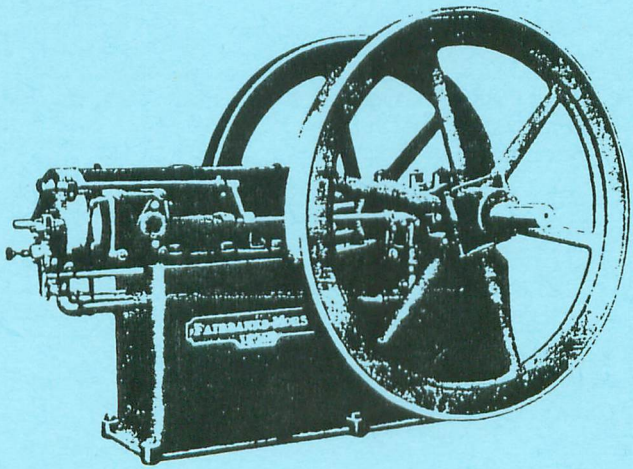
INSTRUCTIONS No. 2099K

FOR SETTING UP AND OPERATING

Fairbanks-Morse

Type "N" Horizontal Gasoline Engines with Hit-and-Miss Governor



FAIRBANKS, MORSE & CO.
(INCORPORATED)

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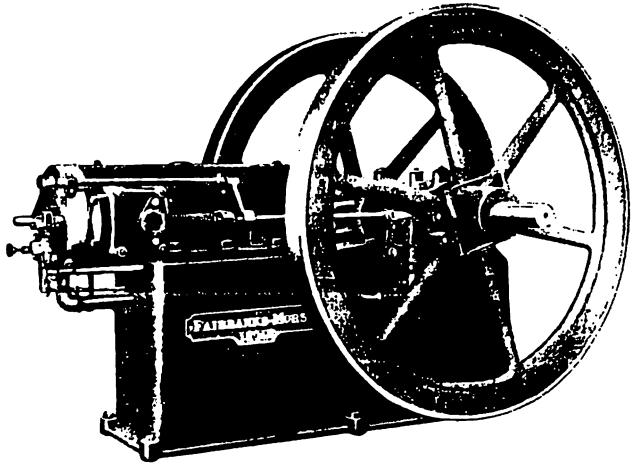
This book should be carefully read before attempting to do anything with the engine



Fairbanks-Morse Standard Horizontal Engine (Fig. 1058G)

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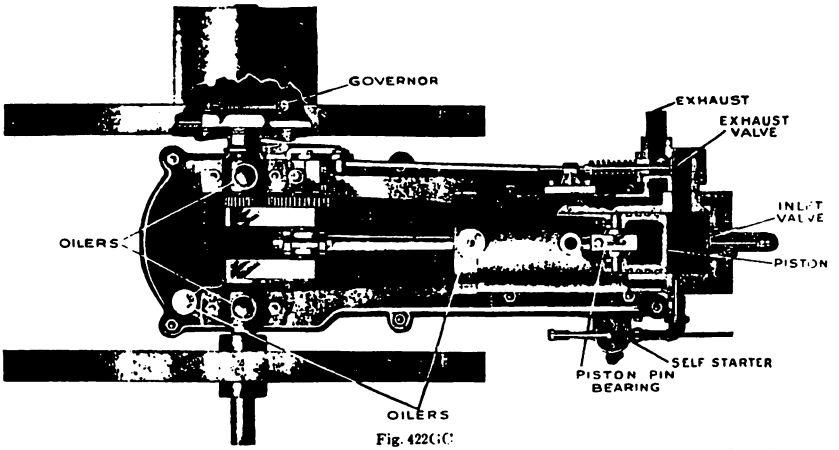


