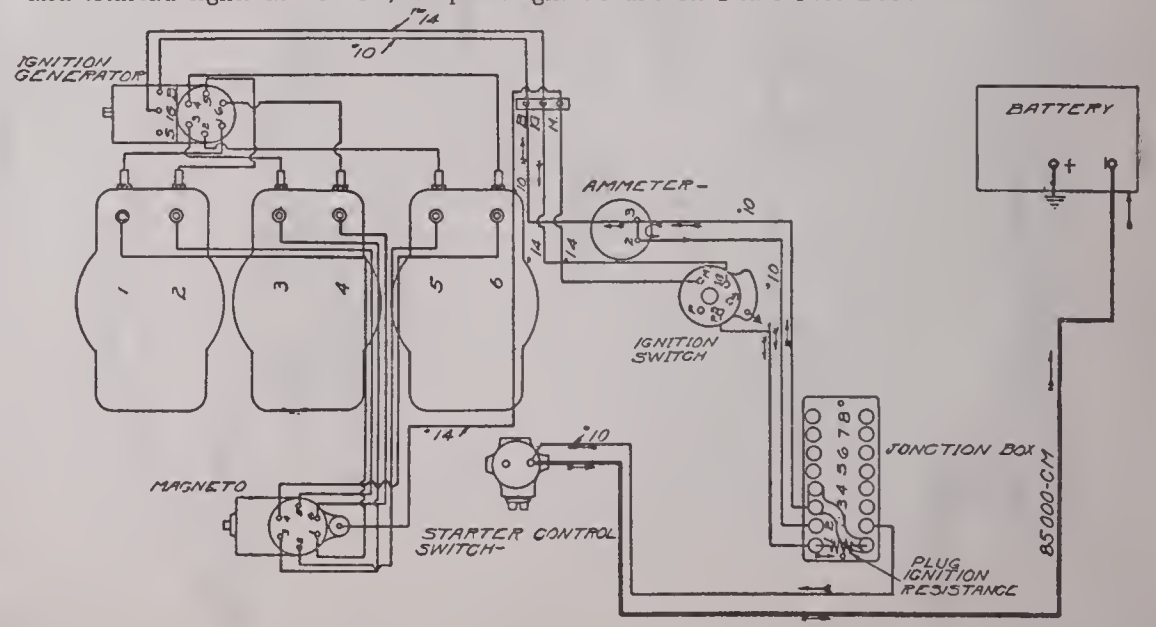
The breaker contacts in the battery ignition system should open .012 in. to .018 in. Should contacts become badly burned or pitted, resurface them with a fine, flat, jeweler's file or a small strip of worn No. 00 sandpaper. On the "A4" cars the battery spark should occur when the upper dead center mark on the flywheel is ¼ in. past the indicator, spark lever on the breaker ⅛ in. from the fully retarded position. On the "B4" and "C4" cars the battery spark should occur when upper dead center mark is at the indicator, spark lever on the breaker box ⅛ in. from the fully retarded position, as indicated by the marks on the breaker box. For further care of the ignition apparatus see Plate No. 200. Every 500 miles put three or four drops of light machine oil in the oiler at the side of the end bracket on which the distributor is mounted.

For magnetic starter pinion shift see Plate No. 201.

Voltage regulation of the generator is by a vibrating regulator. The relay is combined with the regulator. Relay should close at about 9 miles per hour and open at 7 miles per hour, high gear car speed. The maximum charging rate should be 15-20 amperes, just after the starter has been used or where battery is nearly discharged. When battery is fully charged, this rate will be reduced to 4-9 amperes.

Generator characteristics are given on Plate No. 203.

Head lamps are 7 volt, 21 cp. Side lamps are 6 volt, 4 cp. Dash and inspection lamps are 6 volt, 4 cp. Tail light is 6 volt, 4 cp. Dome light is 6 volt, 6 cp. Pillar and tonneau lights are 6 volt, 4 cp. Light circuits on Plate No. 205.



IGNITION SYSTEM.

Pierce Arrow

SERIES 4 and 5

(For text see Plate No. 204.)

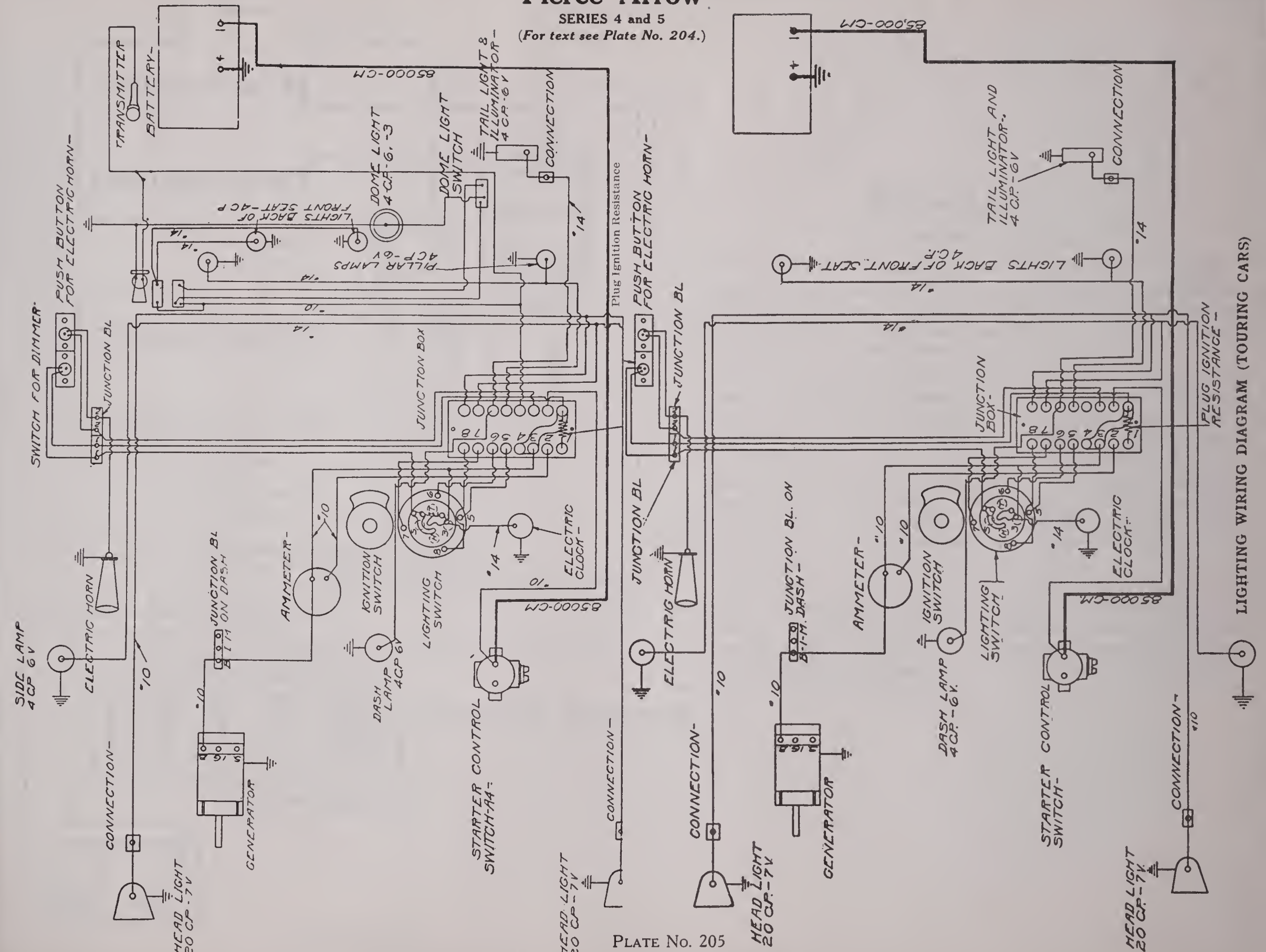
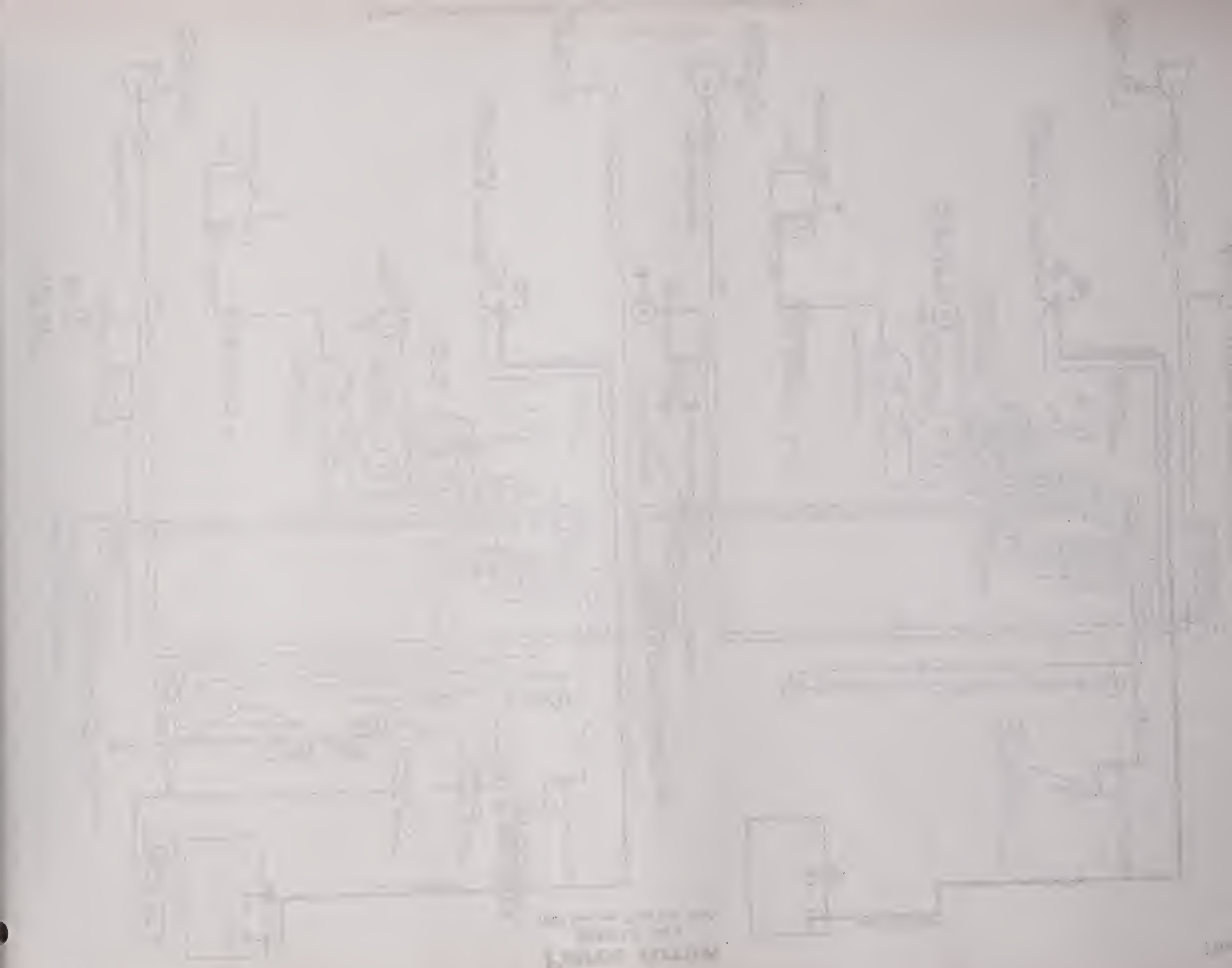
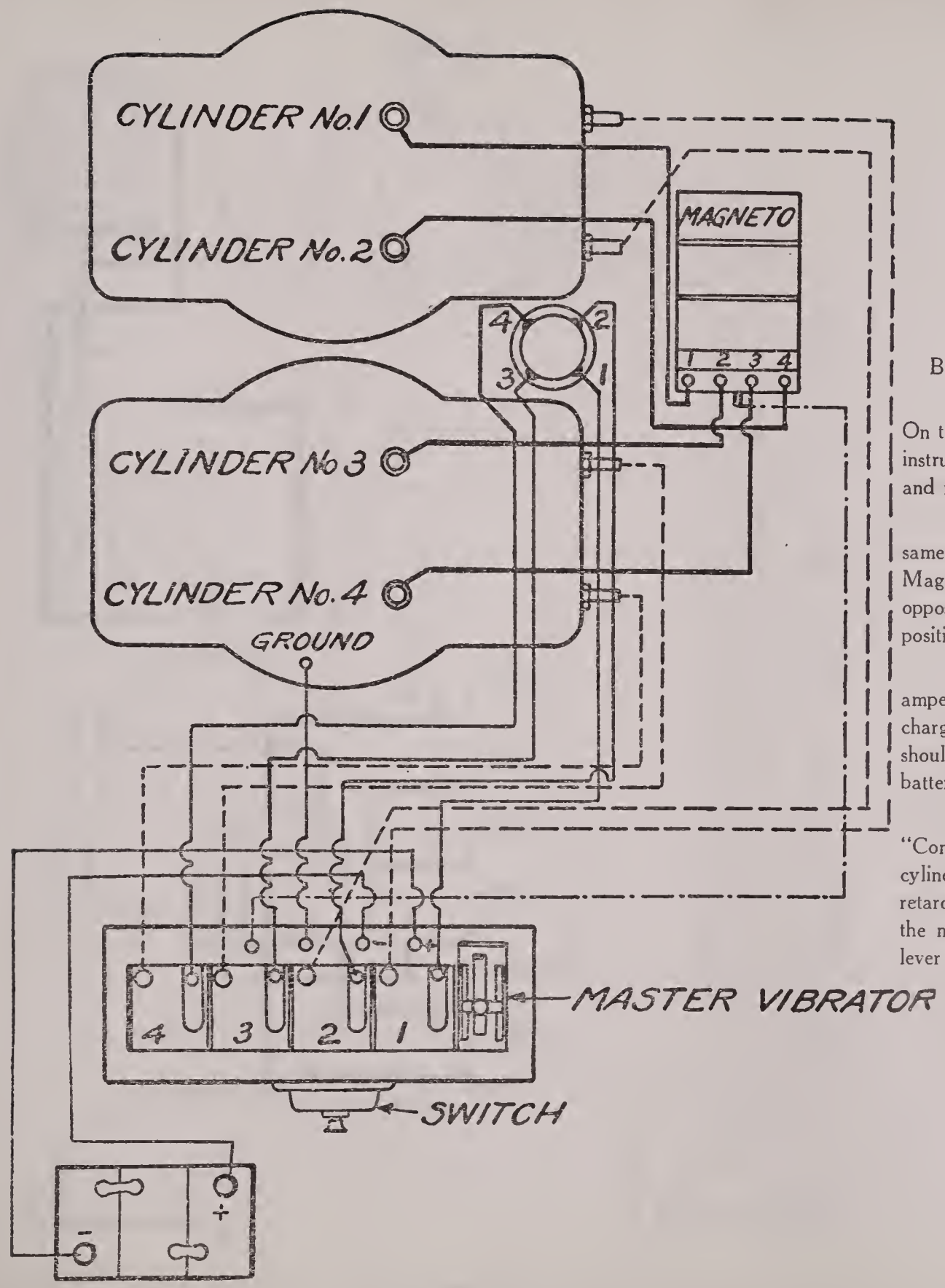


PLATE NO. 205





Pierce-Arrow

Two-Ton and Five-Ton Trucks

Bosch or Eisemann Magneto and Pierce-Arrow Battery Ignition

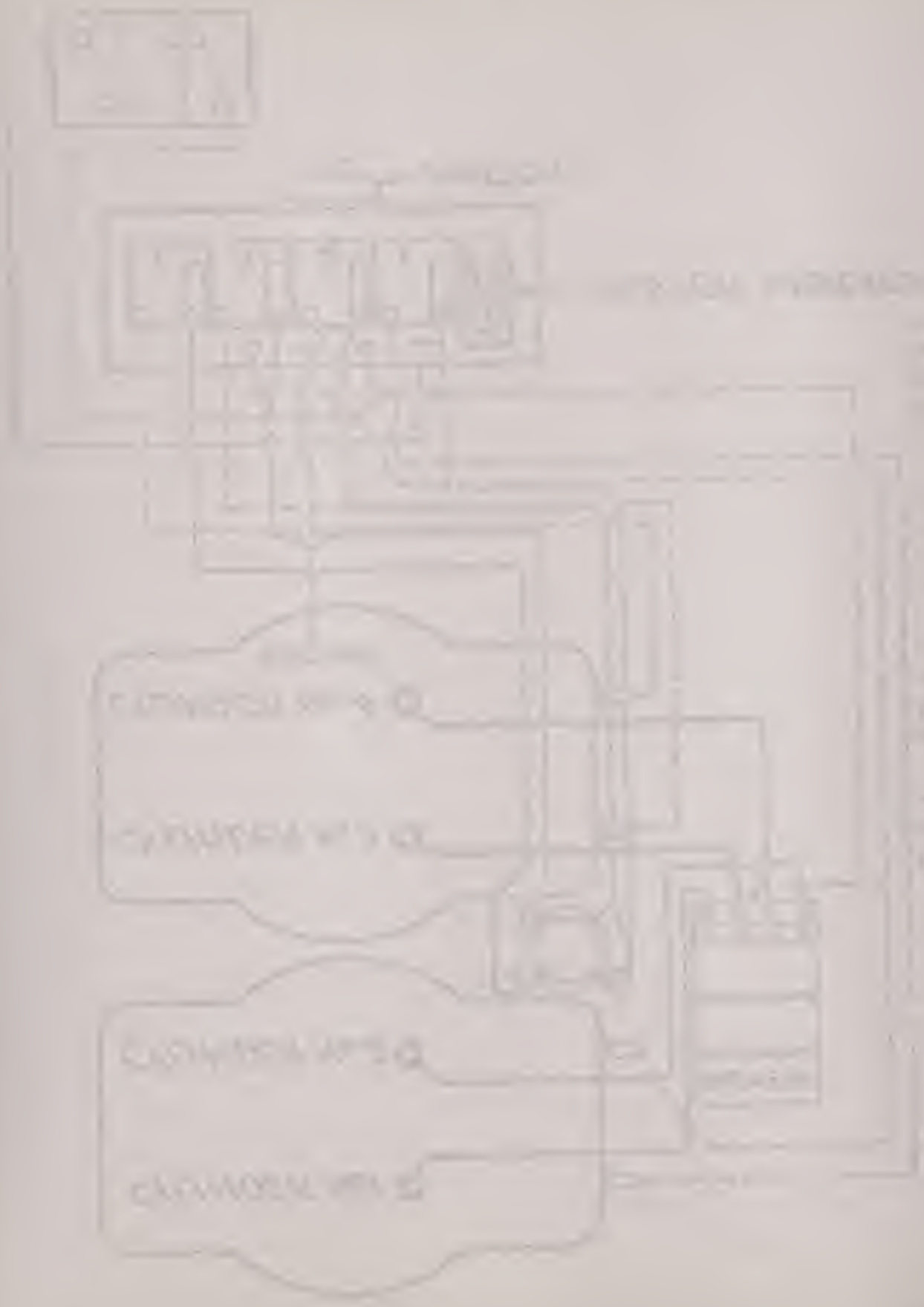
On the two-ton truck, previous to 1918, the Type ZR4 Bosch magneto was used. On the 1918 models the magneto is Eisemann, Type G4 Edit. 2. For a description and instructions for the care of the Bosch magneto see Plate No. 186. For a description and instructions for the care of the Eisemann magneto see Plate No. 153.

On the five-ton trucks a double ignition system is provided. The magneto is the same as used on the two-ton truck. There is a line on the flywheel marked "Magneto." Magneto breaker contacts should be just beginning to open when the mark is directly opposite the indicator, No. 1 cylinder in firing position, spark lever in the fully advanced position. The firing order is 1, 3, 4, 2. Spark gap should be .028 in. to .030 in.

Current for the battery ignition is supplied by a set of dry cells or a three-cell, 75 ampere-hour, "National" storage battery. When charging the battery it should be charged at about a 10-ampere rate until the voltage reaches 2.5 volts per cell. The rate should then be reduced to 3 amperes and the charge continued until the gravity of the battery ceases to rise.

To time the battery ignition, turn engine until the line on the flywheel marked "Commutator" is directly under the indicator, intake and exhaust valve on the No. 1 cylinder closed. With the engine in this position and spark control lever in the fully retarded position, set the rotor so that the slightest advance of the control lever will cause the master vibrator to cease operation, yet cause it to again resume operation when the lever is moved to the fully retarded position.

Plate No. 206



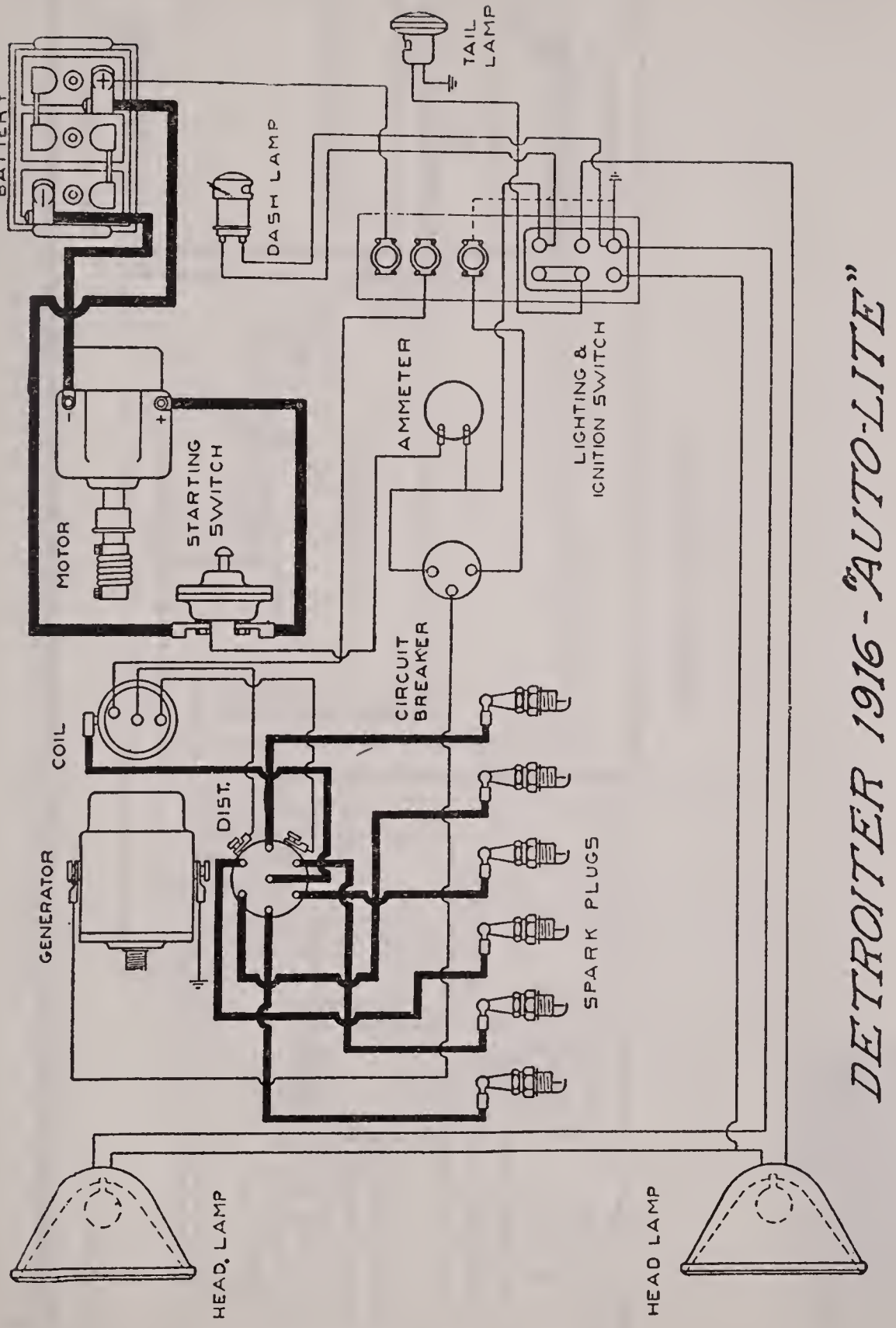


PLATE No. 207

Detroiter

1916

AUTO-LITE STARTING AND LIGHTING SYSTEM. CONNECTICUT IGNITION

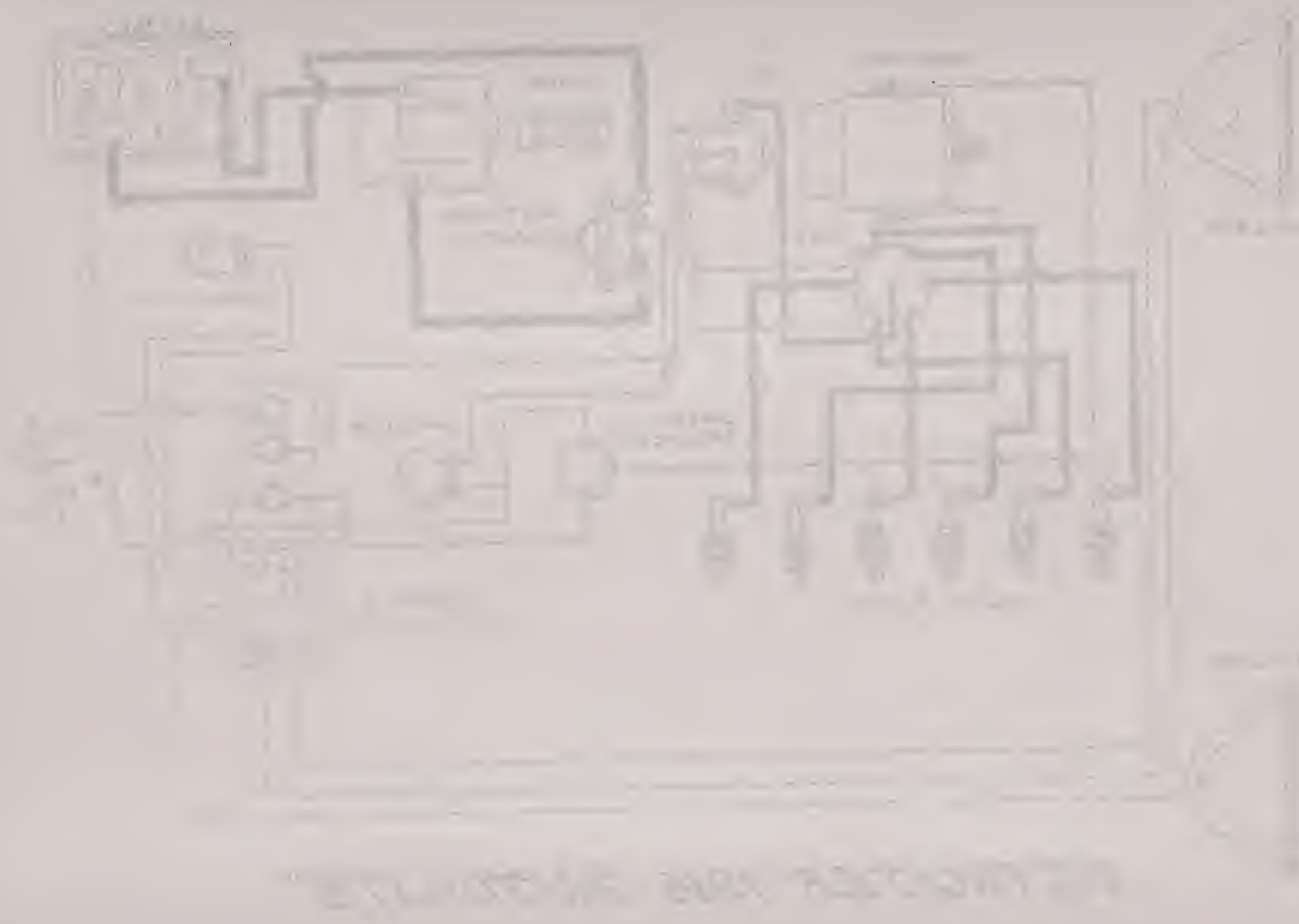
Battery is 6 volt, 80 ampere-hour. The negative terminal is grounded at the lighting switch, through the relay and ammeter.

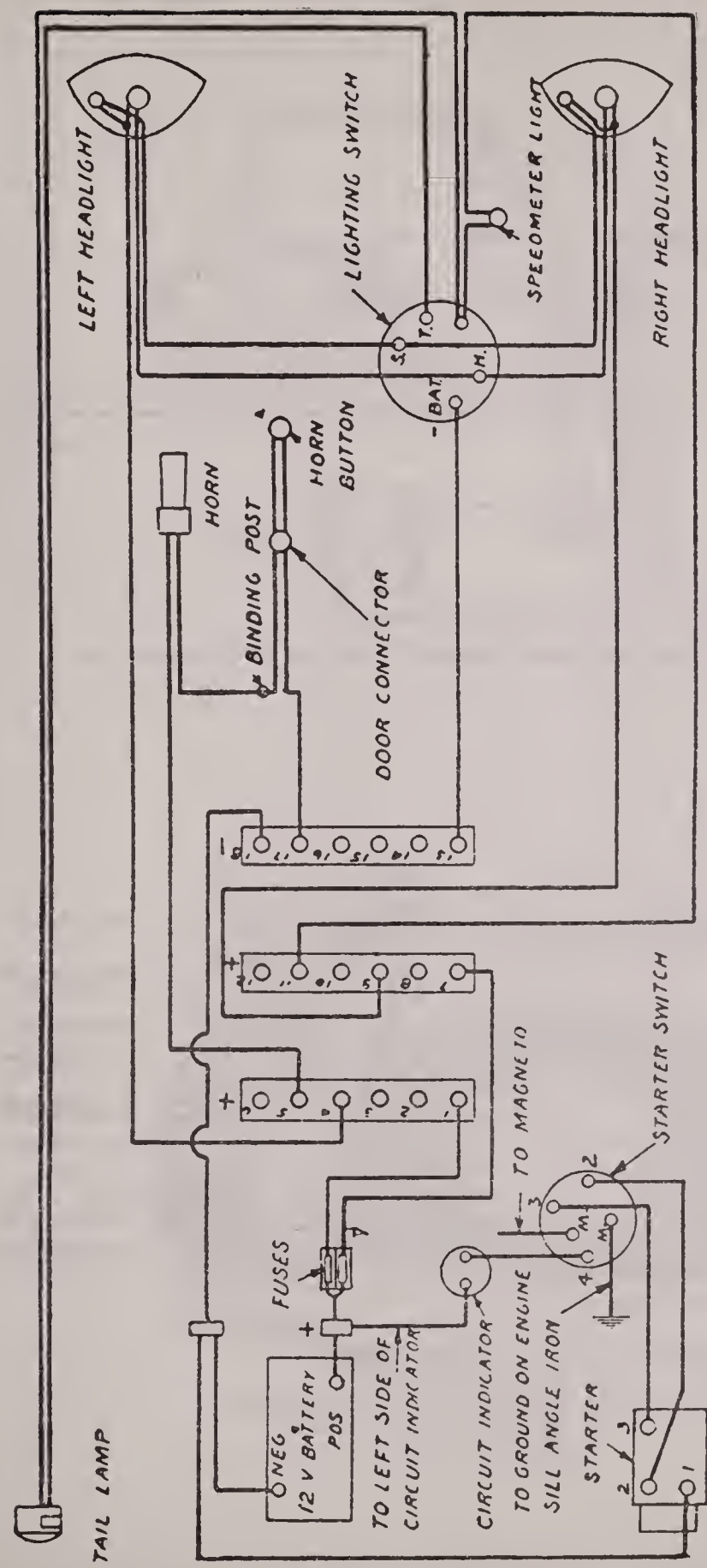
Breaker contacts should open .016 in. to .020 in. Contacts are made of tungsten metal. The breaker will operate properly even though the contacts are quite rough. Contacts should not be filed nor sandpapered. Should contacts become so badly corroded or pitted as to impair the proper operation of the engine, the entire breaker mechanism should be renewed as directed on Plate No. 50. Breaker contacts should be just beginning to separate when the piston receiving the spark is on top dead center, spark lever in the fully retarded position. The firing order is 1, 5, 3, 6, 2, 4. Spark gap should be .30 in.

The driving power of the starter is transmitted to the flywheel by a Bendix drive. Put four or five drops of light engine or machine oil in each of the motor oilers every 1,000 miles.

Voltage regulation of the generator is by third brush. Relay should close at about 8 miles per hour. The maximum charging rate of 12-15 amperes should be reached at 18-20 miles per hour. Every 500 miles put four or five drops of light oil in each of the generator oilers.

Head lamps are 6-8 volt, 17 cp. Dash light is 6-8 volt, 2-4 cp. Tail light is 6-8 volt, 2-4 cp.





FRANKLIN SERIES 8.

PLATE No. 208

Franklin

SERIES 8

DYNETO STARTING AND LIGHTING SYSTEM. EISEMANN MAGNETO IGNITION

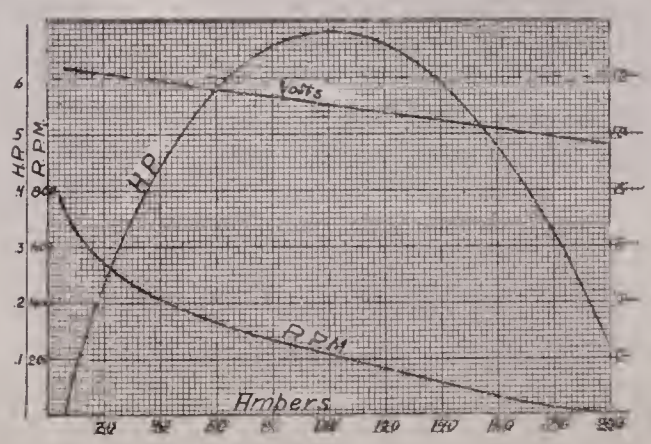
Battery is 12 volt, 60 ampere-hour. The two-wire system is used.

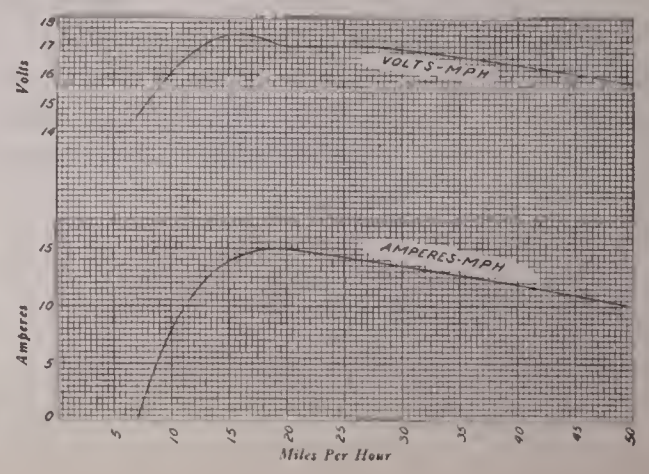
The magneto is the Type EMA6D. Breaker contacts should open .012 in. to .014 in. Clean contacts with gasoline whenever necessary. Should contacts become badly burned or pitted, resurface them with a fine, flat, jeweler's file or a worn strip of No. 00 sandpaper. Spark should occur when the top dead center mark $\frac{C\text{-}L}{1\&6}$ on the flywheel is 1¾ in. before the indicator. The firing order is 1, 4, 2, 6, 3, 5. The spark gap should be .034 in. For directions for the care of the magneto see Plate No. 151.

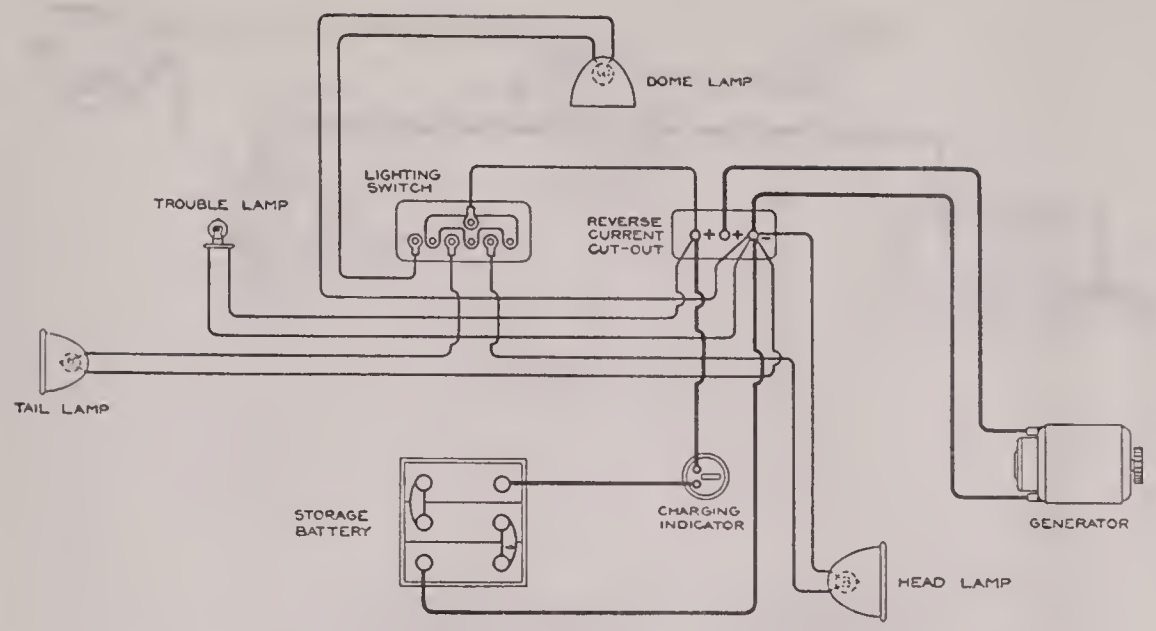
Voltage regulation is by third brush. Fig. 2 shows the characteristics of the machine as a generator. Fig. 3 shows the characteristics when operating as a motor. Every 500 miles put a few drops of engine oil into the oilers on each end of the motor-generator.

Should the driving chain become too slack, a rumbling noise will result when engine is running at a slow speed. To adjust the chain, remove the mud apron and timing gear case cover. Then, loosen the three screws holding the motor-generator in place. After the screws are loosened take up the slack in the gears by backing out the adjusting set screw, until the chain has the proper tension. The chain should allow ⅝ in. upward movement from its normal position. Care must be taken to tighten the three screws holding the frame and the lock nut on the adjusting screw before the tension of the chain is finally checked. After chain tension is adjusted the motor-generator must be lined up. If the sprockets are not in proper alignment the chain will be noisy and will wear rapidly. Check alignment with a straight edge placed across the surface of the two sprockets. The armature should have 1/32 in. end play.

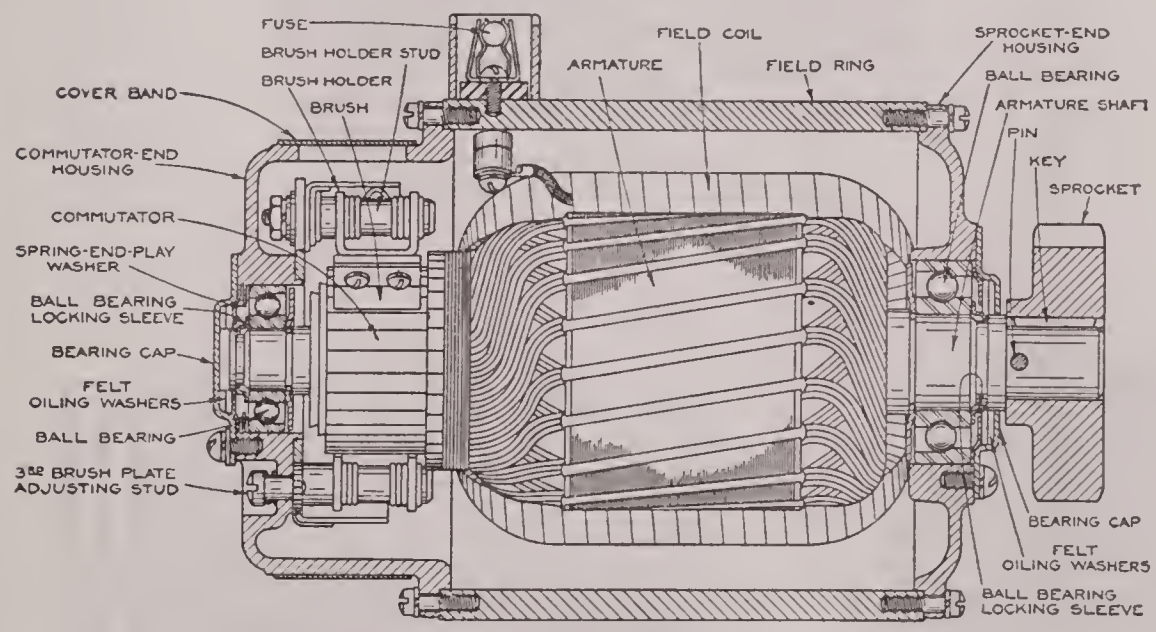
Head lamps are 12 volt, 18 cp. Dimmer lamps are 12 volt, 4 cp. Dash and tail lights are in series. They are 6 volt, 2 cp. Fuses are all 10 ampere.







