Fairmont

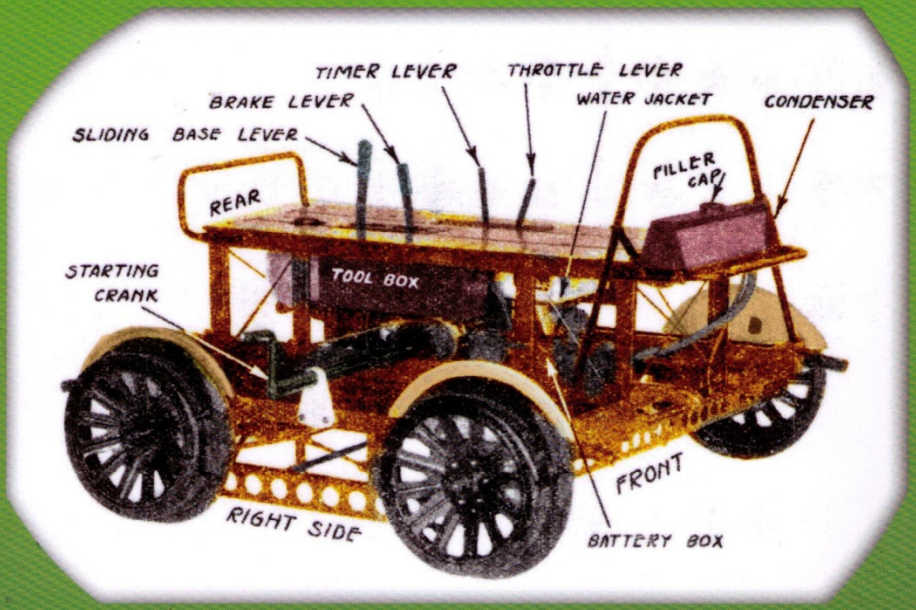
M19 MOTOR CAR

SERIES C

INSTRUCTIONS

AND

SPARE PARTS LISTS



FAIRMONT RAILWAY MOTORS, INC.

FAIRMONT, MINNESOTA, U. S. A.

DISTRICT SALES OFFICES:

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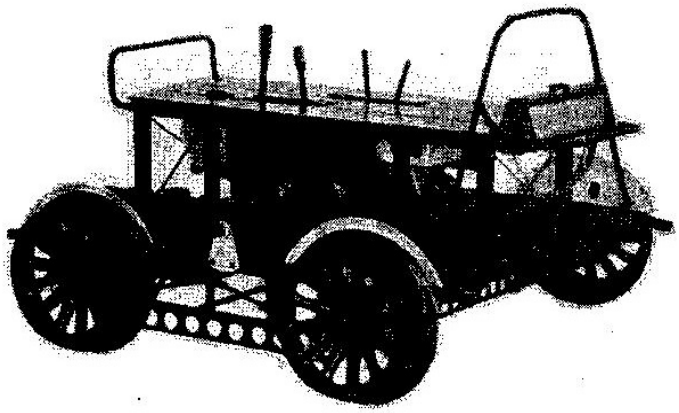
INSTRUCTIONS
and
SPARE PARTS

Fairmont
INSPECTION CARS

ONE TO FOUR MAN

Class M19 Series C (Battery Ignition)
Class MM19 Series C (Magneto Ignition)



Service Division

FAIRMONT RAILWAY MOTORS, INC.
FAIRMONT, MINNESOTA, U. S. A.

DISTRICT SALES OFFICES:
Chicago St. Louis Washington, D. C. San Francisco
Fairmont Railway Motors, Ltd., Toronto, Canada

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TO USERS OF FAIRMONT MOTOR CARS:

FAIRMONT railroad motor cars and engines have an established reputation for dependability, simplicity, and economy. Built to uniform standards, of quality materials, and consistently improved, they are the first choice of those who want maximum performance with minimum upkeep.

The M19 Series C spring mounted steel frame inspection car covered in this book incorporates the results of many years research and field experience. Light and easily handled by one man, it is exceptionally smooth running and amply powered to carry full loads over heavy grades and against head winds.

The general instructions carefully read and followed, will insure excellent service from the M19 Series C car with ordinary care. All important points pertaining to operation and maintenance are fully explained and indexed following for quick reference by operator or repairman.

Upon receipt of this book promptly fill in the car and engine record on page 25, and always mention these factory numbers when writing about the car or ordering parts. Don't give us railroad numbers.

Take good care of this book so it is available for reference when making adjustments and repairs, or ordering spare parts.

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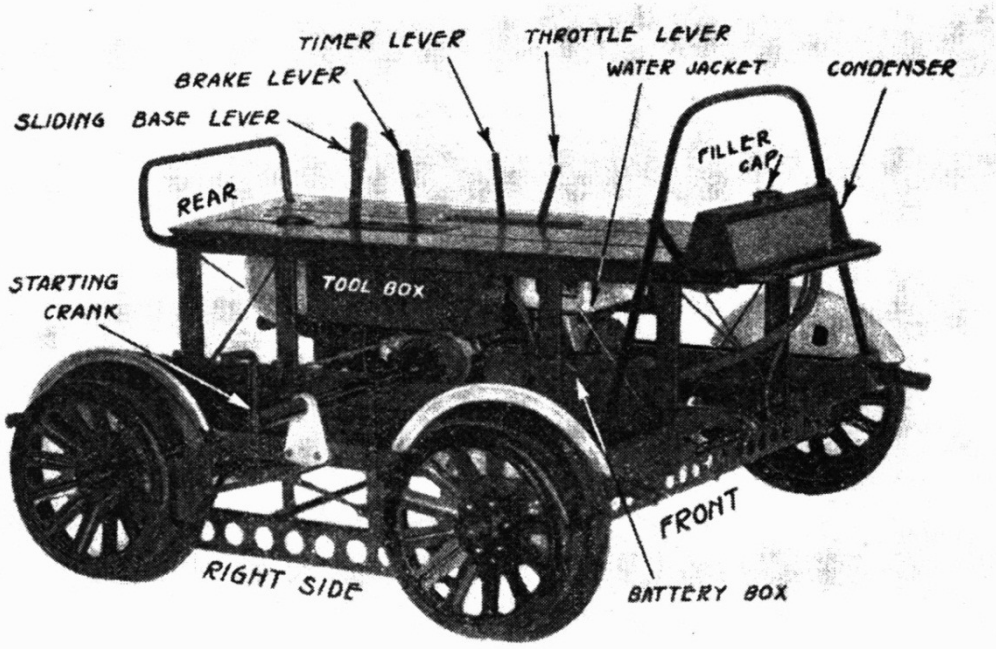
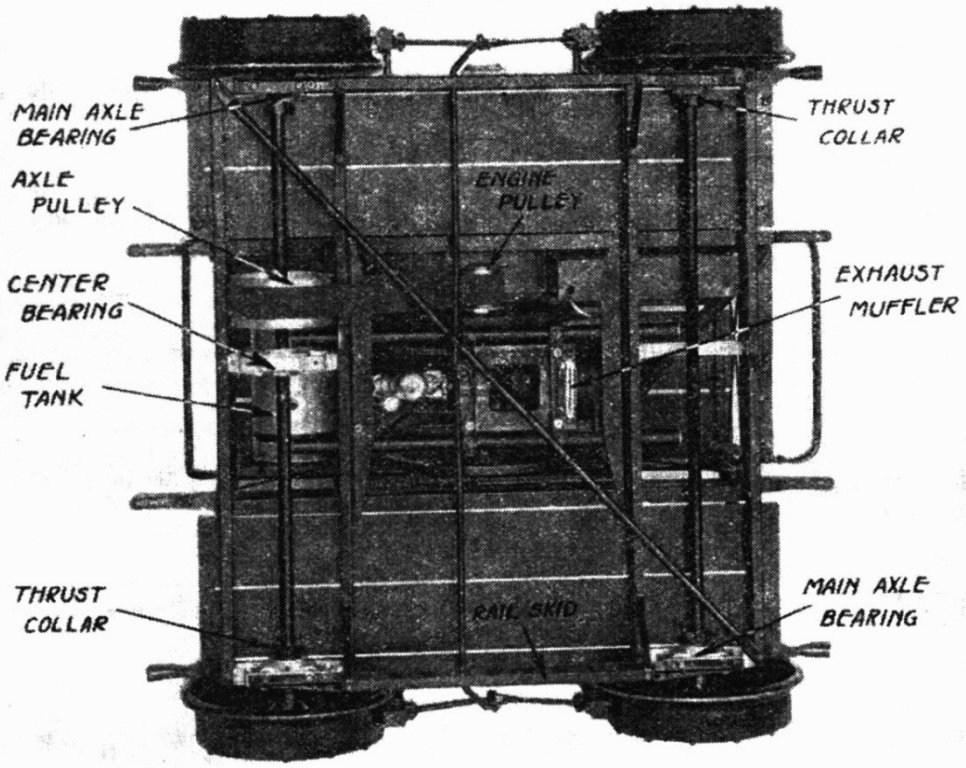