Fig. 422GC

Sectional View of Fairbanks-Morse Type "N" Gasoline Engine

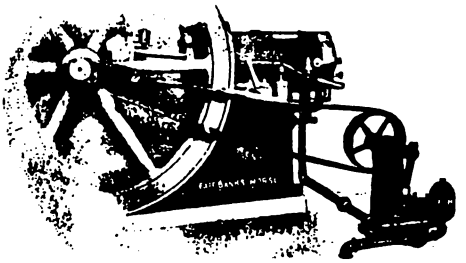


Fig. 1044G

Fairbanks-Morse Type "N" Engine and Circulating Pump

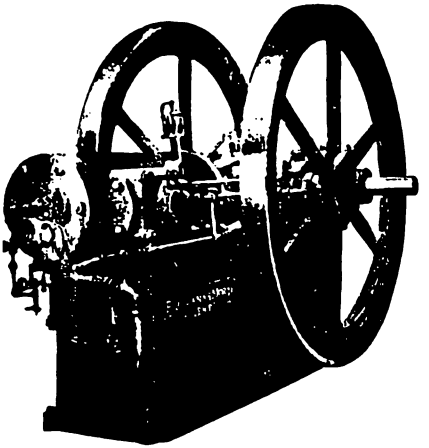


Fig. 1189G

Fairbanks-Morse Type "NB" Horizontal Gas Engine

INSTRUCTIONS No. 2099K

For Setting Up and Operating Fairbanks-Morse Type "N" Horizontal Gasoline Engines

Leave Space

The Fairbanks-Morse Horizontal Gasoline Engine runs in the direction of arrow shown over fly wheel, on page 3. The end with crankshaft is the front of engine. In locating the engine, at least two feet of space should be left between the side of the engine having the starter pump and the wall; this for convenience in starting. A like amount of space must also be left between back end of engine and any wall, leaving sufficient room to get around the valves and connections.

Foundation

Have a thin bed of cement and fine sand to finish top of foundation, set the engine on its foundation, as per foundation plan, draw down bolts, keeping engine level.

Read All Tags

See that all pipes which are to be used have been carefully washed out, to remove all scale and foreign matter. All openings and attachments are tagged with directions how to connect and operate. Be careful to follow directions on each tag.

Water Tanks. (See below.)

The opening for water inlet pipe is in lower part of exhaust valve chamber. If cooling tank is used, the pipe (2) connecting this opening with opening near bottom of tank should be full size of this opening, and connected as shown. The water outlet pipe (3) is on top side of cylinder. If tank is used, connect this with upper opening in tank. Flexible couplings (9) are furnished and should be used in pipes (2) and (3). When tank used is of our standard dimensions, the temperature will regulate itself under ordinary conditions. If conditions should be such that all water in tank is heated above 180 degrees, the temperature should be lowered by adding cold water to tank. Tank should not be covered, as water should have exposure to atmosphere, and so arranged that the water can be drained from cylinder and connecting pipes, to prevent freezing and bursting in cold weather. Be sure to leave open end of pipe (5) over cylinder high enough to be above water in tank. In operation, the water must always be above the upper pipe in the tank, otherwise the water cannot circulate.

Full Size Pipe

Freezing

To obviate the necessity of draining tank entirely in freezing weather when engine is shut down, the valves (6) and (7) may be placed inside the cooling tank.

Inside Valve

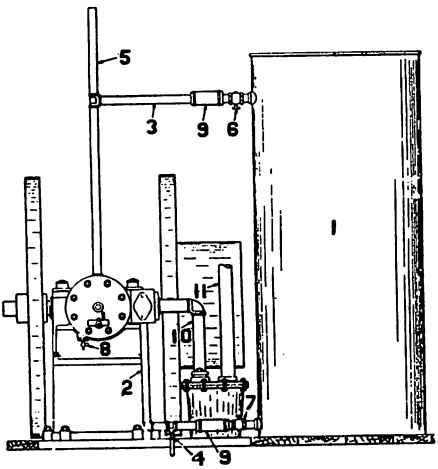


Chart 660GNI
Showing Water Connections Using Cooling Tank.

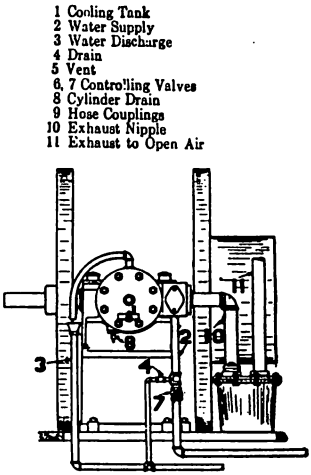


Chart 659GNI
Showing Water Connections Using Running Water.

This requires special nipples with sufficiently long thread to extend through bushing in tanks and allow two or three inches of water between valve and tank. These valves are then operated by key rod from top of tank. Special fittings are required for this arrangement.