Wiring Diagram of North East Model L Generator as applied to the Holt Caterpillar Tractor



North East Model L, Type 3579, 6 Volt Generator

PLATE NO. 209

Holt Caterpillar Tractor

NORTH EAST, 6-VOLT LIGHTING SYSTEM. K-W MAGNETO IGNITION

Battery is 6 volt, 100 ampere-hour. The two wire system is used.

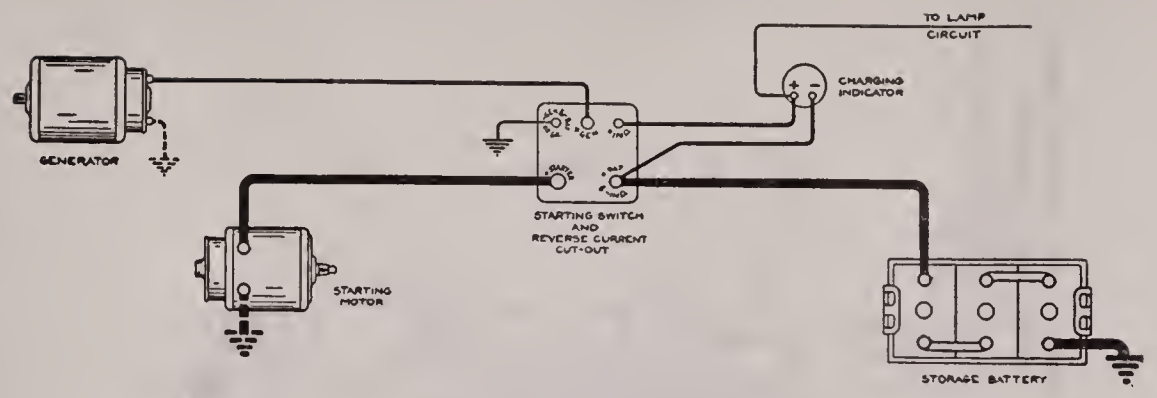
The models TK and HK magnetos have been used on these tractors. For a description of the Type TK magneto see Plate No. 157. For care of the Type HK magneto see Plate No. 158. The spark should occur when the piston just about to enter power stroke is on top dead center, spark lever fully retarded. The firing order is 1, 2, 4, 3. The spark gap should be about .030 in.

The generator is driven at 1½ times engine speed. It should rotate in a clockwise direction, viewed from the driving end. Voltage regulation is by third brush. The relay should close at about 550 R. P. M. of the generator. The maximum output should be about 8½ amperes. There is a 5-ampere fuse in the small rectangular housing at the commutator end of the generator. This fuse is in the shunt field circuit. If the tractor is being run during the day and does no night work, requiring no lights, remove the generator fuse, to prevent superfluous charging of the battery. If the battery discharges through the generator, the relay contacts are closed. In this case do not try to force them open, but run the generator at sufficient speed to charge the battery and then reduce the speed, which will cause the contacts to open, if not welded together from sparking or excessive current. If the fuse is removed the battery must be watched, replacing the fuse and giving the battery a short charge once a month and the water kept above the top of the plates. Clean the cutout relay contacts by drawing a piece of soft paper between them. Do not leave the contacts closed after cleaning, as this will discharge the battery and burn out the relay coils.

The driving chain should have about ½ in. up-and-down play. It must be kept well lubricated at all times. Every two or three weeks the chain should be removed and thoroughly cleaned with gasoline or kerosene, being well lubricated before being placed in service again. Should the generator not be in proper alignment with the cam shaft, the chain and sprocket will wear rapidly.

The generator bearings are packed with grease. A few drops of oil should be put in each of the generator oilers every two or three months, to keep the grease soft. The generator driving chain should be lubricated by applying a good grade of medium or heavy machine oil to its inner surface every two or three weeks.

North East Two Unit Wiring Diagram



Ground-return System

North East Two-Unit System

MODELS H AND K MOTOR. MODEL L GENERATOR

FOR TRUCKS, TRACTORS, MARINE AND AEROPLANE ENGINES

This is a 6-volt, two-unit system. Battery is 6 volt, 80 ampere-hour, to a 6 volt, 120 ampere-hour, according to the requirements of the machine on which it is mounted. Either the one- or two-wire system can be used.

The driving power of the starter is connected to the engine by a Bendix gear. It should crank the average engine at 100 to 200 R. P. M., depending on the gear ratio. The gear ratio ranges from 10:1 to 15:1. The average operating speed of the motor is 1400 to 1500 R. P. M. Figure 1 is the characteristic curve of the Model H and K, Frame 8306 Motor. Figure 2 is the characteristic curves of the Model H and K, Frame 8550 Motor.

Voltage regulation of the generator is by a third brush. Relay should close at 6-8 miles per hour if the generator is on passenger cars, or at about 400 R. P. M. of the generator. The third brush is capable of varying the maximum output of the generator between 6 and 20 amperes. The average maximum charging rate required is about 17 amperes. The output gradually decreases after maximum is reached, as shown in Figures 3 and 4. Figure 3 is the characteristic curves for the Model L, Frame 8401 Generator. Figure 4 is the characteristic curve for the Model L, Frame 8500 Generator.

The cutout relay is mounted in the starting switch case.

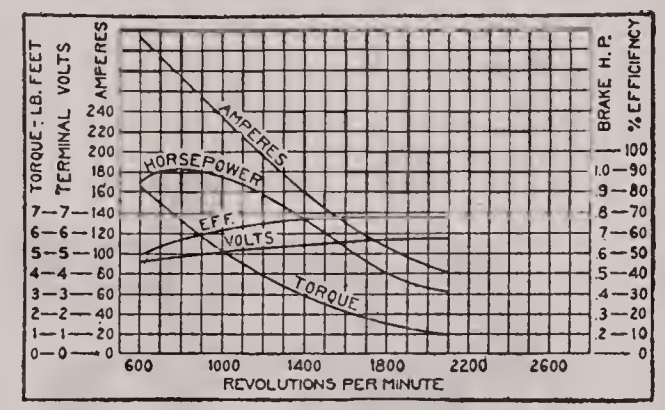


Fig. 1. Characteristic Curve
Model H Starting Motor—Frame 8306

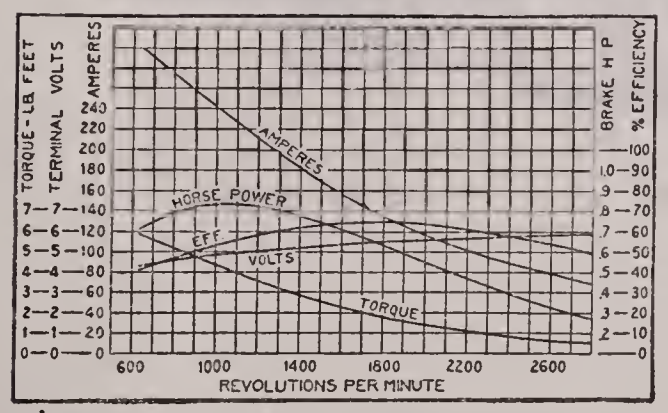


Fig. 2. Characteristic Curve
Model H Starting Motor—Frame 8550

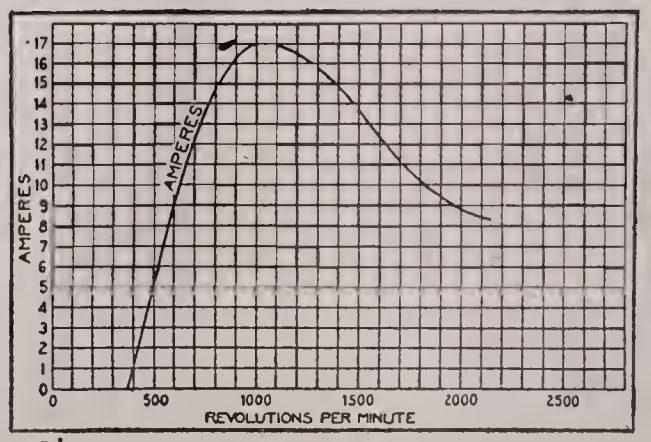


Fig. 3. Characteristic Curve
Model L Generator—Frame 8401

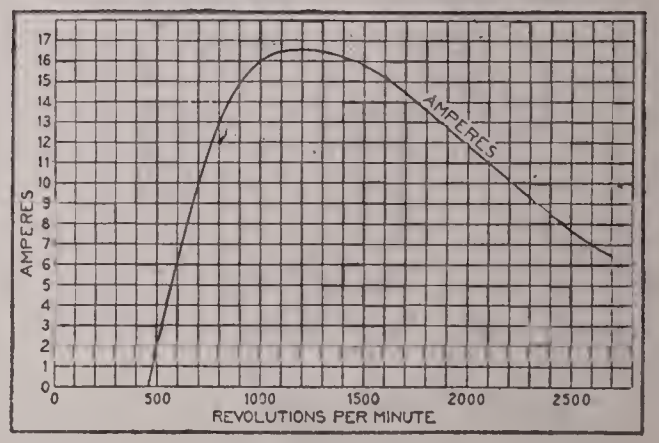
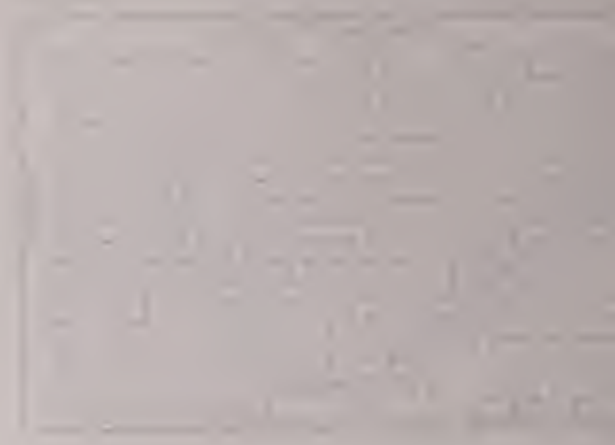


Fig. 4. Characteristic Curve
Model L Generator—Frame 8500



Eiseman Magneto

With Separate Transformer Coil
Types A8, BK and BL

These magnetos are made for 2, 3, 4, 6, and 8 cylinder engines. The direction of rotation is indicated by the arrow on the gear wheel case.

The breaker contacts should open 1/64 in. Clean contacts with gasoline whenever necessary. If contacts are badly burned or pitted they should be cleaned with a fine, flat, jeweler's file or a piece of worn No. 00 sandpaper. The movable contact arm can easily be removed without the aid of any tool.

If for any reason the magneto has been taken down, when reassembling be sure that the numbers stamped on the gear wheels are exactly opposite each other.

The wire in the primary circuit must be 7/32 in. and the wire in the secondary circuits 5/16 in. When connecting to the magneto, the insulation should be scraped from the wire for a distance of 3/16 in. from the end. After the copper wire is cleaned well, the wire should be inserted into the socket and the set screw tightened, in order to hold it in place and to make a good electrical connection, then the brass contact screwed into the ebonite socket.

The magneto may be changed from an independent ignition type magneto to a dual type magneto. To do this, a switch similar to that illustrated at "A", Figure 2, must be substituted for the grounding switch used for the independent type ignition. The switch may be obtained from the Eisemann Magneto Co., 225-227 West Fifty-seventh Street, New York, N. Y., or any of its branches or from an electrical supply house. A six volt storage battery or five dry cells connected in series may be used to supply the battery current. To make the change, remove the brass bar from the terminals A-B, Figure 1, and place it on the terminals A-C, wiring up the system as shown in Figure 2.

On the Type A8 there is a small lubricator outside the large toothed wheel, which must be kept filled with good grease. Use light machine oil in the wick oilers on the bearings. Clean the oilers and bearings every three or four months. Put in three to five drops of oil every 1,000 miles. The bearing of the contact arm should also receive one or two drops of light machine oil every 500 miles.

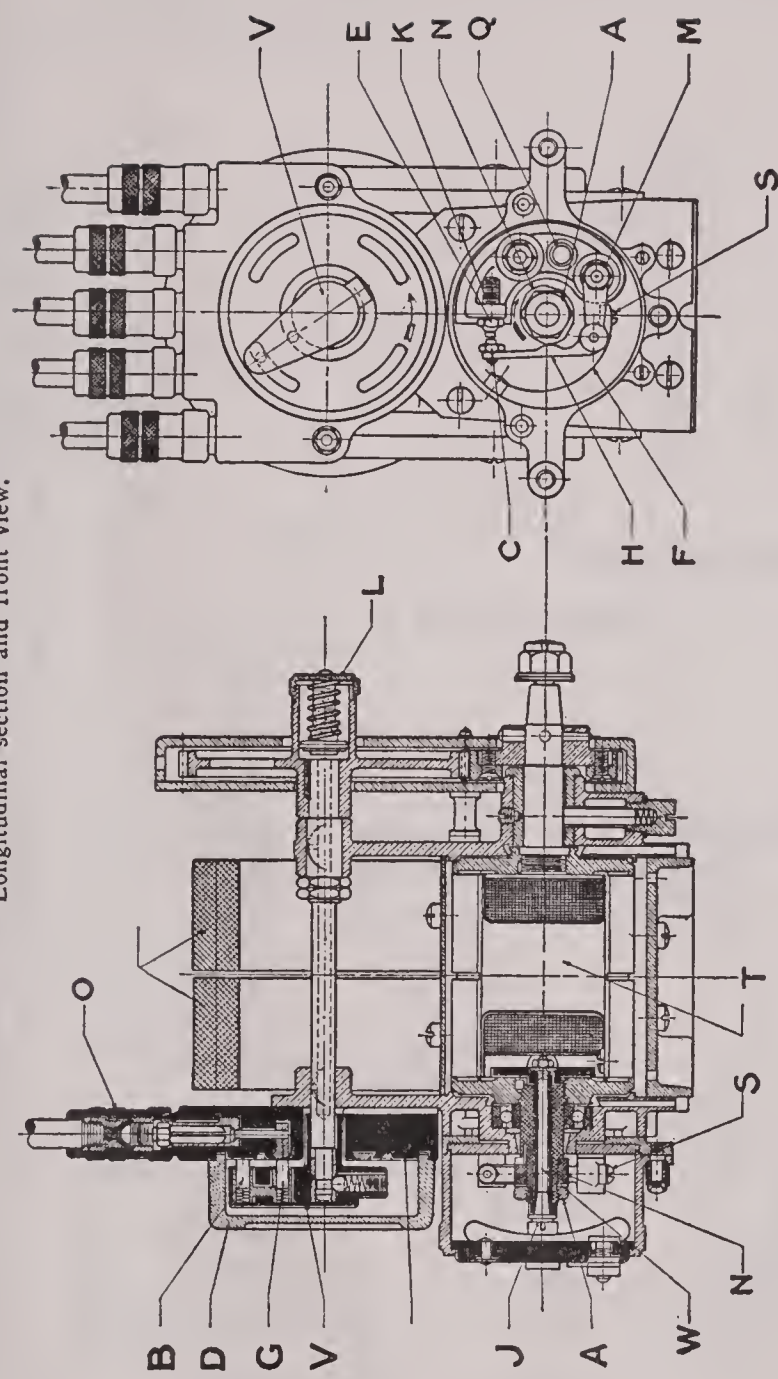


Diagram of types A8, BK and BL.
Longitudinal section and front view.

A Cam nut.
B Steel contact for high tension distributor.
C Platinum contact for make and break lever.
D High tension distributor cover.
E Nut for adjustable contact screw.
F Spring for make and break lever.
G Carbon contact for high tension distributor.
H Make and break lever.
I Low tension carbon brush.
K Adjustable platinum contact screw.
L Grease box for large toothed wheel.
M 5 mm nut.
N Cam.
O Cable joints.
Q Metal contact.
S Screw for spring for make and break lever.
V High tension distributor.

When ordering spare parts please state whether for type A8, BK or BL or else mention number stamped on base plate of magneto.

PLATE No. 211

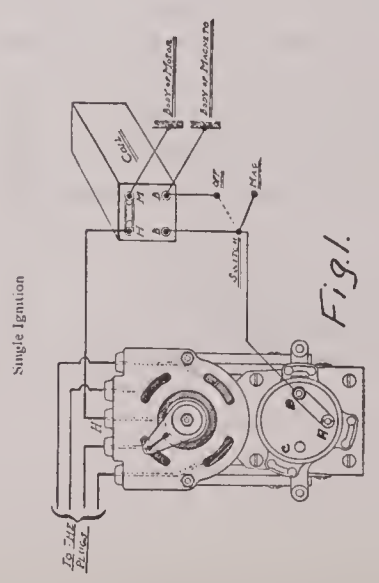
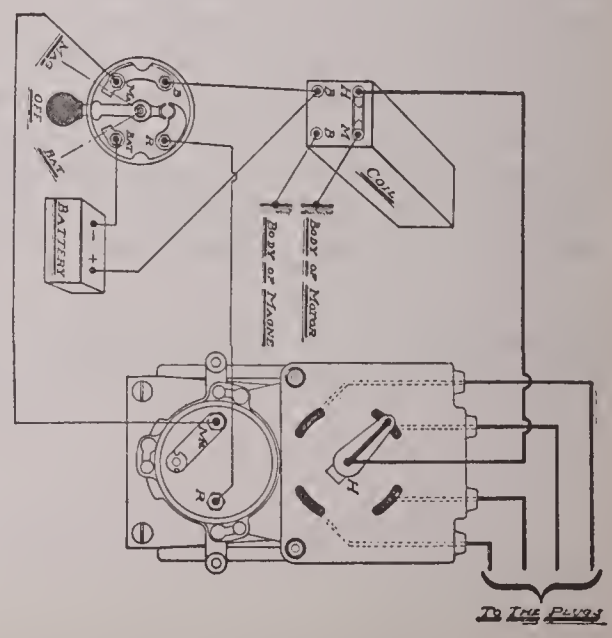


Fig. 1.



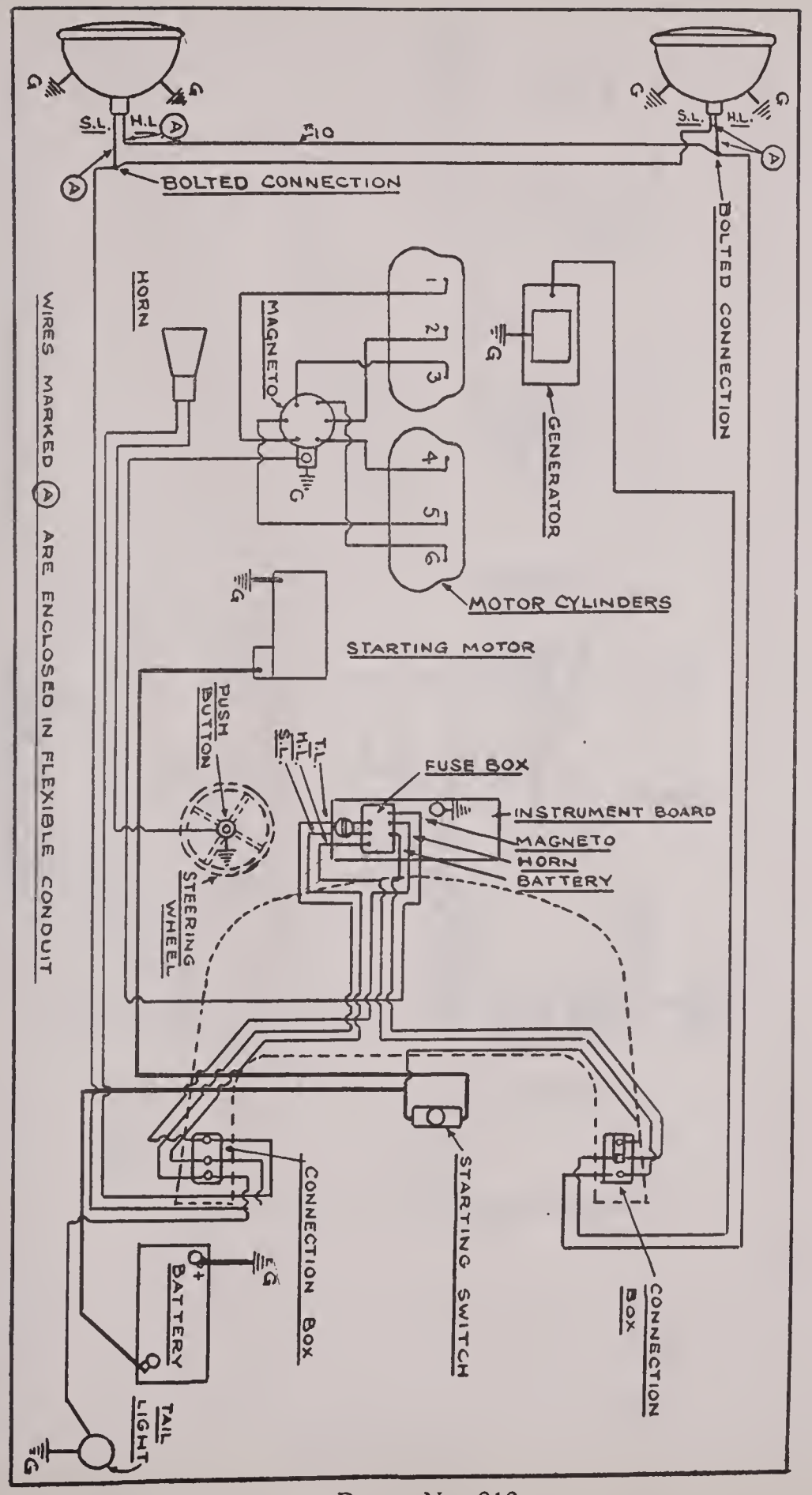


PLATE NO. 212

Chandler

CARS NO. 35,001 TO 60,000

GRAY AND DAVIS TWO-UNIT STARTING AND LIGHTING SYSTEM
BOSCH MAGNETO IGNITION

Battery is 6 volt, 100 ampere-hour. The positive terminal is grounded.

The magneto is Bosch, Type DU6. Directions for the care of this magneto are given on Plate No. 182. The spark should occur on top dead center, spark lever fully retarded. The firing order is 1, 5, 3, 6, 2, 4. Spark gap should be .028 in. to .030 in. Breaker contacts should open .014 in. to .016 in. Clean with gasoline whenever necessary. If badly burned or pitted resurface with a fine, flat, jeweler's file or a worn piece of No. 00 sandpaper. Should the magneto pencil, connecting the collector brush with the distributor, be removed frequently, to prevent unauthorized operation of the car, the series of light shocks of replacing it will sometimes crack the hard rubber insulation. This will often allow the spark to pass through the crack to the frame of the magneto, thus causing the engine to misfire. If the engine misfires irregularly and the defect cannot be traced to any one cylinder, the above may be the trouble. The constant removing of this pencil may also affect the insulation of the collector brush holder.

The driving power of the starting motor is transmitted to the flywheel by a Bendix drive. Every 1,000 miles put several drops of light machine oil in each of the motor oilers. Motor should crank engine at about 200 R. P. M.

Voltage regulation of the generator is by third brush. The position of the third brush is changed by turning the screw located on the upper left-hand corner of the rear end of the generator. To adjust the rate, insert a screw driver through the slot in the generator frame and turn the screw slightly to the right to increase the rate or to the left to decrease the rate. The maximum charging rate should be 9-11 amperes at about 15 miles per hour, all lights off. This rate reduces to 2 or 3 amperes below the maximum at 25 miles per hour. Relay should close at about 7 miles per hour. Every 500 miles or every two weeks put four or five drops of light machine oil in each of the generator oilers.

The large head lamps are 6-8 volt, 16-18 cp. The small head lights are 6-8 volt, 4 cp. Dash lamp is 6-8 volt, 4 cp. Tail lamp is 6-8 volt, 2 cp. Dome light is 6-8 volt, 6 cp. The fuses are 20 ampere.

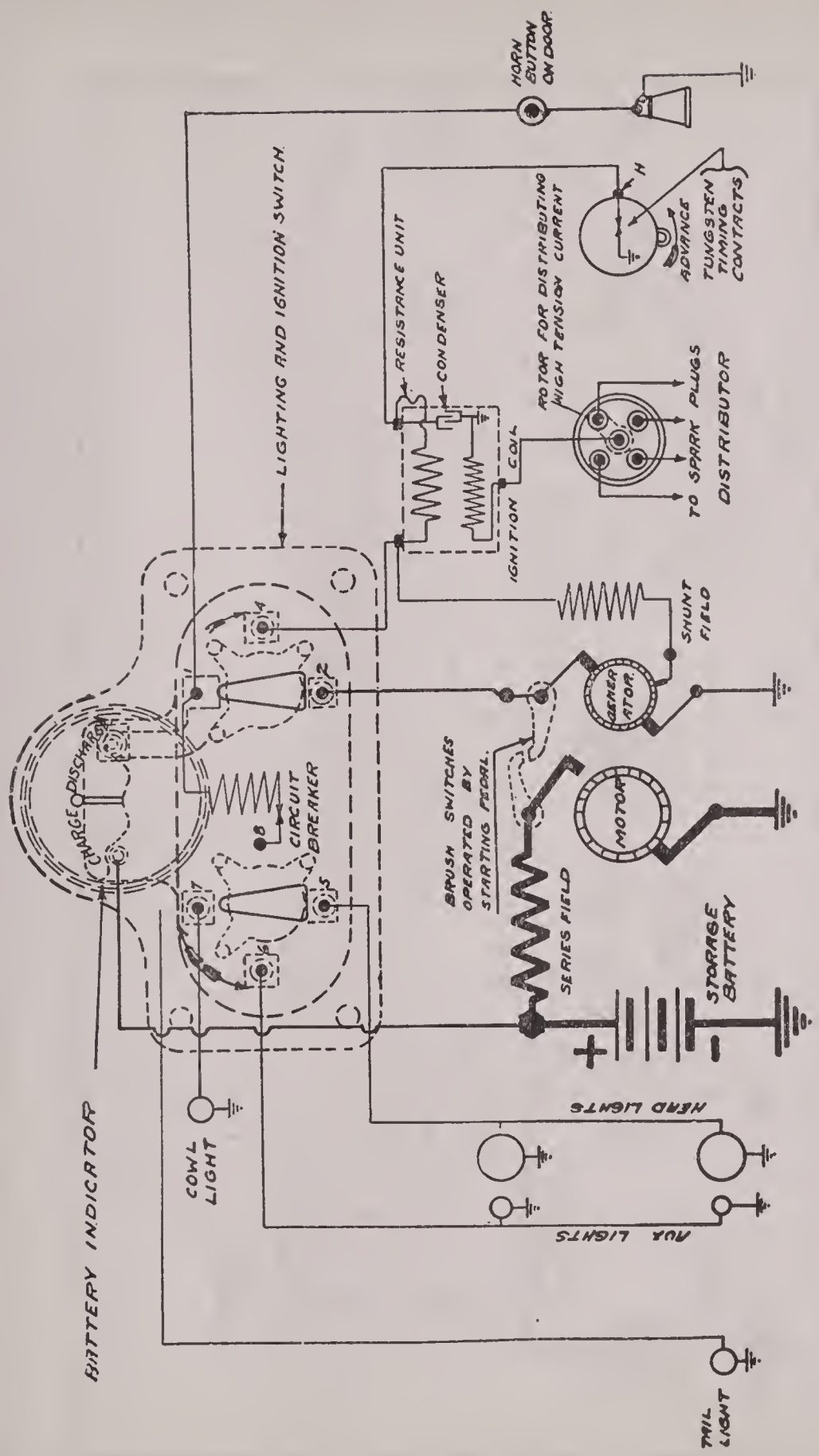


PLATE No. 214

Buick

MODELS E-4-34, E-4-35 AND E-4 (1918-19)

DELCO DOUBLE-UNIT STARTING AND LIGHTING SYSTEM. DELCO IGNITION

Battery is 6 volt, 90 ampere-hour. The negative terminal is grounded.

Breaker contacts should open .018 in. Timing contacts are made of tungsten metal. For care of these contacts see Plate No. 20. Breaker cam should be set so that when the upper dead center mark on the flywheel is 1 in. past the indicator, spark lever at full retard, the contacts will just open when the unit is moved forward as far as the slack in the gears will allow and again close when the breaker is rocked back. The firing order is 1, 3, 4, 2. Spark gap should be .028 in. to .030 in. Every two weeks fill the oiler in the side of the breaker. If the rotor button and the track it follows are not well polished, lubricate with a very small amount of vaseline.

The motor is connected to the flywheel by a non-automatic, mechanical shift. When the ignition switch is closed the generator runs as a motor to facilitate the meshing of the gears. When the starting pedal is depressed the gears are drawn into mesh, the generator circuit is broken by the raising of the generator brush and the motor brush is allowed to come into contact with the commutator, thus applying the full battery pressure to the motor, cranking the engine, in the order named. The above operation is reversed when the starting pedal is released. There is an over-running clutch to prevent the engine driving the motor. Should the generator fail to motor when the ignition switch is closed, remove the cover from the front of the machine and try to turn the armature. If the armature cannot be turned with the fingers, the clutch is sticking and must be taken down and repaired. If the armature turns freely, look for defective connections at the motor and battery terminals and see that the three fingers on the ignition switch are making proper contact.

There is no relay. The circuit between the generator and battery is controlled by the ignition switch. There is an overrunning clutch to allow the generator to run as a motor during the cranking operation or when it is not being driven fast enough to produce a pressure equal to or above that of the battery. The generator should begin to supply current at about 8 miles per hour. Voltage regulation is by third brush. The maximum output should not exceed 16-18 amperes at 20-25 miles per hour. This rate gradually decreases at higher speeds. Every two weeks remove the brush cover from the front end of the generator and put four or five drops of light engine oil in the hole exposed. At the same time put four or five drops of the same grade oil in the rear generator oiler. Every six months the cover at the lower edge of the distributor driving gear housing should be moved aside and the distributor gear case packed with soft cup grease. In very cold weather, when the grease has a tendency to become hard, add a few drops of oil occasionally to keep the grease soft.

There is a vibrating circuit breaker mounted on the light and ignition switch, to take the place of fuses in the lighting circuits. It should not allow more than 7-10 amperes to flow when it is vibrating. For care of this device see Plate No. 12.

The head lights are 6-8 volt, 15 cp. Dimmer lights are 6-8 volt, 4-6 cp. Dash and tail lights are each 6-8 volt, 2 cp.

MODELS D-6-44, D-6-45, D-6-46, D-6-47

DELCO DOUBLE-UNIT STARTING AND LIGHTING. DELCO IGNITION

Battery is 6 volt, 100 ampere-hour. The negative terminal is grounded.

Breaker contacts should open .018 in. Contacts are made of tungsten metal. For the care of these contacts see Plate No. 20. Breaker should be set so that when the upper dead center mark on the flywheel is 1 in. past the indicator, spark lever fully retarded, the contacts will just open when the breaker is rocked forward as far as the slack in the gears will allow and close again when it is rocked back. Spark control is by both automatic and manual devices. The firing order is 1, 4, 2, 6, 3, 5. The spark gap should be .028 in. If the rotor button and its track are not well polished, lubricate with a very small amount of vaseline. Every week put four or five drops of light oil in the oiler in the side of the breaker.

Motor is connected to the flywheel by a non-automatic mechanical pinion shift. When the ignition switch is closed the generator runs as a motor to facilitate the meshing of the gears. The depressing of the starting pedal draws the pinion into mesh with the flywheel gears; opens the generator circuit and allows the motor brush to come into contact with the commutator; thus completing the motor circuit, applying the full battery pressure to the motor, and cranking the engine. There is a grease cup on the end of the starting motor gear shaft. Use medium cup grease in this cup and tighten two turns every two weeks. This cup provides lubrication to the overrunning clutch which prevents the gas engine driving the starting motor. The oiler at the rear end of the armature shaft should receive four or five drops of light oil every week. The front motor-generator bearing is packed with medium cup grease. It should be refilled at least twice a season. In very cold weather add a few drops of lubricating oil every week, to keep the grease soft.

Voltage regulation of the generator is by third brush. There is no relay. The circuit between the generator and the battery is controlled by the ignition switch. There is an overrunning clutch to allow the generator to run as a motor while cranking or when it is not being driven fast enough to produce a pressure equal to or above that of the battery. Generator should begin to supply current when car speed reaches 6-7 miles per hour. The maximum output of the generator should never exceed 20 amperes. This output should be reached at 20-24 miles per hour. This rate should gradually decrease to about 10 amperes at 50 miles per hour. There is a vibrating circuit breaker in the light and ignition switch, to take the place of fuses in the light circuits. It should not allow more than 7-10 amperes to flow, when vibrating. The large head lamps are 6-8 volt, 17 cp. The dimmer lights are 6-8 volt, 5 cp. Dash and tail lights are in series. They are 3-4 volt, 2 cp.

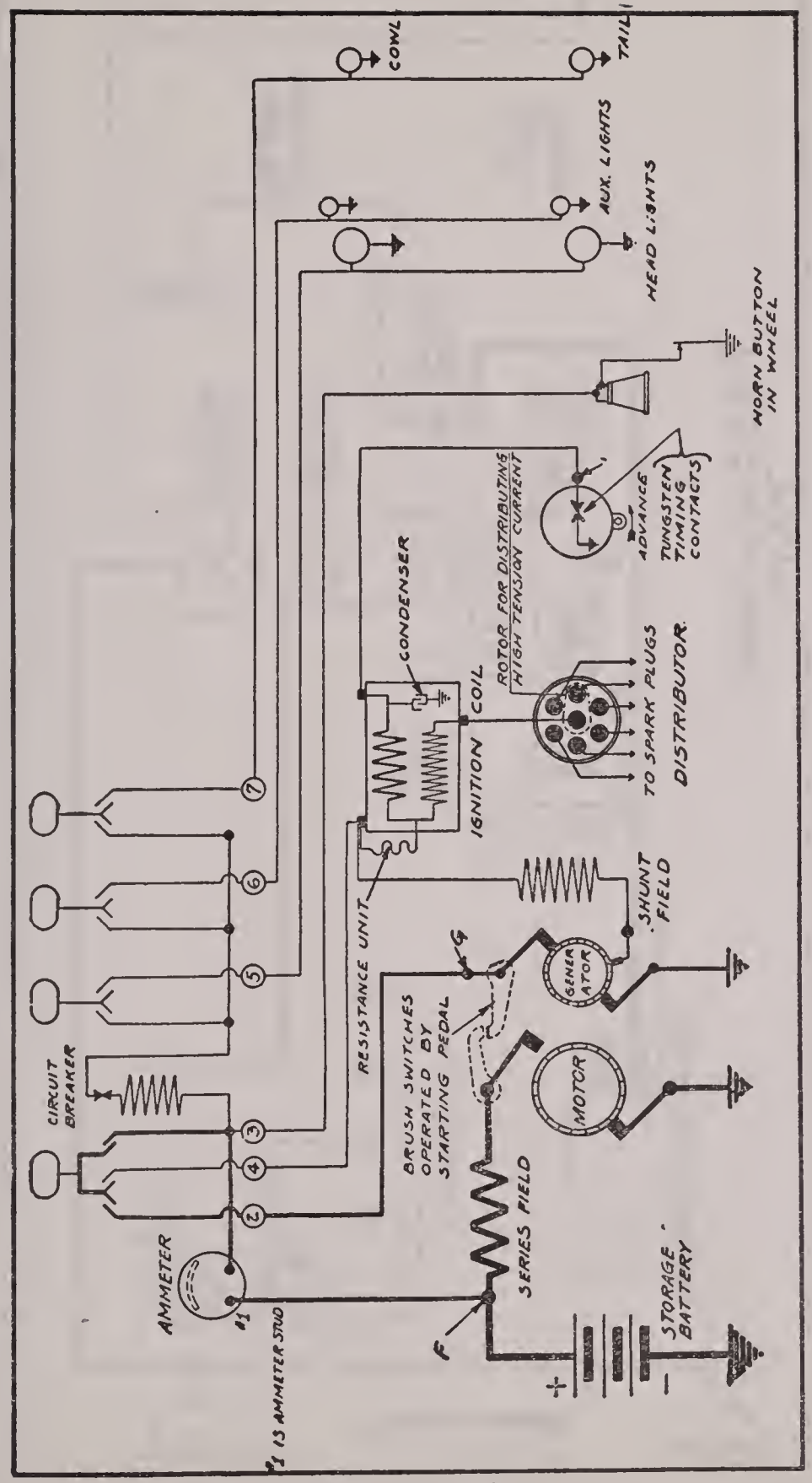
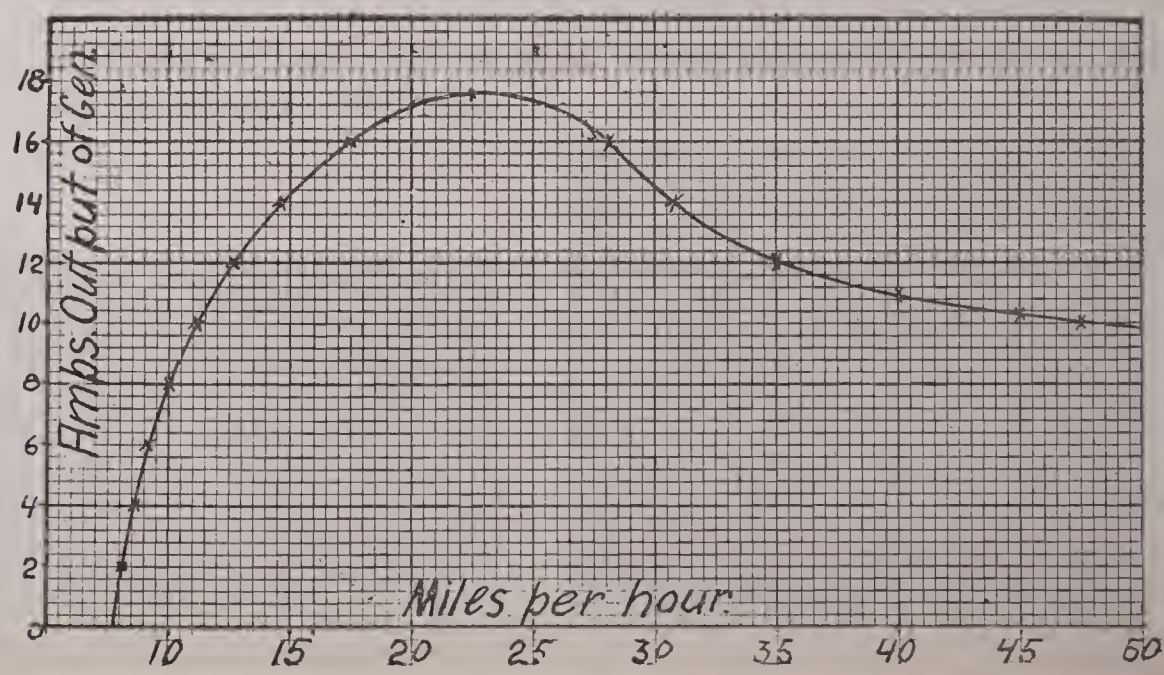


PLATE NO. 215



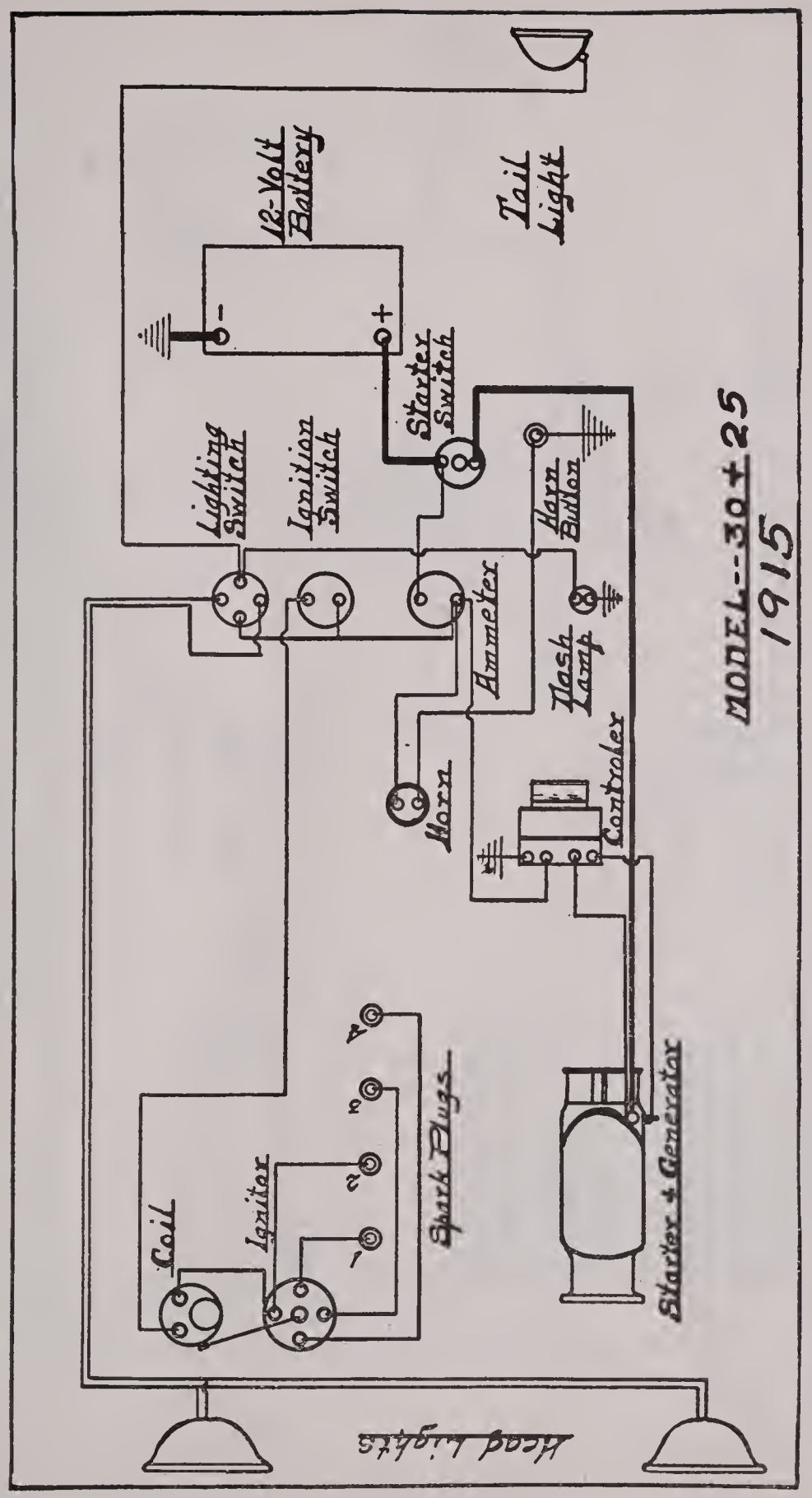


PLATE NO. 216

Crow-Elkhart

MODELS 25 AND 30 (1915)

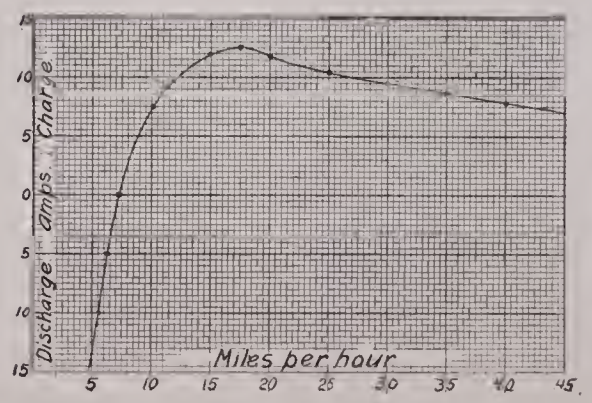
DYNETO SINGLE-UNIT STARTING AND LIGHTING SYSTEM
CONNECTICUT IGNITION

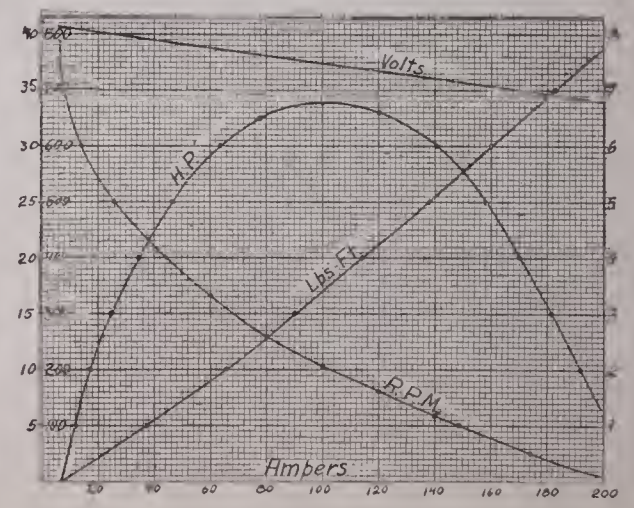
Battery is 12 volt, 35 ampere-hour. The negative terminal is grounded.