These illustrations show a general view, and the underside of a standard M19 Series C car, with the more important parts pointed out. Reference is frequently made to these parts throughout the bulletin, and the user should thoroughly familiarize himself with them and their functions before placing the car in service or making adjustment and repairs.



PREPARING CAR FOR SERVICE

Uncrate car, open packing box, and inspect everything for possible damage in transit. If in bad condition make a full report to supervising officials at once.

Open switch on top of car if it has battery ignition, then attach high tension cable to spark plug and connect the loosened wire in battery box. If not sure where to attach this wire see diagram on page 16. On magneto cars it is only necessary to attach high tension cable.

Examine all bolts, nuts and electrical connections for tightness. See that all cotter pins are spread open.

Fill the oil can with the same kind of oil as mixed in the gasoline. Squirt a few drops in each of the five acle bearing oil holes. One is located in the drive axle center bearing. The other four are accessible through openings in outer floor boards. Replace cotters in oil holes to exclude dirt. Oil the loose wheel at the right front of the car.

Oil the two guides in each of the four main axle bearing housings, through holes in aluminum caps bolted to deck side rails. Early cars had short guides stuffed with wicking, and were oiled through small holes in side rails. Also oil drive axle center bearing guides.

Oil the four sliding base bearings and thoroughly work it in by moving the sliding base lever back and forth. Engine support tubes must slide freely in these bearings. Also oil brake rigging and sliding base lever at working points.

Remove filler cap on top of condenser, open drain cock on left side of water jacket, and pour in clean water up to this level. About six quarts are required. Close cock after water stops running out, and replace filler cap.

Remove the gas tank filler cap through opening in rear of housing and fill tank with oil and gasoline mixed according to instructions on this page, then replace and lock filler cap. Strain this fuel through a fine mesh screen funnel or clean cloth free from lint when filling tank.

Open shutoff valve in fuel line under gas tank. Open drain cock on bottom of carburetor and see that gasoline flows, then close it tight.

The spark and throttle levers stand vertically. The right hand one is the throttle, the left one the timer control.

The carburetor control knob next to brake lever, turns to open or close the needle valve, and pulls up to choke carburetor.

Finally set car on the track and operate the controls to become familiar with them. Release brake, pull sliding base lever back and latch in guide, and see that car rolls freely. Be sure wheels and axles run true, and brake shoes do not drag.

OIL—WATER—FUEL

Satisfactory performance of a motor car depends to a great extent on these three essentials. A FAIRMONT motor car engine of the two-cycle type must not be run without water in the water jacket and lubricating oil thoroughly mixed with the gasoline.

OIL is of vital importance in protecting a motor car and engine against rapid wear. The proper amount and grade of oil must be mixed in the fuel, and bearings and other moving parts must be lubricated regularly.

WATER in the jacket should be kept at the correct level to insure proper engine cooling. When not filled above this level, the jacket will not be damaged by freezing of the water. The simple FAIRMONT cooling system keeps the engine at the most efficient temperature, which insures economical operation.

FUEL can be any standard grade of gasoline. It must be mixed with the correct amount of oil to properly lubricate and operate the FAIRMONT two-cycle engine.

MIXING OIL AND GASOLINE

S. A. E. 30 gas engine or automobile cylinder or will give good results all year 'round. in nearly any climate. We do not recommend the use of an oil heavier than S. A. E. 40. Read "Oil Recommendations" in the next section.

Measure 3/4 pint of oil for each gallon of gasoline (1 part oil and 11 parts gasoline by measue) and stir the mixture thoroughly. Strain through a fine mesh screen funnel or clean cloth free from lint, when filling fuel tank.

Don't use poor oil or reduce the proportions recommended. Never pour oil and gasoline in the tank separately —they will not mix properly. Remember that all internal working parts of the engine are lubricated by the oil mixed in the fuel.

When "breaking in" new engines add 1/4 pint more oil per gallon to the mixture during the first 500 miles of operation, so closely fitted parts wear in smoothly. If gasoline and oil are supplied mixed, add an extra 1/4 pint of oil to each gallon of fuel.

OIL RECOMMENDATIONS

Oils properly refined from either asphalt or paraffine base crudes furnish good lubrication if they do not contain acids, alkalies, and impurities in injurious quantities. In general the lower viscosity oils give cleaner results, and provide a higher factor of safety. Heavy oils have high viscosities and they form excessive carbon and do not flow freely in cold weather.

Engines in which such oils are used quickly carbonize, and hard starting and lack of power result unless carbon deposits are cleaned frequently. Mixing heavy oil in the gasoline in smaller proportions than recommended, reduces the lubricating value of the mixture and lower engine efficiency and higher maintenance costs will result.

FAIRMONT engines are water cooled and the cylinders, pistons, and rings operate at lower temperatures than in air cooled engines. Good lubrication is assured by using oils of suitable viscosity having fairly low pour test. Carbon deposits are also reduced and engines start easier. S. A. E. 30 oils of approximately the following viscosity characteristics are most satisfactory for year 'round use:
At 130° Fahrenheit 185 to 255.
At 210° Fahrenheit 50 to 63.

Oils up to S. A. E. 40 as follows, may be used if S. A. E. 30 is not obtainable.
At 130° Fahrenheit 255 to 450.
At 210° Fahrenheit 62 to 75.

Practically all refiners and oil companies can supply oils conforming to these specifications, and Fairmont Railway Motors, Inc., will gladly render assistance in the selection of lubricants if desired.

STARTING AND STOPPING ENGINE

(Battery Ignition)

The engine will run either forward or backward, but the timer control lever must be set differently for starting and operating in each direction.

STARTING ENGINE FORWARD

(top of flywheels running clockwise or toward water jacket.)

Pull sliding base lever back and latch in guide, and set and lock the brake. Slip starting crank through steady bearing on right side of car, and over the end of crankshaft. Apply a few drops of oil at these places if crank sticks.

TO TEST IGNITION—Retard the spark by moving timer control lever **toward the front** of car as far as it will go. Close switch and slowly crank the engine forward. The coil should buzz only while the timer contact points close. If it buzzes at any other time or does not buzz at all, there may be a short circuit or improperly connected wire, and a check should be made by following instructions on page 16. Finally open switch.

TO PRIME ENGINE—See that shut-off valve at gas tank is open and fuel flows to carburetor. Partly open the throttle by moving lever toward front of car. Open carburetor needle valve 1½ to 2 turns from the closed position by turning control knob to the left.