To Drain Water from Cylinder

To drain cylinder and pipe connections, close valves(6)and(7)and open valve (4). Also open valve(8)to completely drain cylinder.

Elevated Tanks

The water circulation will be much better if the cooling tank can be elevated at least enough to bring the bottom above the lower water opening on the engine cylinder. We advise doing this where possible, as the power of the engine will be slightly increased by this improved circulation. If the tank is not set close to the engine, one size larger pipe should be used between the tank and the engine.

Running Water.

Temperature Required

Where running water is used the pipe is much smaller, water inlet pipe (2) being connected to pipe opening in bottom of exhaust valve chamber, and outlet or waste pipe (3) connected to the cup on side of base as shown. The bent pipe from cylinder to cup carries discharge water from cylinder. Where running water is used do not keep the cylinder cool, but about such a temperature as you can stand with bare hand, about 160 degrees to 180 degrees Fahrenheit. Where tank is used this will regulate itself.

Evaporator Cylinder.

Open Jacket

Portable engines 5 and 8 H.P. are furnished with special open cylinder which is fitted with a small water reservoir for cooling purposes, and are known under the name of Evaporator, Hopper Cooler, Open Jacket Cooler Engines, etc. Such engines require no piping whatever, the water reservoir being cast integral with the cylinder, and the circulation of the water is natural.

Boiling Water

In operating the engine, the reservoir should not be filled entirely as the water will slop out more or less after it becomes hot. It should be understood and expected that the water will boil, but that the engine will work properly when the water is boiling hot, the only difference being that the maximum power capacity will be a little less. Provision must be made for replacing the water lost by evaporation. The stop cock below the engine cylinder will drain both reservoir and cylinder jacket.

Exhaust Pipe. **(See page 1.)**

The pipe from engine to exhaust pot is always shipped fitted ready for connecting.

The long nipple (10), which is threaded at one end only, is to be placed in a vertical position between the engine and exhaust pot, with the end not threaded extending down through the expansion joint into the exhaust pot.

Exhaust Pot

This expansion joint is simply a stuffing box, the packing for which is asbestos wicking. This wicking is sent in the box of parts shipped with each engine.

The cavity around the nipple should be nearly filled with the wicking and the gland drawn down with the nuts as in the case of any stuffing box.

Pipe (11) from pot to open air should be same size as openings in pot, and larger for long and crooked runs; never use smaller pipe. It is dangerous to exhaust into any house flue. Use a T on bottom of all upright exhaust pipes, with a drain fitted in the bottom of the T, as water collects in long exhaust pipes.

***Fuel Tank (H).** **(See Page 3.)**

Fuel Tank

The fuel tank may be located outside of building in a covered pit, or box, as shown, and should be placed in a horizontal position and sufficiently lower than the engine, so that the fuel will flow towards the tank from the engine. Anywhere from six to twenty-four inches will do. With this tank are furnished the proper connections for outlet and return pipe, which are carefully marked before shipping. Use the size pipe furnished. In connecting the fuel tank with engine, care must be taken to wash out every piece of pipe or joint with gasoline; this removes all scale and loose matter, which, if left in pipes, would interfere with proper working of valves. Extra care must be taken in making all water and fuel pipe connections so that they do not leak; use soap or shellac in joints of fuel pipes, and white lead in joints of water pipes.

Extra Care

Float

Where gasoline engines are installed in basements, or in case where engine room floor is below general level from which the gasoline tank will be filled, care should be taken to have the top of the gasoline tank slightly below the level of engine room floor. In case the top of the filling pipe, connected to engine tank **has to be above** the level of the gasoline reservoir in the engine, the gasoline tank should be fitted with a reliable float device which will close the filling pipe before the tank is completely full. This float device will give warning so that the fuel will not overflow into the engine room in case there are any loose joints. Fuel tanks fitted with this float device will be furnished on special orders only.

Vent

Care should be taken to see that the cap on the fuel tank filler pipe is not screwed down to cover the vent hole in the side of the filler pipe so the air cannot enter tank and maintain atmospheric pressure on the fuel.

*The word "Fuel" in this instruction book applies to gasoline, petrol or naphtha.