Breaker contacts should open about .025 in. The contacts are made of tungsten metal. They should not be filed nor sandpapered, even though they do become quite irregular. Should the contacts become so badly burned or pitted as to impair the proper operation of the engine, the breaker mechanism should be replaced as directed on Plate No. 50. Spark should occur on top dead center, spark lever advanced about 1 in. The firing order is 1, 3, 4, 2. Every 500 miles tighten the grease cup under the breaker head two or three turns. Use soft cup grease.

The motor-generator should begin to charge the battery at about 8 miles per hour. Below this speed it acts as a motor, helping to propel the car. Voltage regulation is by third brush. The maximum output should never exceed 12 or 13 amperes. The motor should crank the engine at about 175 R. P. M. The normal cranking current is approximately 200 amperes. The characteristics of the unit as a motor and as a generator are shown in Figs. 2 and 3.

Large head lamps are 14 volt, 17 cp. Dimmer lamps are 14 volt, 4-6 cp. Dash and tail lights are 14 volt, 2-4 cp.





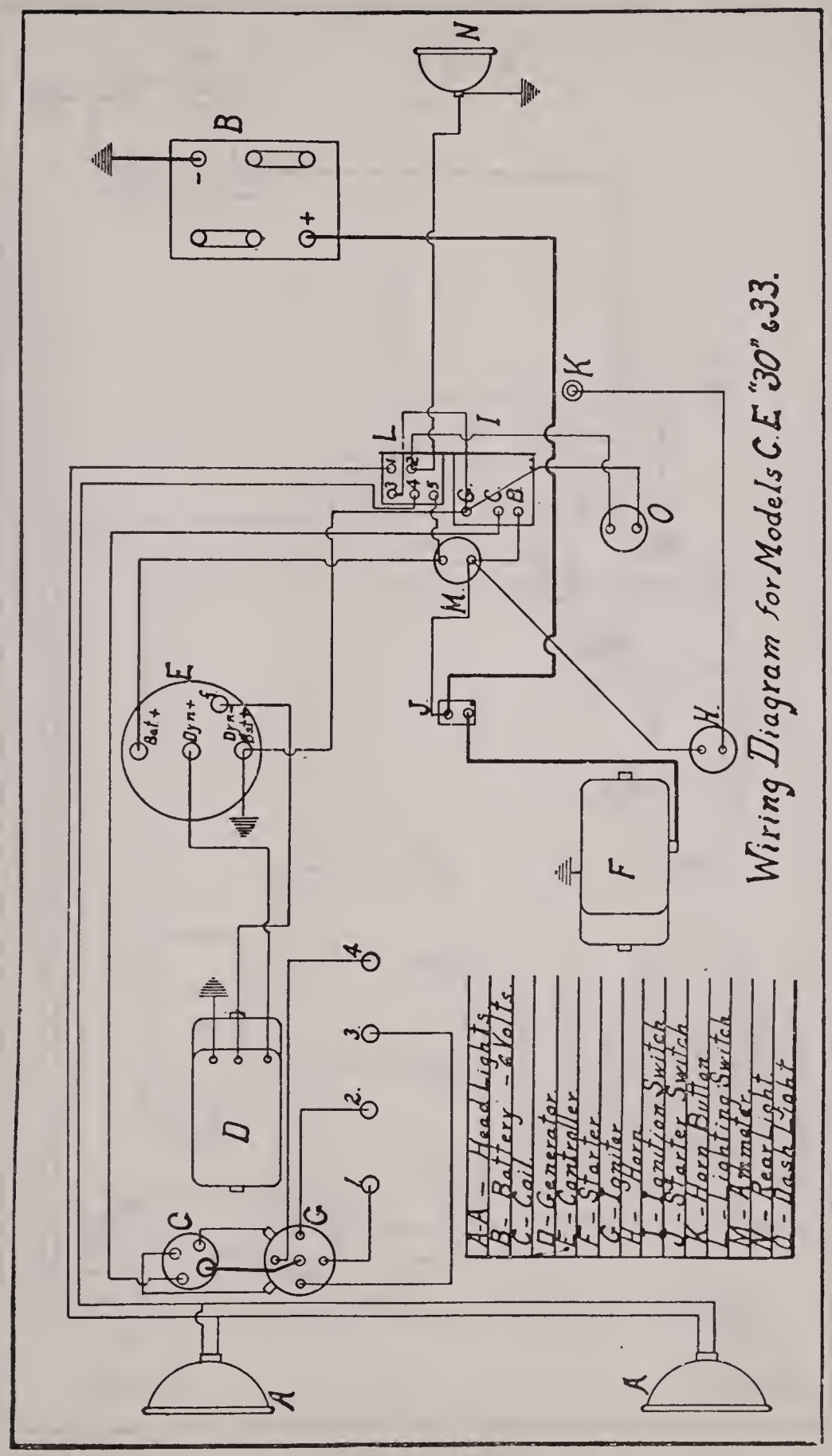


PLATE No. 217

Crow-Elkhart

MODELS CE, 30 AND 33 (1916)

DYNETO STARTING AND LIGHTING SYSTEM. CONNECTICUT IGNITION

Battery is 6 volt, 70 ampere-hour. The negative terminal is grounded.

Breaker contacts should open about .025 in. Break should occur on top dead center, spark lever advanced about 1 in. The firing order is 1, 3, 4, 2. Breaker contacts are made of tungsten metal. They should not be filed or sandpapered. The ignition will operate even though the contacts are quite irregular. Should they become so badly burned or pitted as to impair the proper operation of the engine, the entire breaker arm and contacts should be renewed as directed on Plate No. 50. Every 500 miles, tighten the grease cup under the breaker head two or three turns. Use soft cup grease in this cup.

The driving power of the motor is transmitted to the flywheel through a Bendix gear. For a description and directions for the care of the motor and generator, see Plate No. 64.

Large head lamps are 6-8 volt, 17 cp. Small head lamps are 6-8 volt, 4 cp. Dash and tail lights are in series. They are 3-4 volt, 2 cp.

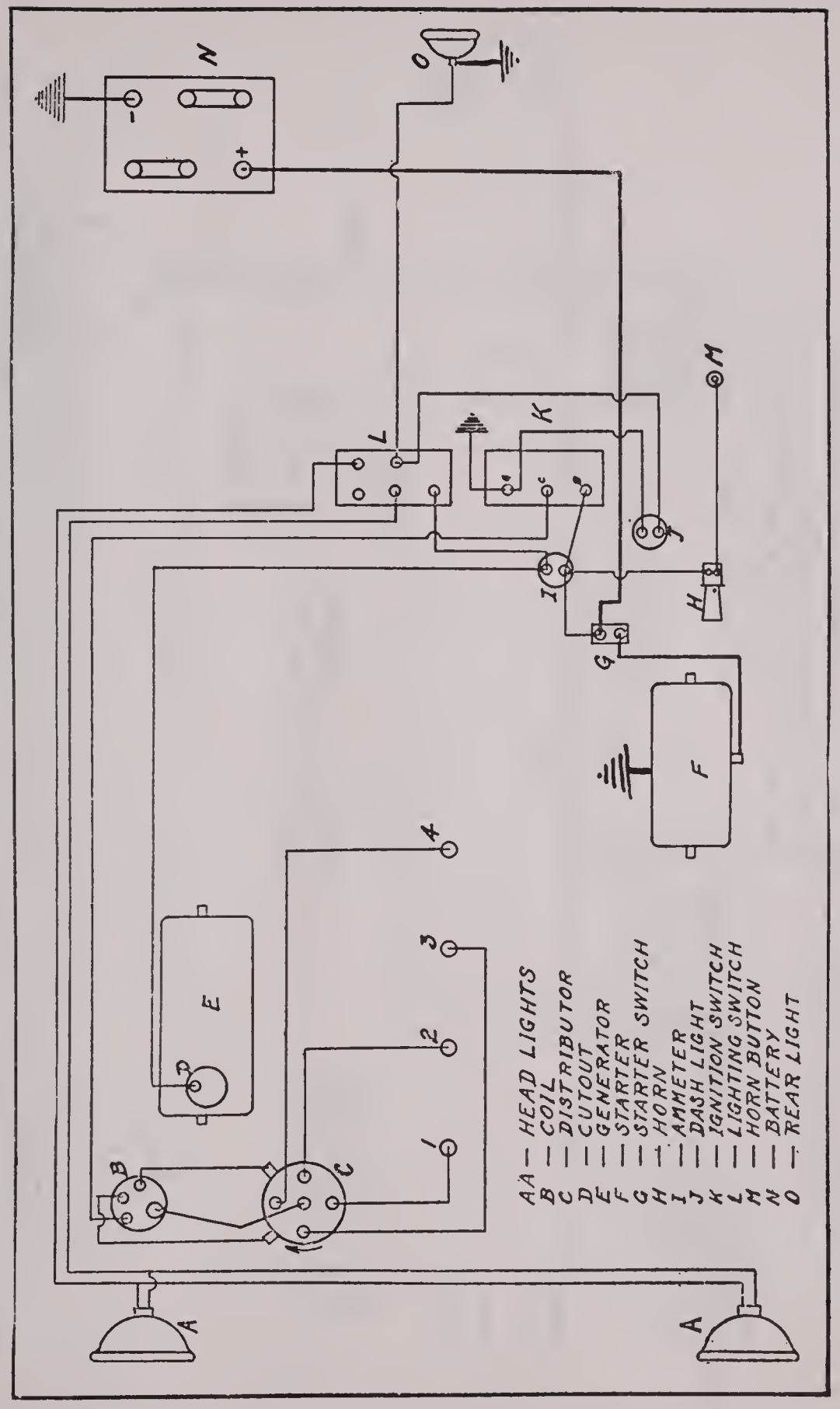


PLATE No. 218.

Crow-Elkhart

MODELS 33 AND 35 (1917)

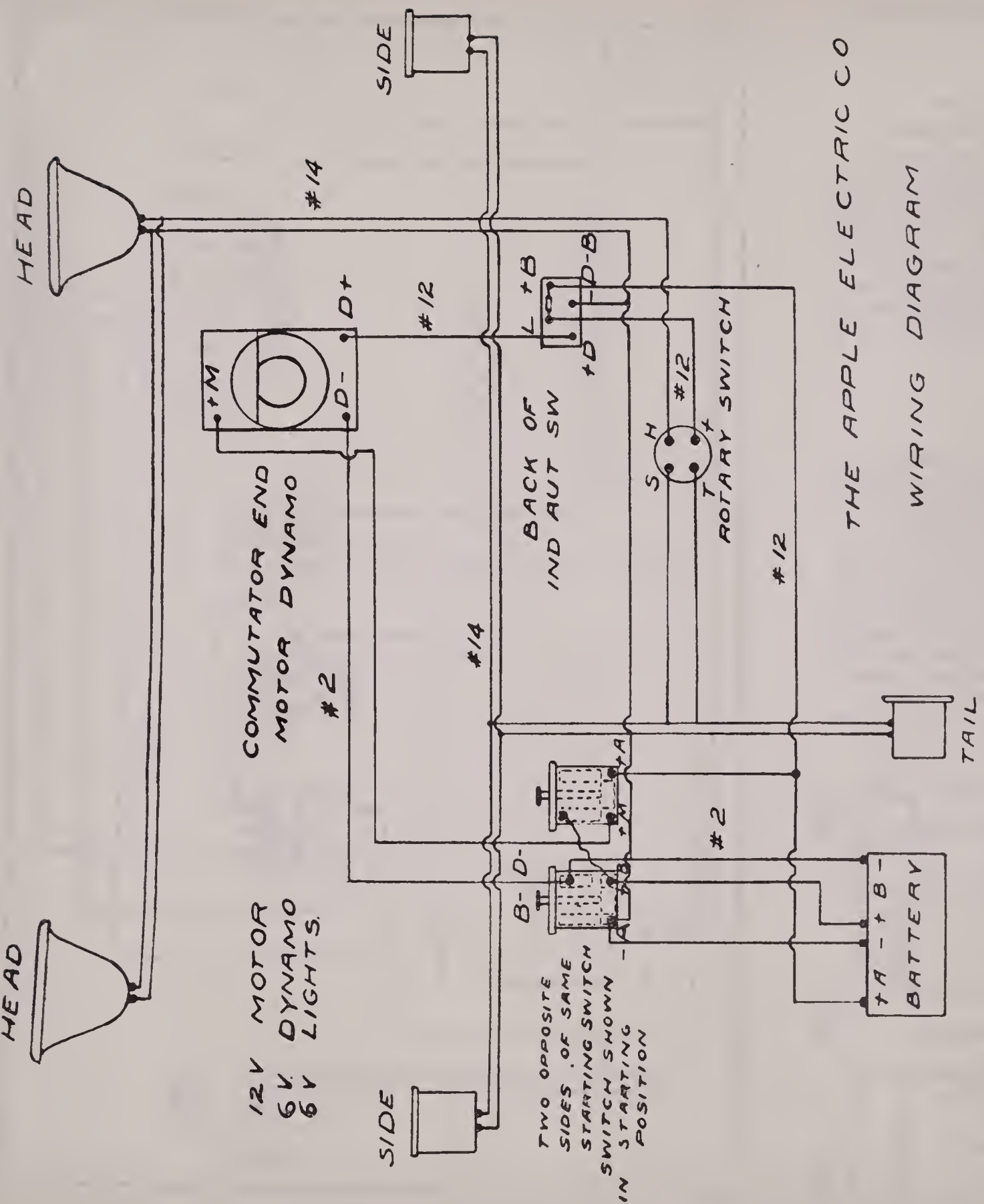
DYNETO STARTING AND LIGHTING SYSTEM. CONNECTICUT IGNITION

Battery is 6 volt, 80-ampere hour. The negative terminal is grounded.

Breaker contacts should open about .025 in. Breaker contacts should just begin to separate when the piston entering power stroke is on top dead center, spark lever advanced 1 in. The firing order is 1, 3, 4, 2. Breaker contacts are made of tungsten metal. They should not be filed nor sandpapered. They will function properly although they are quite badly burned or pitted. Should contacts become so worn as to impair the proper operation of the engine, the entire breaker mechanism should be renewed as directed on Plate No. 50. Use soft cup grease in the grease cup under the breaker head. Every 500 miles tighten this cup two turns.

The driving power of the starter is transmitted to the flywheel by a Bendix drive. A description and directions for the care of the motor and generator are given on Plate No. 63.

Large head lamps are 6-8 volt, 17 cp. Dimmer lamps are 6-8 volt, 6 cp. Dash and tail lights are 6-8 volt, 2-4 cp.



Wilcox Trucks

SPLITDORF-APELCO STARTING AND LIGHTING SYSTEM.
BOSCH MAGNETO IGNITION

Battery is 12 volt, 60 ampere hour. The two-wire system is used.

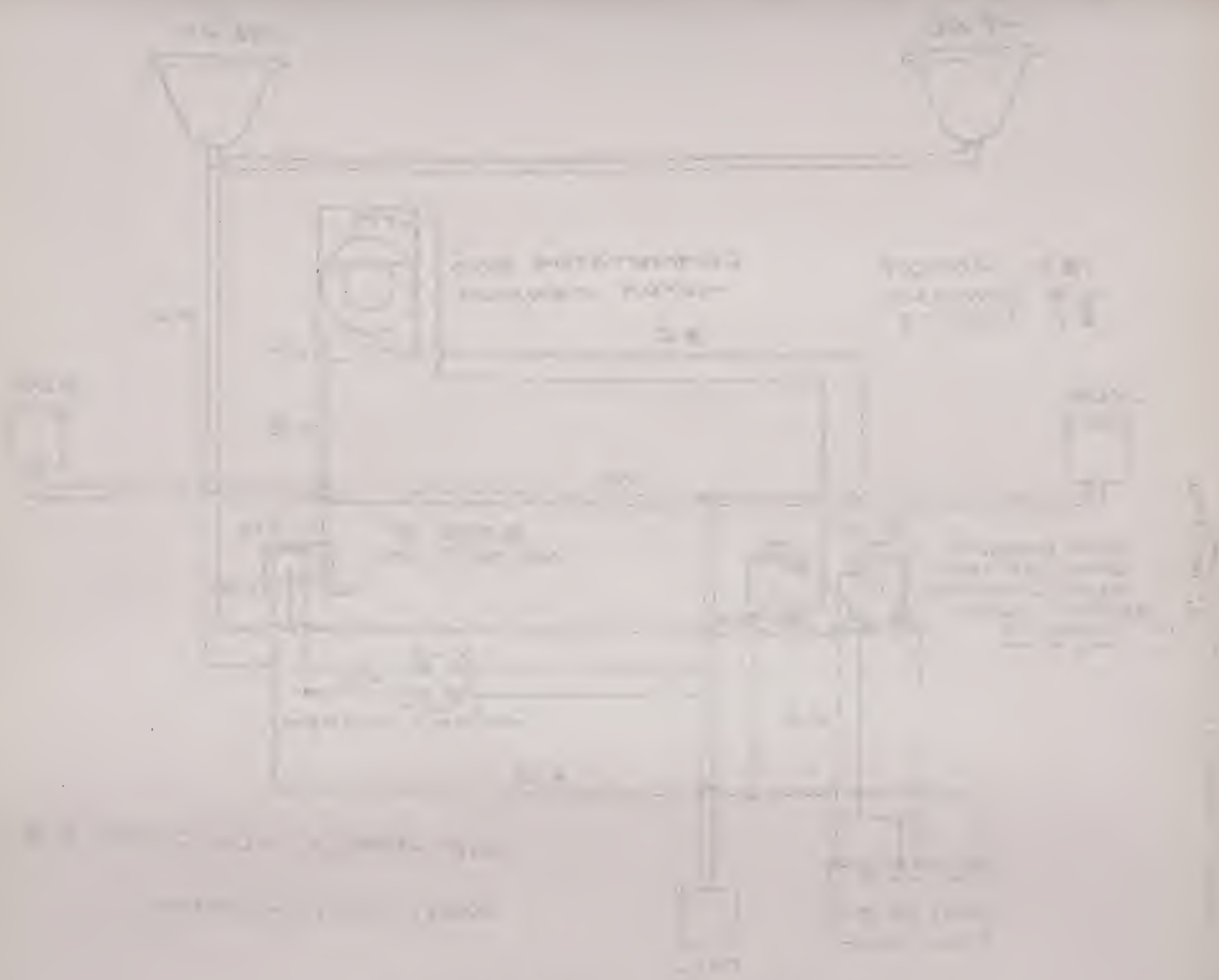
The Bosch Type ZR4 Dual magneto is used. Contacts should open .014 in. Clean contacts with gasoline whenever necessary. Should contacts become badly burned or pitted, they should be resurfaced with a fine, flat, jeweler's file or a worn strip of No. 00 sandpaper. Spark should occur when the top dead center mark on the flywheel is 1¼ in. past the indicator, spark lever in the fully retarded position. The firing order is 1, 3, 4, 2. Further directions for the care of the magneto are given on Plate No. 186.

The starter operates at 12 volts, and the generator and other apparatus at 6 volts pressure. Depressing the starting switch connects the two 6-volt batteries in series to supply the motor with 12 volts. This does not apply 12 volts to the other equipment.

Should the indicator flutter and show "On" and "Off" in rapid succession, engine running at medium or high engine speed, there is a loose connection in the line between the generator and battery. This must be located and repaired at once, as the relay contacts will be badly burned if it is allowed to exist. The charging and cranking circuits are both fully explained on Plate No. 161.

Head lights are 6-8 volt, 12 cp. Side lights are 6-8 volt, 6 cp. Tail light is 6-8 volt, 4 cp.

PLATE NO. 219



Wilcox Trucks

Models N, JA and LA (1913-14-15)

Remy Starting and Lighting System. Bosch Ignition

Battery is 6 volt, 180 ampere-hour. The two-wire system is used.

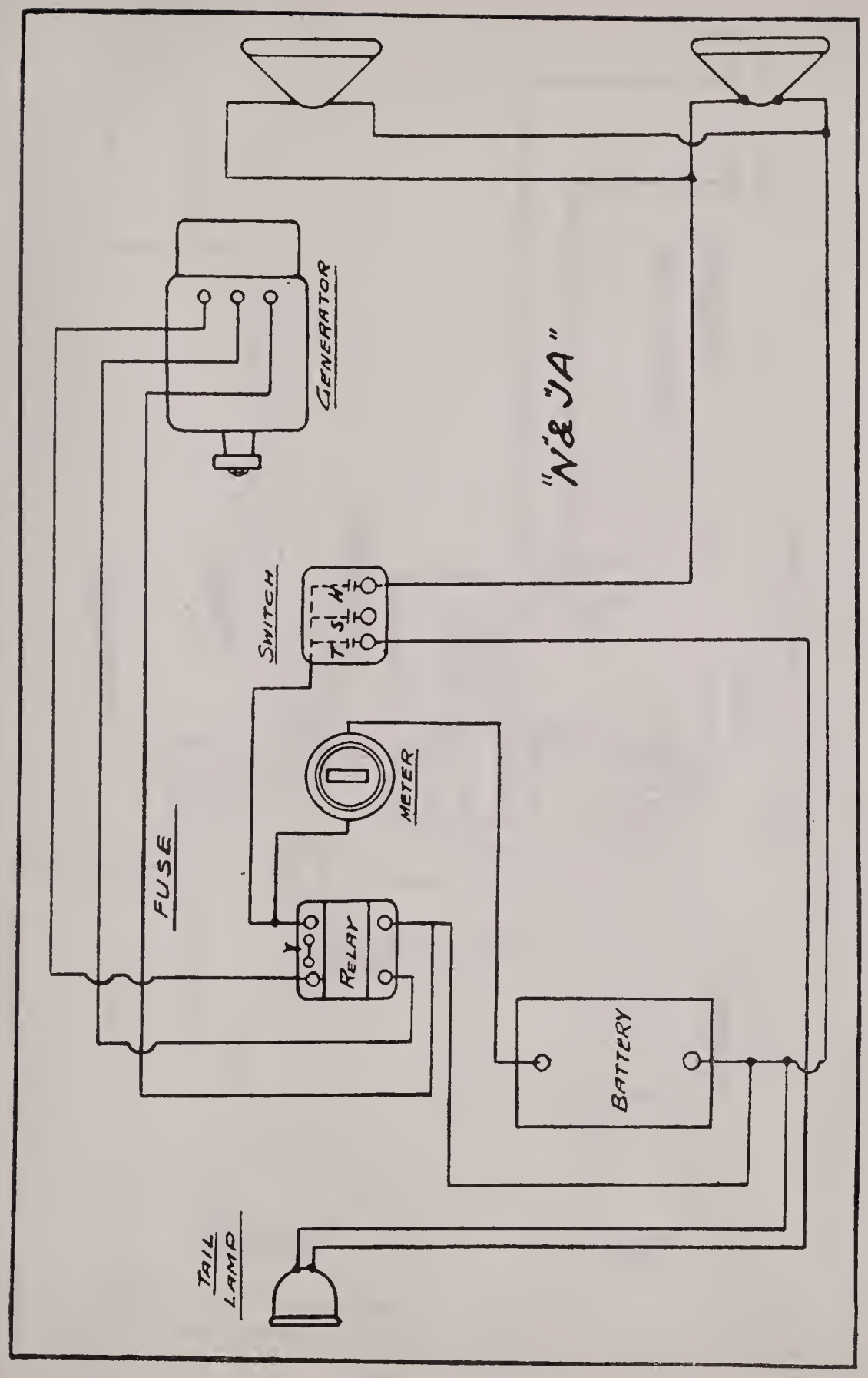
The magneto is Bosch, Type DR-4 or Type ZR-4 Dual, both having been installed. For care of the Type DR magneto see Plate No. 182. For care of the Type ZR magneto see Plate No. 186. Spark should occur when the top dead center mark on the flywheel is 1¼ in. past the indicator, spark lever in the fully retarded position. The firing order is 1, 3, 4, 2. The spark gap should be about .028 in.

Relay should close at about 500 R. P. M. of the generator. Two types of generators were used. On the early models the voltage regulation was by third brush. On the later models voltage regulation is by a vibrating regulator. The following data applies to the old or third brush type of generator using the No. 62 relay:

Amperes	R. P. M.	Volts
0.	330	6.4
7.	550	6.9
14.	1000-1200	7.6
8-13	2000	7.4

On the new type generator—having the Model 60 relay-regulator, four brush and the new type rocker ring—the output should be the same as on the old type. On battery test, armature should draw 12.2 amperes at 6.5 volts. Field draws 5.2 amperes at 6.5 volts. Put four or five drops of light machine oil in each of the generator oilers every week, or 150 miles. Increasing the spring tension on the vibrator arm of the regulator will increase the output. Before adjusting the regulator clean the contacts by drawing a piece of soft paper between them. If contacts are badly burned or pitted, they may be resurfaced with a very fine, flat, jeweler's file or a piece of worn No. 00 sandpaper. Do not resort to this method unless necessary, as this may change the output. There is a 15-ampere fuse on the relay base to protect the generator windings. Use commercial, 15-ampere fuse wire.

Head lights are 6-8 volt, 12 cp. Side lights are 6-8 volt, 6 cp. Tail light is 6-8 volt, 4 cp.



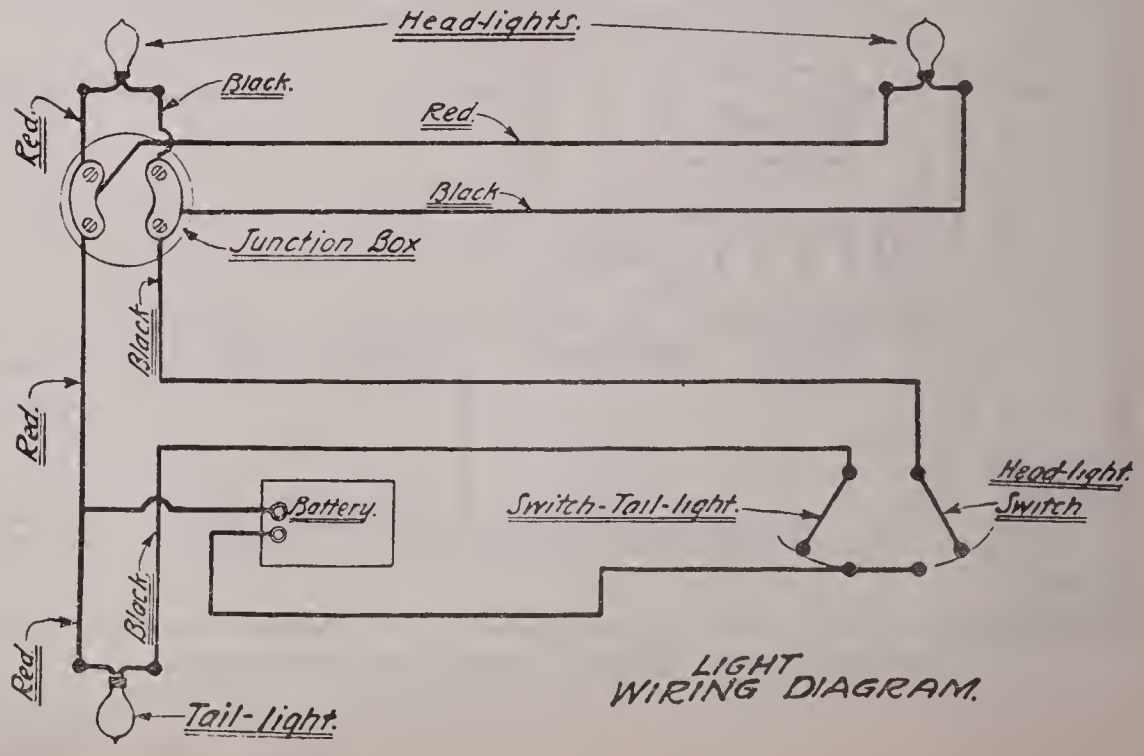
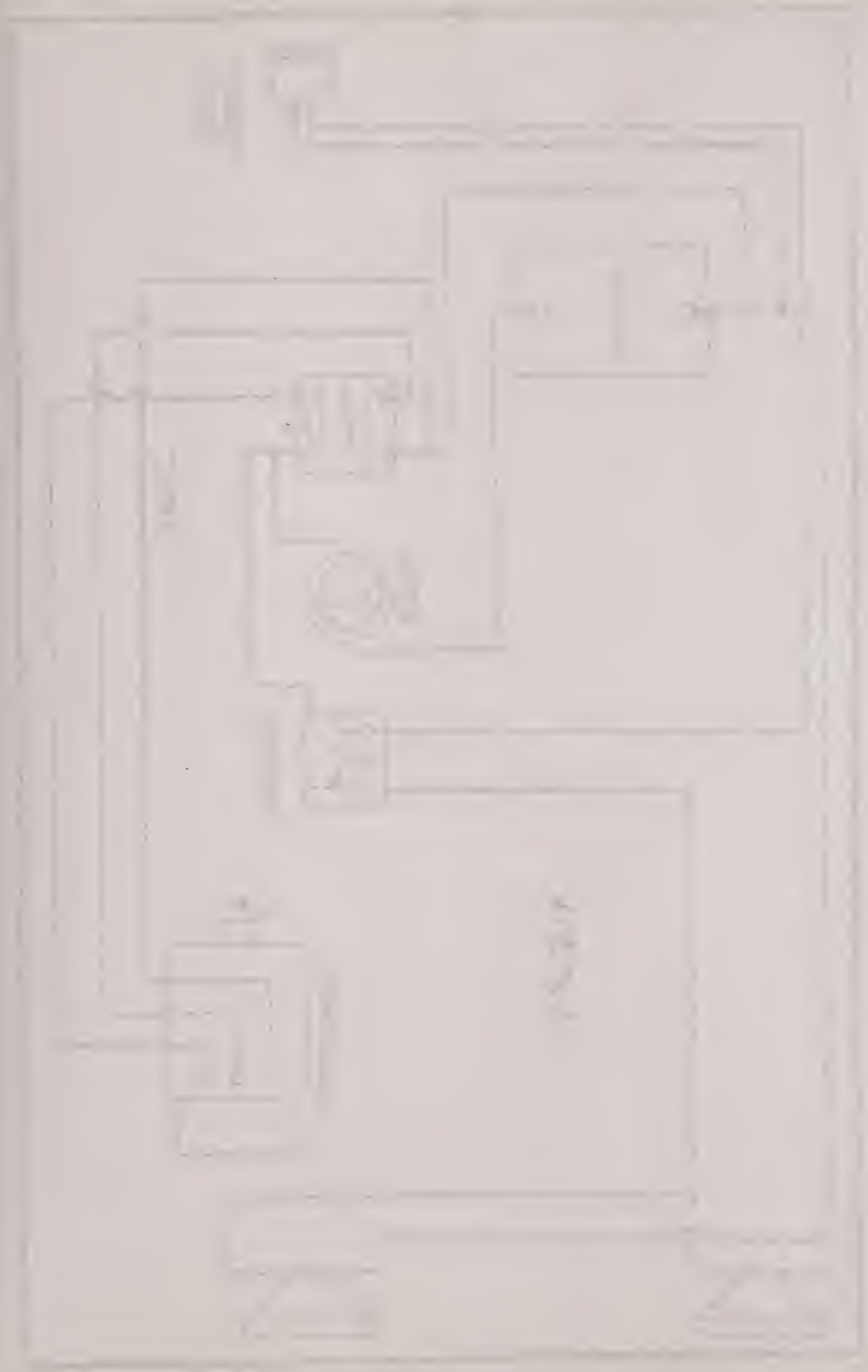


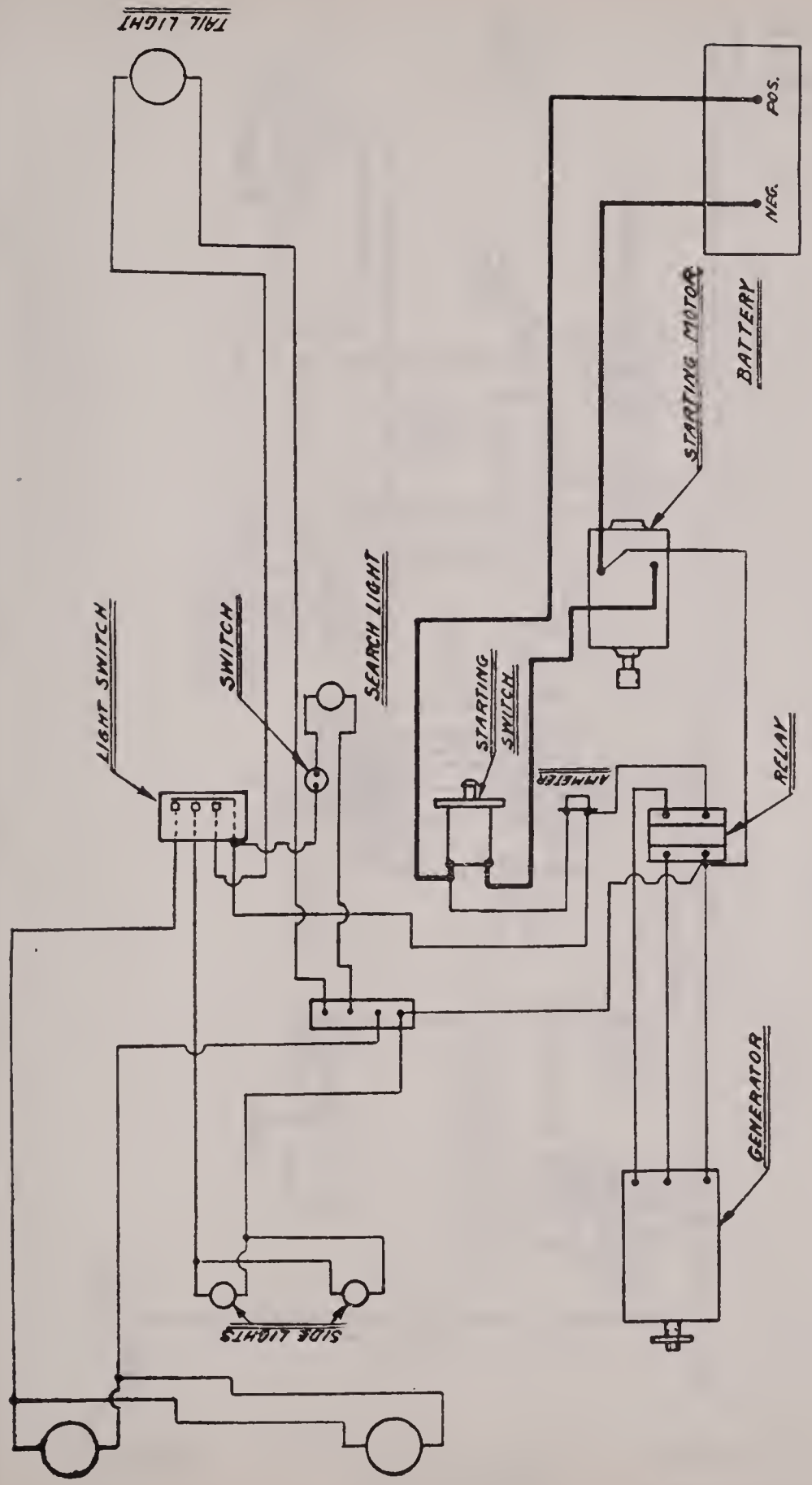
Plate No. 220



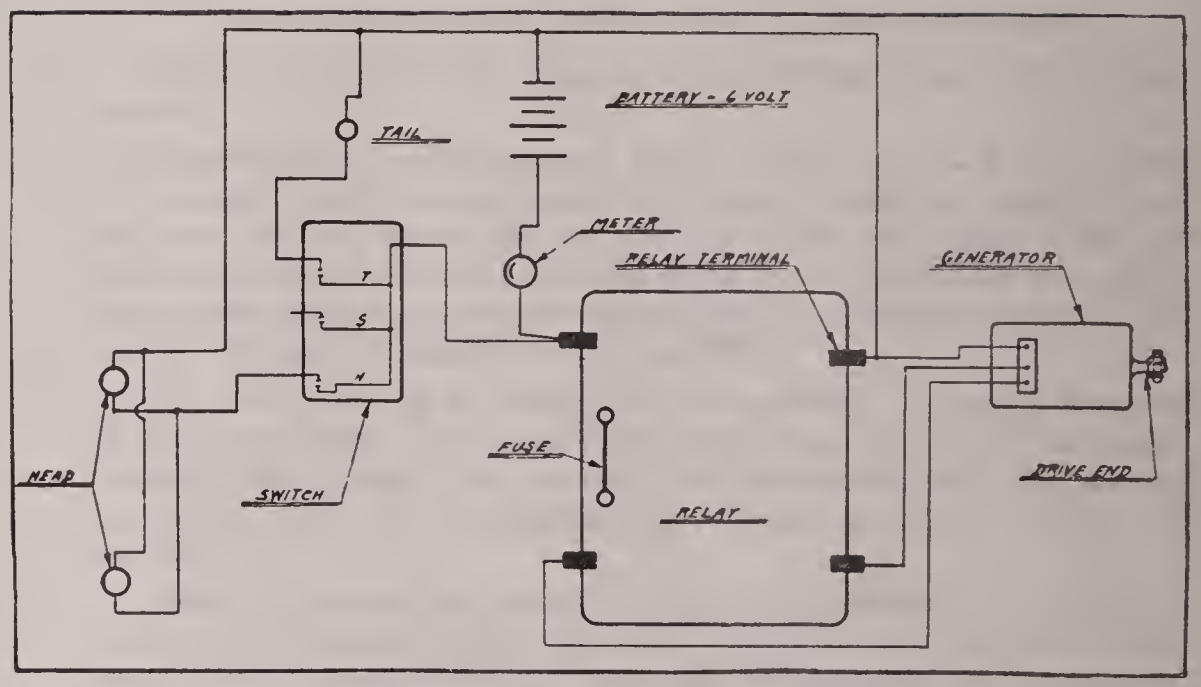
(Continued from Page 220)