Be sure ignition switch is open, then spin the engine several times with the crank while pulling up control knob to choke carburetor. This fills the cylinder and crankcase with fresh gas. In cold weather it can also be primed by injecting some of the fuel mixture through the priming cup on throttle valve cover. Choking the carburetor or priming is usually only necessary when starting a new or cold engine.

CRANKING ENGINE—Next release choke control knob, be sure spark is retarded, close switch, and firmly holding the starting crank engaged quickly pull it upward in a clockwise direction. If engine does not start the first time, continue these upward pulls on the crank until it does, priming again if necessary. When the engine starts remove the starting crank. **Never spin the engine with switch on**—injury might result.

IDLING ENGINE—As soon as it starts move the timer control lever toward the rear of the car to advance the spark, and slightly close throttle so engine runs slowly until it warms up, then set carburetor needle valve to the best running position, about 3/4 to 1 turn open.

Never "race" a cold engine to warm it up, nor run it at high speed when the car is standing. The aluminum piston will expand faster than the cylinder and these parts are liable to seize and score.

TO STOP ENGINE open the switch. Just before it stops turning open the throttle to fill the engine with fresh gas and make starting easier next time.

(Continued on following page.)

(Continued from preceding page.)

STARTING ENGINE BACKWARD
(top of flywheels running anticlockwise or away from water jacket.)

Retard the spark by moving timer lever **toward the rear** of car as far as it will go.

Follow the preceding instructions for testing ignition, setting throttle, priming, and starting, but crank the engine anticlockwise or backward.

As soon as it starts, move the timer lever toward the front of the car to advance the spark, and after warming up set needle valve to proper running position.

TO STOP ENGINE open switch and then the throttle, to fill the engine with fresh gas.

REVERSING ENGINE
(Battery Ignition)

To reverse a battery engine when running, without using starting crank, the belt must be free.

Open ignition switch and leave timer set in advance position. Open throttle as engine slows down. Just before flywheels stop turning, close switch and engine will kick back and run in the opposite direction.

Then advance the spark for this reverse direction by properly setting timer lever, and close throttle so engine idles.

Magneto ignition engines cannot be reversed in this way.

STARTING AND STOPPING ENGINE
(Bosch or Eisemann Magneto Equipped)

Cars and engines equipped with these magnetos have the same throttle control as battery types, but no timer lever or switch. The magneto is timed so an engine can be run in either direction. The spark is "fixed" or permanently set, there being no "advance" or "retard."

The magneto is controlled by a rod attached to the magneto interrupter arm, and extending from the lower middle of the housing on the left side of the car. The interrupter can be moved to its two extreme positions, by pushing or pulling this rod.

Thoroughly study magneto bulletin 202 attached, in addition to the following.

STARTING ENGINE FORWARD
(top of flywheels running clockwise or toward water jacket.)

FOR STARTING ENGINE FORWARD the control rod must be pushed in as far as it will go. This turns on the ignition.

TO STOP ENGINE RUNNING FORWARD the control rod is pulled out until the magneto interrupter arm stands vertically. This cuts off the ignition.

Pull sliding base lever back and latch in guide, and set and lock the brake. Slip starting crank through steady bearing on right side of car, and over the end of crankshaft. Apply a few drops of oil at these places if crank sticks.

TO PRIME ENGINE—See that shut-off valve at gas tank is open and fuel flows to carburetor. Partly open the throttle by moving lever toward front of car. Open carburetor needle valve 1½ to 2 turns from the closed position by turning control knob to the left.

Set magneto control rod to **cut off ignition** as already instructed, before cranking forward. Then spin the engine **forward** or clockwise several times with the crank while pulling up control knob to choke carburetor. This fills the cylinder with fresh gas. In cold weather it can also be primed by injecting some of the fuel mixture through the priming cup on throttle valve cover.

TO START ENGINE FORWARD after priming, release the choke and **push** control rod in as far as it will go to turn on ignition.

Firmly holding the crank in place give a quick upward pull in a forward or clockwise direction. If the engine does not fire the first time continue these upward pulls on the crank until it does. **Never spin the engine with the magneto set for starting**—injury might result.

IDLING ENGINE—As soon as it starts remove the starting crank and slightly close the throttle so engine runs slowly until it warms up, then set carburetor needle valve to the best running position, about ¾ to 1 turn open.

Never "race" a cold engine to warm it up, nor run it at high speed when the car is standing. The aluminum piston will expand faster than the cylinder and these parts are liable to seize and score.

(Continued on page 8.)

(Continued from page 7.)

TO STOP ENGINE WHEN RUNNING FORWARD—Pull the magneto control rod out until the magneto interrupter arm stands vertically. Just before engine stops open the throttle to fill the engine with fresh gas and make starting easier next time.

STARTING ENGINE BACKWARD
(top of flywheels running anti-clockwise or away from water jacket.)

FOR STARTING ENGINE BACKWARD the control rod must be pulled out as far as it will come. This turns on the ignition.

TO STOP ENGINE RUNNING BACKWARD the control rod is pushed in until the magneto interrupter arm stands vertically. This cuts off the ignition.

TO PRIME ENGINE—Prepare the car as explained previously, but set magneto control rod to **cut off ignition** as already instructed before cranking backward. Then spin the engine **backward** or anti-clockwise several times with the crank while choking carburetor, to fill the cylinder with fresh gas.

TO START ENGINE BACKWARD after priming, release choke and **pull** control rod out as far as it will come to turn on ignition. Crank the engine backwards or anti-clockwise by quick upward pulls. **Never spin it with the magneto set for starting**—injury might result.

Follow previous instructions for idling and warning up the engine.

TO STOP ENGINE WHEN RUNNING BACKWARD—Push the magneto control rod in until the magneto interrupter arm stands vertically, and open the throttle to fill engine with fresh gas and make starting easier next time.

STARTING AND STOPPING ENGINE
(Wico Magneto Equipped)

Cars and engines equipped with Wico LD1 magnetos have the same throttle control as battery types, and either a switch or push button in the ignition circuit. The switch must be closed, or the push button held down, to cut off the ignition.

These magnetos are timed so an engine can be run in either direction. There is no magneto control as the reversible impulse coupling automatically retards the spark while starting, and advances it when the engine is running.

Partly open throttle and make the same preparations for starting as with other engines, then **close** the switch or **hold down** the push button to **cut off** the ignition. Spin the engine several times with the crank in either direction while choking carburetor, to fill the cylinder with fresh gas.

Then release choke, turn on ignition by opening switch or releasing push button, and crank the engine in the desired direction by pulling upward on the starting crank.

After the engine starts close the throttle so it runs slowly until warmed up, then set carburetor needle valve to best running position, about ¾ to 1 turn open.

OPERATING THE CAR

HANDLING CAR

Pull out extension lift handles when setting car on and off the track. The rail skids assist in handling over high rails. Be careful not to strike axle pulley on rails. Avoid dropping car on rail skids, or off rails when removing from track. Use care in setting off at crossings, switches and frogs so axles are not sprung by pinching wheels in flangeways.

STARTING THE CAR

Always drive with the engine ahead in normal service and on long trips. After starting and warming up the engine seat passengers on the car, operator facing ahead, and release brake.

Then gradually open the throttle to increase power, and at the same time tighten the belt by slowly releasing the sliding base lever. This allows the belt to slip and act as a clutch while the engine picks up the load.

After the car gets under way, fully release the sliding base lever. Then regulate car speed by opening and closing the throttle.

DRIVING THE CAR

Always drive a new car slowly and carefully until thoroughly familiar with the controls. A speed of 15 to 20 miles per hour for the first 500 miles is recommended.

Keep the sliding base tension springs adjusted just tight enough to prevent belt slippage when driving. The adjusting wing nuts at the front end of sliding base tubes should be secured with lock wires after proper belt tension adjustment is made. For average conditions the spark should be well advanced,

and the throttle set to maintain proper traveling speed. This insures full power from the engine and economical operation.

If the car loses speed or the engine knocks on hard pulls with open throttle, give the spark more retard, and slip the belt a little if necessary. When coasting down light grades the belt can be released and throttle closed, thereby saving fuel and cooling the engine. In descending heavy grades the engine can be used as a brake by leaving belt tight, closing throttle, and cutting off ignition, also using car brake if needed.

When making a brief stop leave the engine running, so the car can be started again without cranking the engine.

STOPPING THE CAR

First close the throttle, then retard the spark part way.

Next pull sliding base lever back and latch in guide plate to release belt, and apply the brake.

Shut off ignition to stop the engine if car is to be removed from the track.

REVERSING THE CAR

To reverse a battery ignition car without cranking, release belt and bring car to a full stop, allowing the engine to run slowly. Then reverse the engine as explained on page 7, after which the car can be driven in the other direction.

The reversing feature permits running back to setoffs, making inspections, etc., but the car should not be driven backward for long distances. Always operate the engine and condenser ahead on long trips.

A magneto equipped car cannot be reversed in this way. The engine must be stopped and cranked in the opposite direction.

LUBRICATION

The same grade of oil that is mixed in the gasoline is satisfactory for general lubication of the car.

Always mix ¾ pint of oil with each gallon of gasoline. This mixture lubricates all internal moving parts of the engine.

Once a month unscrew the plug in the belt side bearing on the engine and oil the outboard ball bearing well. Be sure no grit or foreign matter enters. Screw plug back tight.

Once a week apply a few drops of oil through the oil holes in the four main axle bearings and in the drive axle center bearing.

Oil the axle bearing guides daily.

Once a week apply a few drops of oil to the four sliding base bearings.

Oil the loose wheel frequently to prevent its sticking.

Occasionally oil working points of sliding base lever and brake rigging.

GENERAL SUGGESTIONS—SAFETY FIRST

Careful observance of the following and study of this instruction book will insure a long lived dependable motor car and a clean safety record.

Inspect the car before starting out each day, and make sure it is in good operating condition.

Once a week clean the entire car thoroughly, examining gasoline joints, electrical connections, bolts, screws, etc., and tighten all loose parts.

When making inspection see that:

(1) Wheel tire bolts are tight.

(2) Wheel tires are not worn dangerously thin at flange or on tread.

(3) Wheels and axles run true.

(4) Axle end nuts are secured by cotters.

(5) All wheels except loose one are tight on axles.

(6) Loose wheel is not worn too loose on bushing.

Keep engine and axle pulleys aligned so the belt runs true, and does not rub pulley flanges or flywheel.

Keep the brake adjusted and in first class working condition.

Lubricate all moving parts regularly.

Don't "race" the engine at high speed when car is standing.

Handle car on and off the rails carefully to avoid damage.

If car must stand outside in bad weather protect it with a fireproof canvas cover.

Don't overload the car—maximum capacity is 750 lbs. at ordinary speeds.

Load baggage and tools carefully to prevent their working into moving parts or falling under the car and causing an accident.

Drive slowly with car under full control where there is not a clear view ahead, over road crossings, through gangs of workmen, through railroad yards, and over frogs and switches.

Don't drive during rain or snow storms or foggy weather unless necessary, and then only with a lineup and extra precaution.

When following other motor cars or trains remain 500 feet or more behind.

If car is run at night protect it with proper signal lights at front and rear.

Keep fire and lights away from gasoline tank and carburetor.

Above all, adhere strictly to local railroad motor car rules.

WHEELS

Standard M19 series C cars use 17"x¼" two-piece pressed steel wheels, with malleable hubs riveted in place. Three wheels are mounted on the tapered axle ends with fiber bushings in the hubs and fiber washers next to the outer hub faces to provide electrical insulation. The group is drawn tight by the axle end nut and a steel washer.

The loose wheel at front on right side, is straight bored and mounted on a bronze bushing. A few drops of oil daily insures proper operation. Keep this bushing just tight enough on the axle to prevent its turning. Never operate car when loose wheel is a sloppy fit on bushing.

Each wheel tire is tightly held on the hub and disc assembly by twelve heat-treated stretch proof bolts. Removing these bolts and swinging the brake shoe clear, permits of quickly exchanging a tire without taking the complete wheel off the axle. Common bolts must not be substituted for the heat treated ones, as they will stretch and tires will loosen.

To remove an insulated wheel or hub and disc assembly, take off axle end nut and screw an M8705 shock wheel puller on the axle until it seats tight. Strike the end of the puller several sharp blows with a heavy hammer, at the same time prying between the car frame and wheel hub.

The loose wheel can be slipped off after end nut and steel washer have been removed. Jar bronze bushing off with shock puller while prying between frame and bushing shoulder.

Before applying a wheel or a hub and disc assembly be sure the axle runs true. Before applying insulation smooth all burrs in the wheel hub and wipe the bore clean. Then carefully drive insulating bushing in until flush with the outer face; and tighten wheel on the axle with end nut and steel washer, being sure the fiber washer is next to outer hub face. If wheels come too close together (under gauge) tough paper can be wrapped around the bushing. If too far apart (over gauge) slightly ream the bushing with M7666 taper reamer. Be sure insulated wheels are tight on the taper and all wheels run true.

Drive wheels must be approximately the same size. They can be measured with a steel tape around the tread, being careful to keep it equidistant from the flanges at all points. Sometimes small differences in their circumferences cause a car to run to one side when perfectly aligned.

WHEEL ALIGNMENT

NOTE—Sometimes a small difference in drive wheel circumferences causes a car to run to one side even though perfectly aligned. Again, another car will operate satisfactorily with drive wheels showing more variation. Track conditions, direction of wind, car loading, and windshield have more or less effect on a car, and it may tend to run to one side even when in alignment.

Careful observance of these instructions insures a safe running car. This diagram represents the running gear of any motor car, but the instructions apply only to the M19 series C cars with 17" pressed steel wheels.

(1) Replace bent or sprung frame members if any, and check frame for squareness. Measurements "G" across corners should be the same if frame is square. Finally tighten all frame bolts and nuts.

(2) Carefully block up under the car frame so all wheels turn freely and frame is level.

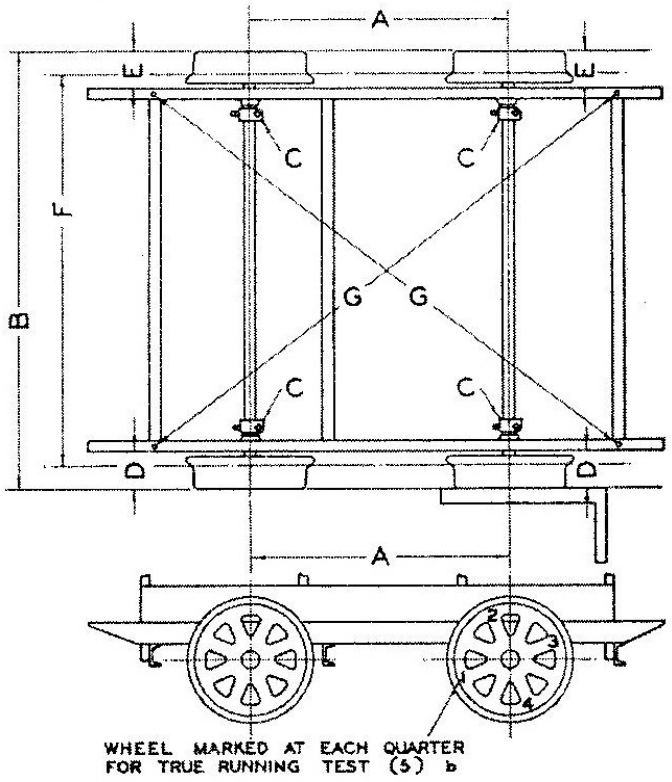
(3) Examine wheels and replace tires or wheels with badly worn flanges.