Wilcox Trucks

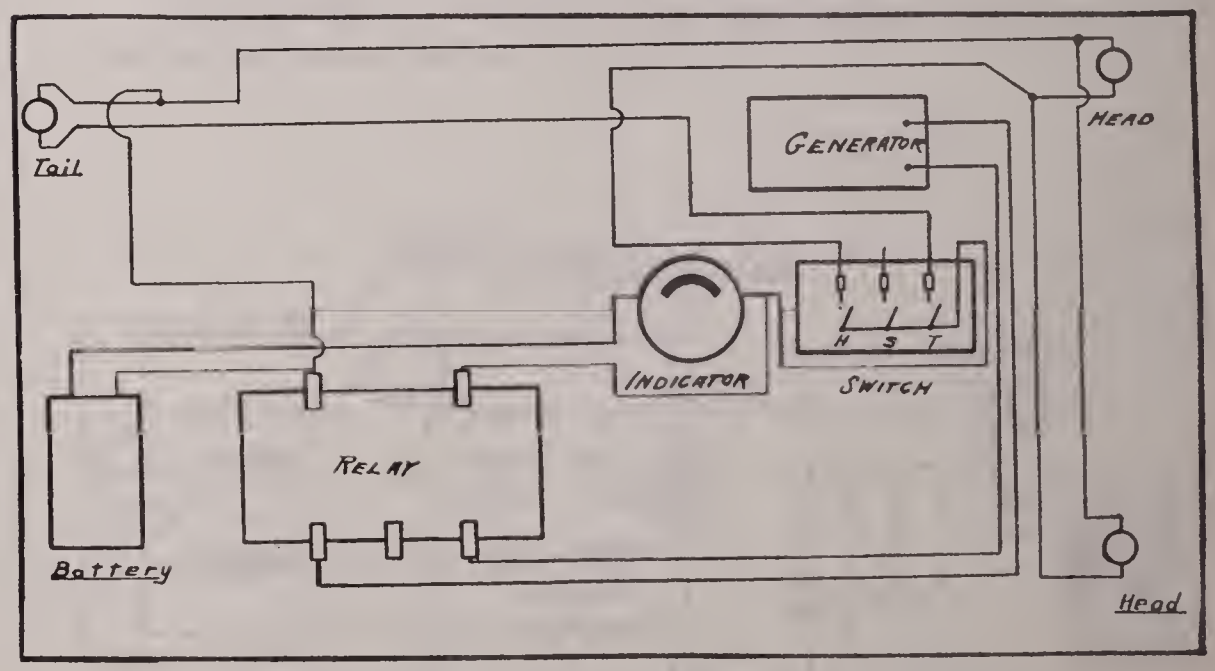
Models N, JA and LA



Model LA Wiring Diagram

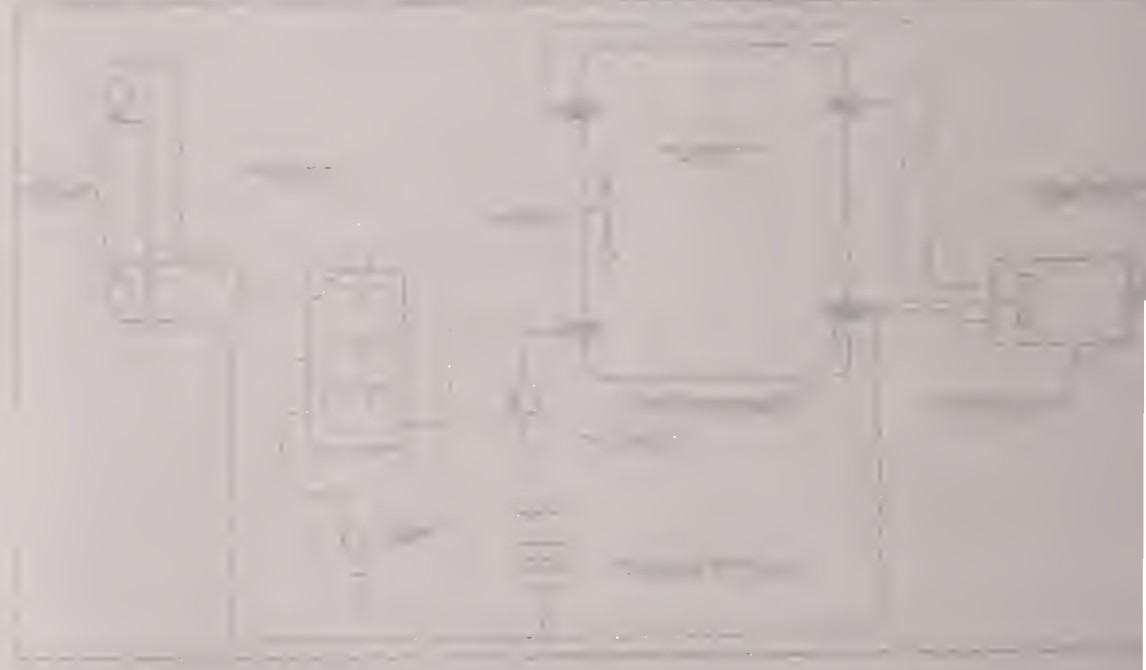


Models N and JA with Two-Brush Generator



Models N and JA with Three-Brush Generator

Plate No. 221



Marmon

BOSCH STARTING AND LIGHTING SYSTEM. BOSCH IGNITION

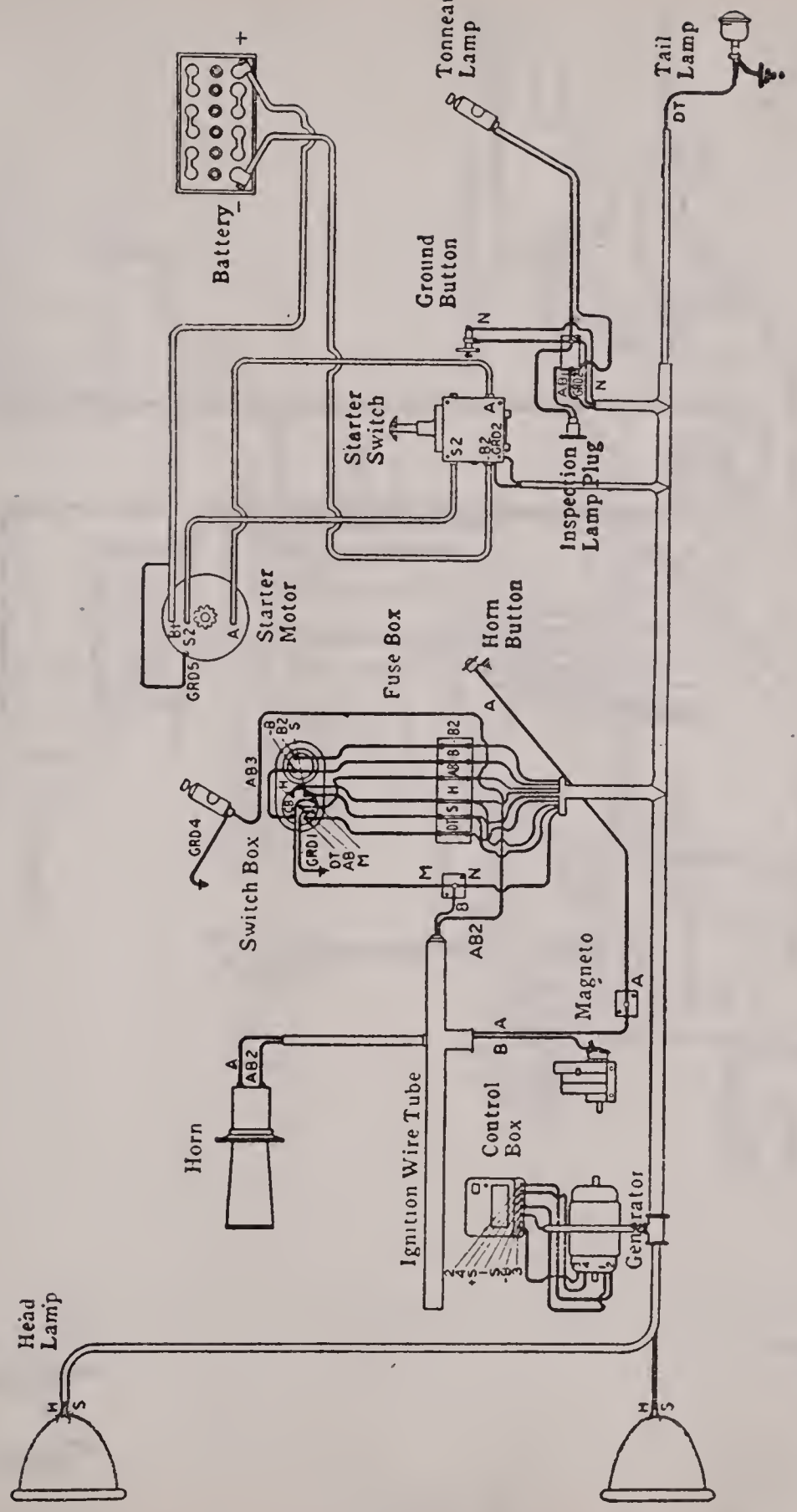
Battery is 12 volt, 60 ampere-hour. The positive terminal is grounded at the starting motor.

Magneto contacts should open about .016 in. Clean contacts with gasoline whenever necessary. Should contacts become badly burned or pitted they should be resurfaced with a fine, flat, jeweler's file or a strip of worn No. 00 sandpaper. The spark should occur when the top dead center mark on the flywheel is one inch before the indicator, spark control lever in the fully advanced position. The firing order is 1, 5, 3, 6, 2, 4. The spark gap should be .028 in. to .030 in.

The driving power of the starting motor is transmitted to the engine through the ring gear on the flywheel and the small pinion which is drawn into mesh by the magnetic attraction of the field poles for the armature. The action of this motor is fully described on Plate No. 177. The motor should crank the engine at a speed of 135 to 145 R. P. M.

Voltage regulation of the generator is by a reverse field operating in conjunction with a ballast coil as described on Plate No. 178. The wires are covered with different colored braids to facilitate tracing. All connections to the junction blocks are numbered with corresponding numbers on the connector. The horn circuit is connected to the ignition switch, so that horn cannot be blown when the ignition is cut off.

Large head lights are 12-16 volt, 12 cp. Marker lights are 12-16 volt, 6 cp. Dash, tail and tonneau lights are 12-16 volt, 4 cp.



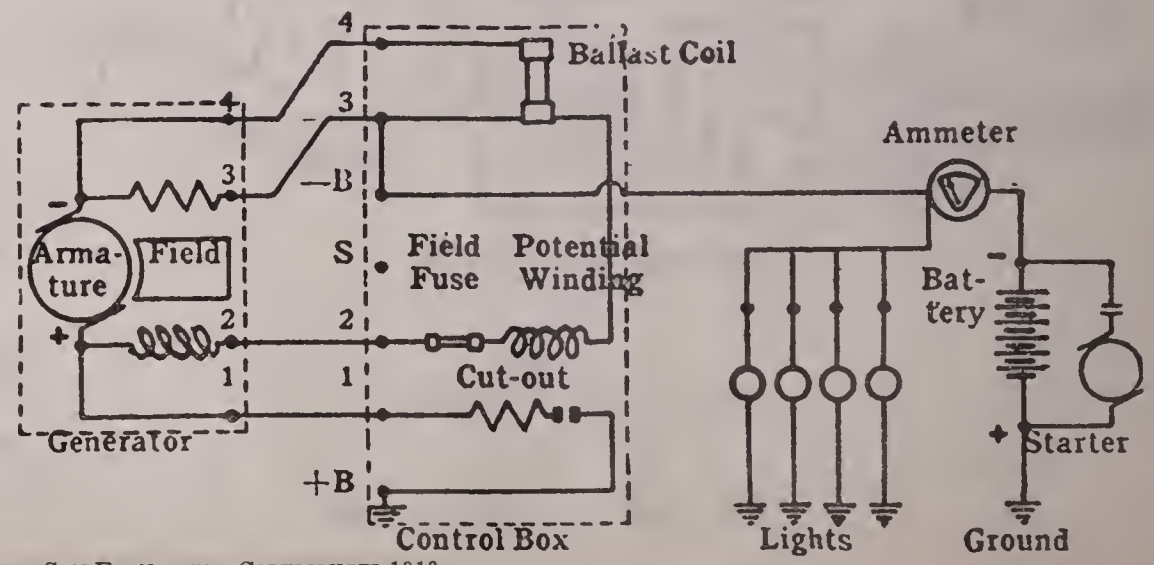
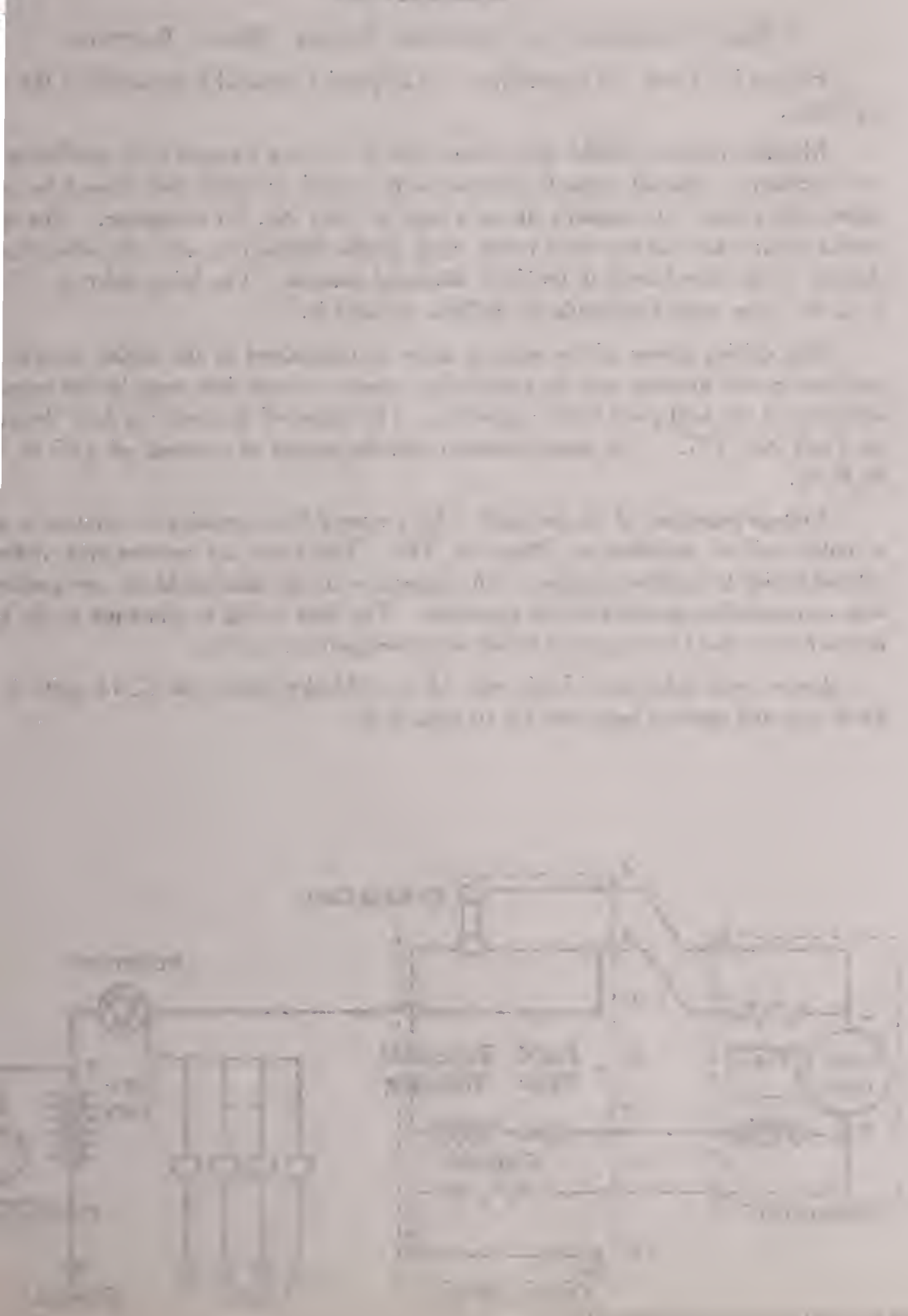


PLATE NO. 222



Marmon

Model 34 (1917-18)

Bijur Starting and Lighting System. Bosch Magneto Ignition

Battery is 6 volt, 120 ampere-hour. The positive terminal is grounded from the back of the lighting switch. The grounded system is used in the generator and lighting circuits. The motor circuit is two wire.

Magneto breaker contacts should open .014 in. to .016 in. Clean them with gasoline whenever necessary. Should contacts become badly burned or pitted they may be resurfaced with a fine, flat, jeweler's file or a small strip of worn No. 00 sandpaper. Breaker contacts should be just beginning to separate when the dead center mark on the flywheel is one inch before the indicator, spark fully advanced. Firing order is 1, 5, 3, 6, 2, 4. Spark gap should be .032 in.

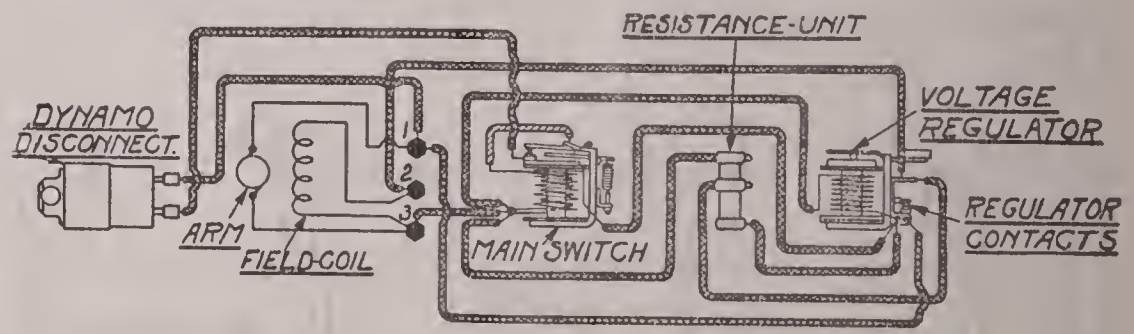
Voltage regulation of the generator is by a vibrating regulator. Relay should close at about 8-10 miles per hour. Maximum charging rate is reached at about 12 miles per hour. Charging rate will be high when the battery is nearly discharged and very low when the battery is fully charged. When battery is very low, the charging rate may reach a value as high as 25 amperes, the lights out. The relay and the regulator are mounted in a small aluminum box mounted on the generator. Projecting from one end of this box and fitting into a receptacle on the box is a disconnecting and reversing plug. Due to the reversing current characteristics of the generator, no care need be taken as to which terminal is connected to the battery, as it will automatically assume the right polarity to charge the battery.

The lights and ignition can be operated direct from the generator, should it be necessary to remove the battery, without making any other electrical connection. To remove the regulator, loosen the knurled screw on top of the regulator box and lift off the box by pulling straight upward, taking care not to damage the connecting pins. Connections of the relay and regulator are shown below. The guarantee on this regulator ceases when this seal is broken.

Every two weeks, or 500 miles, the disconnecting plug on the regulator should be pushed inward to unlock and then turned past its vertical position until it springs forward and locks on the opposite side. By doing this the current through the regulator contacts is reversed and tends to keep them true.

Head lamps are 6-8 volt, 24-30 cp. Dimmer lamp is 6-8 volt, 8 cp. Dash, tail, inspection and tonneau lights are 6-8 volt, 4 cp.

Fuses are 20 ampere.



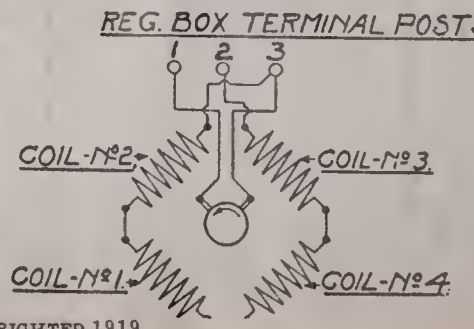
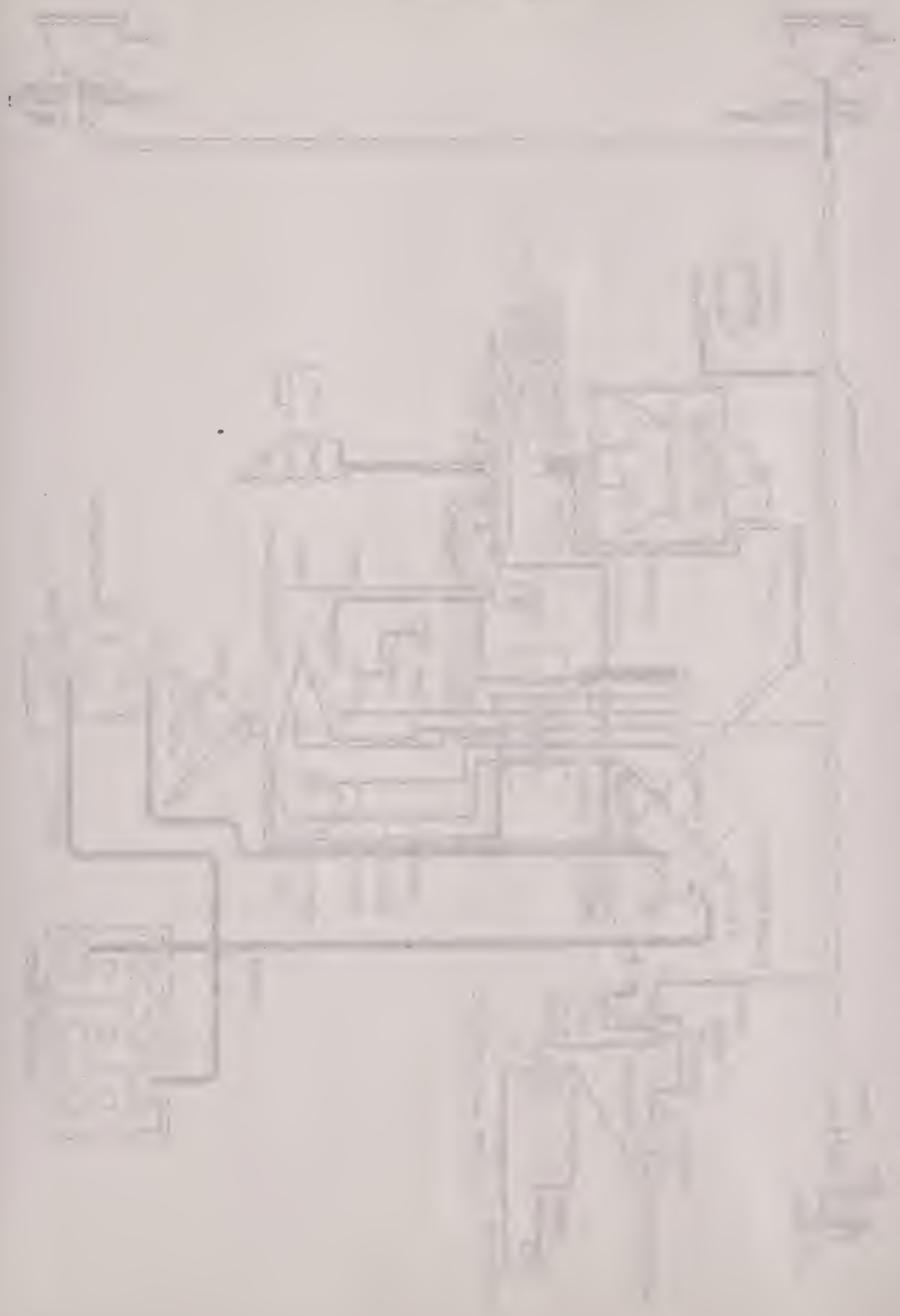


Plate No. 223



Studebaker

1913

Wagner Starting and Lighting System. Splitdorf and National Ignition

Battery is 12 volt, 50 ampere-hour. The two-wire system is used. There is a tap taken to supply 6 volts to the lights and horn.

Breaker contacts should open .014 in. to .016 in. Clean with gasoline whenever necessary. Should they become badly burned or pitted, resurface with a fine, flat, jeweler's file. Contacts should just begin to separate when the top dead center mark on the flywheel is ¾ in. past the indicator, spark lever in the fully retarded position. The firing order is 1, 3, 4, 2.

The driving power of the starter is transmitted to the engine through a set of planetary reduction gears. The rotary switch on top of the motor-generator changes connections of the unit, causing it to operate as a series motor and compound generator. When operating as a motor the two armature windings are in parallel and the shunt fields are cut out of the circuit. The cranking circuit is shown diagramatically in Fig. 2. The heavy lines show the path of the current. When the switch lever is drawn into the starting position, the motor connections are made and the brake band tightened on the case, bringing the planetary gears into operation. The relay is out of circuit during the cranking operation. When the lever is released, the spring draws the lever back into the charging position and loosens the brake, which puts the planetary gears out of operation, causing the engine to drive the generator.

Voltage regulation of the generator is by an inter brush. (Third brush system.) Connections when the machine is operating as a generator are shown in Fig. 3. The heavy lines represent the wires through which the current is flowing. Relay should close at 7-10 miles per hour. Maximum charging rate of 7-10 amperes is reached at 20 miles per hour. This rate gradually reduces at higher speeds. Two brushes of the same polarity are connected as shown. The two armature windings are in series when the machine is operating as a generator. The two shunt windings, however, are not connected to each other in any way.

Head lamps are 7 volt, 17-21 cp. Side lamps are 7 volt, 6 cp. Dash lamp is 7 volt, 2-4 cp. Tail lamp is 7 volt, 2 cp.

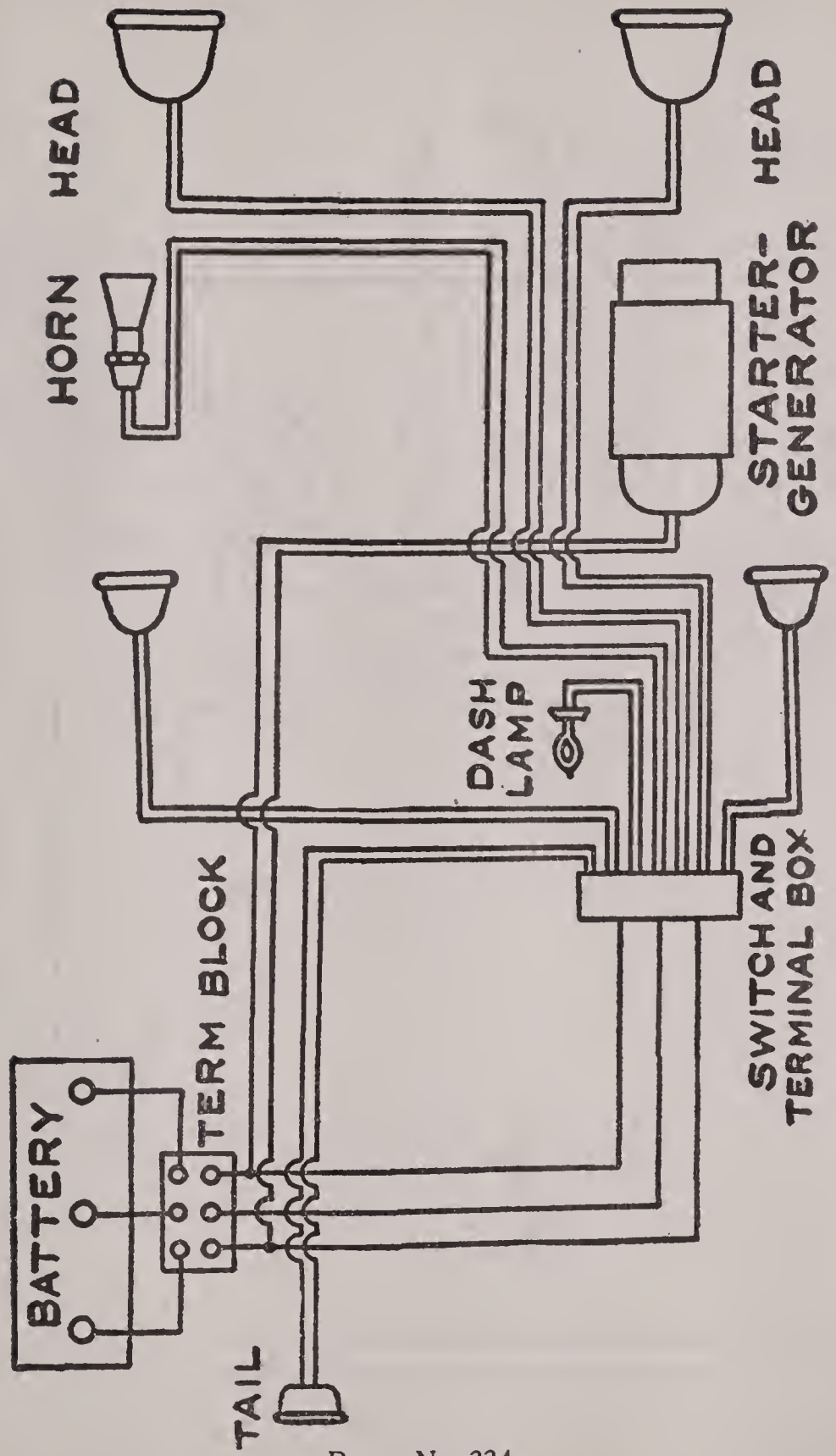
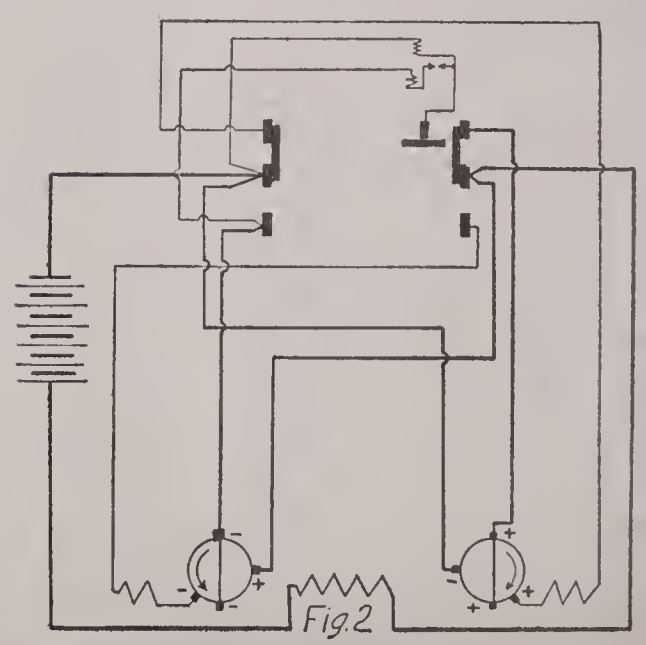
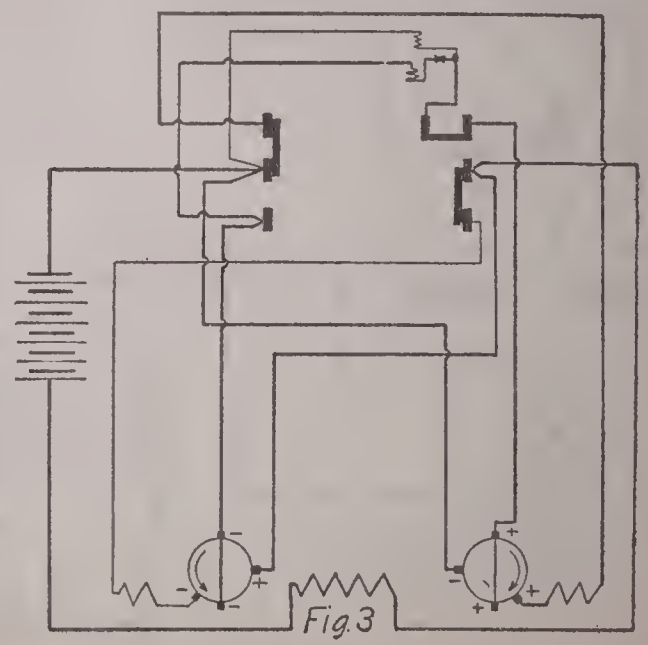


Plate No. 224





MODELS "SIX" AND "FOUR" (1914)

WAGNER STARTING AND LIGHTING SYSTEM. REMY IGNITION

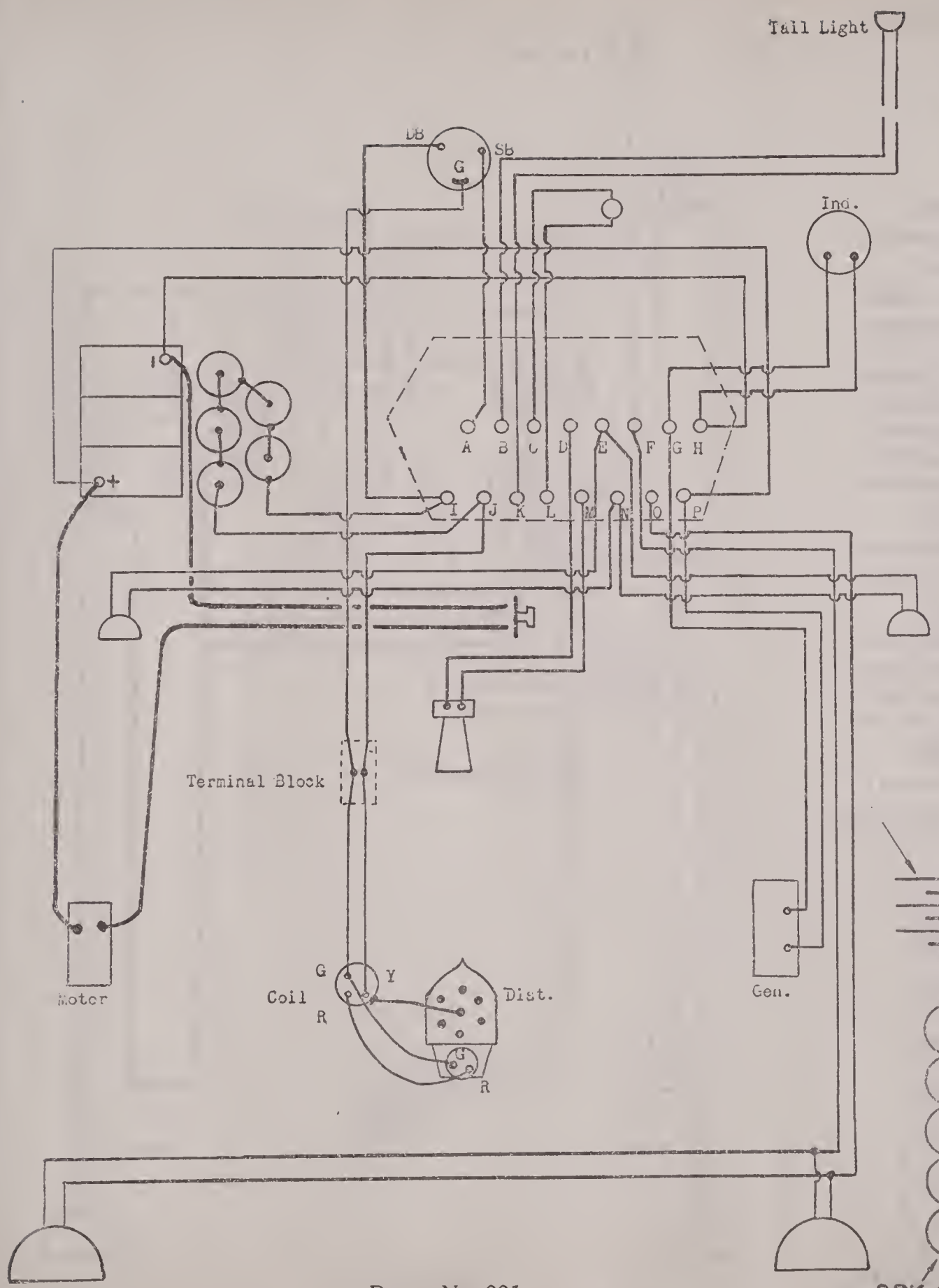
Battery is 6 volt, 100 ampere-hour. The two-wire system is used.

Breaker contacts should open .015 in. to .018 in. Should they become badly burned or pitted, resurface them with a fine, flat, jeweler's file or a small strip of worn No. 00 sandpaper. With the spark control lever in the fully retarded position, contacts should just begin to separate when the top dead center mark (U. D. C.) on the flywheel is 5/8 in. to 7/8 in. past the indicator. The firing order of the "Four" is 1, 3, 4, 2. The firing order of the "Six" is 1, 5, 3, 6, 2, 4. Spark gap should be .025 in. The diagram given below shows ignition circuits on cars using the insulated battery or complete two-wire system. The diagram (Fig. 2) on Plate No. 226 applies to cars on which the battery is grounded.

The driving power of the motor is transmitted to the flywheel through a set of reduction gears, a chain and an overrunning clutch. Once every 1,000 miles, remove the blind screw in the rim of the clutch and inject a quantity of light machine oil. The felt packing must be kept well oiled, as if it is not the clutch is apt to stick, which will cause the engine to drive the starter at very high speed. Should the engine drive the starter for a short time after the starting pedal is released, the clutch needs oil. Keep chain clean and well oiled with light engine oil. Every 500 miles remove the plug from the reduction gear casing and inject a quantity of medium weight grease. "Gredag" is a good grease for this purpose. At the same time put three or four drops of light machine or engine oil in the rear motor oiler.

Relay should close at 7-10 and open at 5-8 miles per hour. The maximum charging rate of 15-16 amperes is reached at 18-20 miles per hour, generator warm. Every two weeks, or 500 miles, put four or five drops of light machine or engine oil in each of the two generator oilers.

Head lights are 7 volt, 15 cp. Side lamps are 4 cp. Dash and tail lamps are 2 cp. On the Sedan models the side lamps are replaced by 7 volt, 2 cp. pillar lamps. On this model there are also two 7 volt, 2 cp. body lights. Fuses are 15 ampere.