(4) Drive wheel tires must be approximately the same size. Measure them with a steel tape around the tread, being careful to keep it equidistant from the flanges at all points.

(5) (a) Rotate wheel and axle assembly, and hold a piece of chalk steady so it just touches outer face of each wheel. If wheel and axle run true chalk will mark evenly around wheel—if wheel is sprung or axle is bent chalk will mark the high spot on wheel. Wheels or axles badly out of true usually must be replaced, though axles can sometimes be straightened. A maximum tolerance of 1/32" out of true is recommended on wheel tread, and up to 1/16" out of true on wheel face or flange.

(b) Another method of check is with a straight edge or two-foot carpenter's square across outer wheel faces (see diagram). Mark each tire face in quarters and measure from the square to the side rail at each quarter. The measurements should be the same for each wheel, if the wheel and axle run true.

(6) Axle center distance "A" should be the same on both sides of car. Axle bearing support bolts can be loosened to permit shifting the wheel and axle



Wheel Alignment Diagram.

assemblies a trifle. If necessary replace worn parts, such as bearing supports and casings.

(7) A tolerance of $\frac{1}{16}$" over or $\frac{1}{8}$" under gauge "F" is recommended. The measurement over the outside faces of wheels at "B" is 62⅛" when M19 series C 17" wheels are exactly to 56½" gauge. Both axle assemblies must measure the same to properly align wheels.

(8) New insulating bushings are sometimes necessary to bring wheels to gauge. These must be carefully fitted so wheels run true. If loose wheel and loose wheel bushing are badly worn, both may have to be replaced.

(9) With frame approximately centered between the four wheels, the outside faces of left wheels should be in line and parallel with left side rail. Check with a straight edge, tight cord, or carpenter's square, being sure distances "E" are both the same. If necessary loosen and shift thrust collars "C" to align these wheels.

(10) Next check right side of car where distances "D" should also be equal and approximately the same as "E".

(11) Carefully set all thrust collars "C" against axle bearings, being sure lugs engage in slots. First tighten clamp bolts, then set screws and lock nuts.

(12) After thrust collars are set, make another check of wheels to be sure alignment has not been disturbed.

AXLES AND BEARINGS

The alloy steel axles run on Bower bearings at each end, and a Hyatt steady bearing supports the drive axle next to the pulley.

The axle bearings are enclosed in oil tight and dust proof casings. A few drops of oil in each casing through the oil hole once a week provides sufficient lubrication. Use the same kind of oil that is mixed in the gasoline. Also oil the Hyatt steady bearing at the same time.

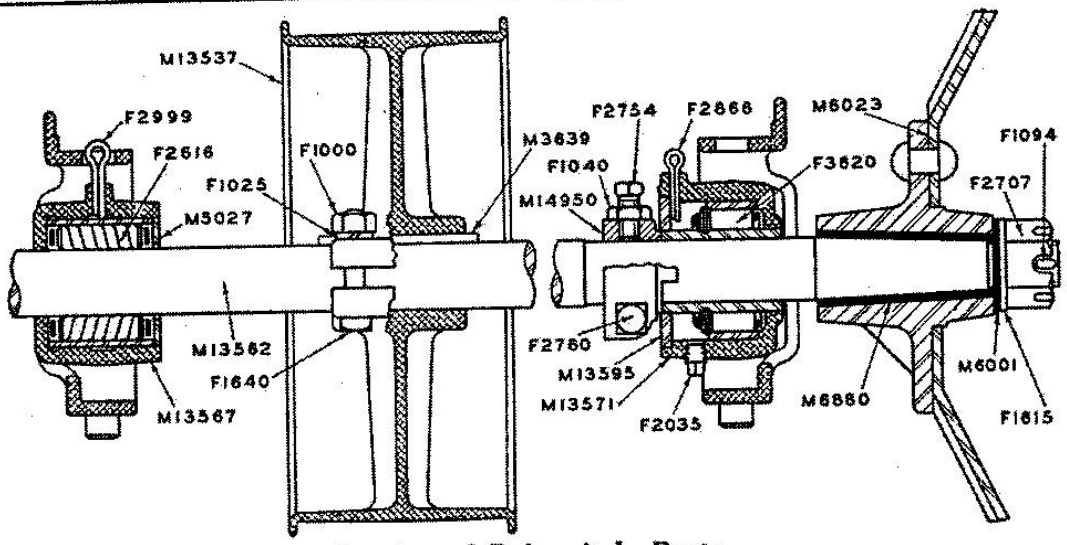
When general overhauling or extensive repairs require the removal of axles and bearing assemblies, disconnect brake rigging and take off wheels, then the side rails. Unbolt rail skids, and bearing supports from cross channels, permitting the removal of main axle bearings. The drive axle with pulley and center bearing may be slipped out toward the rear after removing rear cross channel, and bolts securing the center bearing.

For lighter repairs such as replacing bent axles, proceed as above but remove side rail, rail skid, and bearing assemblies from right side only. Then pull axle out of bearing on opposite side. When removing drive axle in this manner, loosen bolts in axle pulley and wedge the hub open enough to permit pulling the axle through.

The bearings can be jarred out of casings after removing the riveted covers. Wash all parts clean and inspect them whenever removed from the axle. When reassembling rollers and races, oil them well and be sure to have beveled edge of outer race against beveled flanges of the rollers. These surfaces carry the side thrust of car and must run together.

The Hyatt center bearing should also be cleaned and oiled whenever the drive axle is removed.

Two thrust collars on each axle take up end play. To adjust a thrust



Section of Drive Axle Parts.

collar loosen set screw and clamp bolt, then tap collar snugly against axle bearing. Driving lugs on collar must be in the slots in bearing race. When correctly set, tighten clamp bolt first, then set screw, and finally lock nut. Be sure wheels are in alignment when thrust collars are finally set.

A slightly sprung axle can usually be straightened cold, but one badly bent should be replaced at once. Never heat alloy steel axles when straightening, as the steel will be weakened.

BRAKE

To bring the car to a quick stop apply the brake with firm steady pressure, yet allowing the wheels to revolve. If applied suddenly, or too hard, the wheels may lock and slide on the rails.

Go over the brake when weekly car inspection is made, and tighten bolts and adjust shoes if necessary. Be sure cotter pins are spread. Remember a car is no safer than the brake.

To adjust brake, disconnect adjustable toggles (one on each side of car). Unscrew the yoke on each toggle 3 or 4 turns, then reconnect parts. Try the brake and if necessary make further adjustment until all four shoes take hold on the wheels at the same time. Also be sure the lever can be latched in the first notch in the guide plate.

Suspension of the brake shoes on hanger links insures maximum brake efficiency, as the full face of each liner bears on the wheel when the brake is applied. Replacement liners should be installed when the steel faces of the old ones wear through. Be sure liners and bolts securing them do not touch other brake parts, as electric signals might be operated.

Each brake shoe on late cars is firmly held between the hanger links by a friction spring and long hanger pin. These parts are applicable to early cars which used short hanger pins without friction springs.

SLIDING BASE

The engine supports are mounted on tubes that slide in bearings bolted to car frame. Inside each tube is a heavy coiled spring, anchored at rear end and carrying a stud and wing nut on front end. These sliding tubes telescope inside the front end tension tubes. Tightening the wing nuts draws support tubes forward and holds engine into belt.

To release belt, pull sliding base lever back and latch it in notch in guide plate. When lever is unlatched for driving car, it must not bear against front end of slot or belt will slip. Check this by lightly pulling back on lever when car is being driven. It should clear slot end by at least an inch.

The lever is adjusted by turning the pull rod adjuster wing nut. With engine shut off, adjust so that lever pulls back about four inches from front end of slot before moving engine. When lever is latched in notch the belt should not drag on pulleys.

The endless cord belt has very little stretch, and after the first few adjustments it settles to its permanent length. Then pull rod adjuster and belt require little attention.

If belt slips when lever is properly adjusted, tighten wing nuts just enough to prevent slipping. Too much tension shortens belt life. If necessary to remove sliding base tubes or bearings, loosen the wing nuts.

ENDLESS CORD BELT DRIVE

Always leave the belt slack when car is not in use. The endless cord belt is "endless" and it must not be cut or laced. Properly cared for it will give many thousands of miles service. Never use belt dressing on the belt.

If the belt glazes over and slippage cannot be overcome by increasing spring tension, scrub the inner belt face with a rag saturated in gasoline from the fuel tank. Also clean pulley faces, then dust a little tire talc or powdered soapstone on belt and pulleys before operating car.

To change belts: Release sliding base lever and turn adjuster wing nut tight so as to obtain maximum belt release when lever is again latched, then run belt off engine pulley. Raise the rear of car about a foot and securely block up under No. 3 cross channel.

Remove the right rear tool tray block and four bolts which secure floor boards to No. 3 and No. 4 cross channels on the right side of car. Take out remaining bolts that hold right side rail, remove one brake toggle link pin, and swing rear end of rail (with wheel guards and brake parts attached) upward in the clear.

Remove rear center bearing bolt, two bolts holding sway brace and rail skid brace to No. 3 cross channel, two housing bolts through No. 3 and No. 4 cross channels on right side, and bolts holding rail skid and rear cross channel to right rear bearing support.

Pull back the right end of No. 4 channel. Slip belt off axle pulley and through this opening between channel and bearing, also along top of No. 3 channel and between rail skid and bearing support and finally around wheel. Apply new one and reassemble in reverse order.

Measure axle center distance on both sides, being sure it is equal. See paragraph 6 on page 10. Adjust sliding base lever as instructed on page 12.

PULLEYS

The engine pulley is held on the flywheel by three cap screws which must be kept tight. If these screws are removed, or replaced with others, be sure lock washers are used under the heads and that screws are flush with the pulley lugs, or the belt will be damaged by projecting ends.

The axle pulley is clamped in place and driven by a key. Keep the clamp bolts in the hub tight so the pulley does not shift out of alignment. In handling the car on and off the rails be careful not to damage the axle pulley.

Keep the pulleys in line at all times so the belt runs true and does not rub the flanges or climb over them.

COOLING SYSTEM

Use clean soft water in the water jacket if it is available. Check the water regularly and keep it up to the water level cock. Capacity of the system is six quarts.

Unlike an automobile radiator, the condenser is not filled with water. Instead, steam from boiling water in the jacket passes through upper hose into the condenser where it is condensed to water which drains back through lower hose into the jacket. This maintains a supply of water in the engine, and insures uniform temperature and economy of operation.

If there are no leaks in the cooling system and the car is driven with condenser ahead, the water supply will provide ample cooling for average conditions. When the car is driven hard in unusually hot weather, or backward for long distances, some water will have to be added. After long service, lime and scale deposits from the water may cause overheating. These can be scraped off the cylinder walls after removing the jacket and head.

A motor car operated in severe cold weather may cool too much, or the condenser may fill with frost causing water to be forced out thru the overflow. To insure normal operation, partially or entirely cover the front of the condenser with cardboard or canvas. This protection should be varied according to temperature conditions, and entirely removed on warm days.

Cars can stand in freezing weather without harm to the jacket, providing water is not carried above the proper level. If filled too full, the jacket may be damaged by freezing. Before operating a car with frozen water in the jacket, run the engine slowly for a few minutes to thaw ice around the cylinder and in drain hose. Do not move

engine back and forth with ice in drain hose.

For easiest starting in cold weather, drain water at night and refill with hot water the next morning.

Many operators use anti-freeze mixtures during the winter months. While these have little or no effect on the starting of a cold engine, they do have an advantage in that they do not freeze like water.

Automobile anti-freeze mixtures which contain mineral salts must not be used, as they corrode the aluminum jackets and soldered joints.

Mixtures of alcohol and water give fair satisfaction in severe weather, providing the condenser is not covered. Under these conditions the alcohol which boils at a lower temperature than water, is condensed and drained back to the jacket without loss and there is little danger of frost forming in the condenser. There will however be more or less loss of alcohol from the mixture at temperatures near freezing and above, or if the condenser is covered.

Equal parts of water, and radiator glycerine or Prestone make a satisfactory anti-freeze, providing the condenser is protected to prevent frost forming inside. They may freeze slushy in severe weather, but quickly thaw when the engine is started. Glycerine or Prestone must not be used without water as their high boiling points will result in damage to the engine. Always use water to replenish any loss by evaporation.

FUEL SYSTEM

Inspect the fuel system regularly and see that the tank is securely held by the tank straps. At least once a year, oftener if necessary, remove the tank from the car and thoroughly flush it out to remove sediment, water, and lint.

Leaks at fuel pipe couplings can usually be stopped by tightening the brass nuts snugly. If this does not overcome leakage cut off the ends of fuel pipe just back of the old sleeves, and apply new F3030 compression sleeves with the pipe extending about ⅛" through them. Then tighten coupling nuts firmly to seat all parts together.

The F3613 gas tank cap has an air vent to allow free flow of fuel to the carburetor. Never use an F5115 condenser cap on the gas tank as it has no vent and will cause fuel trouble.

Loops and bends in the fuel pipe sometimes cause "air locks" which prevent the flow of gasoline. Blowing in the tank will start the flow if fuel pipe is not clogged.

The carburetor strainer bowl should be taken off and cleaned at least once a month, oftener in winter to prevent freezing of accumulated water. Be sure gaskets are in good condition when replacing bowl.

Don't use heavy wrenches on fuel pipe couplings or carburetor bowl.

CAR FRAME AND HOUSING

The car frame is assembled from steel channels and angles, and oak floor boards securely bolted together. This construction, with the long diagonal sway brace provides maximum strength and rigidity and maintains alignment. Keep all frame bolts tight. In case members become damaged straighten them, or if badly out of shape replace.

To remove the complete housing from car, close gasoline shutoff valve and disconnect fuel line and choke wire at carburetor. Drain water jacket and disconnect both hoses from engine. On battery cars disconnect the two wires from timer and one each from battery and coil. On magneto cars disconnect magneto control rod.

Pull sliding base lever back, block between engine and No. 2 cross channel, then release sliding base and brake levers. Remove cotters and slotted nuts from the 8 housing chassis bolts, also two machine bolts holding front safety rail to floor end blocks, and lift housing off.

ENGINE MOUNTING

Engines used on M19 series C cars are designated as O and OM. They are secured to the engine supports by four bolts with lock washers and hex nuts.

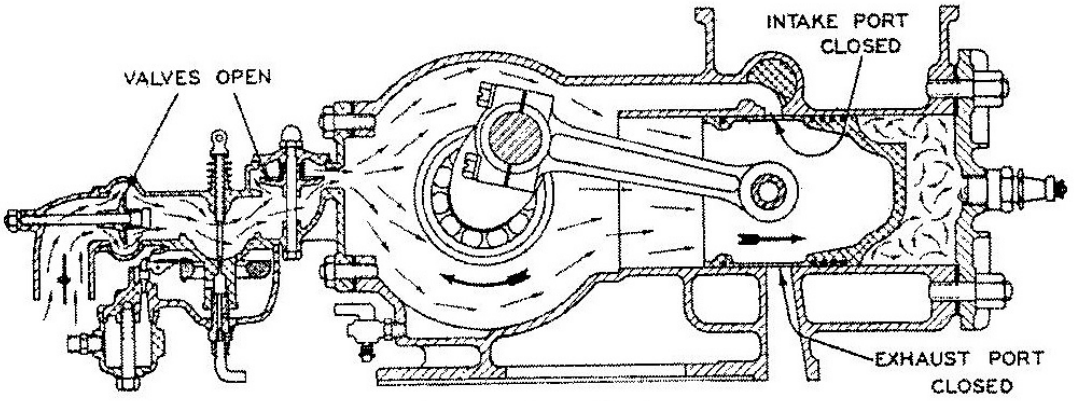
With the complete housing lifted from car, the engine is accessible for any repairs. If it is to be removed from the frame, loosen sliding base tension wing nuts, then unbolt and lift it out. Always use lock washers when reassembling.