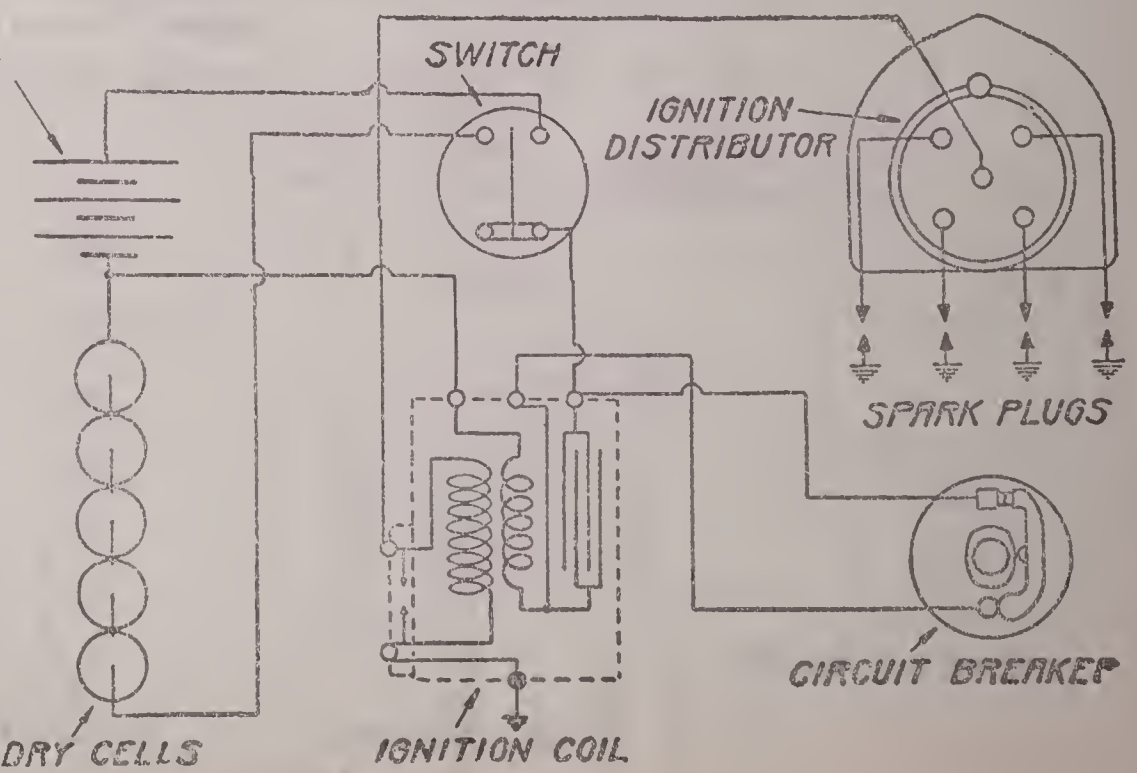
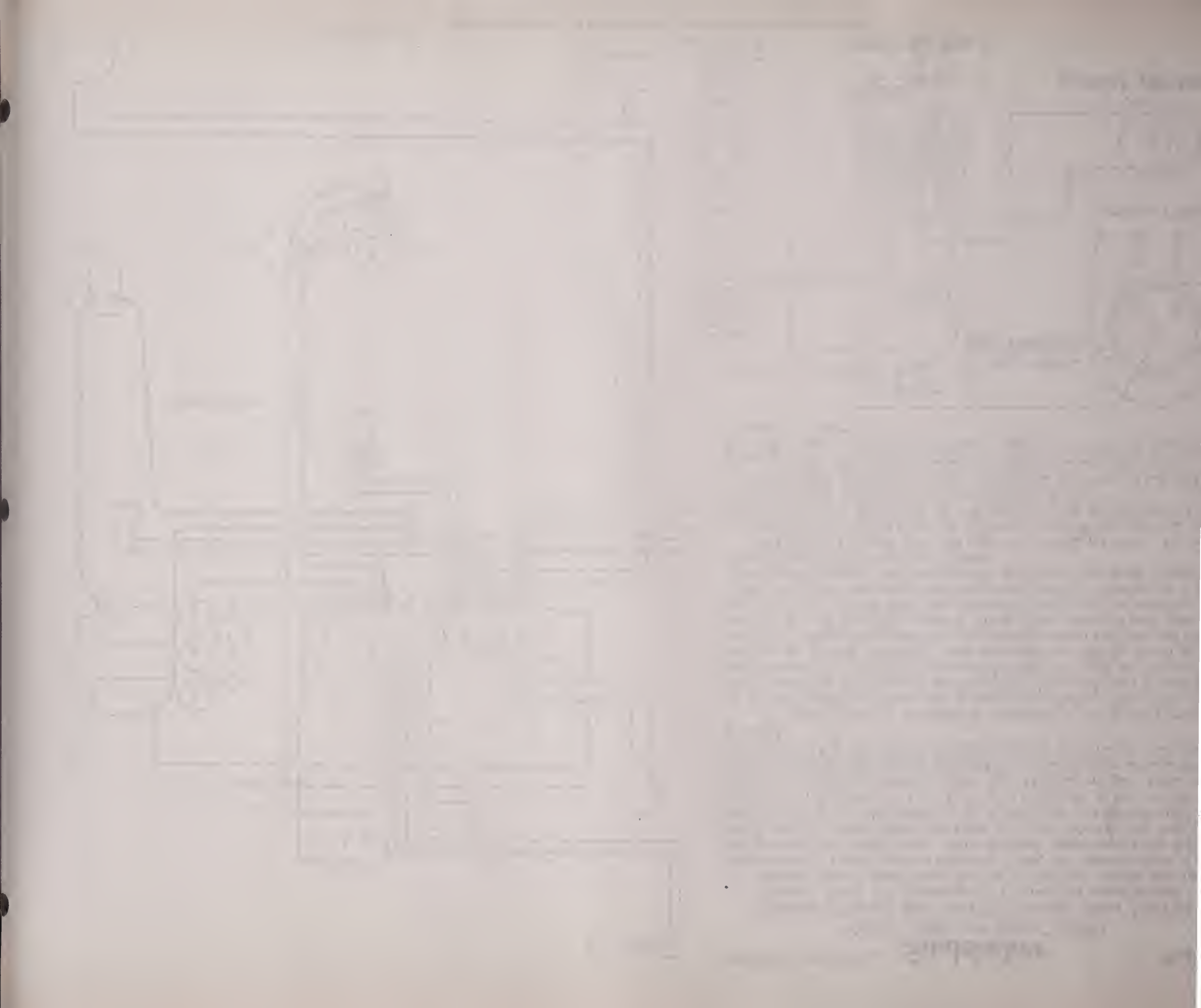


PLATE NO. 225.



Studebaker

Models "EG-6" and "DS-4" (1915)

Wagner Starting and Lighting System. Remy Ignition

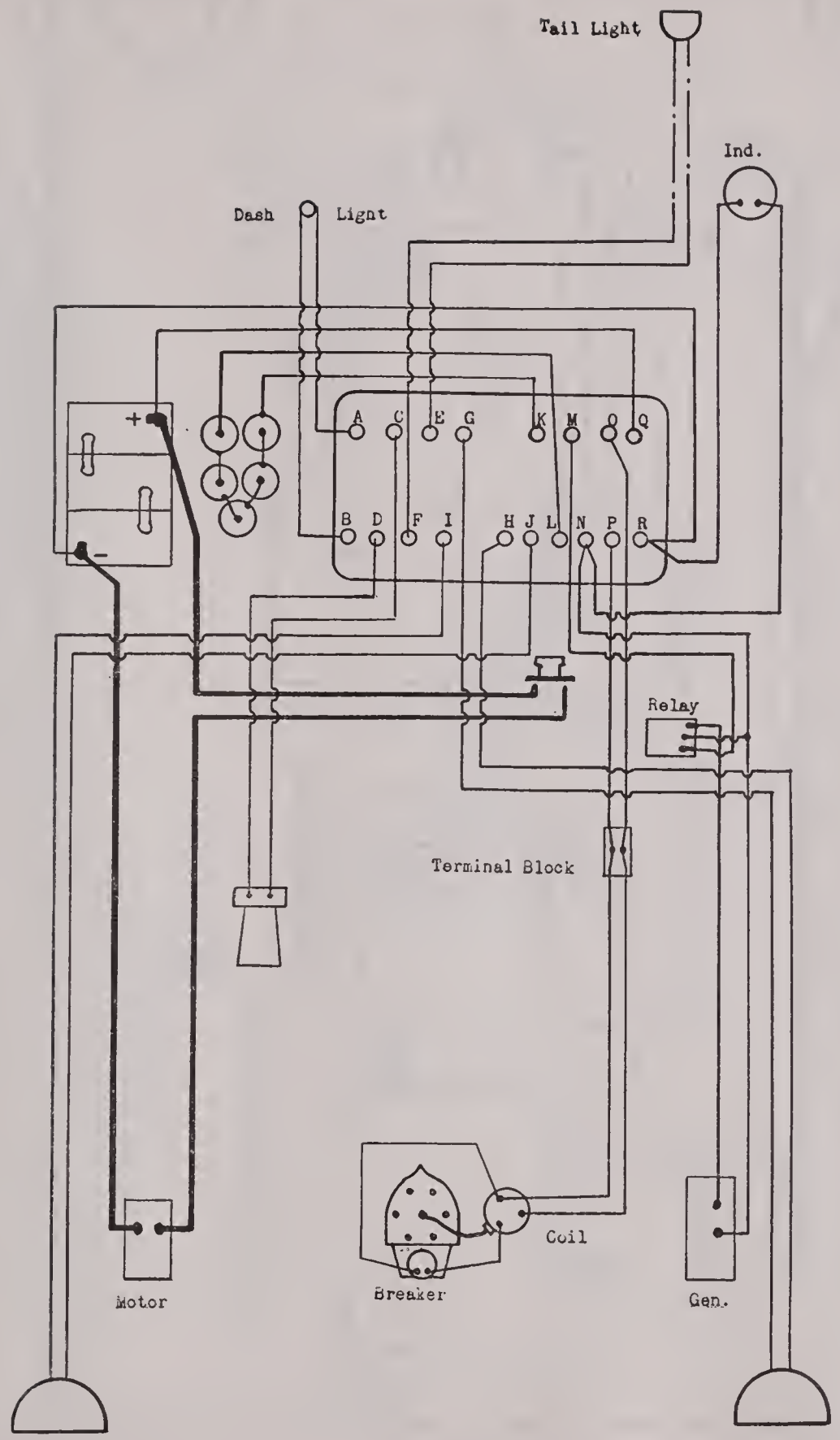
Battery is 6 volt, 100 ampere-hour. The two-wire system is used on most cars. On cars where the single-wire system is used the negative terminal is grounded.

Breaker contacts should open .015 in. to .018 in. Should contacts become badly burned or pitted, resurface them with a fine, flat, jeweler's file or a strip of worn No. 00 sandpaper. Contacts should just begin to separate when the top dead center mark (U. D. C.) on the flywheel is 5/8 in. to 7/8 in. past the indicator, spark lever in the fully retarded position. The firing order of the six-cylinder model is 1, 5, 3, 6, 2, 4. The firing order of the four-cylinder model is 1, 3, 4, 2. The spark gap should be .025 in. The diagram given below shows the ignition circuits on cars having the battery grounded. The diagram on Plate No. 225 shows the ignition circuits on cars using the insulated or two-wire system.

The motor is connected to the engine crankshaft through a set of reduction gears, an overrunning clutch and roller chain. Directions applying to this starter are given on Plate No. 225.

Voltage regulation of the generator is by third brush system. Relay should close at 7-10 miles and open at 5-8 miles per hour. The maximum charging rate of 15-18 amperes is reached at 18-20 miles per hour, all lights out. This rate reduces at high speeds. Once every two weeks, or 500 miles, put four or five drops of light machine or engine oil in each of the generator oilers.

Head lamps are 7 volt, 15 cp. Dash lamp is 7 volt, 2 cp. Tail lamp is 7 volt, 2 cp. Fuses are 15 ampere.



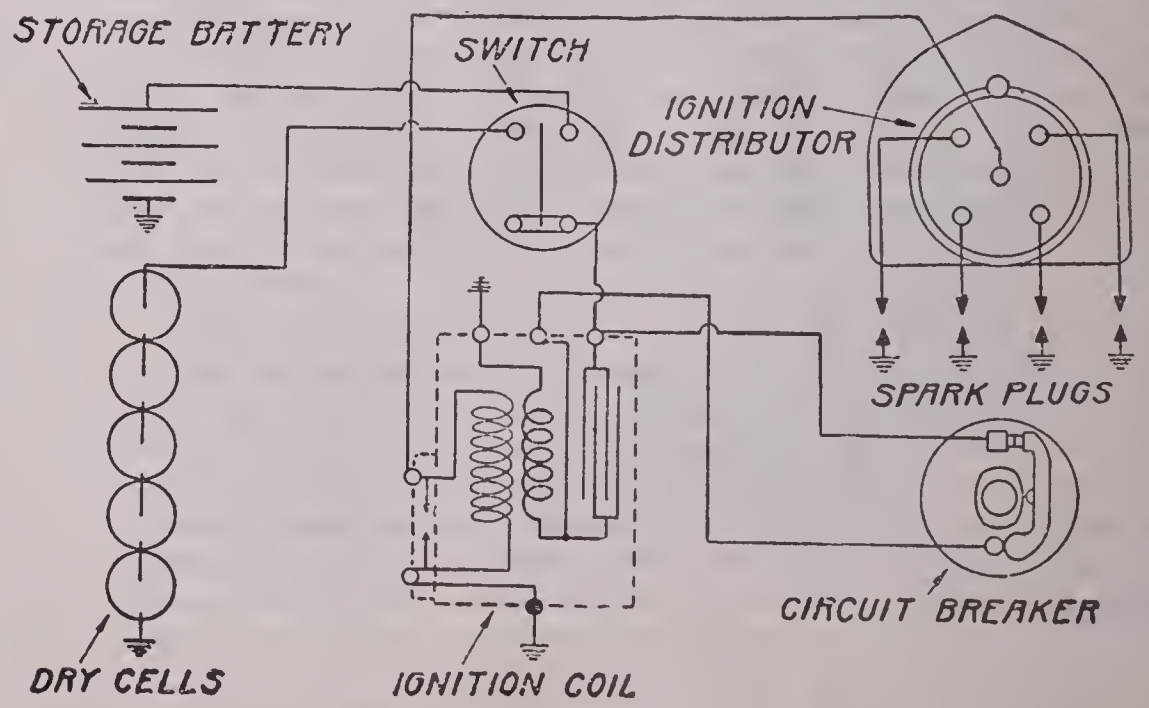


Plate No. 226

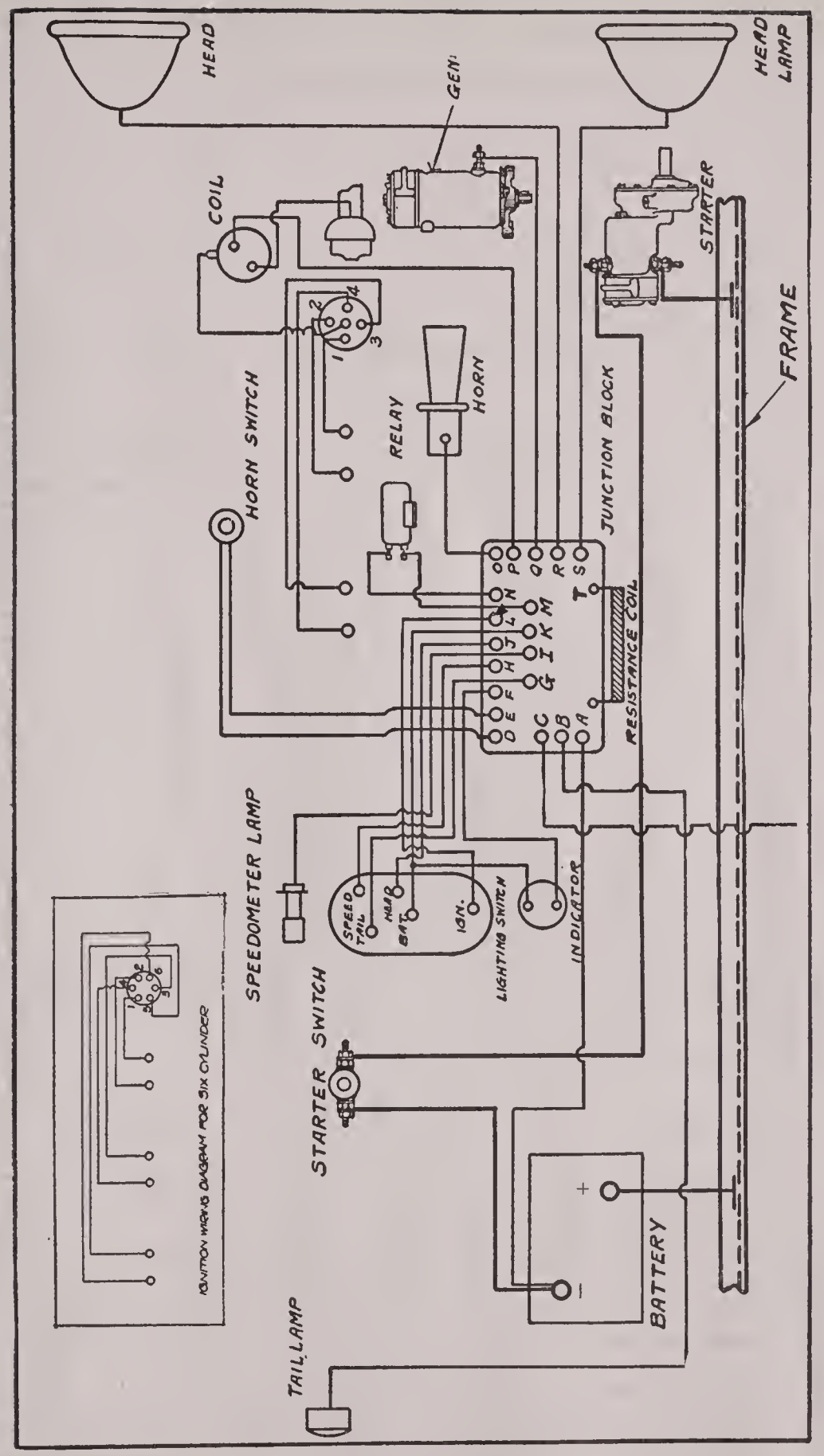


PLATE NO. 227

Studebaker

SERIES 16, 17 AND 18

WAGNER STARTING AND LIGHTING SYSTEM. REMY IGNITION

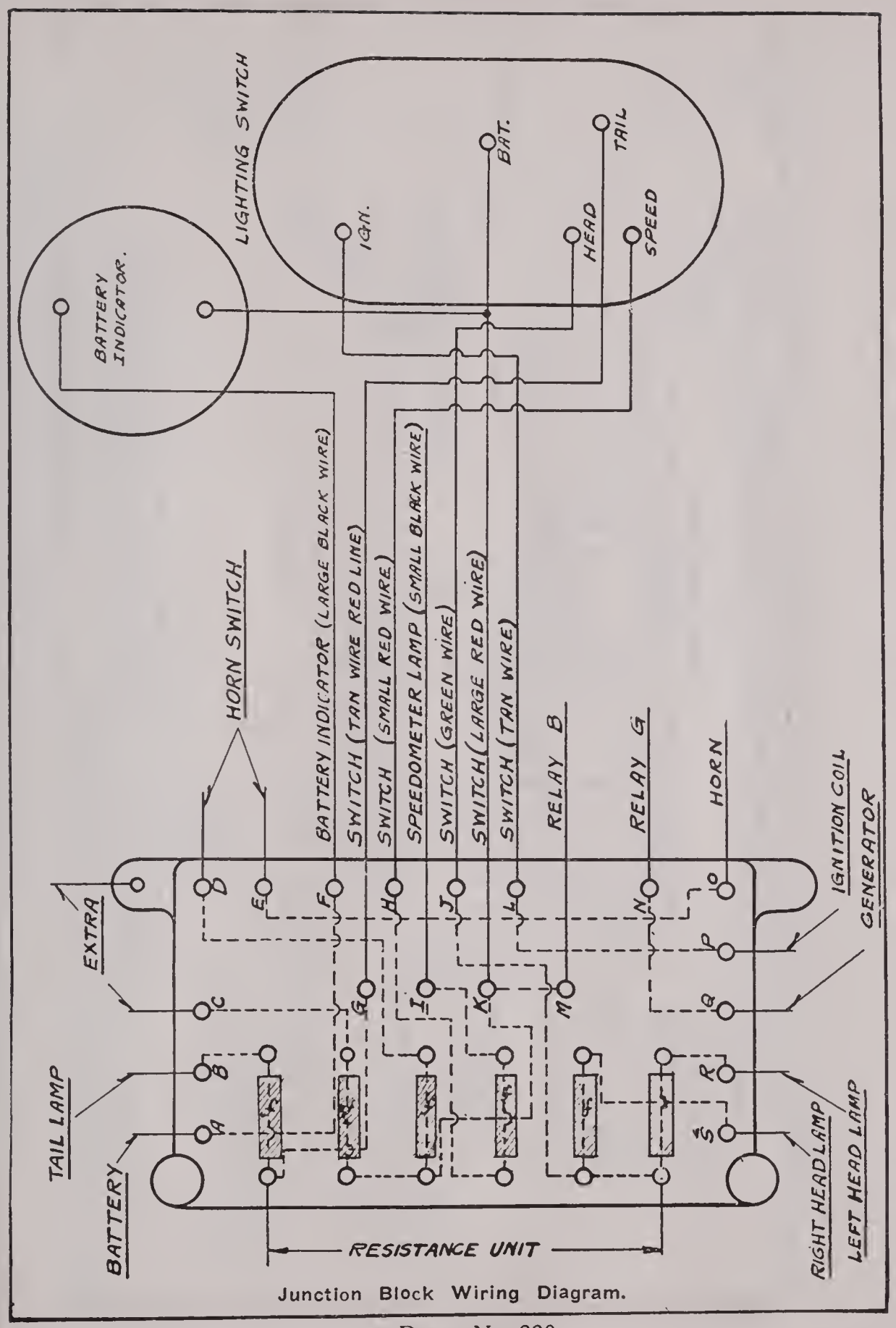
Battery is 6 volt, 100 ampere-hour. The positive terminal is grounded.

Breaker contacts should open .018 in. to .020 in. Contacts should just begin to separate when the mark UP-DC 1 & 4 or 1 & 6 on the flywheel is 1¼ in. to 1¾ in. past the indicator, spark lever in the fully retarded position. The firing order of the "Four" is 1, 3, 4, 2. The firing order of the "Six" is 1, 5, 3, 6, 2, 4. Should contacts become badly burned or pitted they may be resurfaced with a fine, flat, jeweler's file or a worn strip of No. 00 sandpaper. Use soft cup grease in the cup under the breaker head. Tighten one turn every 2,000 miles. Spark gap should be .025 in.

The driving power of the starting motor is transmitted to the front end of the crankshaft through a set of reduction gears, a roller chain and an overrunning clutch. Every 1,000 miles put three or four drops of light engine oil in the front and rear motor bearing oilers. At the same time remove the plug from the reduction gear case and inject a liberal amount of a good grade of graphite grease. In the rim of the overrunning clutch there is a blind screw. Should the clutch stick, this screw should be removed and the felt packing well oiled. If the engine drives the starting motor for a short time after engine begins to run on its own power, the clutch needs oil. The driving chain should be well lubricated with light or medium weight engine oil. Every 500 to 1,000 miles, clean the chain and lubricate it well with oil. After the oil has had time to penetrate to the bearings of the chain, wipe the surplus from the surface, to prevent the collection of dust. The commutator and brushes should be cleaned with a cloth moistened with gasoline every 1,000 miles. Should the starter fail, see that the battery connections, motor terminal connections and the battery and motor grounds are O. K. Should these be O. K., see that the starting switch and terminals are not at fault. If these are in good order and there are no short or open circuits in the wiring, the trouble is in the motor, there being tight bearings, a dirty commutator, open circuits, or grounded, wet or short circuited armature.

Voltage regulation of the generator is by third brush. The relay should close at 9-10 miles per hour, and open at 7-8 miles per hour. The maximum charging rate of 18-19 amperes is reached at about 20 miles per hour. There are two oilers, located one at the top and one at the bottom of the generator. Every 1,000 miles put three or four drops of light machine oil in each of the generator oilers. Clean relay contacts by drawing a piece of soft paper between them. Should the relay contacts become badly burned or pitted, resurface them with a piece of worn No. 00 sandpaper. Should it ever be necessary to run the generator with the relay or battery removed or disconnected, ground the terminal at the lower, front side of the generator.

(*Continued on Plate No.* 228)



Junction Block Wiring Diagram.

PLATE No. 228

Studebaker

SERIES 16, 17 AND 18

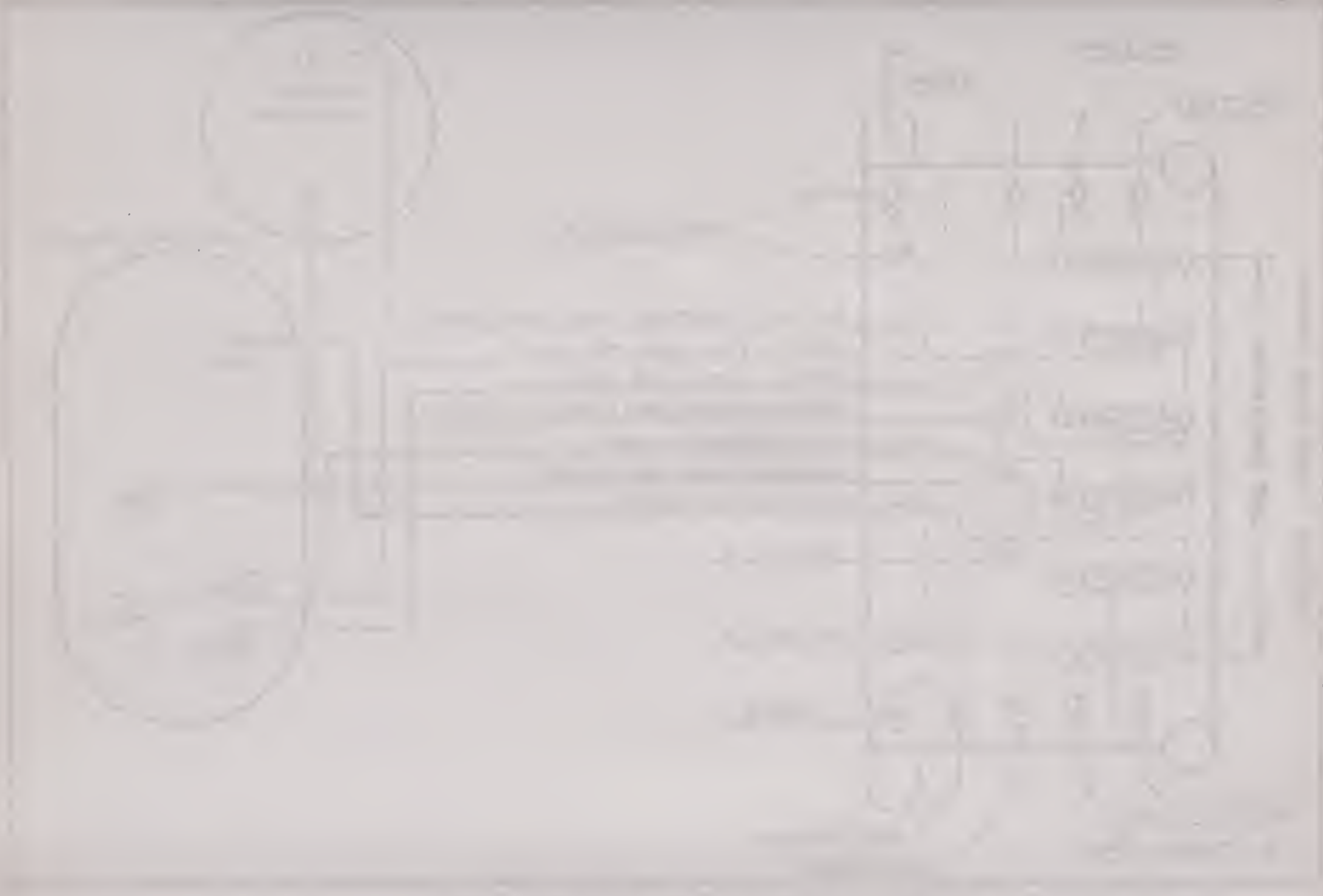
WAGNER STARTING AND LIGHTING SYSTEM. REMY IGNITION

(*Continued from Plate No. 227*)

Should the generator fail to supply current with the engine running at the equivalent to 12-15 miles per hour, first determine whether or not the relay is closing. Should relay be closing, yet the indicator not show charge, either the relay contacts are defective or there is a ground or high resistance in the circuit between the relay and the negative terminal of the battery. Should the relay fail to close, short circuit the relay and indicator terminals in turn, with engine running above cut-in speed. If the battery will now charge, the relay or indicator, respectively, are at fault, or the terminals are defective. If generator will not then charge the battery or charges at too low a rate, see that the commutator and brushes are not oily or dirty and that the brushes make good contact with the commutator. Should all of the above be found O. K., connect a test lamp to the generator terminal and the frame of the car and run the engine at a fair rate of speed. Should the lamp fail to light up, the generator is at fault. Should the lamp light, go over the entire charging circuit and see that all connections are in good order, that there are no broken wires and that the battery is properly grounded. Should all of the above be in good order, test for circuit, in the order named, between terminals Q and N, M and K, F and A on the junction block, as shown in diagram. No circuit between any of the two terminals named in one group, indicates a broken wire, on the back of the junction block connecting these terminals, which must be repaired.

Head lamps are 7 volt, 12 cp. Tail and dash lights are each 7 volt, 2 cp. To remove the door from the head lights, press in hard against the rim and twist in a counter-clockwise direction. Should the lights fail, first inspect the fuse and then the bulb. Should both be found to be O. K. and fuses are making good contact with the clips, go over the circuits of the lights affected, looking for broken or grounded wires, defective connections or defective contacts in the switch. Should both head lights fail and all of the above be O. K., test between terminals J and T, T and R (diagram) on the junction block. There should be a circuit. Should head lights operate on bright, yet fail on the dim position—tail light O. K.—the dimming resistance is at fault. Should the tail light or the dim and tail lights fail—bright head light and dash lights O. K.—the switch contact fingers are at fault, the terminal on the back of the switch marked "Tail" or terminal G on the junction block (diagram) are at fault, or the tan and red wire connecting these terminals is probably broken or grounded or the bulbs are defective.

All fuses are 10 ampere.



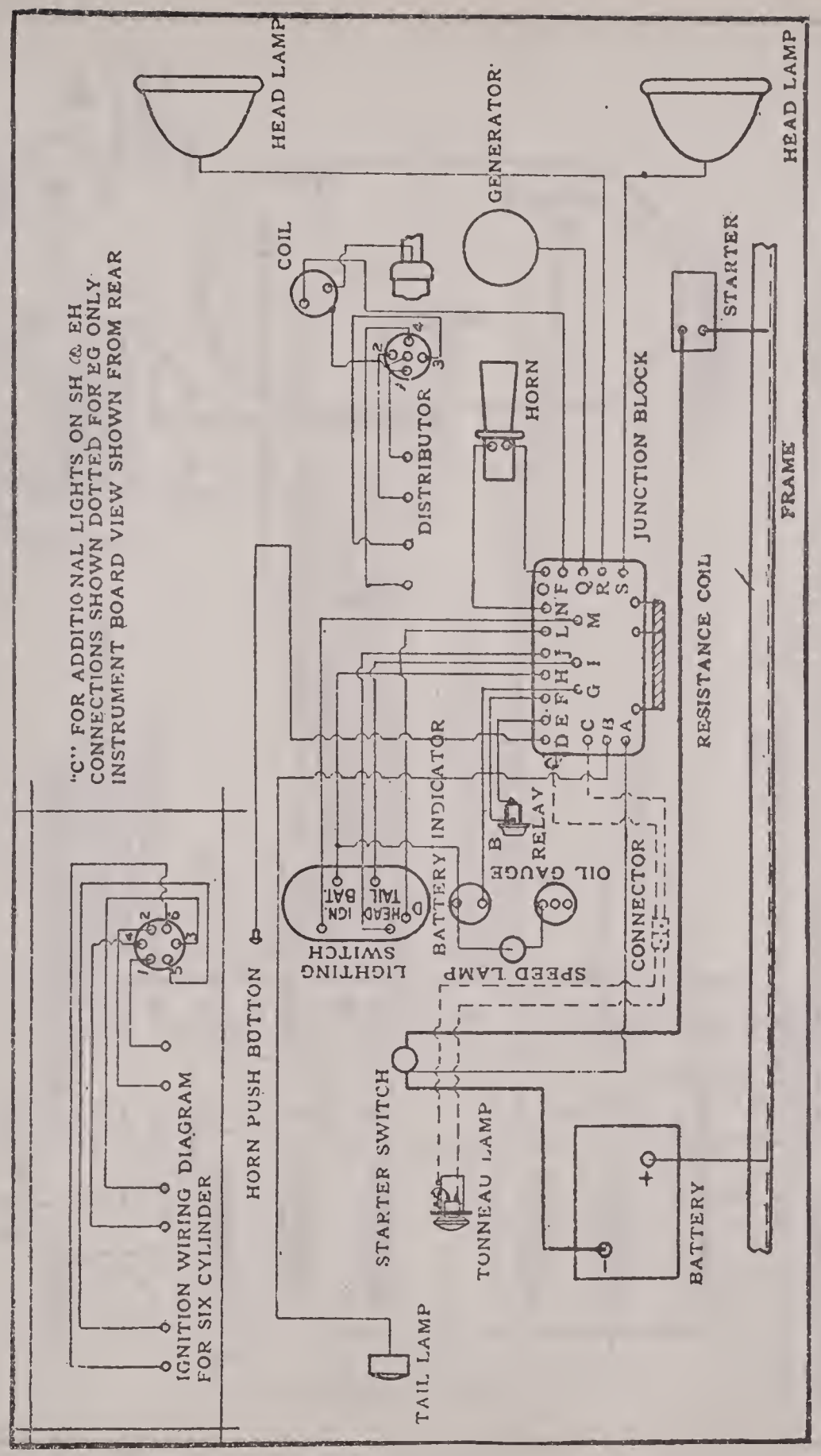


PLATE NO. 229

Studebaker

SERIES 19

WAGNER TWO-UNIT STARTING AND LIGHTING SYSTEM. REMY IGNITION

Battery is 6 volt, 100 ampere-hour. The positive terminal is grounded.

Breaker contacts should open .020 in. Should contacts become badly burned or pitted they may be resurfaced with a fine, flat, jeweler's file or a worn strip of No. 00 sandpaper. Spark should occur when the mark "AD-SP" on the flywheel is at the indicator, spark control lever in the fully advanced position. The firing order of the "Four" is 1, 3, 4, 2. The firing order of the "Six" is 1, 5, 3, 6, 2, 4. Spark gap should be .025 in. Use soft cup grease in the grease cup under the breaker head. Every 500 miles tighten this cup one or two turns. The rotating segment moves very close to, but does not quite touch the pins in the distributor cap. The clearance between the segment and pin should be 1/64 in.

The driving power of the starter is transmitted to the crankshaft of the engine through a set of reduction gears, roller chain and overrunning clutch on the front end of the flywheel. Every 1,000 miles put several drops of light motor oil in the rear motor oiler. At the same time inject a liberal quantity of good graphite grease into the gear case, through the plugged hole provided on the top of the case. Clean the driving chain well, oiling thoroughly before again putting into operation. The blind screw on the rim of the clutch should be removed and the felt packing well oiled. Should the engine drive the starter for a short time after the starter switch is opened, the starting clutch needs oil.

Voltage regulation of the generator is by third brush. The cable leading to the starting switch should be connected to the upper motor terminal. The lower motor terminal should be grounded. The relay should close at about 10 miles per hour. Maximum charging rate of 17 amperes is reached at 19 miles per hour. Rate gradually decreases at higher speeds. Every 1,000 miles put four or five drops of light engine oil in each of the generator oilers. The terminal on the side of the generator must be grounded if generator is to be run with battery disconnected.

All circuits except those of the starter and dash lamp are led through the junction box. The connections of the different terminals on the junction block are shown in Fig. 2. The first and second from the lower right-hand corner are in the head lamp circuits. The next is in the horn circuit. The fifth from the right is in the tail lamp circuit. The remaining fuse is for the tonneau lamp circuit on the "Big Sixes" and for the extra circuit on the "Fours" and "Light Sixes". All fuses are 10 amperes.

Should the apparatus on any line fail, first inspect the fuse for that circuit, and see that it makes good contact with the clips; that the terminals at the instrument and the junction block are in good order; and that the instrument is not at fault. Should all of the above be found in good order, proceed as follows:

Should all circuits passing through the junction block fail, see that battery terminals and ground are in good order. Next see that the small wire connected to the negative side of the starting switch makes good contact and that there are no grounds or open circuits in the wire which leads to the junction block. Should the circuit between terminal A Fig. 1 or 2) and the battery be in good order and the switch and instruments be in good order, test as follows:

(*Continued on Plate No. 230*)

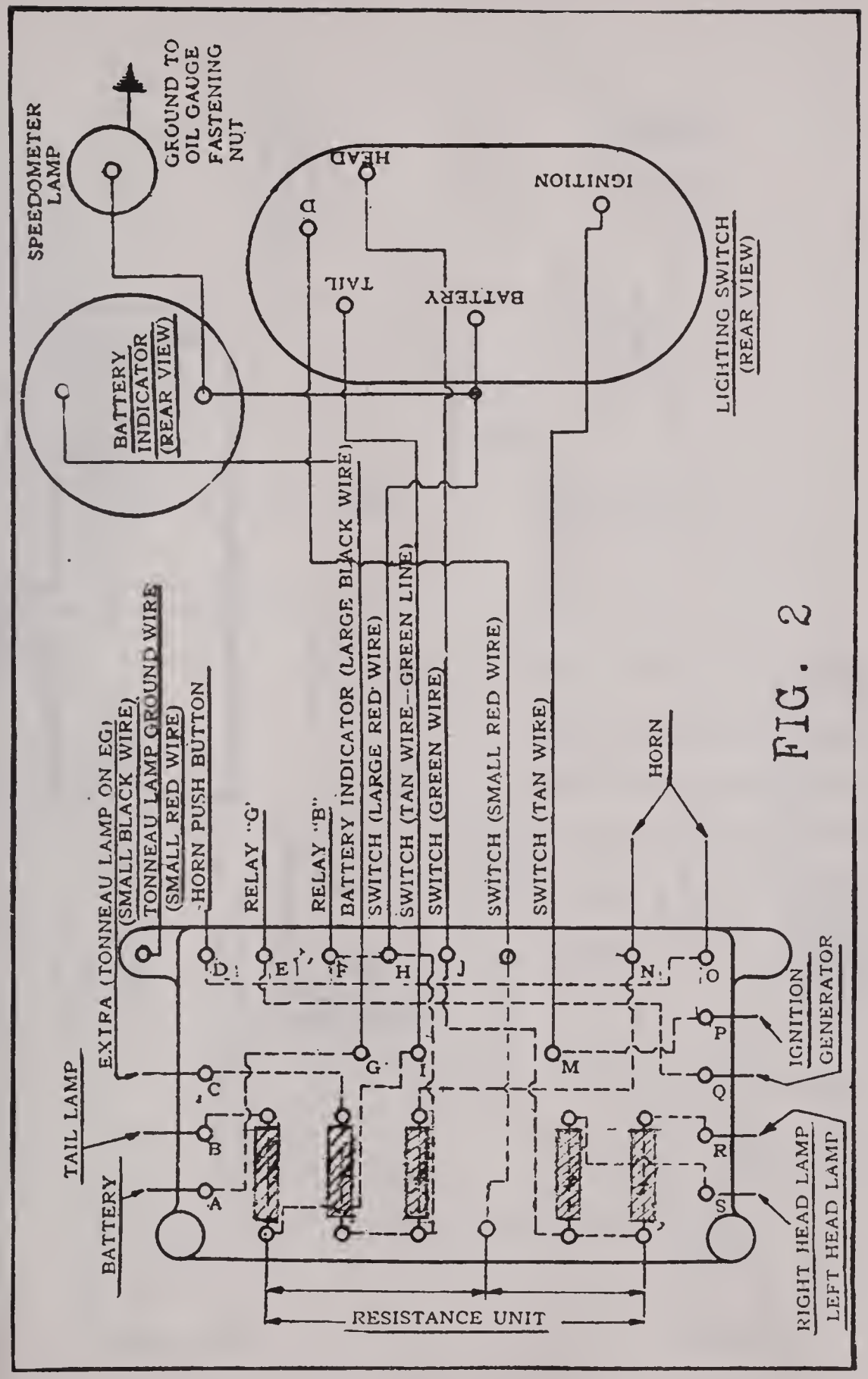


FIG. 2.

PLATE NO. 230

Studebaker

SERIES 19

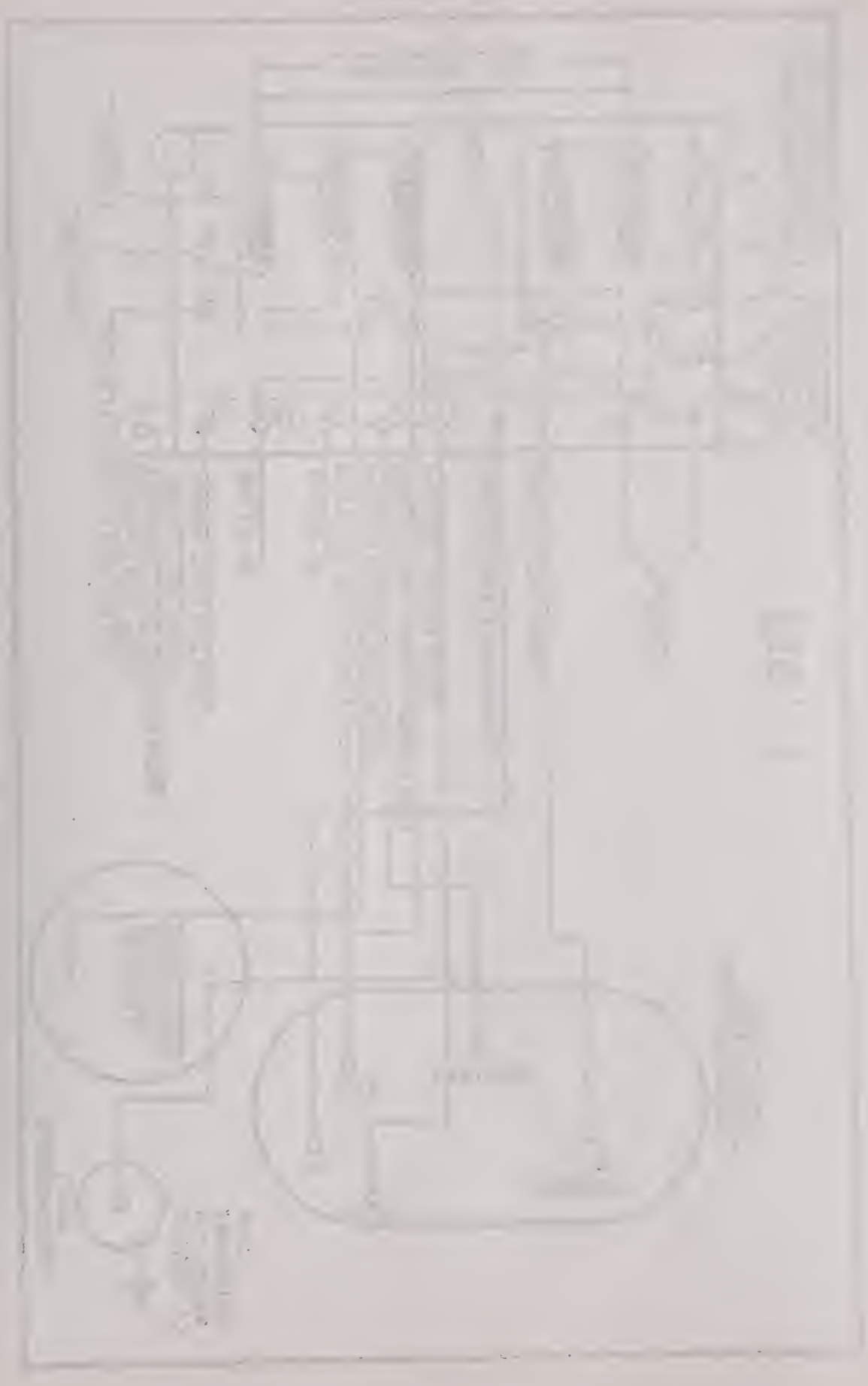
WAGNER TWO-UNIT STARTING AND LIGHTING SYSTEM. REMY IGNITION

(*Continued from Plate No. 229*)

Should right head lamp fail, test for circuit and grounds between terminals S and J, between S and the lamp and between terminal J and the terminal marked "Head" on the light switch. Trouble in this last circuit will affect both lights. Should the left head lamp fail, test between terminals J and R and between R and the lamp. Should the lights operate on the bright, yet fail on the dim position—tail light being O. K.—the dimming resistance is at fault. Should the tail light, or the dim head and tail lights fail, the switch contact fingers; the terminal marked "Tail" on the back of the switch; or the dimming resistance or connections at terminal I on the junction block, are at fault, or there may be a ground on an open circuit in the tan and green wire leading from terminal I on the junction block to the tail light circuit on the back of lighting switch.

Should the horn fail, test for voltage at the horn terminals, when the button is pressed. If full voltage is indicated or a lamp will burn brightly, the trouble is in the horn and may be either dirty commutator, tight bearings, tight or loose brushes, open circuited, short circuited, grounded, or wet armature or field coils, or defective connections between the field coil leads and the terminals or the brush holders. Should the horn be in good order and there be no current when the button is pressed, test for grounds or open circuits in the wires leading from the horn to N and C on the junction block, between the terminals N and H, O and D and D and the push button.

Should the generator fail to deliver current at an engine speed equal to 12-15 miles per hour of the car, first determine whether or not the relay is closing. Should relay be closing yet the indicator not show charge, the relay contacts are defective or there is high resistance, open circuits or grounds in the circuit between the relay and the negative terminal of the battery. Should the relay fail to close, short circuit the relay contacts and the indicator contacts in turn, engine running above cut-in speed. If the battery will not charge, (indicated by an ammeter in the line, terminals still shorted as above) the relay or indicator are at fault. Should the generator then fail to charge battery, see that the generator is delivering current. To determine this, stop the engine, disconnect the generator lead, connect the generator to the frame of the car, in series with a light similar to the large head light. Then, start the engine and run it at the equivalent to a high gear car speed of 12 miles per hour. Do not run it above this speed, as the generator voltage will build up, causing danger of burning out the lamp and generator windings. The lamp should burn brightly, with engine running at this speed. Should generator be O. K., test for grounds, open circuits and defective contacts in the order named, between the following terminals: Generator and O on junction block, O and E, E and relay, F and relay, F and H, H and battery terminal on back of lighting switch, battery terminal on switch and indicator, indicator and G on the junction block, G and A and A and the battery.



Empire

Models 50, 51, 70 and 70A

Auto-Lite Two-Unit Starting and Lighting System
Connecticut Ignition

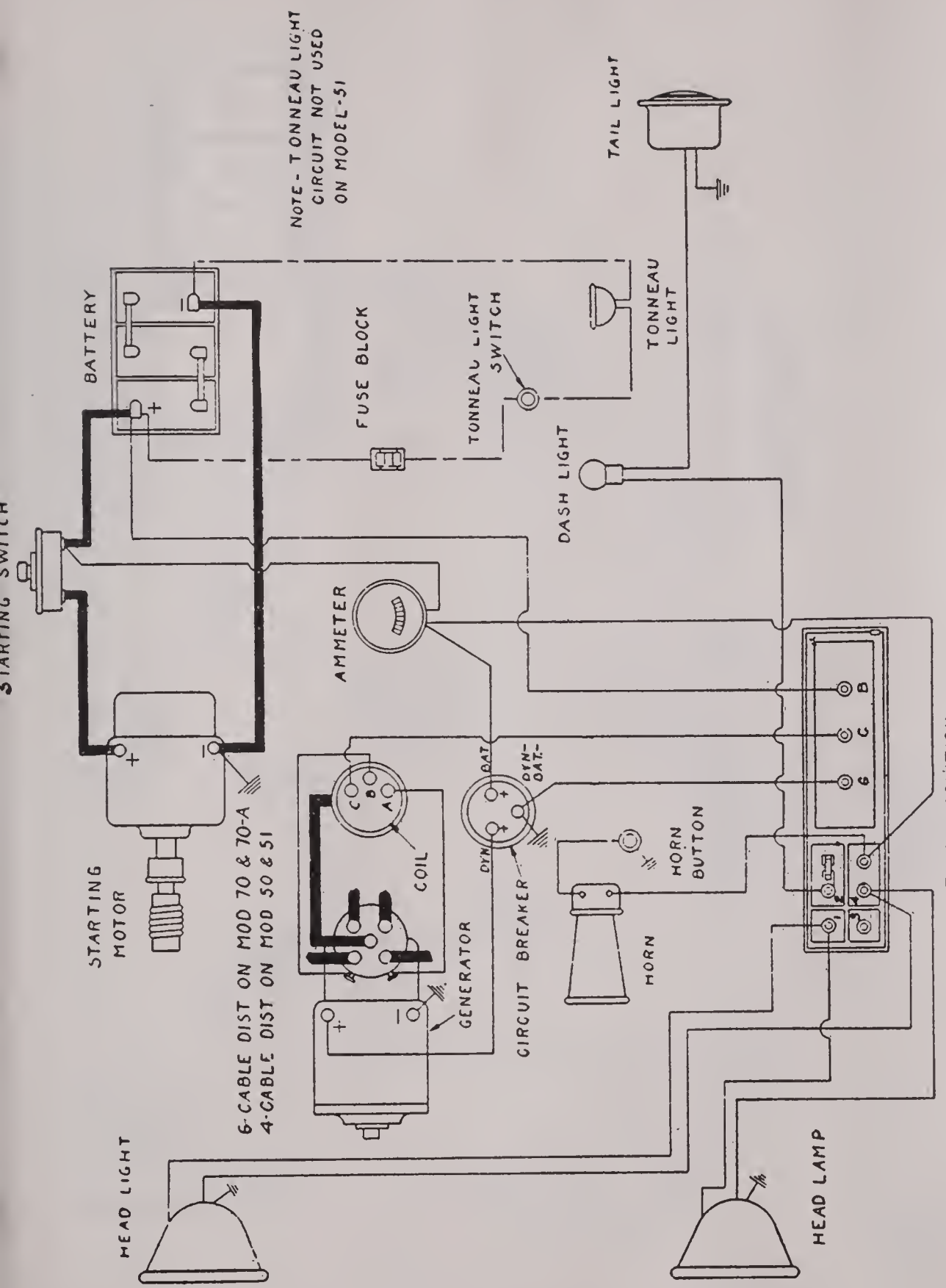
Battery is 6 volt, 80 ampere-hour. The negative terminal is grounded at the starting motor.

Breaker contacts should open about .020 in. Contacts are made of tungsten metal. They should not be filed nor sandpapered. The breaker will function properly even though the contacts become very irregular. Should contacts become so badly pitted as to impair the proper operation of the engine, the entire breaker mechanism should be renewed as directed on Plate No. 50. There is a circuit breaker in the ignition switch to open the ignition circuit should it accidently be left on when the engine is idle. Spark should occur when the piston entering power stroke is on top dead center, spark lever in the fully retarded position. The firing order of the "Four" is 1, 3, 4, 2. The firing order of the "Six" is 1, 5, 3, 6, 2, 4. Spark gap should be about .030 in.

The driving power of the starter is transmitted to the flywheel through a Bendix drive. Fig. 2 shows the internal circuits of the starter. Starter bearings are packed with grease, which should be renewed at least once a season.

Voltage regulation of the generator is by reverse series field. The internal connections of the generator are shown in Fig. 2. Maximum charging rate of 9-11 amperes should be reached at 15-18 miles per hour. Put five to eight drops of light engine oil in each of the generator oilers every 1,000 miles. Brushes are of a special composition found best suited for this machine and should not be substituted by others.

Large head lamps are 6-8 volt, 17 cp. Small head lamps are 6-8 volt, 4 cp. Dash and tail lights are in series. They are 3-4 volt, 2 cp. Tonneau light is 7 volt, 6 cp. Fuses are 10 ampere.



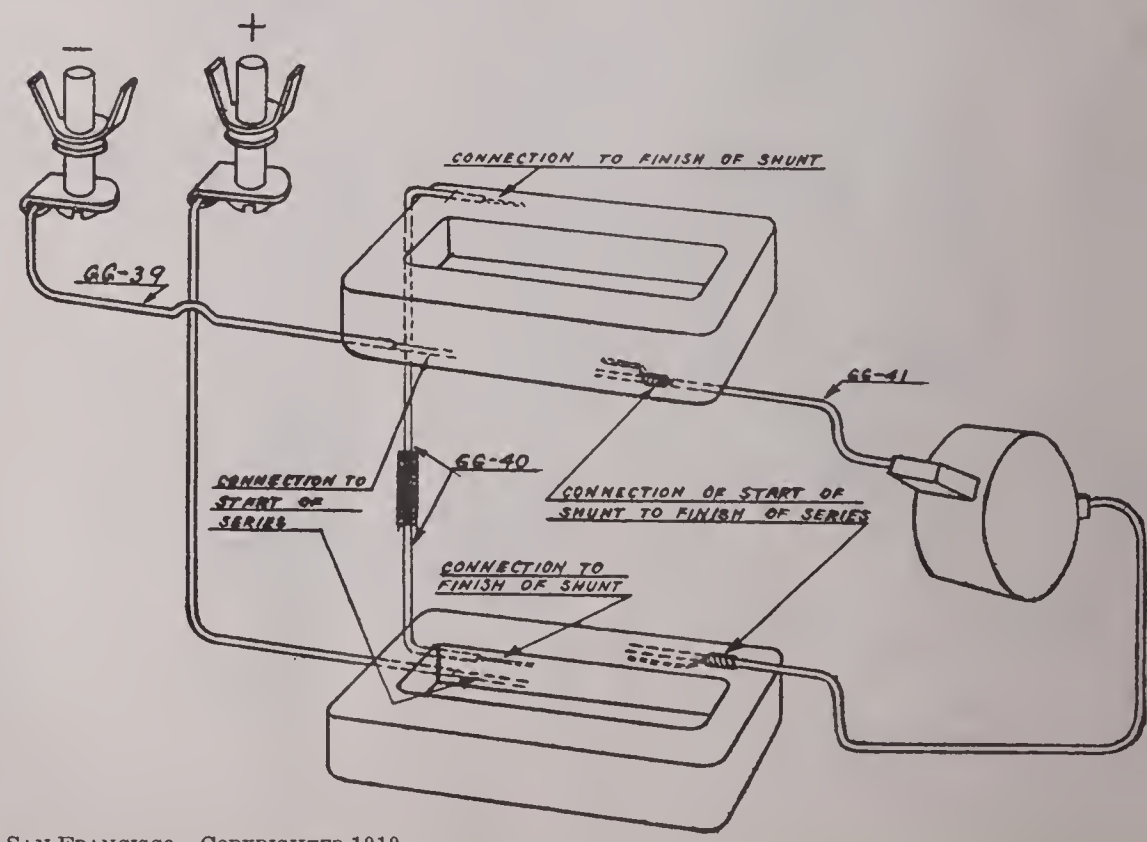


Plate No. 231

Models 31-40 and 33 (1915)

Remy Starting and Lighting System. Remy Ignition

Battery is 12 volt, 50 ampere-hour. The negative terminal is grounded at the motor.

Breaker contacts should open .018 in. to .020 in. Should contacts become badly burned or pitted they should be resurfaced with a very fine, flat, jeweler's file or a worn strip of No. 00 sandpaper. Spark should occur on top dead center, spark lever in the fully retarded position. The firing order is 1, 3, 4, 2. Spark gap should be .030 in.

The following data applies to the motor-generator when operating as a motor:

Torque (with 6 in. pulley)	R. P. M.	Amperes	Volts
0 lbs.....	1100-1200	6-16	12-13
8 lbs.....	900-1000	20-30	11.4-11.8
12 lbs.....	800-900	30-40	11.3-11-5
20 lbs.....	600-700	40-50	10.5-10.8
30 lbs.....	500-600	70-80	10.0-10.5
32 ft. lbs....	Lock Torque	300-350	10

Voltage regulation of the generator is by a vibrating regulator mounted on the relay base. Relay should close at about 10 miles per hour. The following data applies to the generator, tests to be made without ignition:

Amperes	R. P. M.	Volts
0.	1050-1140	13. -13.5
5.	1200-1356	14. -14.5
7.5	1250-1450	14.5-15
6.5	6000	14.0-15

Increasing the spring tension on the regulator will increase the output. Clean regulator relay contacts by drawing a piece of soft paper between them. Should contacts become badly burned or pitted they may be resurfaced with a fine, flat, jeweler's file or a small strip of worn No. 00 sandpaper. Carefully blow out all dust or filings after resurfacing. Do not file nor sandpaper the contacts unless absolutely necessary, as it will affect the output. Relay and regulator contacts should open .012 in to 0.15 in.

Large head lamps are 14 volt, 16 cp. Small head lamps are 14 volt, 6 cp. Dash and tail lights are in series. They are each 7 volt, 2 cp. Fuses are 4 ampere.

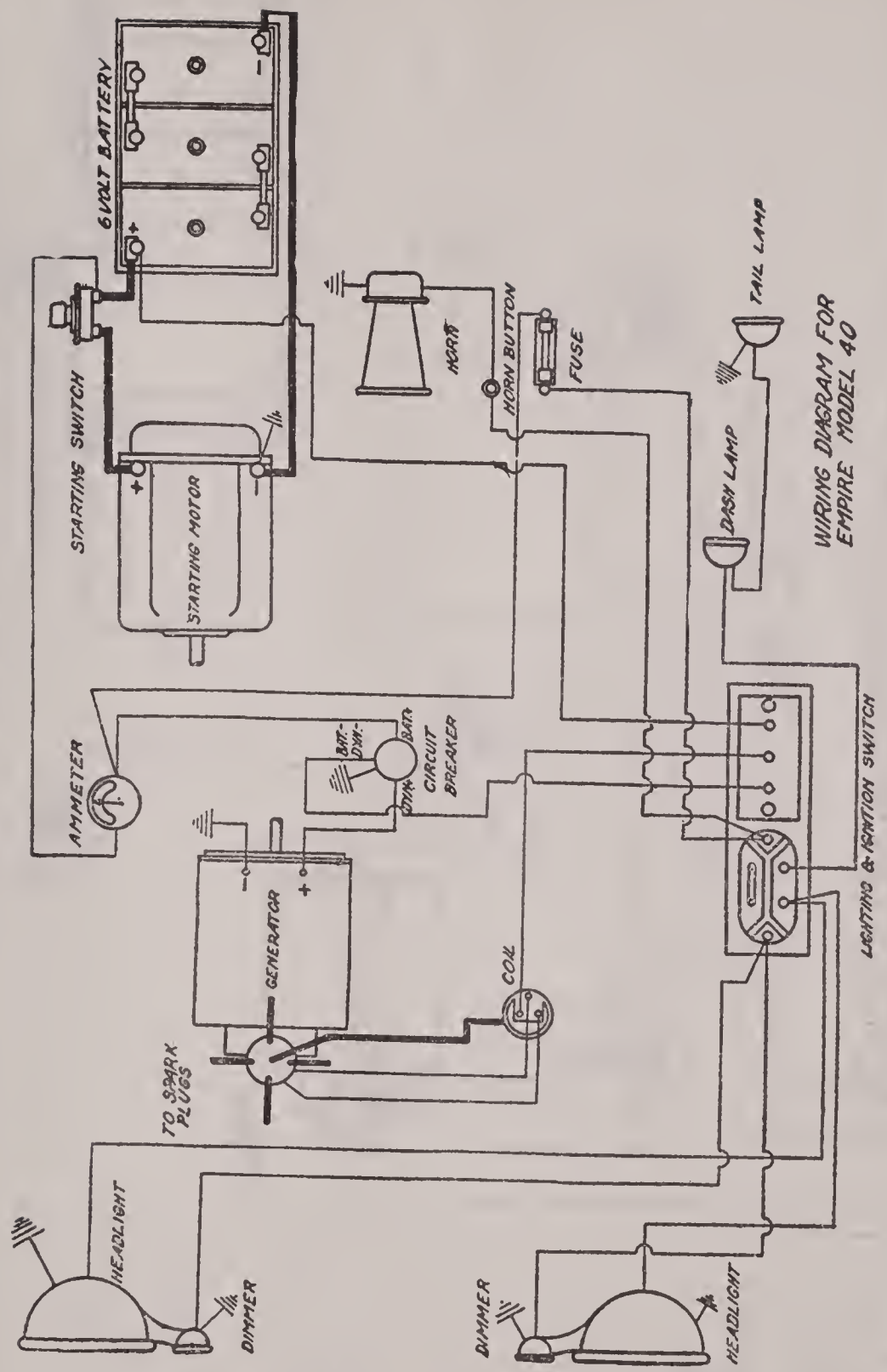
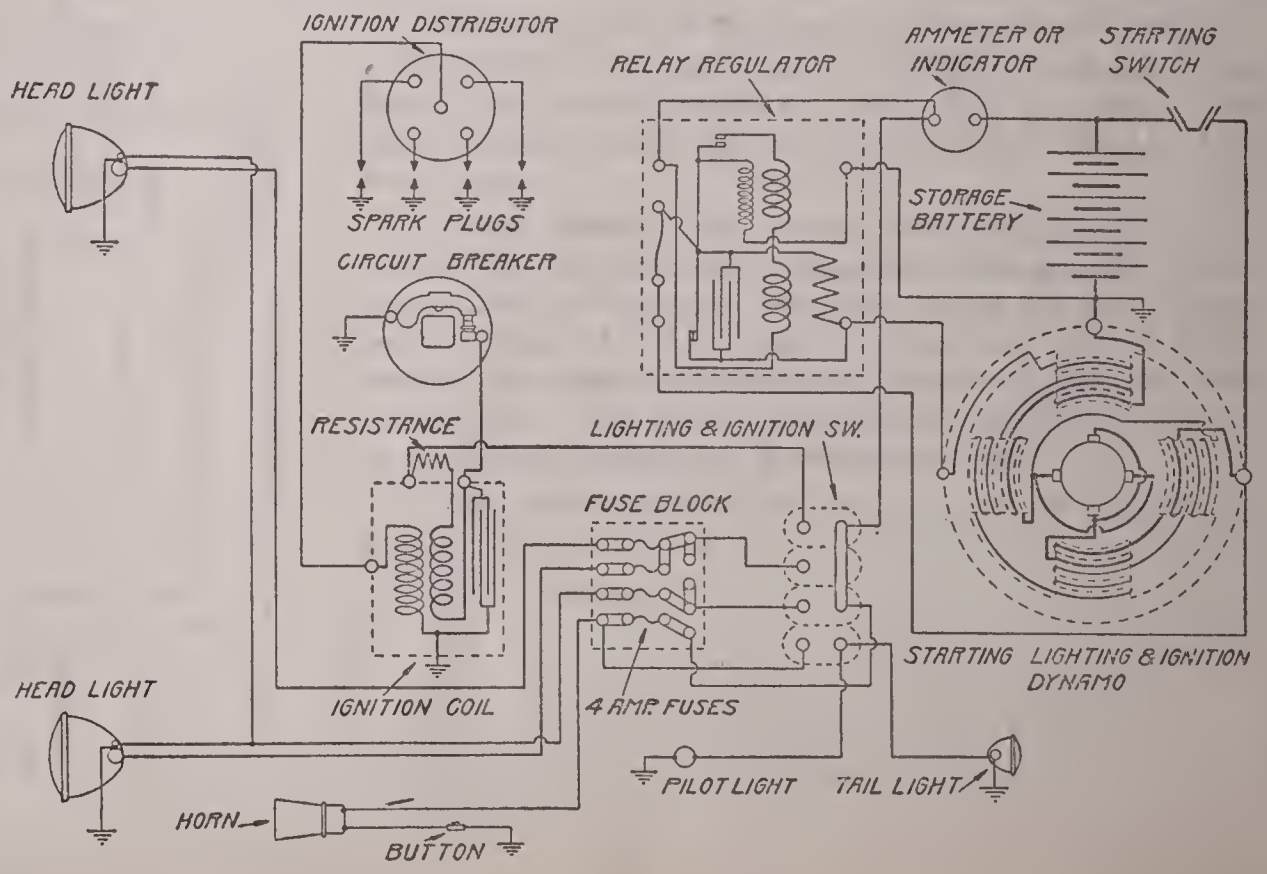


Plate No. 232



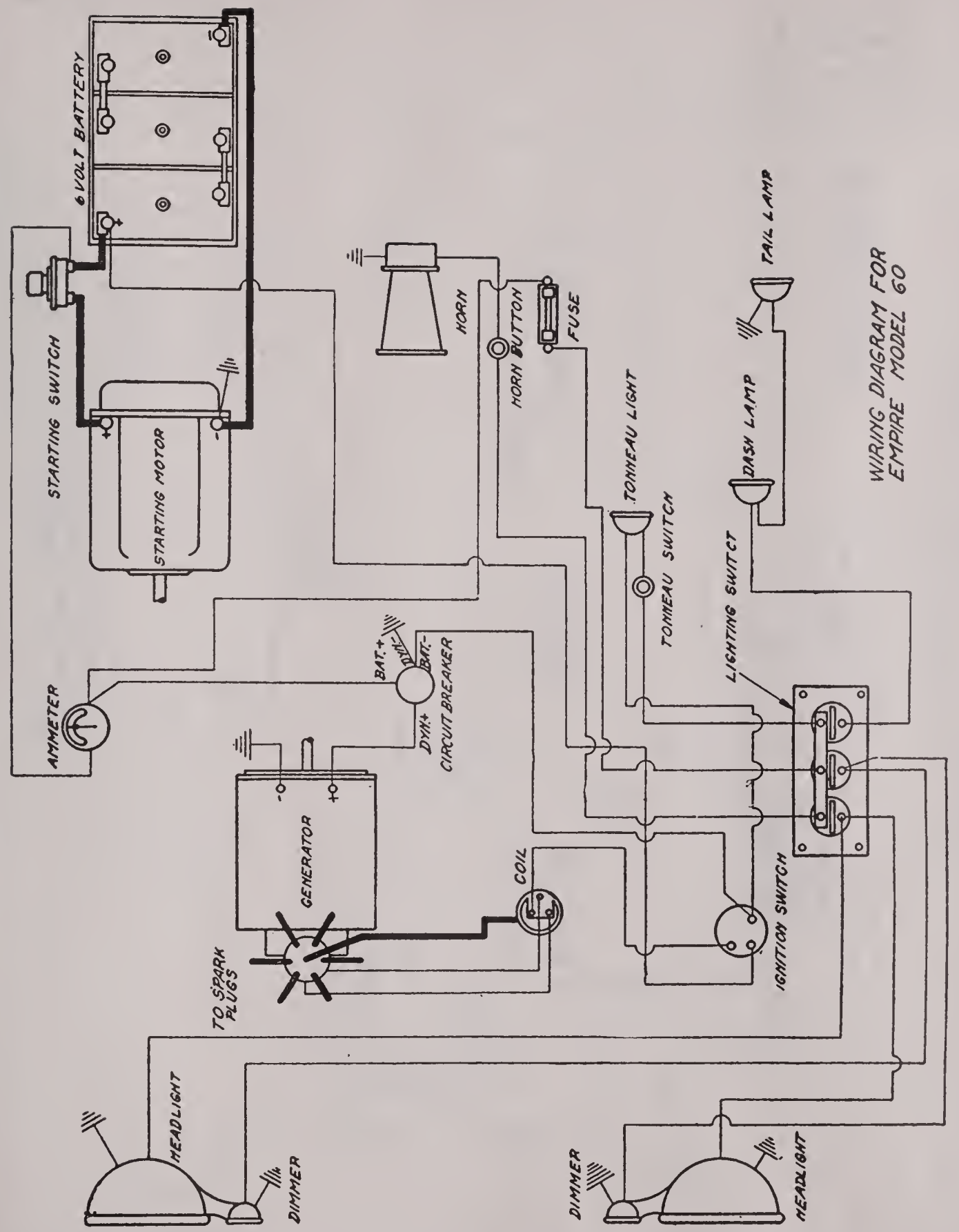


PLATE NO. 233

Empire

MODEL 40, 45 AND 60 (1916)

AUTO-LITE STARTING AND LIGHTING SYSTEM. CONNECTICUT IGNITION

Battery is 6 volt, 80 ampere-hour. The negative terminal is grounded at the starting motor.

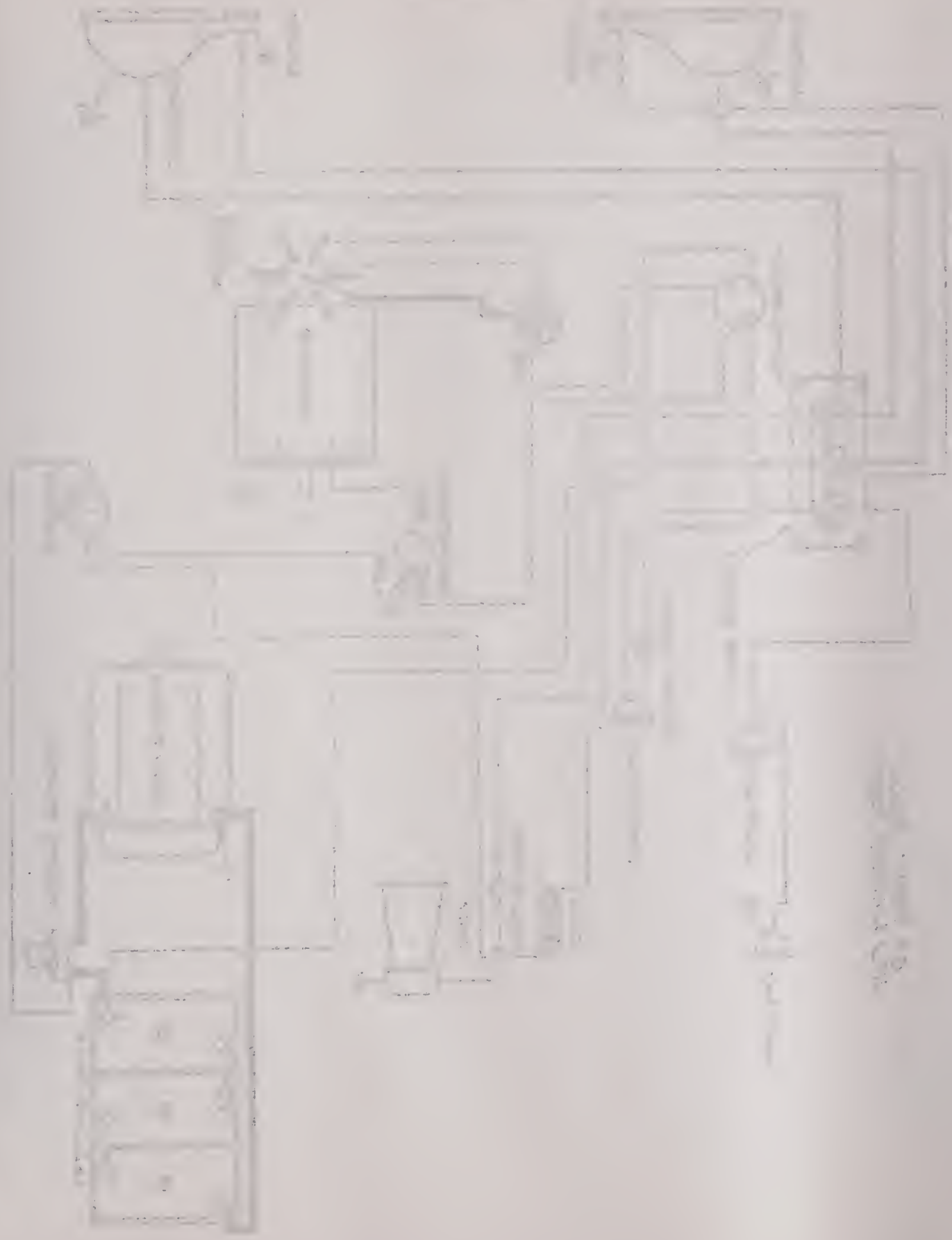
Breaker contacts should open .012 in. to .014 in. They are made of tungsten metal. They should not be filed nor sandpapered, as they will work properly even though quite irregular. Should the contacts become so badly worn as to impair the proper operation of the engine the entire breaker mechanism should be removed as directed on Plate No. 50. Breaker contacts should just begin to open when the piston receiving the spark is on top dead center, spark control lever in the fully retarded position. Spark gap is .028 in. to .030 in. The firing order of the "Six" is 1, 5, 3, 6, 2, 4. The firing order of the "Four" is 1, 3, 4, 2.

The driving power of the starter is transmitted to the flywheel by a Bendix drive. Once every month, or 1,000 miles, put four or five drops of light engine or machine oil in each of the motor oilers. The starter bearings are packed with grease, which should be removed at least once a season.

Voltage regulation of the generator is by reverse series field. Fig. 3, Plate No. 231, shows internal connections of the generator. Relay closes at 8-10 miles per hour. Maximum charging rate of 10-12 amperes is reached at 15-18 miles per hour. Once every month, or 1,000 miles, put five to eight drops of light machine or engine oil in each of the generator oilers. The brushes are of a special composition best suited for this machine and should not be substituted by others.

Large head lamps are 6-8 volt, 4-6 cp. Dash and tail lamps are in series. They are 3-4 volt, 2 cp.

Fuse is 10 ampere.



Empire

MODELS 40 AND 45

(For text see Plates Nos. 232 and 233)

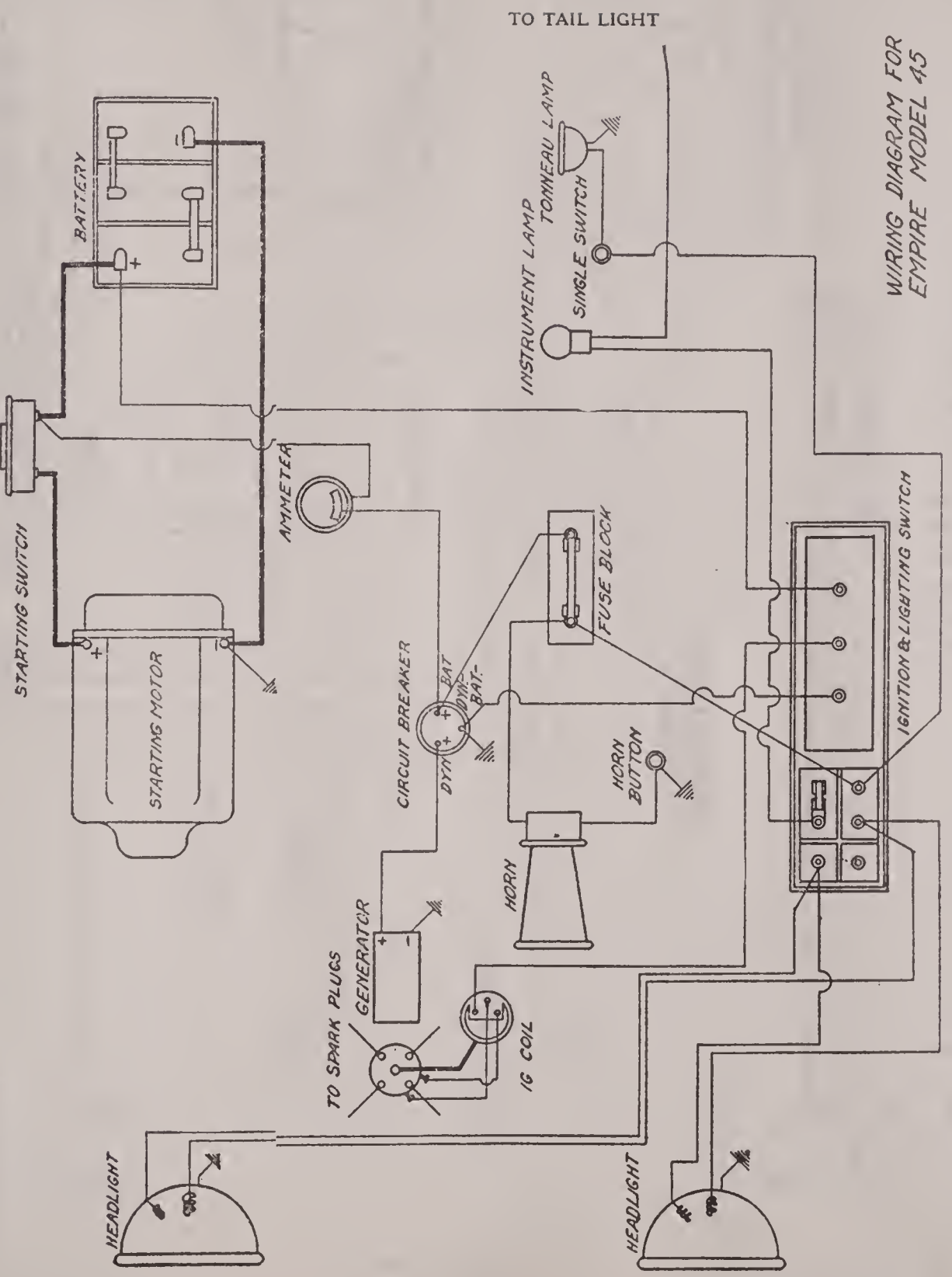


PLATE NO. 234

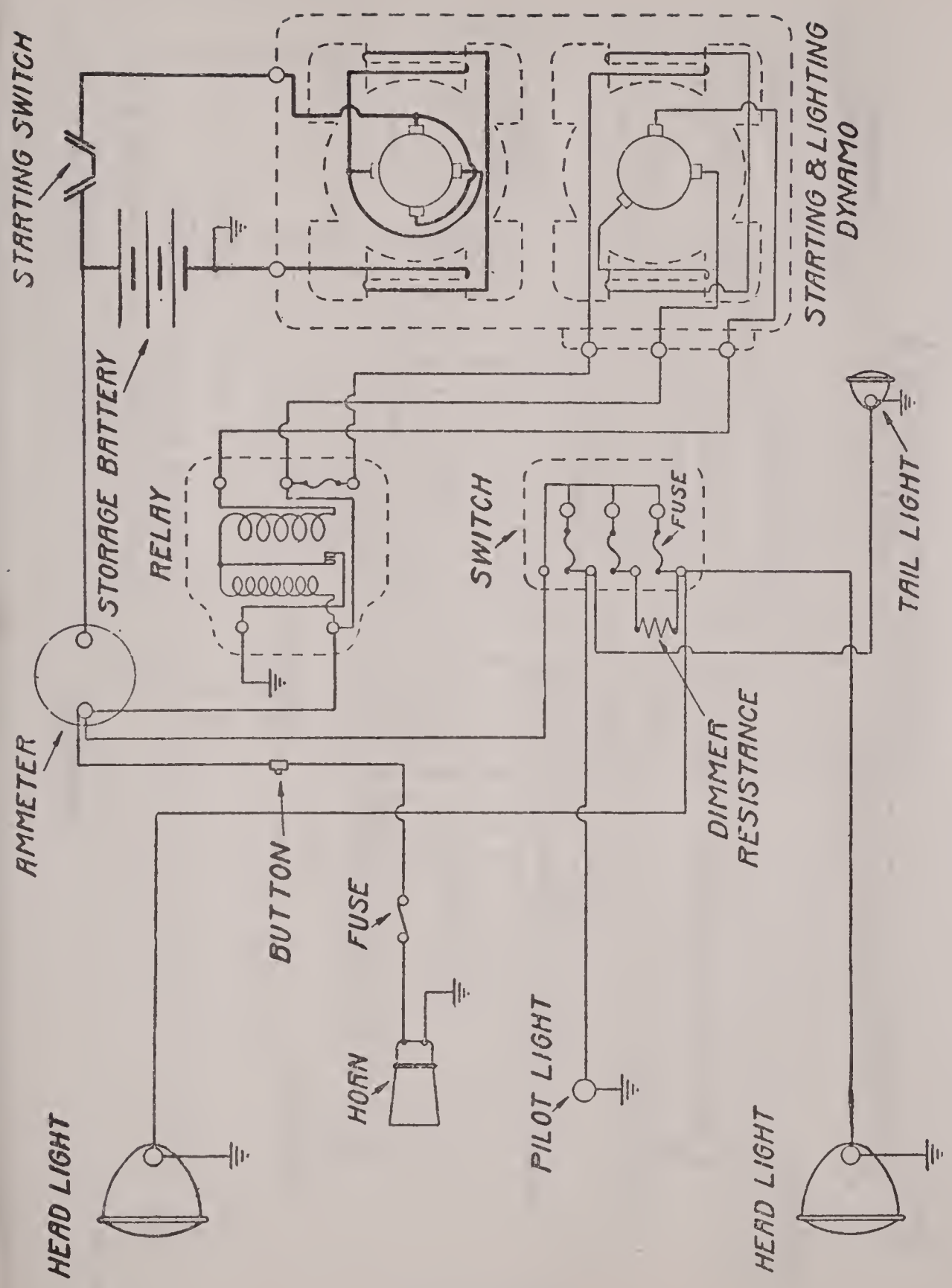


PLATE NO. 235

Empire

MODEL 31 (1914)

REMY TWO-ARMATURE STARTING AND LIGHTING SYSTEM. REMY IGNITION

Battery is 6 volt, 100 ampere-hour. The negative terminal is grounded at the motor.

Breaker contacts should open .018 in. to .020 in. Should contacts become badly burned or pitted they may be resurfaced with a fine, flat, jeweler's file or a small strip of worn No. 00 sandpaper. Breaker contacts should be just starting to separate when the piston receiving the spark is on the top dead center, spark lever in the fully retarded position. The firing order is 1, 3, 4, 2.