HOW THE ENGINE OPERATES

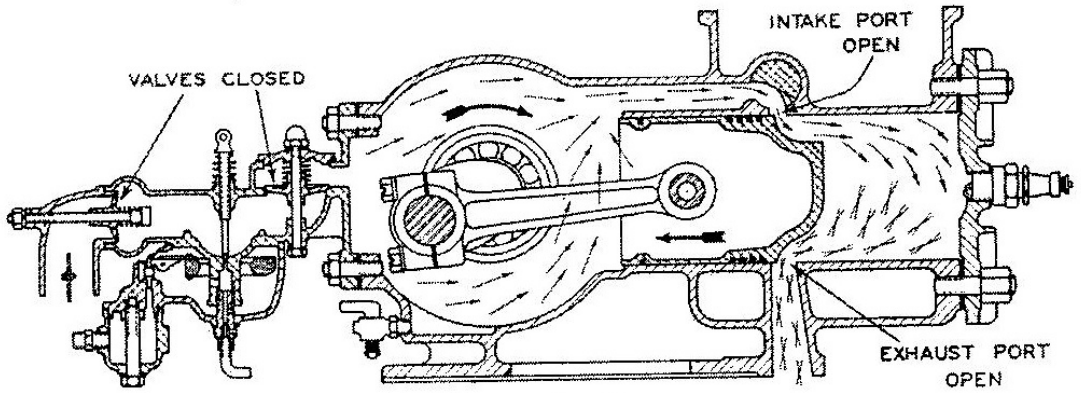
The top view below shows the piston passing over the exhaust and intake ports, as it moves toward the cylinder head and compresses fresh gases in the cylinder. At the same time it creates a vacuum in the crankcase, opening the carburetor check valve and air valve, through which fresh gases are drawn into the crankcase.

rush through them into the cylinder. The deflector on the piston sweeps these fresh gases, toward the cylinder head and spark plug, forcing the remaining burnt gases out through the exhaust ports.

As the flywheels and crankshaft turn, the piston starts back toward the cylinder head on another "compression



Compression Stroke



Power Stroke

When the piston reaches the end of this "compression stroke" the spark at the spark plug ignites the compressed gases, and expansion of the burning mixture drives the piston away from the cylinder head. As the piston moves away the carburetor valves close, and gases in the crankcase are compressed.

The lower view shows the piston nearing the end of this "power stroke" where it first uncovers the exhaust ports, and burnt gases start to escape. Immediately afterward the piston also uncovers the intake ports, and fresh compressed gases from the crankcase

stroke" and again covers the ports. The fresh gases are again compressed, ignited, expanded, and exhausted. This same cycle of events is repeated over and over rapidly when the engine runs.

The FAIRMONT engine runs equally well in either direction, has no valves in the combustion chamber, and delivers a power impulse at every revolution. It is far more powerful for its size and weight than the four cycle type, and having comparatively few moving parts it can be maintained more economically.

MAGNETO IGNITION

The magneto which furnishes ignition on magneto engines is a self-contained unit connected to the spark plug

by one wire. See bulletin 202 for instructions on magneto maintenance and magneto spare parts.

BATTERY IGNITION

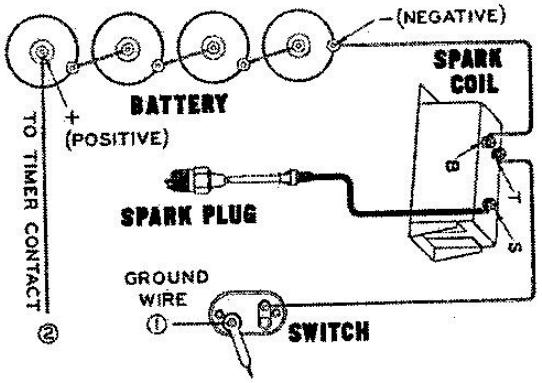
A battery ignition system includes four dry cells to supply current, and a coil which transforms this current to a jump spark, both carried in the battery box, and wired to the timer on the engine which closes and opens the electrical circuit at the proper time. A switch on top of the car cuts off or turns on the ignition. This switch must always be open when working on the engine or not using the car.

An engine which misses when cold and first started, will usually fire regularly after being warmed up. Therefore before changing ignition system adjustments to overcome such missing, always drive the car until warmed up and try different carburetor adjustments.

Then if ignition is suspected of causing the trouble check all wiring, switch and connections to be sure there are no loose connections, or broken or bare wires. Sometimes wires which appear to be good are broken inside the insulation. A wire suspected of being broken should be replaced with a new piece. Scrape all wires and connections clean and tighten with pliers. Coil connections should be lightly tightened to prevent twisting wires loose inside the coil.

The wiring of the M19 Series C is shown in the diagram above. The "ground" wire from the lower terminal of the timer connects to the switch blade. Wiring should be kept free from oil, gasoline, and water, as they rot the insulation and weaken the ignition.

New dry cells test 30 to 35 amperes each and a set is good for several



Battery Ignition Wiring

months' service. Usually they furnish good ignition until exhausted to 8 or 10 amperes each, when the entire set should be replaced and connected according to the diagram. Never use cells which test less than 6 to 8 amperes after standing unused for several hours.

Freezing reduces the efficiency of dry cells and they require replacement more often in cold weather than in summer. In severely cold weather they can be taken inside over night to prevent freezing, and they will then deliver full current for starting next morning.

The inside of the battery box must be kept dry, and dry cells must be firmly clamped or wedged in place so they do not shift and permit connections to touch each other. Never remove cardboard cases from dry cells, or lay tools on them in the battery box.

SPARK COIL

Keep the spark coil dry at all times and never connect more than four dry cells to it. When the ignition system is in good working condition a ¼" to ⅜" spark should jump from the end of the high tension cable to the engine. If the coil will not deliver this spark the vibrator points may require attention, or a new coil may be necessary.

Turning the coil adjusting nuts to the right tightens the vibrator and produces a hotter spark, but also increases current consumption. Turning them to the left loosens the vibrator and reduces the spark. Keep the vibrator adjusted as loosely as possible without causing the engine to miss—this lengthens battery life and prevents burning the points.

The platinum alloy vibrator points should be dressed clean and smooth with a fine file, pocket stone, or emery cloth, when they become rough or pitted. After these points wear thin a complete new vibrator F4166 should be fitted on the coil. Always see that points match and seat together evenly after dressing them, or when fitting a new vibrator.

Inferior tungsten point vibrators reduce the efficiency of the ignition system, and they should not be used.

SPARK PLUG

To test the spark plug, remove it from the engine and lay on some metallic part of the car frame or engine, with high tension cable attached. Close switch and slowly turn engine until timer contacts close and the coil buzzes. If the spark at the plug gap is not steady while the coil buzzes, check the high tension cable for defects and clean the plug, then test again. If the spark plug porcelain is cracked or suspected of being defective, replace the plug with one known to be in good condition.