The motor-generator is two-armature type, often called the "Double Decker," as it has two armatures mounted one above the other and contained in one case. There is only one driving shaft. The driving power of the motor is transmitted to this shaft, through a set of reduction gears and an overrunning clutch. The clutch and gears run in a bath of heavy oil or thin grease. This grease should be about the consistency of thick cream. Do not put in any graphite, as it will cause the clutch to slip. Keep a plentiful supply of the grease in the case at all times. The following data applies to the motor:

Torque (with 12 in. pulley)	R. P. M.	Amperes	Volts
0 lbs.	300	40-50	6.0
16 lbs.	175	80-90	5.9
32 lbs.	125	110-120	5.8
48 lbs.	100	135-140	5.7
64 lbs.	90	150-170	5.6

Voltage regulation of the generator is by third brush. Relay should close at 8-10 miles per hour. The following data applies to the generator:

Amperes	R. P. M.	Volts
0.	525-600	6.2-6.4
7.5	750-825	6.8-7.0
13.5	950-1050	7.2-7.4

The gear ratio between the engine and the drive shaft is 2 to 1. The maximum speed of the armature should not exceed 4000 R. P. M.

Head lamps are 6-8 volt, 14 cp. Dash lamp is 6-8 volt, 2 cp. Tail lamp is 6-8 volt, 2 cp. Fuses are 5 ampere.

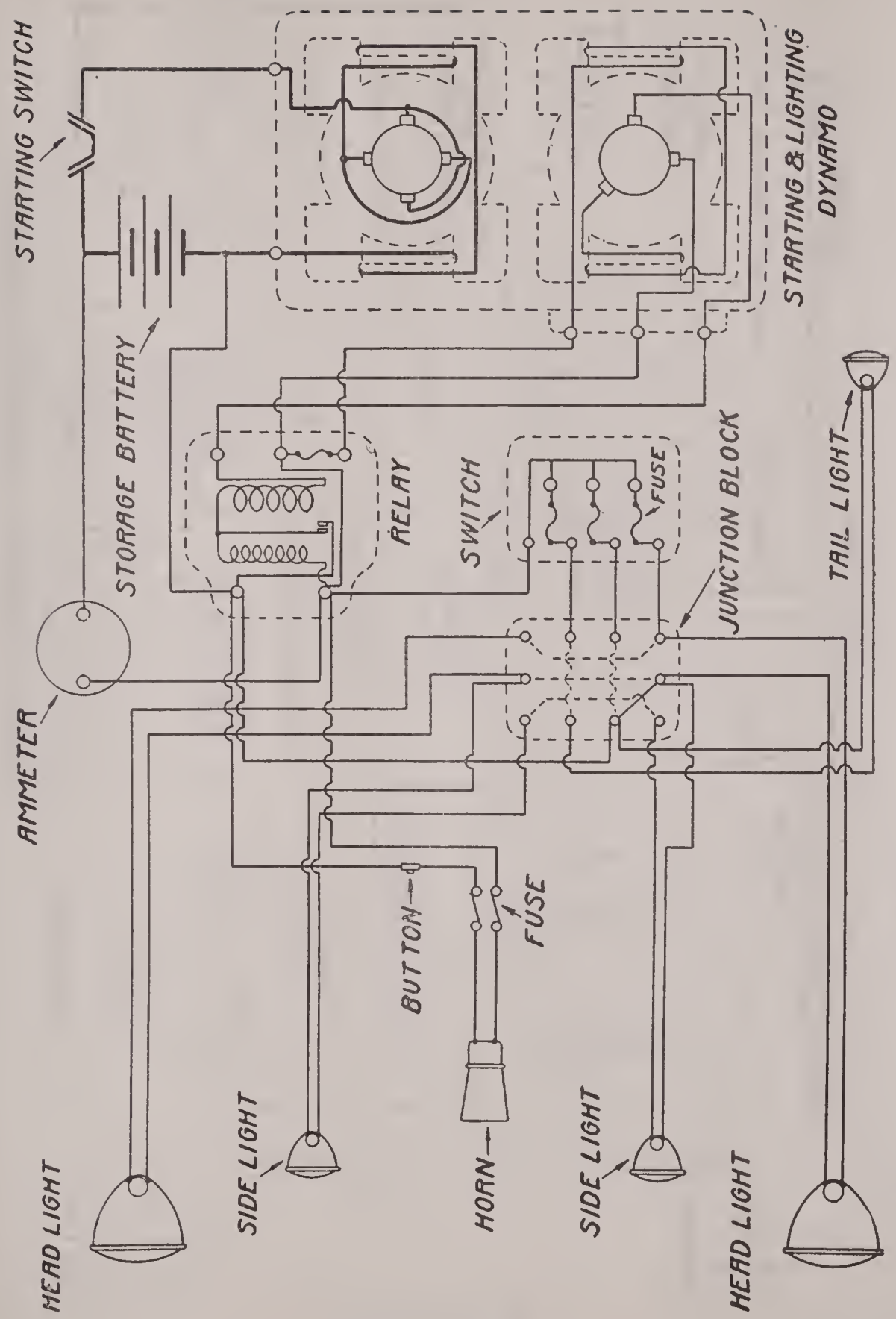


PLATE No. 237

Auburn

MODELS 4-40, 4-41, 6-45, 6-46 (1914)

REMY TWO-ARMATURE STARTING AND LIGHTING SYSTEM. BOSCH IGNITION

Battery is 6 volt, 94 ampere-hour. The two-wire system is used.

Bosch duplex ignition is used. This system is described on Plate No. 185. Magneto breaker contacts should open .014 in. to .016 in. Clean contacts with gasoline whenever necessary. Should contacts become badly burned or pitted they should be resurfaced with a fine, flat jeweler's file or a small strip of worn No. 00 sandpaper. On the Models 4-40 and 4-41 the breaker contacts should just begin to open when the piston receiving the spark is on top dead center, spark lever one inch from the fully retarded position. The firing order of these cars is 1, 3, 4, 2. On the Models 6-45 and 6-46 the breaker contacts should just begin to open when the piston receiving the spark is on top dead center, spark lever in the fully retarded position. The firing order of these models is 1, 4, 2, 6, 3, 5. The coil may be removed from the case if the screw at the position marked "B" is removed.

The motor generator is the two-armature, or "Double Decker" type, as it is sometimes called, the two armatures being contained one above the other in the same case. The driving power of the starter is transmitted to the driving shaft of the generator through a set of reduction gears and an overrunning clutch. The gears and clutch run in a bath of heavy oil, or, better, thin grease. This grease should have about the consistency of thick cream. Do not put in any graphite, as it will cause the clutch to slip. A plentiful supply of lubricant must be kept in the gear case at all times.

The following data applies to the motor:

Torque (with 12 in. pulley)	R. P. M.	Amperes	Volts
0 lbs.	300	40-50	6.0
10 lbs.	175	80-90	5.9
32 lbs.	125	110-120	5.8
48 lbs.	100	135-140	5.7
64 lbs.	90	150-170	5.6

The gear ratio between the driving shaft and the engine is 2 to 1. The maximum speed of the generator should not exceed 4,000 R. P. M. Voltage regulation of the generator is by a third brush. The following data applies to the generator.

Amperes	R. P. M.	Volts
0.	525-600	6.2-6.4
7.5	750-825	6.8-7.0
13.5	950-1050	7.2-7.4

Head lamps are 6-8 volt, 17 cp. Side lamps are 6-8 volt, 5-6 cp. Tail light is 6-8 volt, 2 cp. Light and horn fuses are 10 ampere. There is a 5 ampere fuse on the relay base to protect the generator windings. This fuse is in the shunt field circuit.

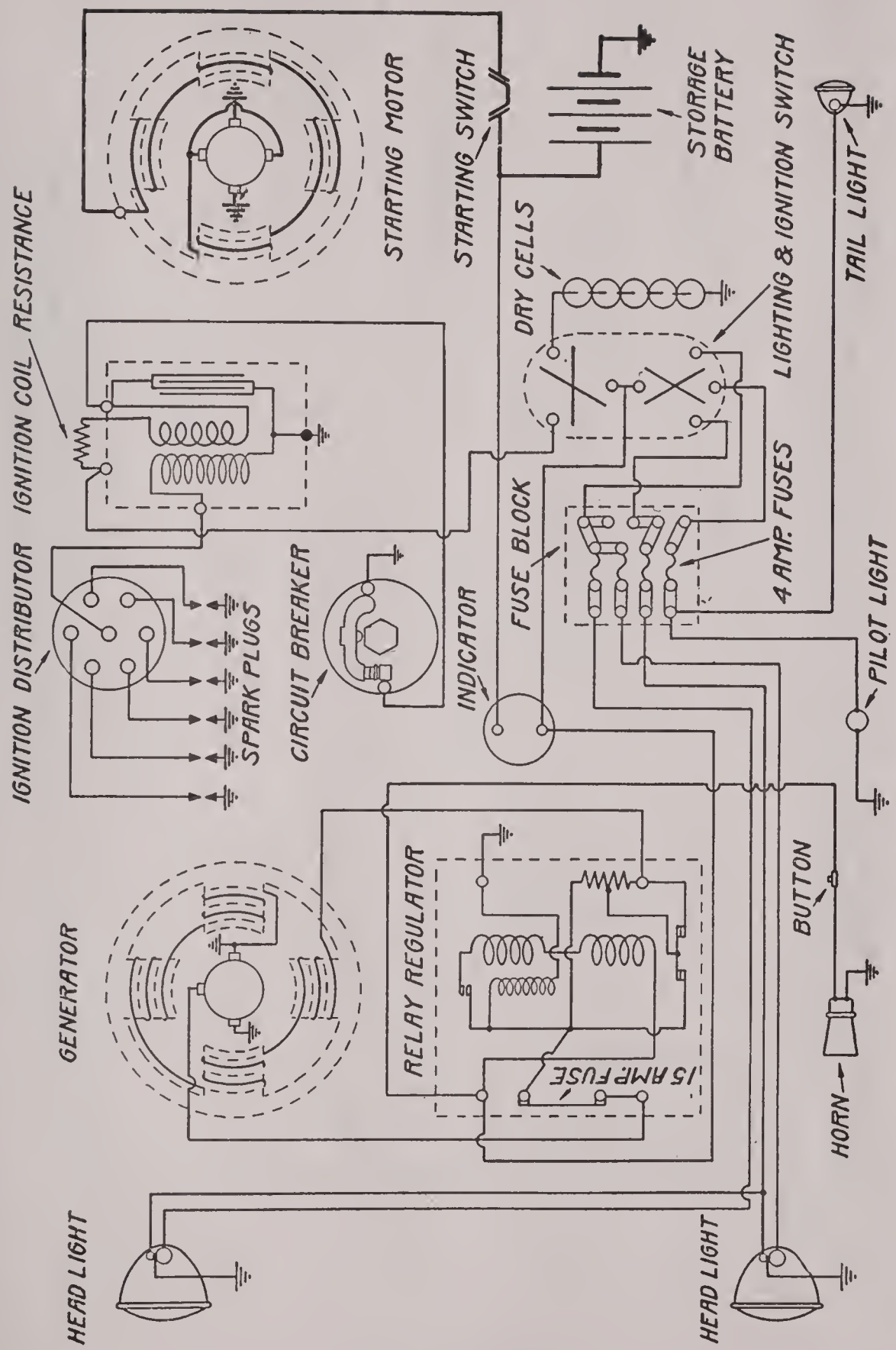


PLATE NO. 238

Auburn

MODELS 4-38, 6-38, 6-40 (1915-16)

REMY TWO-UNIT STARTING AND LIGHTING SYSTEM. REMY IGNITION

Battery is 6 volt, 80 ampere-hour. The negative terminal is grounded.

Breaker contacts should open .018 in. to .020 in. Should contacts become badly burned or pitted they may be resurfaced with a fine, flat, jeweler's file or a small strip of worn No. 00 sandpaper. On the 4-38, the breaker contacts should just begin to separate when the piston receiving the spark is on top dead center, spark control lever 1 in. from the fully retarded position. The firing order of this model is 1, 3, 4, 2. On the Model 6-38 and 6-40, the breaker contacts should just begin to open when the piston receiving the spark is on top dead center, spark lever in the fully retarded position. The firing order of these models is 1, 4, 2, 6, 3, 5.

The driving power of the motor is transmitted to the flywheel by a Bendix drive. The following data applies to the motor:

Torque (with 6 in. pulley)	R. P. M.	Amperes	Volts
0 lbs.....	3600-4200	56-64	6.0
16 lbs.....	1200-1450	200-230	4.7-4.8
24 lbs.....	900-1100	290-310	4.5-4.6
40 lbs.....	300-450	450-500	3.5-3.6
14 ft. lbs.....	Lock Torque	570-600	3.0

Voltage regulation is by a vibrating regulator mounted with the relay. The relay contacts should open .012 in. to .015 in. The air gap between the armature and the core of the magnet should be .012 in. to .015 in. when the contacts are closed. Clean relay and regulator contacts by drawing a piece of soft paper between them. Do not use sandpaper unless absolutely necessary, as its use will change the output. There is a 15 ampere fuse in the shunt field circuit, on the relay base. The following data applies to the generator, tests to be made without ignition:

Amperes	R. P. M.	Volts
0.	600-650	6.0
7.	780-850	6.4
14.5	2500-3000	7.2

On battery test, field draws 4 amperes at 5.9 volts. Generator motoring draws 5.5 amperes at 5.7 volts and runs at 420 R. P. M.

Large head lamps are 6-8 volt, 17 cp. Dimmer lamps are 6-8 volt, 4 cp. Dash light and tail lights are 6-8 volt, 2 cp. Fuses are 4 ampere.

Auburn

Model 6-39 (1917)

Remy Starting and Lighting System. Remy Ignition

Battery is 6 volt, 80 ampere-hour. The negative terminal is grounded.

Breaker contacts should open .018 in. to .020 in. Contacts should be just beginning to separate when the piston receiving the spark is on top dead center, spark lever in the fully retarded position. The firing order is 1, 4, 2, 6, 3, 5. Spark gap should be .028 in. to .030 in. Should contacts become badly burned or pitted they should be resurfaced with a fine, flat, jeweler's file or a piece of worn No. 00 sandpaper.

The driving power of the starter is transmitted to the flywheel through a Bendix drive. The following data applies to the motor:

Torque (with 6 in. pulley)	R. P. M.	Amperes	Volts
0 lbs.	3300	60	6.0
4 lbs.	2400	110	5.7
16 lbs.	1000	270	4.65
28 lbs.	225	395	3.7
36 lbs.	50	435	3.6
40-44 lbs.	Lock Torque	450	3.6

Put four or five drops of light engine oil in each of the motor oilers every 1,000 miles.

Voltage regulation of the generator is by a vibrating regulator mounted with the relay. Relay contacts should open .012 in. to .015 in. The air gap between the core of the magnet and the armature of the relay should be .012 in. to .015 in., with contacts closed. Clean relay and regulator contacts by drawing a piece of soft paper between them. Do not use sandpaper on contacts unless absolutely necessary, as it will affect the output. There is a 5-ampere fuse in the shunt field circuit, on the regulator base. The following data applies to the No. 240-A Generator used, test to be made without ignition:

Amperes	R. P. M.	Volts
0.	360	6.0-6.4
7.0	500	6.3-6.7
11.0	800	6.5-6.9
12.1	1000	6.5-6.7
12.5	1500	6.5-6.7

On battery test, field draws 2 amperes at 5.9 volts. Generator motoring draws 3 to 4 amperes at 5.8 volts and runs at 240 R. P. M.

The following data applies to No. 245-A Generator used, test to be made without ignition:

Amperes	R. P. M.	Volts
0.	600-650	6.0
7.	700-750	6.5
13-14	1500	6.9
13-14	3000	6.9

On battery test, field draws 3.5 to 4 amperes at 5.9 volts. Generator motoring draws 6 to 6.5 amperes at 5.8 volts and runs at 470 R. P. M.

Every 500 miles, or every two weeks, put four or five drops of light engine oil in each of the generator oilers.

Large head lamps are 6-8 volt, 17 cp. Dimmer lamps are 6-8 volt, 4 cp. Dash light is 6-8 volt, 2 cp. Tail lamp is 6-8 volt, 2 cp.

Fuse is 20 ampere.

Plate No. 239

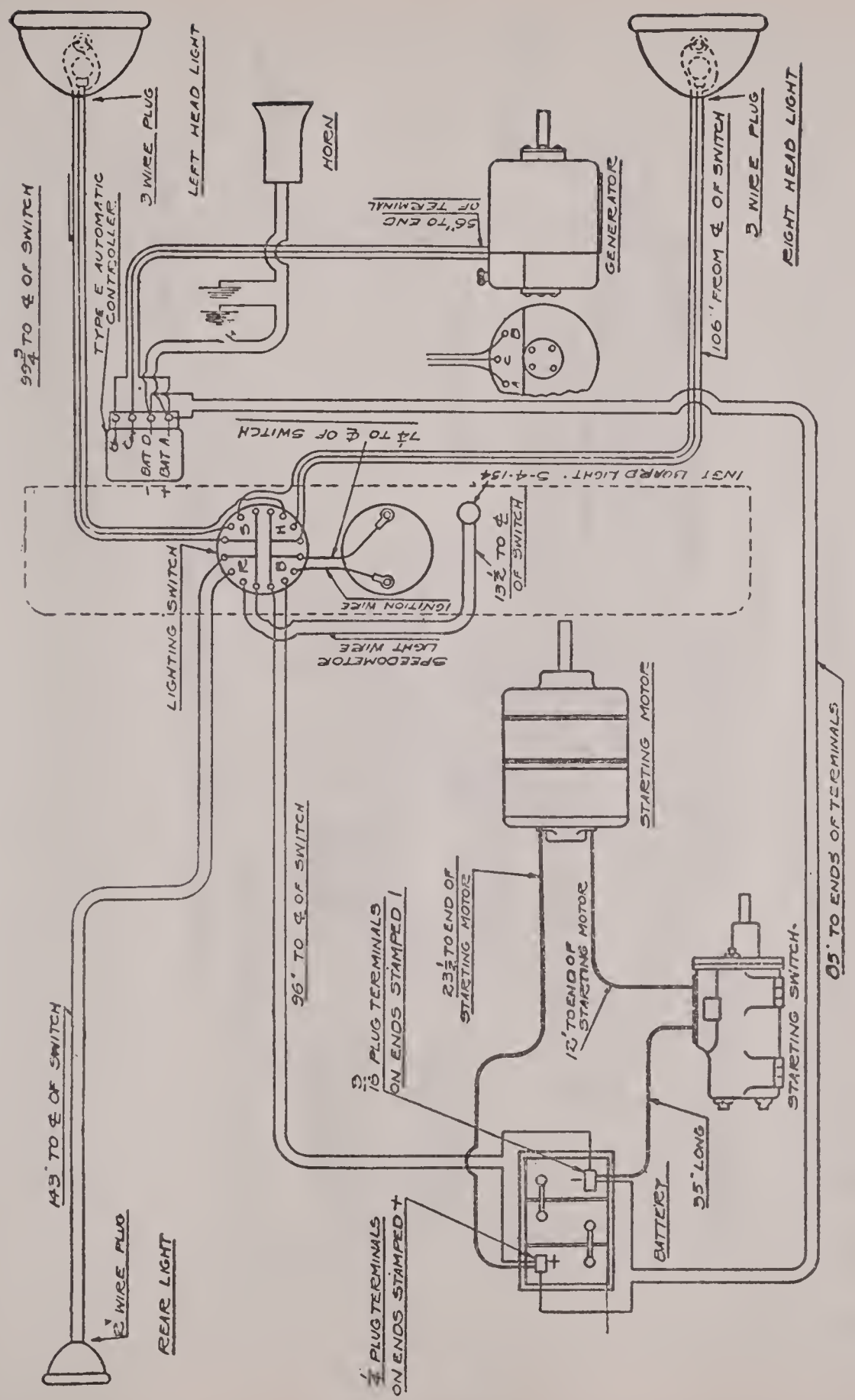


PLATE No. 240

King

MODEL C (1915)

BIJUR STARTING AND LIGHTING SYSTEM. ATWATER-KENT IGNITION

Battery is 6 volt, 80 ampere-hour. The two-wire system is used.

Breaker contacts should open .012 in. to .015 in. These contacts are made of tungsten metal. They should not be filed nor sandpapered except in special cases. These contacts will operate properly even though quite irregular. When contacts are adjusted, it is advisable to remove both the contacts and draw a new file across their surfaces several times to remove any irregularities. They may also be surfaced by drawing across a piece of fine emery cloth laid on a very flat surface, as on the bed of a drill press. The natural color of these contacts is dark gray. Spark should occur when the piston entering power stroke is on top dead center, spark lever advanced about ½ in. The firing order is 1, 8, 3, 6, 4, 5, 2, 7. Number 1 cylinder is the one nearest the radiator on the right-hand block. Number 5 cylinder is the one nearest the radiator on the left-hand block. Spark gap should be .025 in.

The driving power of the motor is transmitted to the flywheel by a Bendix drive. Put three or four drops of oil in motor oilers every 1,000 miles.

Voltage regulation of the generator is by a vibrating regulator combined with the relay. Relay should close at about 10 miles per hour. The maximum charging rate is reached at about 20 miles per hour. Circuits of the relay are shown on Plate No. 242. Should the regulator ever need repair, it should be returned to the manufacturer, as the guarantee on it ceases if the seal is broken. Once every month, or 1,000 miles, put three or four drops of light engine oil in each of the generator oilers.

Head lamps are 6-8 volt, 17 cp. Dimmer lights are 6-8 volt, 6 cp. Dash and tail lights are 6-8 volt, 2 cp.

King

Model E (1916)

Bijur Starting and Lighting System. Atwater-Kent Ignition

Battery is 6 volt, 80 ampere-hour. The positive terminal is grounded.

Breaker contacts should open .012 in. to .015 in. To lessen the gap remove the contact screw and remove one of the thin washers. Contacts are made of tungsten metal. Contacts will work properly even though quite irregular. Do not use a file or sandpaper on them while in place. Should the contacts require adjustment they should both be removed and a new file drawn across them to even up the surfaces. The ignition switch should be put on the opposite side each time the ignition is turned on, as this reverses the current across the contacts, tending to keep them true. Spark should occur when the piston entering power stroke is on top dead center, control lever advanced one inch. The firing order is 1, 8, 3, 6, 4, 5, 2, 7. The cylinder nearest the radiator on the right-hand block being No. 1 and the cylinder nearest the radiator on the left-hand block being No. 5. Spark gap should be .025 in. Every 500 miles or every two weeks remove the distributor cap and put one drop of light machine oil on each of the four bearings which will be exposed.

The driving power of the starter is transmitted to the engine through a Bendix drive. Every three months, or 3,000 miles, clean out the oil cup under the rear generator bearing and refill it with pure vaseline. Once every month, or 1,000 miles, put three drops of light engine or machine oil in the oil hole on top of the bearing.

Voltage regulation of the generator is by a vibrating regulator. The relay is combined with the regulator. Relay should close at 9-10 miles per hour. The maximum generator output is reached at about 20 miles per hour. The rear generator bearing is packed with grease. Once a season this grease should be removed and the bearing cleaned and repacked with acid-free grease. Three or four drops of light engine or machine oil should be put in the oil hole once every month or 1,000 miles. Should the regulator require adjustment it should be returned to the manufacturer, as the guarantee on it ceases if the seal is broken. An illustration and the circuits of the regulator are shown below.

To remove the lens from the head lights, press in on opposite sides of the rim, turn slightly to the left and pull straight off. Head lamps are 6-8 volt, 15 cp. Dimmer lamps are 6-8 volt, 4 cp. Dash and tail lights are each 6-8 volt, 2 cp. Fuses are 10 ampere.

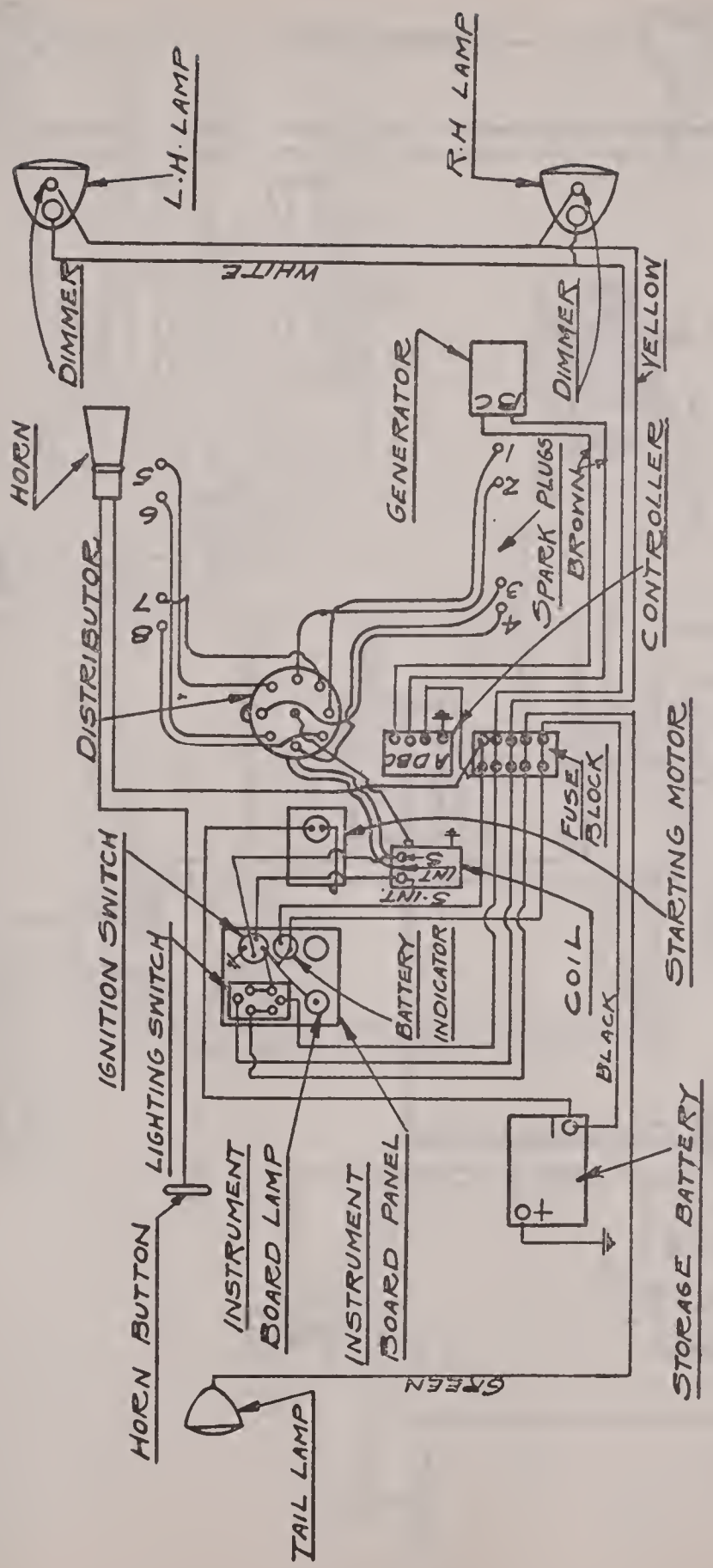
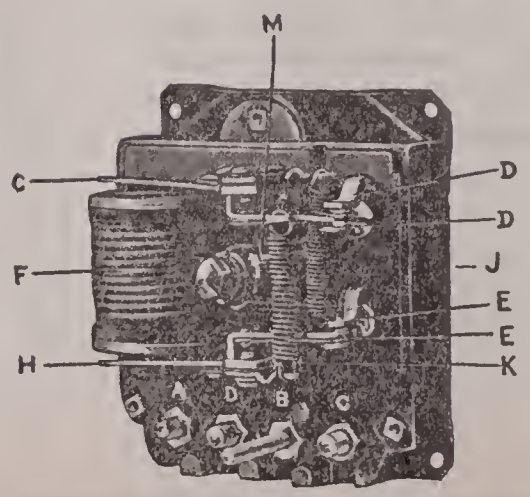
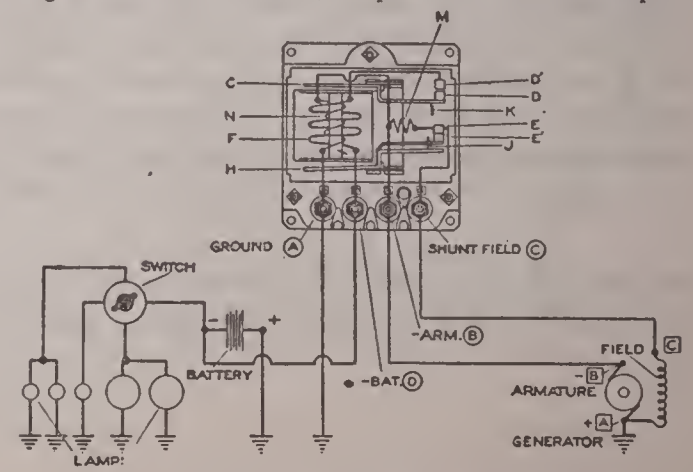


PLATE No. 242





WIRING DIAGRAM OF WARD LEONARD CONTROLLER

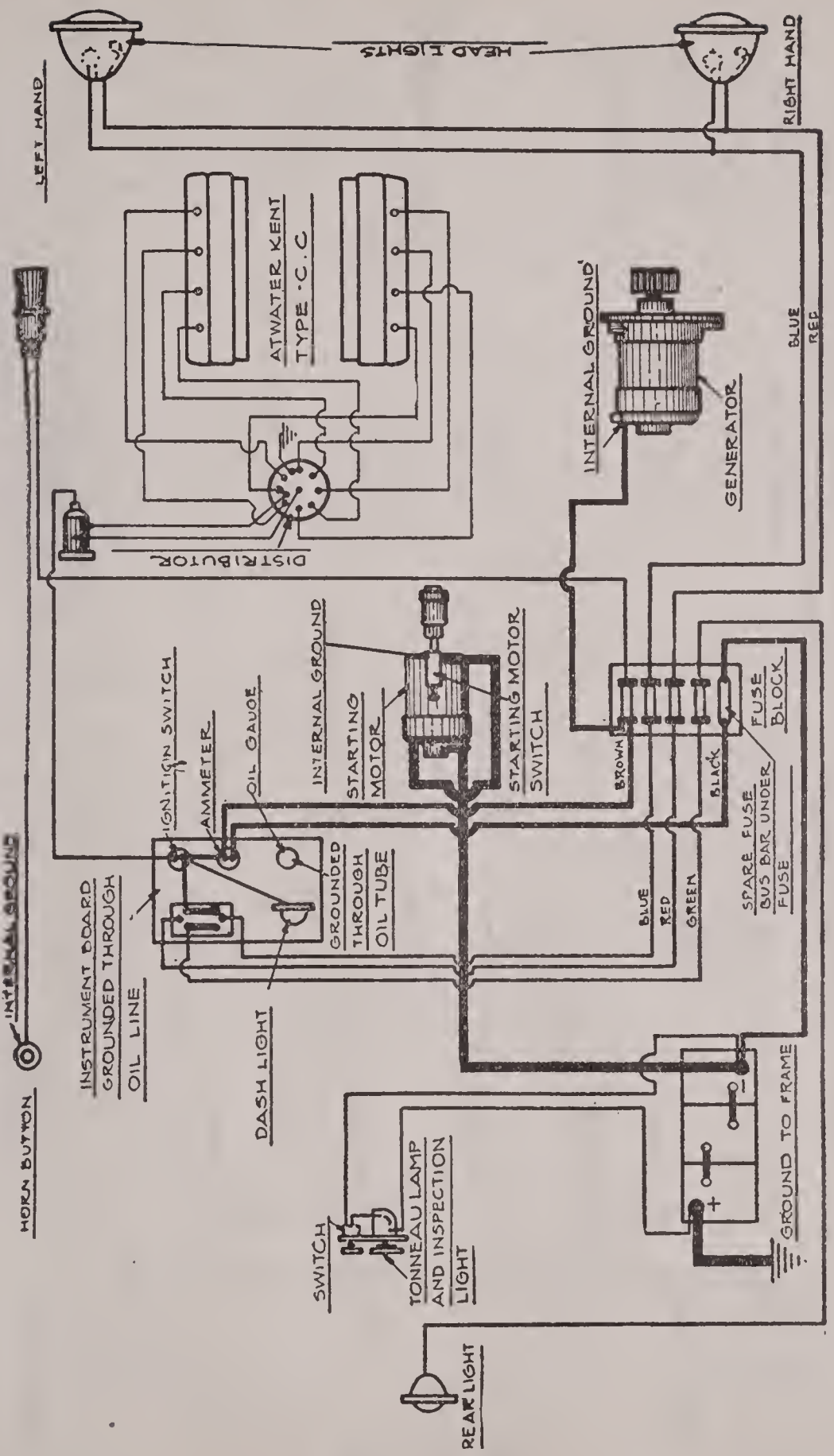


PLATE No. 243

King

MODEL EE (1917)

BIJUR STARTING AND LIGHTING SYSTEM. ATWATER-KENT IGNITION

Battery is 6 volt, 80 ampere-hour. The positive terminal is grounded.

Breaker contacts should separate .012 in. to .015 in. To lessen the gap, remove the contacts, screws and remove one of the thin washers. Contacts are made of tungsten metal. Contacts will work properly even though quite irregular. Do not use a file or sandpaper on them while in place. Should the contacts require adjustment they should both be removed and a new file drawn across them to even up the surfaces. The ignition switch should be put on the opposite side each time the ignition is turned on, as this reverses the current across the contacts, tending to keep them true. Spark should occur when the piston entering power stroke is on top dead center, control lever advanced one inch. The firing order is 1, 8, 3, 6, 4, 5, 2, 7. The cylinder nearest the radiator on the right-hand block being No. 1, and the cylinder nearest the radiator on the left-hand block being No. 5. Spark gap should be .025 in. Every 500 miles, or every two weeks, remove the distributor cap and put one drop of light machine oil on each of the four bearings which will be exposed.

The driving power of the starter is transmitted to the flywheel by a Bendix drive. Every two weeks, or 500 miles, put two or three drops of light machine or engine oil in each of the two motor oilers.

Voltage regulation of the generator is by third brush system. Relay should close at 9-10 miles per hour. Relay is located within the generator frame. Relay should open when the discharge current reaches 1-4 amperes. The maximum charging current should be 10-12 amperes at 20 miles per hour. This rate reduces at higher speeds. Should the discharge current ever exceed 12 amperes there is a ground in the wiring or the relay is not operating properly. It makes no difference which terminal of the generator is connected to the negative terminal of the battery, as it will automatically assume the proper polarity to charge the battery. There is a 12 ampere fuse in the small aluminum case on top of the front head of the generator. This fuse is in the shunt field circuit and will blow out should the generator be run with the battery disconnected. To adjust the driving chain, loosen the three bolts holding generator to crank case and swing in the proper direction on the pivot bolt. Every two weeks, or 500 miles, put four or five drops of light engine oil in each of the generator oilers.

Head lamps are 6-8 volt, 18 cp. Dimmer lights are 6-8 volt, 4 cp. Dash and tail lights are each 6-8 volt, 2 cp. Tonneau or inspection lamps are 6-8 volt, 4 cp. Fuses are 10 ampere.

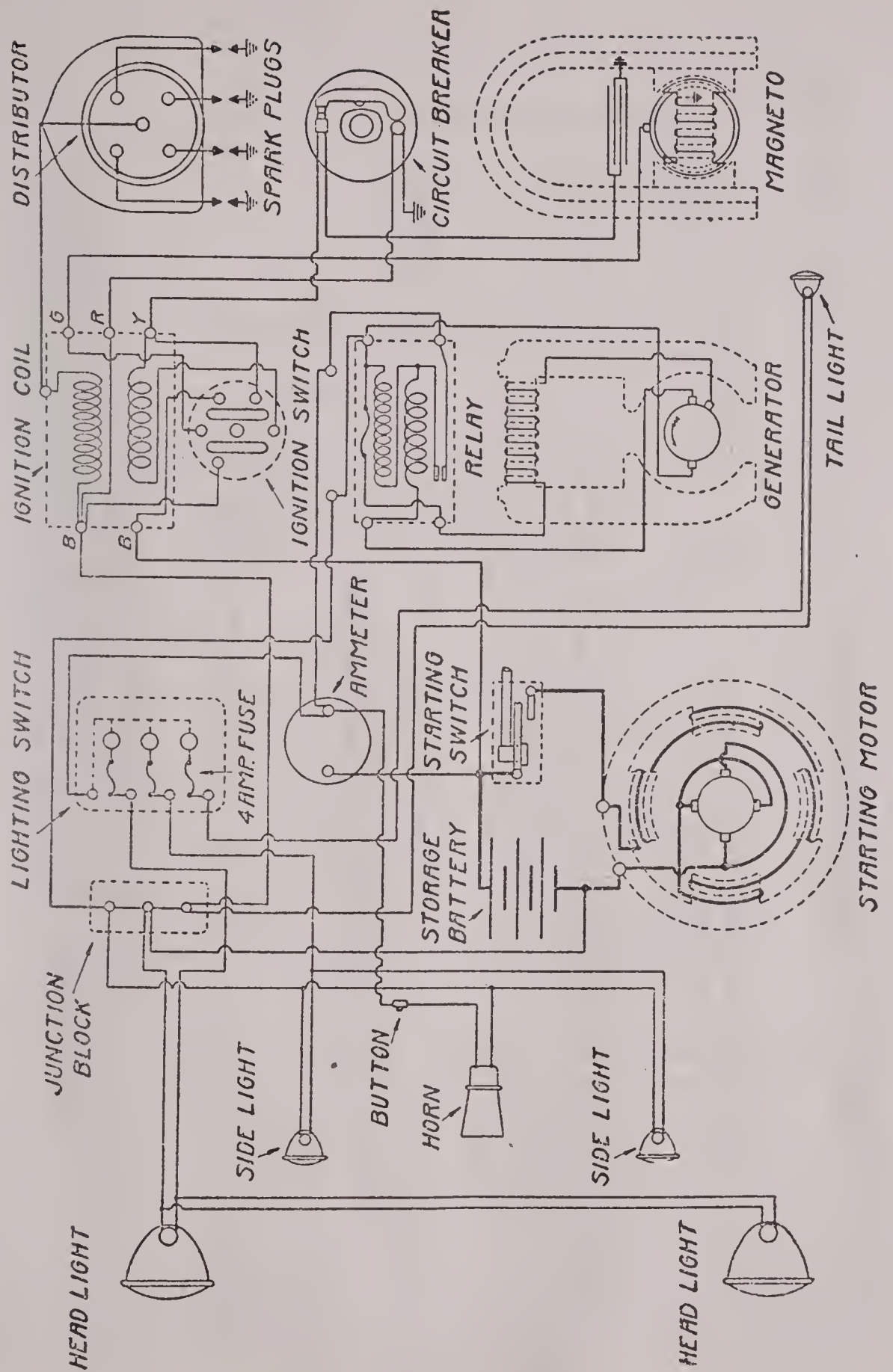


PLATE NO. 245

Mitchell-Lewis

1914-1915

REMY STARTING AND LIGHTING SYSTEM. REMY MAGNETO IGNITION

Battery is 6 volt, 100 ampere-hour. The two-wire system is used.

Breaker contacts should open .014 in. to .016 in. Clean contacts with gasoline whenever necessary. Should contacts become badly burned or pitted, they should be re-surfaced with a fine, flat, jeweler's file or a small strip of worn No. 00 sandpaper. Breaker contacts should be just ready to open when the piston entering the power stroke is on top dead center, spark control lever in the fully retarded position. The firing order is 1, 2, 4, 3. For further care of the magneto see Plate No. 156.

The driving power of the starter is transmitted to the flywheel by a Bendix drive.

The following data applies to the starting motor:

R. P. M.	Amperes	Volts
4300-5500	50-60	5.6-6
2600	100	
1900	140	
1700	160	
1500	180	

When running at 1,000 R. P. M. it should deliver 8 lbs. pull on a 6 in. pulley. When running at this speed it takes 150 amperes. Once every month, or 1,000 miles, put four or five drops of light machine or engine oil in each of the motor oilers.

Voltage regulation of the generator is by third brush. On machines numbered below 30,000, the armature draws 4 amperes and field draws 1.7 amperes, when generator is running freely as a motor. When generator is connected to brush terminals, field disconnected, armature draws 12 amperes, field draws 1.3 amperes at 6.5 volts, generator hot.

The following data applies to the generator:

Amperes	R. P. M.
0.	300 or less
7.5	500 or less
14-18	1000-1300
12.	2050

The air gap between the armature and field poles should be .018 in. to .020 in. Relay contacts should open .014 in. to .016 in. The air gap between relay armature and magnet core should be .040 in. Once every two weeks, or 500 miles, put three or four drops of light machine oil in each of the generator oilers.

Head lamps are 6-8 volt, 17 cp. Side lamps are 6-8 volt, 6 cp. Tail lamp is 6-8 volt, 2 cp. On the 1915 models the head lamps are 14 cp. Fuses in the lighting circuits are 4 ampere.

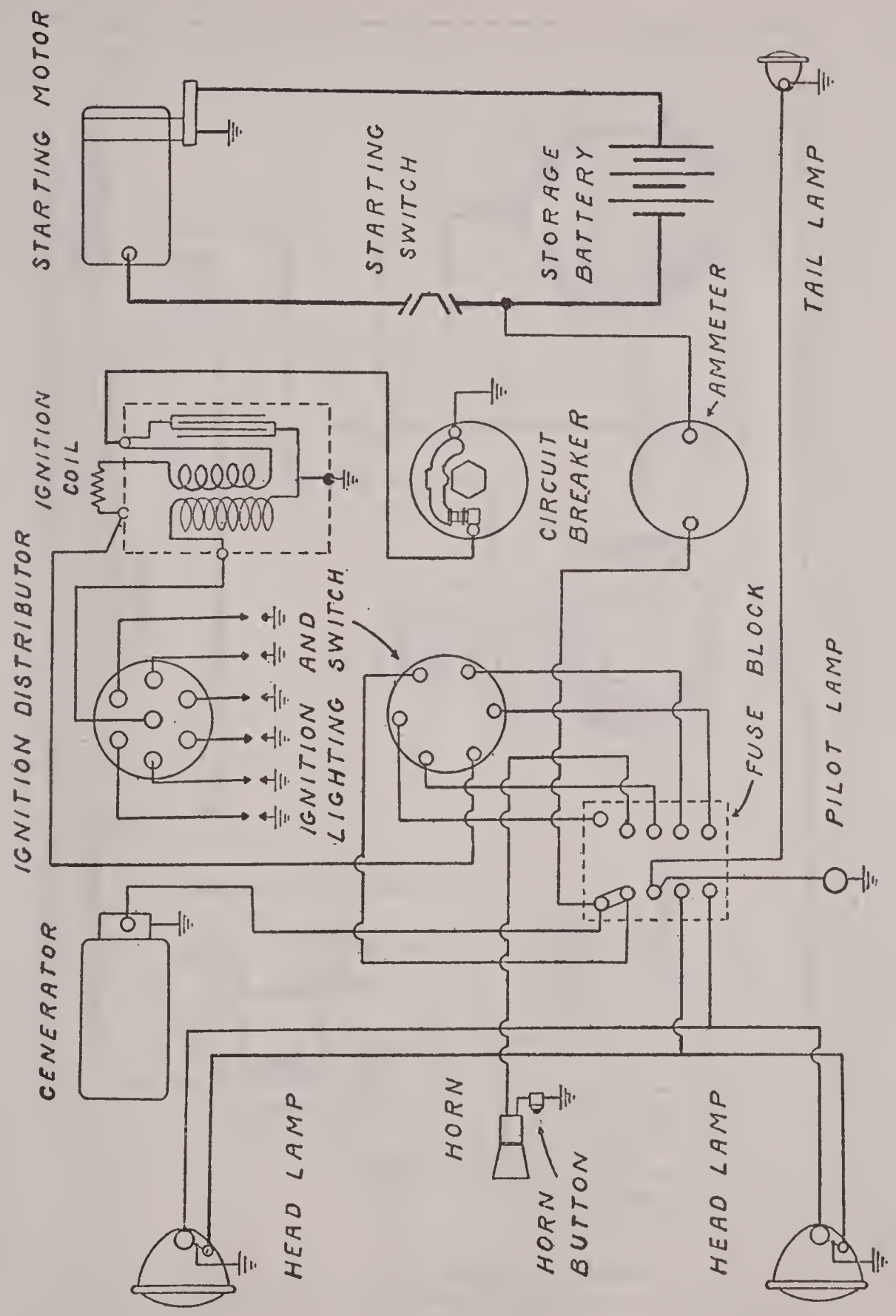


PLATE No. 246

Chalmers

MODEL 35-C (1918)

WESTINGHOUSE STARTING AND LIGHTING SYSTEM. REMY IGNITION

Battery is 6 volt, 100 ampere-hour. The positive terminal is grounded at the motor.

Breaker contacts should open about .018 in. When they become burned or pitted, resurface them with a fine, flat, jeweler's file or a piece of worn No. 00 sandpaper. Contacts should be just beginning to separate when the piston entering power stroke is on top dead center, spark control lever about ½ in. from the fully retarded position. The firing order is 1, 4, 2, 6, 3, 5. Spark gap should be about .028 in. Ignition coil should not take much over 6 amperes.

The driving power of the starter is transmitted to the flywheel by a Bendix drive. Put four or five drops of light machine or engine oil in each of the motor oilers once every month, or 1,000 miles.

Voltage regulation of the generator is by third brush. Relay should close at about 8 and open at about 5 miles per hour. The maximum charging rate of 14-15 amperes is reached at 16-20 miles per hour. Ammeter shows rate of charge or discharge. Put three or four drops of light engine oil in each of the generator oilers once every 500 miles, or every two weeks.

Head lamps are 6-8 volt, 15 cp. Dimmer lamps are 6-8 volt, 6 cp. Dash lamp is 6-8 volt, 2-4 cp. Tail lamp is 6-8 volt, 2 cp. Fuses are 15-30 ampere.

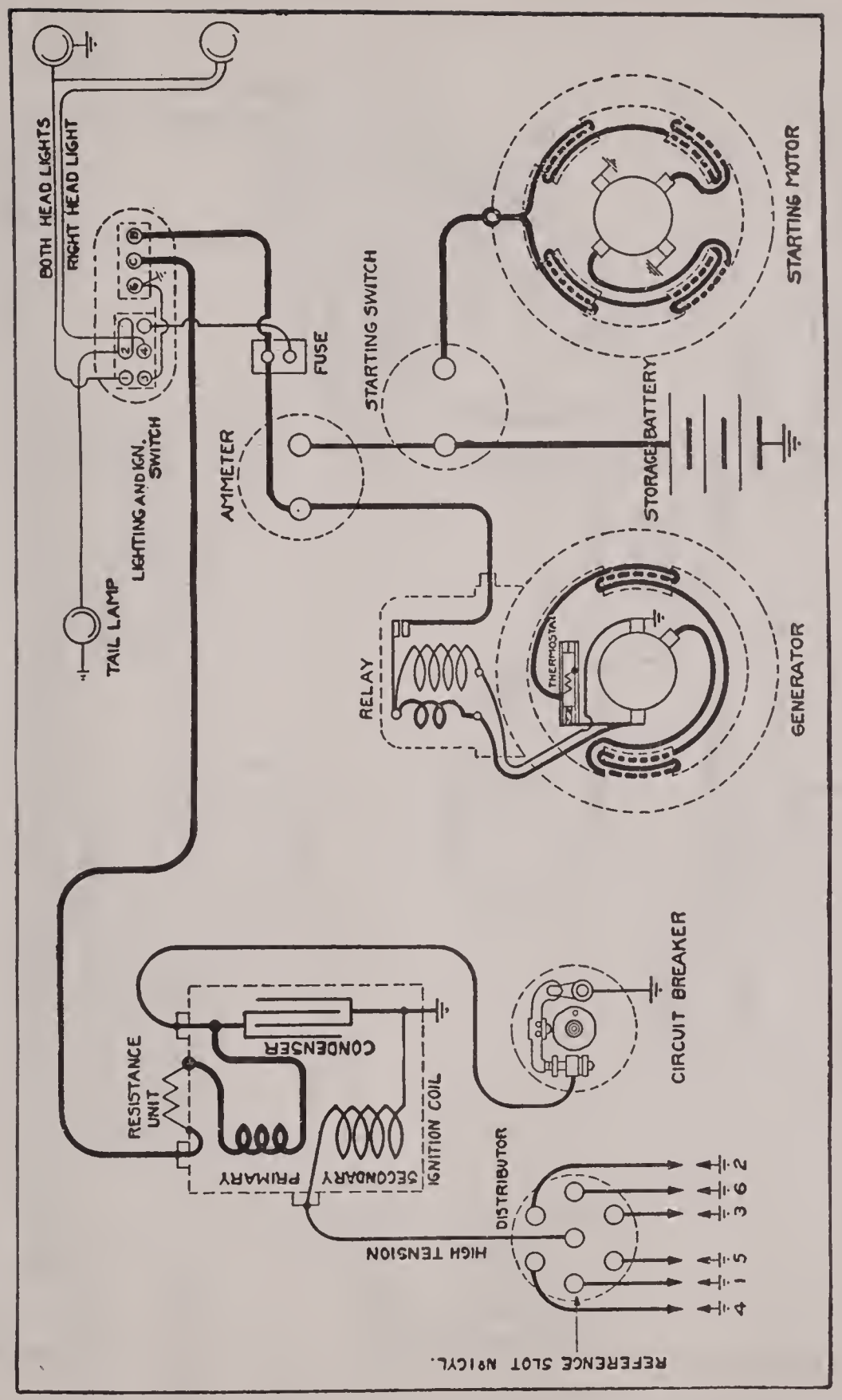


PLATE No. 246A

Mitchell

MODELS D-40 AND C-42 (1916-17-18)

REMY STARTING AND LIGHTING SYSTEM. REMY IGNITION

Battery is 6 volt, 120 ampere-hour. The negative terminal is grounded.

Breaker contacts should open .018 in. to .020 in. When they become burned or pitted, resurface them with a fine, flat, jeweler's file or a piece of worn No. 00 sandpaper. Carefully blow out all dirt or filings after each cleaning. Contacts should just begin to separate when the piston entering power stroke is on top dead center, spark lever advanced about ½ in. from the fully retarded position. The firing order is 1, 5, 3, 6, 2, 4. The coil should not take more than 6 amperes with engine running at a moderate speed.

The driving power of the starter is transmitted to the flywheel through a Bendix gear. Put several drops of light engine oil in each of the motor oilers every 1,000 miles.

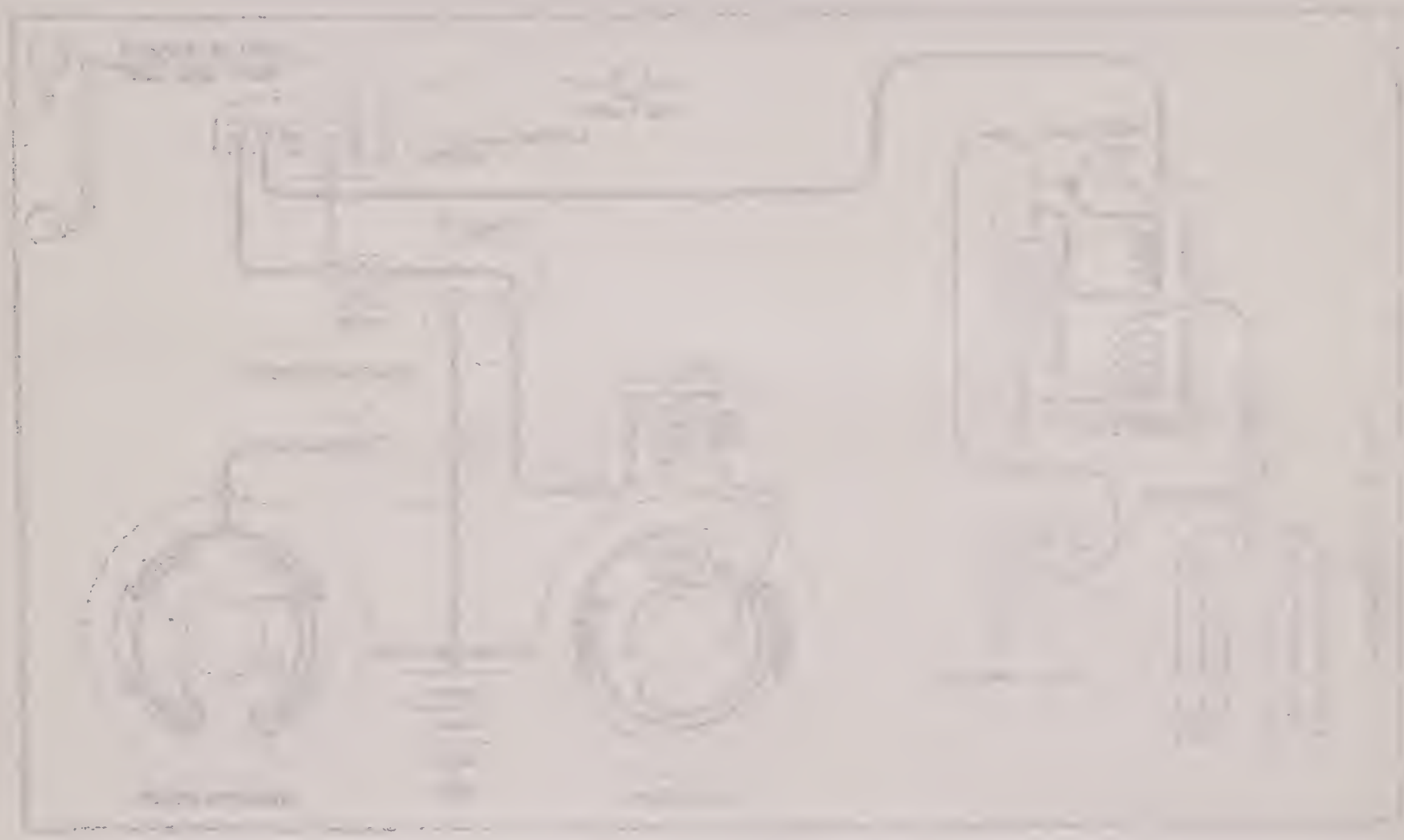
Output regulation of the generator is by third brush and thermostat control. Relay should close at 7-10 and open at 5-8 miles per hour. The following data applies to the generator, tests to be made without ignition, thermostat contacts closed and relay in circuit:

Amperes	R. P. M.	Volts
0.	515	6.4
7.	745	7.1
14.	1000	7.9
22.	1800	8.6
17.	2500	8.2
10.	3500	7.4

Spring tension on main brushes should be 17-20 oz. Spring tension on third brush should be 13-17 oz. Field draws 5 amperes at 6.4 volts. Put four or five drops of light machine or engine oil in each of the generator oilers once every two weeks, or 500 miles. Directions applying to the thermostat are given on Plate No. 32.

Head lamps are 6-8 volt, 17 cp. Tail lamp is 6-8 volt, 2 cp. Side lamps are 6-8 volt, 5-6 cp. Dome lights are 6-8 volt, 2-4 cp., when used.

Fuses are 20 ampere.



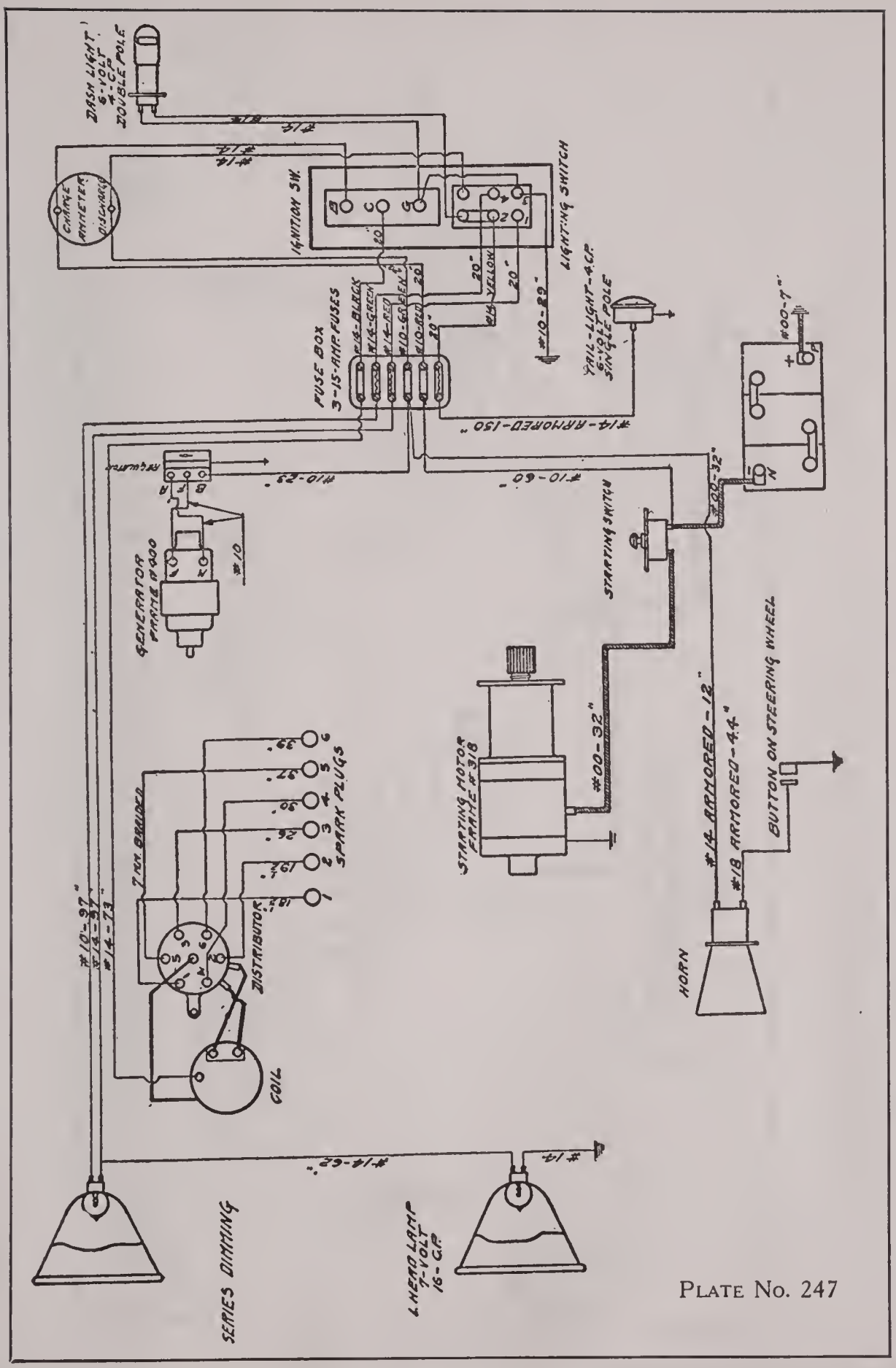


PLATE NO. 247

Lexington

MODEL O

WESTINGHOUSE STARTING AND LIGHTING SYSTEM. CONNECTICUT IGNITION

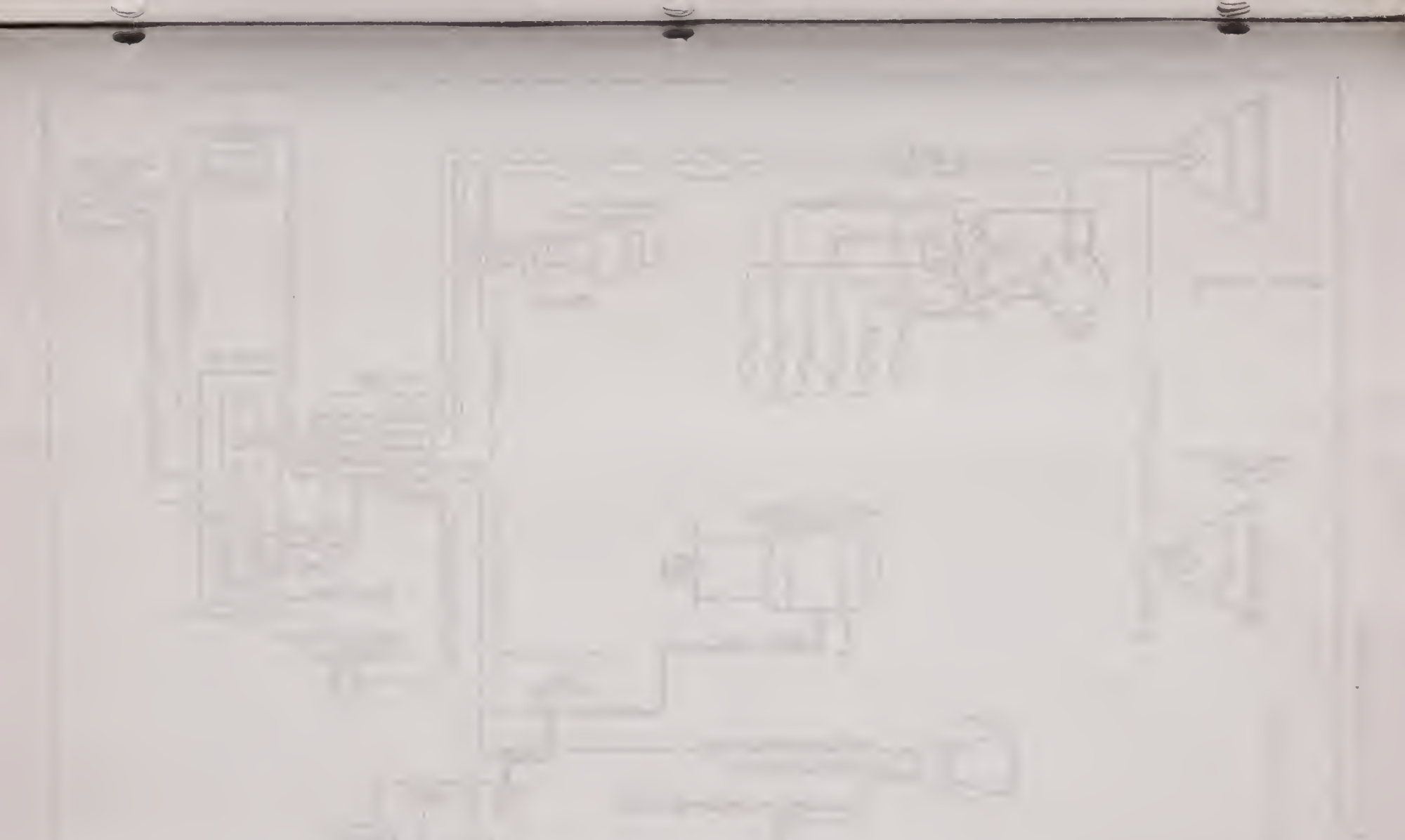
Battery is 6 volt, 20 ampere-hour. The positive terminal is grounded.

Breaker contacts should open .012 in. Contacts are made of tungsten metal. They should not be filed nor sanded. These contacts will function properly even though quite irregular. Should contacts become so badly worn as to impair the proper operation of the engine, the breaker mechanism should be renewed as directed on Plate No. 50. Breaker contacts should be just ready to open when the piston entering power stroke is on top dead center, spark lever in the fully retarded position. The firing order is 1, 5, 3, 6, 2, 4. Spark gap should be .028 in. to .030 in. There is a thermostatic circuit breaker in the switch case which will automatically open the ignition circuit should the switch be left on with engine idle or should a short circuit occur, causing excess current to flow. This device is fully described on Plate No. 41.

The driving power of the starter is transmitted to the flywheel through a Bendix gear. Put several drops of light engine oil in each of the generator oilers every 1,000 miles. Motor should run at about 1,500 R. P. M. when running free. It should develop 5/8 H. P.

Voltage regulation of the generator is by a vibrating regulator, mounted with the relay. Directions for the care of this regulator are given on Plate No. 6. Relay should close at 7-10 miles per hour. The maximum charging rate of 10-12 amperes is reached at about 20 miles per hour. Every two weeks, or 500 miles, put four or five drops of light engine or machine oil in each of the generator oilers.

Head lamps are 7 volt, 16 cp. Dash lamp is 6 volt, 4 cp. Tail lamp is 6 volt, 4 cp. Fuses are 15 ampere.



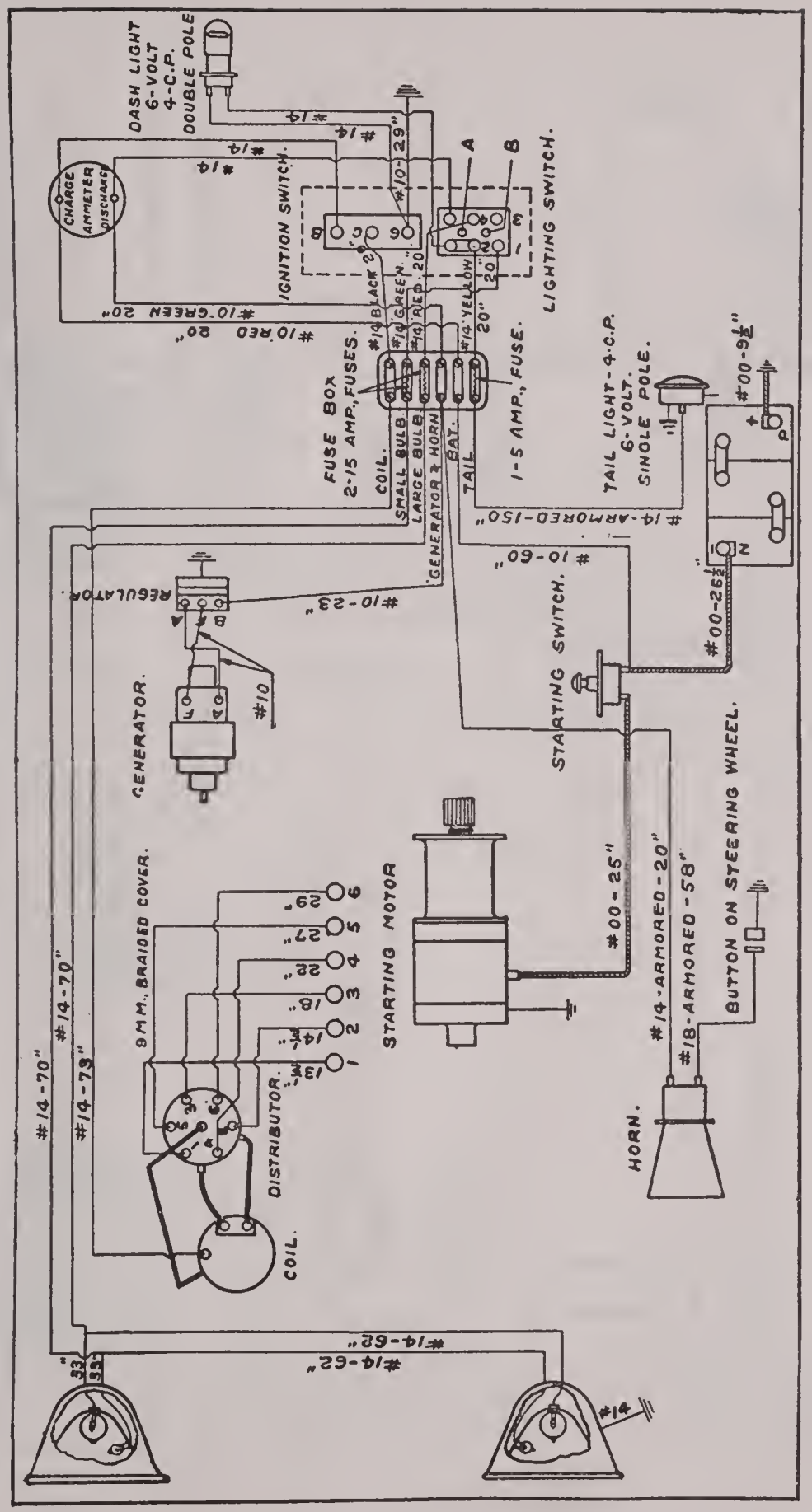


PLATE No. 248

Lexington

MODELS 6-0 AND 6-00 (1917)

WESTINGHOUSE TWO-UNIT STARTING AND LIGHTING SYSTEM.
CONNECTICUT IGNITION

Battery is 6 volt, 80 ampere-hour. The positive terminal is grounded.

Breaker contacts should open .012 in. Contacts are made of tungsten metal. They should not be filed or sandpapered. Should contacts become so badly burned or pitted as to impair the proper operation of the engine, the breaker mechanism should be renewed as directed on Plate No. 50. Breaker contacts should be just ready to open when the mark "D-C 1&6" on the flywheel is at the indicator, spark lever in the fully retarded position. When the flywheel is in this position and breaker is set right, a spark will result should the spark control lever be advanced one inch. The firing order is 1, 5, 3, 6, 2, 4. Spark gap should be .028 in. to .030 in. There is an automatic circuit breaker in the switch case which will open the ignition circuit in a few seconds should the switch ever be left on, engine idle. This device is described on Plate No. 41.

The starter is connected to the flywheel by a Bendix gear. Put several drops of light engine oil in each of the motor oilers every 1,000 miles.

Voltage regulation of the generator is by a vibrating regulator combined in the same case as the relay, mounted on the engine side of the dash. Directions for the care of this regulator are given on Plate No. 6. Relay should close at 7-10 miles per hour. Relay should open at 5-9 miles per hour. The maximum charging rate of 10-12 amperes is reached at about 20 miles per hour. Every two weeks or 500 miles put four or five drops of good light machine oil or engine oil in each of the generator oilers. Brush spring should be compressed ½ in. when the cap is screwed down tight.

Large head lamps are 6-8 volt, 16 cp., tungsten, or 21 cp. nitrogen. Small head lights are 6-8 volt, 8 cp. Dash lamp is 6-8 volt, 4 cp. Tail lamp is 6-8 volt, 4 cp. Head lamp fuses are 15 ampere. Tail light fuse is 5 ampere.

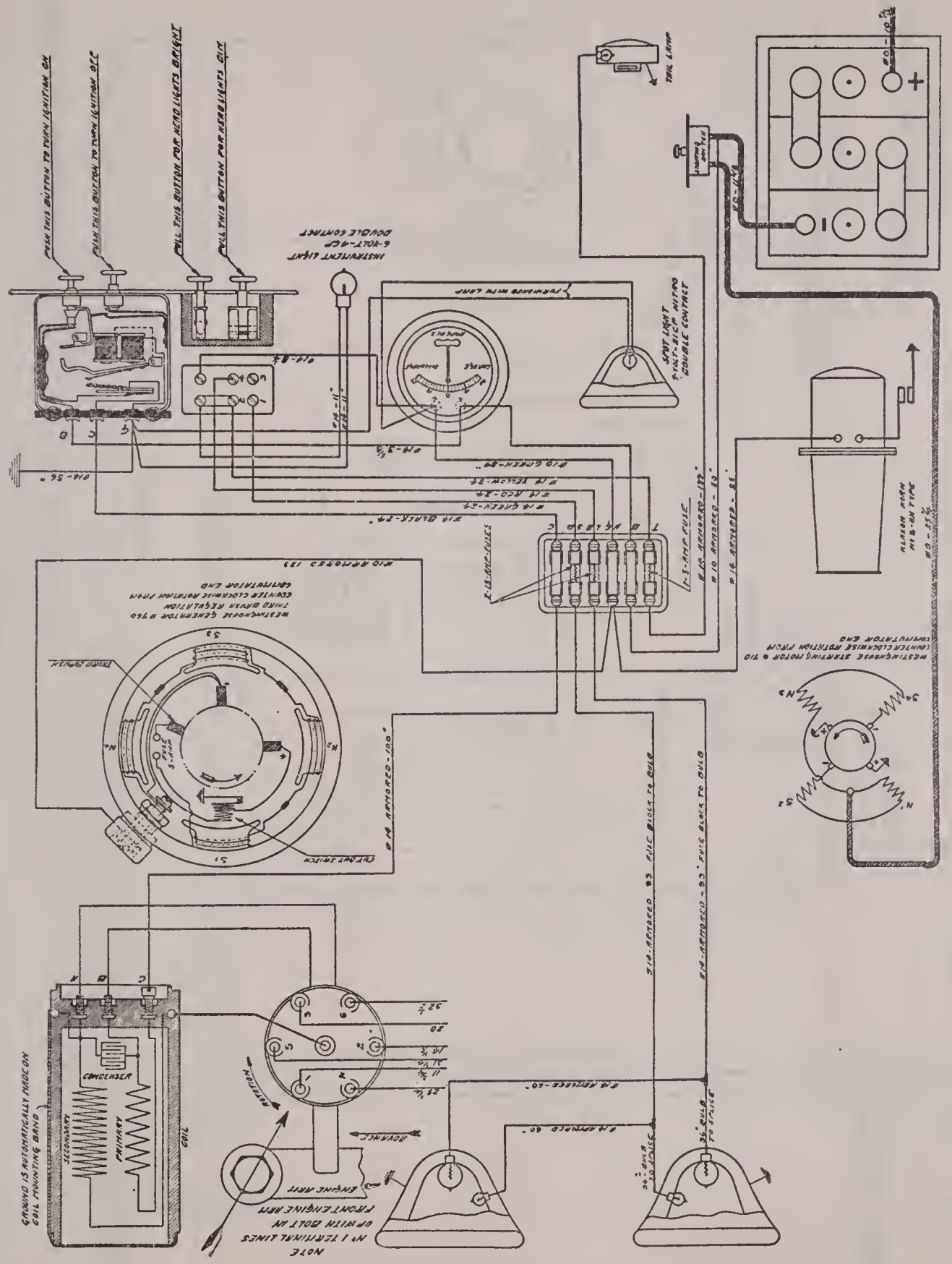


PLATE NO. 249

Lexington

SERIES R (1918)

WESTINGHOUSE STARTING AND LIGHTING SYSTEM. CONNECTICUT IGNITION

Battery is 6 volt, 100 ampere-hour. The positive terminal is grounded.

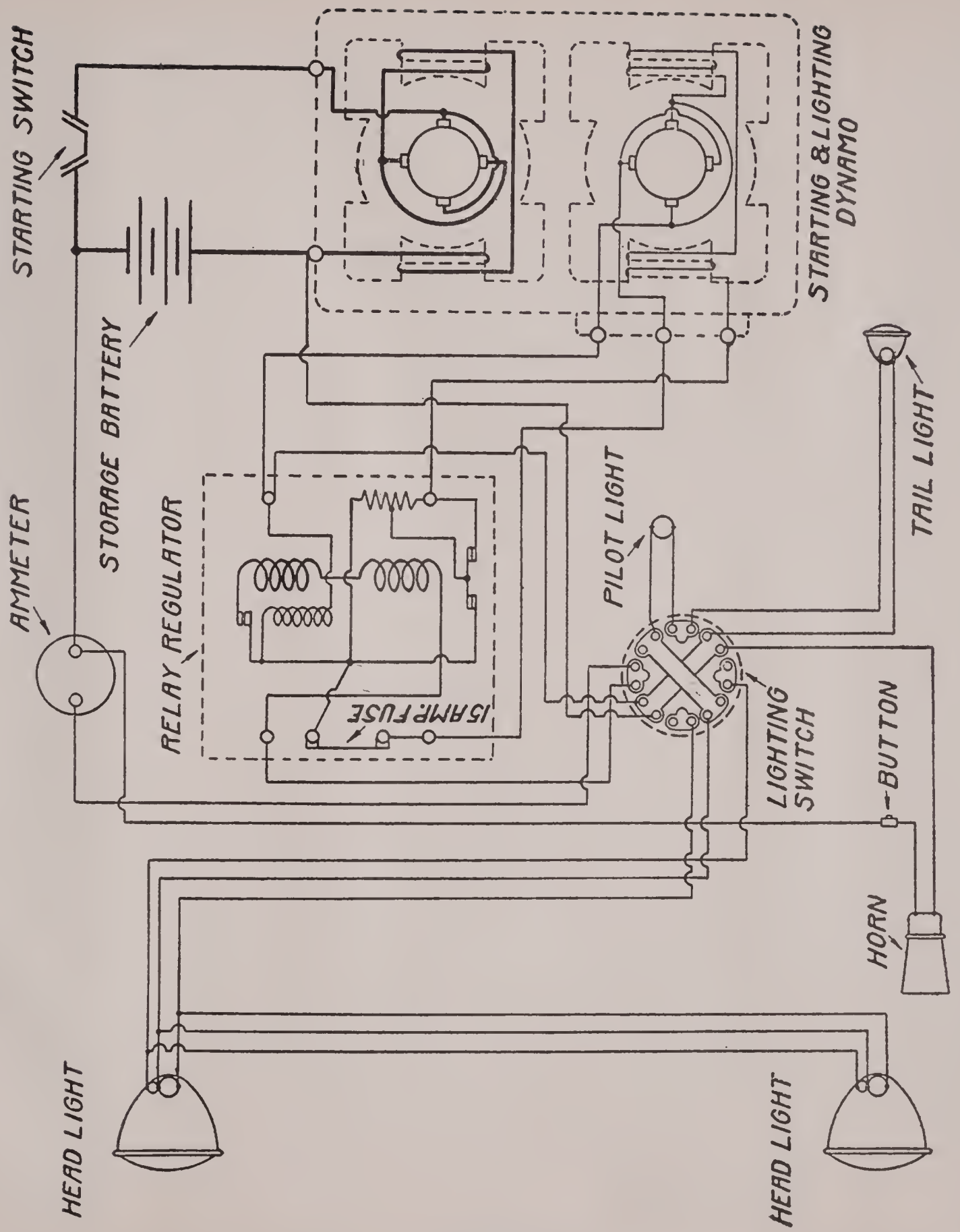
Breaker contacts should open .012 in. Contacts are made of tungsten metal. These contacts should not be filed nor sandpapered. In case the contacts become so badly burned or pitted as to impair the proper operation of the engine, the breaker mechanism should be renewed as directed on Plate No. 50. There is a circuit breaker in the switch case, which will automatically open the ignition circuit in a few seconds should the ignition switch be left in the "On" position, engine idle. This device will also open the circuit should an excess current flow through it. Breaker must be set so that, with the mark "D-C 1&6" on the flywheel at the indicator, spark lever in the fully retarded position, the contacts will open, causing a spark to jump across the spark gap when the spark control lever is advanced not more than one inch. The firing order is 1, 5, 3, 6, 2, 4. Spark gap should be .028 in. to .30 in.

The starting motor is connected to the flywheel by a Bendix gear. Every month, or 1,000 miles, put three or four drops of light machine or engine oil in each of the generator oilers.

Voltage regulation of the generator is by a third brush. There is a 5-ampere fuse on the rear end of the generator. This fuse is in the shunt field circuit. It should be removed if it is necessary to run the generator with the battery disconnected. This fuse is the first place to look in case the generator fails to deliver current. Relay should close at 6-10 miles per hour, and relay, open, at 5-9 miles per hour. The maximum charging rate should be 10-12 amperes at 18-20 miles per hour. The brush spring should have ½ in. compression when the cup is screwed down tight. Every two weeks, or 500 miles, put three or four drops of light machine or engine oil in each of the generator oilers.

Head lamps are 7 volt, 30-32 cp., nitrogen filled. Dimmer lamps are 7 volt, 6 cp., tungsten. Tail light is 6 volt, 2 cp. Dash light is 6 volt, 4 cp. Spot light is 7 volt, 21 cp., nitrogen filled.

Head light fuses are 15 ampere. Tail light fuse is 5 ampere.



National

Series AA (1915)

Remy Two-Armature Starting and Lighting System. Eisemann Ignition

Battery is 6 volt, 100 ampere-hour. The two-wire system is used.

Breaker contacts should open about .014 in. Clean contacts with gasoline whenever necessary. Should contacts become badly burned or pitted they may be resurfaced with a fine, flat, jeweler's file or a worn strip of No. 00 sandpaper. Spark should occur when the piston entering power stroke is on top dead center, spark lever advanced one-third the distance to the fully advanced position. The firing order is 1, 5, 3, 6, 2, 4.

The motor-generator is the Remy two-armature type, often called a "Double Decker." There is only one drive shaft. The driving power is transmitted through an Oldham coupling to facilitate removal of the unit. The two armatures are connected by a set of gears and an overrunning clutch. The clutch and gears run in a bath of oil or very light grease. This grease should have about the consistency of thick cream. Do not put in any graphite, as it is apt to make the clutch slip. It must be well lubricated at all times.

The following data applies to the starter:

Torque (with a 12 in. pulley)	R. P. M.	Amperes	Volts
0 lbs.	300	40-50	6.0
16 lbs.	175	80-90	5.9
32 lbs.	125	110-120	5.8
48 lbs.	100	135-140	5.7
64 lbs.	90	150-170	5.6

Voltage regulation is by a vibrating regulator, mounted on the relay base. Relay should close at about 9 miles per. The generator should supply all current used by the lights, when the car speed reaches 12 miles per hour on high gear. The gear ratio between the motor-generator and the engine is 2 to 1. The maximum speed of the generator is 4,000 R. P. M. The following data applies to the generator:

Amperes	R. P. M.	Volts
0.	525-600	6.2-6.4
7.5	750-825	6.8-7.0
13.5	950-1050	7.2-7.4

Large head lamps are 6-8 volt, 17 cp. Small head lamps are 6-8 volt, 6-7 cp. Dash light is 6-8 volt, 2-4 cp. Tail light is 6-8 volt, 2-4 cp.

Plate No. 250