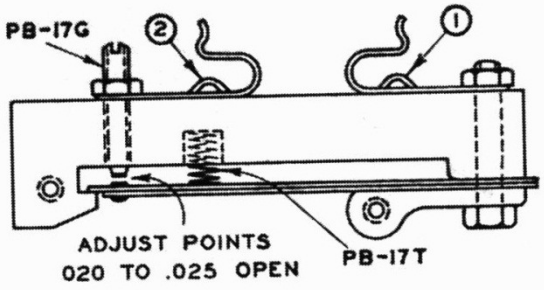
Set plug points at $\frac{1}{32}$" gap for battery ignition and $\frac{1}{64}$" for magneto ignition. They should be checked and reset to these gaps whenever removed, to insure easy starting. Always carry a spare plug well protected, for emergency use on the line.

Replacement spark plugs must be 18 millimeter size, and they should duplicate the factory plug closely. For best results use the F5730 plug. Don't use plugs with long bodies or points which project into the engine further than the original. Such plugs overheat and cause preignition, and the piston may strike them.

TIMER

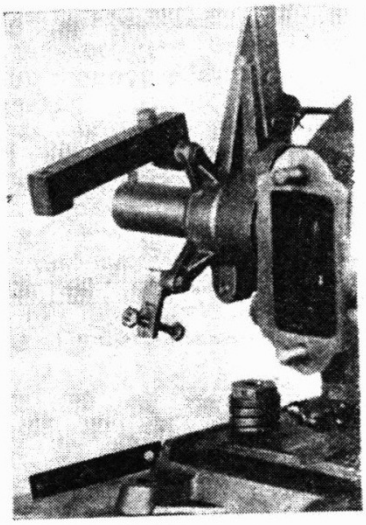
Keep timer connections clean and tight, and the contact points free from grit and oil. The timer must be adjusted closely on the side bearing, yet it must be free to move when the spark is "advanced" or "retarded."

Best ignition is obtained with the contact points adjusted from .020" to .025" opening. Following is an easy way to set them:—turn flywheels so the wiping block clears timer blade, then loosen locknut on timer adjusting screw PB-17G. Turn this screw down until the two points just touch, then back screw out a full ½ turn and tighten the locknut. This gives .020" to .025" opening.



If the points burn or wear unevenly, dress them with a fine file, pocket stone, or fine emery cloth. Be sure they match and seat together evenly when adjusted.

When the wiping block wears, loosen the bolt in flywheel hub and turn the block to a new wearing position, then tighten bolt snugly.



To renew a timer blade remove PB-17P screw which clamps the timer fiber and the ground block together.

Loosen upper mounting screw, then swing fiber clear to permit access to all parts (see cut). Be careful not to lose the PB-17T spiral spring. Re-check all adjustments after assembly.

The "arc of contact" or interval during which the timer contact points close the electrical circuit to produce the spark, should be approximately 30 degrees to 35 degrees or $\frac{1}{12}$ a crankshaft revolution. This measures 5" to 5½" on the flywheel circumference. The "arc of contact" can be re-set if necessary, by loosening the top mounting screw which holds the timer fiber block, and shifting this block closer to, or further from the flywheel hub. Don't change the contact point screw adjustment to set the "arc of contact."

CARBURETOR

Use only genuine FAIRMONT gaskets to repair carburetors. They can be used over many times whereas paper and makeshift gaskets seldom fit and they tear easily and leak. Never use thick gaskets, for they do not allow parts to assemble together properly.

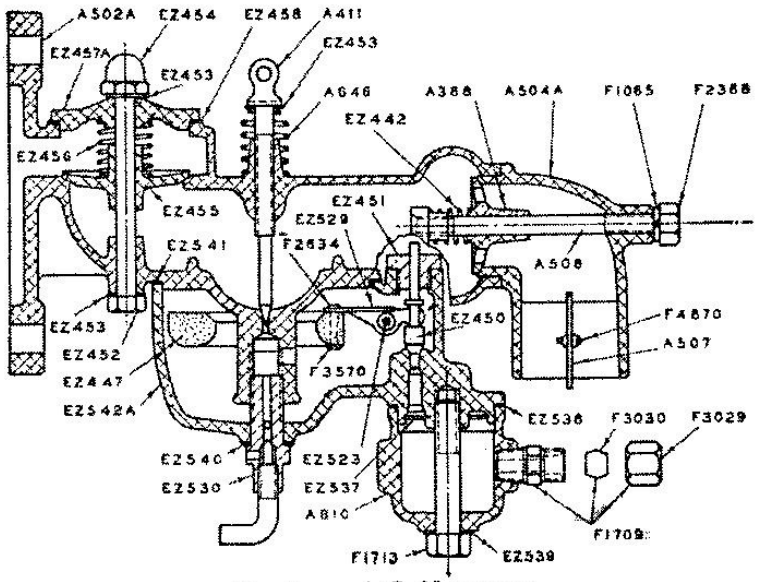
The carburetor is designed with a vertical check valve to prevent troubles common to horizontal check valves used on two-cycle engines. Springs on the check valve and air valve are set with correct tension at the factory and they should not be changed.

The carburetor control knob on the car housing, turns to open or close the needle valve, and pulls up to choke the carburetor. If needle valve is opened too far, the mixture contains too much gasoline, and will be "rich." The engine will then miss explosions, lack power and waste fuel. Black smoke from the exhaust indicates a "rich" mixture.

With needle valve closed too much there is not enough gasoline in the mixture and it is "lean." A "lean" mixture will not fire easily, and it gives a weak explosion, even when spark is advanced. It also causes engine to run unevenly, missing a few explosions or back firing, then firing a few times before missing again.

The needle valve should always be set so the engine runs best with the least gasoline. The best adjustment for a warm engine is between ¾ and 1 turn opening of needle valve.

When starting engine in cold weather, needle valve should be opened at least a turn more than the regular adjustment, and choke also used. After engine is running and warmed up needle valve can be closed to the regular adjustment. When running fast or pulling heavy loads, it is necessary to close needle valve slightly more than when running light. Don't close needle valve when stopping engine. Never screw it shut hard—this ruins the fine pointed end and makes carburetor hard to adjust.



Section of Carburetor

Sometimes a hot engine will start hard after standing a short time. This is caused by "flooding," or a very rich mixture forming in the crankcase. A "flooded" engine can be cleaned out by opening crankcase drain cock and rocking flywheels to blow out the rich mixture.

The small vent hole in body of carburetor must be kept open. If gasoline runs out of vent, or constantly drips from carburetor, float valve is not seating properly. To remedy this trouble first take off and clean strainer bowl and drain carburetor. Then rotate float valve, pressing down on it at same time to make it seat. This will dislodge particles that may be the cause of flooding.

If float valve continues to leak shut off gasoline, remove carburetor bowl, and inspect float valve, float lever bearing and hinge pin. New parts should be applied if these are badly worn, screws holding float to lever should be tightened, and float level should be checked. To tightly seat a new float valve assemble it in the bowl with the guide. Lightly tap the end of the valve, turning it several times and finally rotate it against the seat with pressure to burnish the surfaces.

With cork float lifted to its high position and float valve tight on the seat, the top surface of float should be ⅜ to 7/16 inch below top rim of bowl. The float lever can be carefully bent if it is necessary to change the float level. Be sure to check the float level whenever the carburetor bowl is removed, and replace all gaskets when assembling.

The carburetor strainer bowl should be taken off and cleaned regularly as instructed under "Fuel System." Give carburetor an occasional cleaning and tighten all screws and nuts. Never wipe with rags or wastte when engine is running as litt may be drawn in and thus cause trouble.

PISTON AND CONNECTING ROD

Aluminum alloy pistons and connecting rods are softer than like parts of iron and steel and they must be handled with more care. Don't drop them or clamp tightly in vises as they may spring out of shape.

Cast iron pistons should never be used with aluminum connecting rods, nor steel connecting rods with aluminum pistons, for there is wide difference in the weights of the two groups