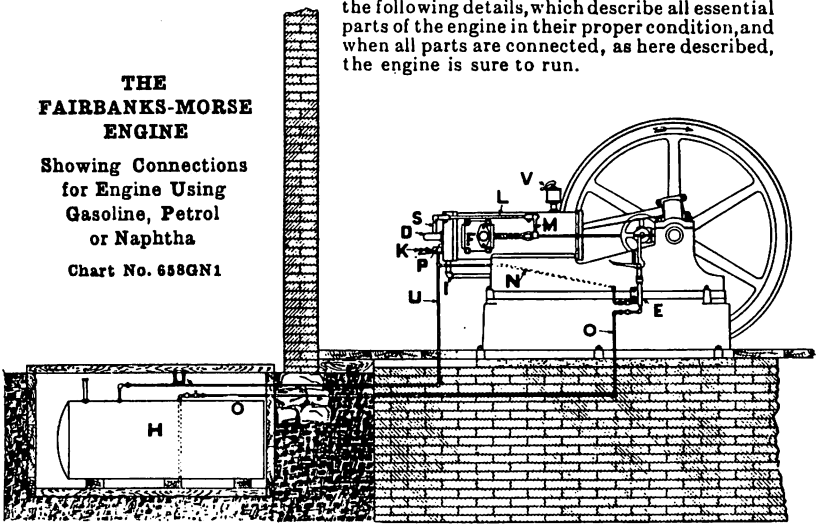
The fuel pump (E) of the horizontal engine is on the side of the engine, near the top of base, and the opening where the inlet or suction pipe should be connected is carefully tagged. To the bottom of pump is connected the suction pipe from fuel supply tank. The purpose of the valve on the fuel tank is to restrict the supply of fuel slightly, if the pump should deliver too freely to the reservoir. From the pump the fuel is delivered to the small reservoir (P) on the cylinder head, and the larger pipe leading from the bottom of this reservoir is the overflow or return pipe for fuel. This pipe projects upward and above the bottom of the reservoir inside, and MUST NEVER BE DISTURBED, as it holds the fuel at the proper height in the reservoir.

Fuel Piping

Engine is shipped with the union attached to the lower end of this pipe, and to this union connect return pipe and carry down to floor or through floor as required and back to fuel tank with a gradual descent, to assist free flow of surplus fuel back to tank.

Avoid Traps in Pipe

Having all piping connected, it will be well to make yourself familiar with the following details, which describe all essential parts of the engine in their proper condition, and when all parts are connected, as here described, the engine is sure to run.



Description and Instruction as to the Action and Care of Parts of the Engine.

Fuel Inlet or Suction Valve (OD). (See page 8.)

This is an ordinary check valve, automatic in its action, and has a lift of about three-eighths of an inch. The lift is limited by means of a spring (OE) on the stem of the valve, and a cotter pin through the nut (CQ) on stem. Should this pin ever need renewing, care must be taken that the new pin is no longer than the original one, for if longer the ends will strike the side wall of shield (RG) and the working of the valve will be interfered with. The collar nut (RH) must be so set as to hold valve closed when the catch (CU) is down, as is the case when the engine is governing. Nut (CQ) should be set hard against collar nut (RH). Should the engine at any time, on starting, turn too easy, or have lost the usual compression, it is evident that a leak is taking place and this valve should be examined; it may not seat perfectly. This valve can be examined by taking out the screws and removing the shield. This will expose valve stem, when by working this valve you can tell whether it works free, and, by means of a wrench on the stem, the valve may be revolved backward and forward, in this way cleaning the seat. On again putting the parts together, care must be taken that they are not twisted, and that they do not bind the valve stem. Look at this very carefully; also see that the steel blade catch works free and locks valve, preventing all movement when the exhaust is held open. This valve lock is used for the purpose of preventing the waste of fuel by allowing it to enter the cylinder while the exhaust valve is open.

Cotter Pin

Lost Compressio

Valve Lock

Exhaust Valve (NC).

This valve is constructed same as the inlet valve; also lies in a horizontal position, with the stem extending through the casing, with a spring over the stem

Exhaust Valve

to hold it to its seat. The nut holds the spring under compression. Should there be a lack of compression, after making sure the leak is not in inlet valve, examination of the exhaust valve must be made to see that it does not leak. This valve can be examined and seat cleaned, if necessary, by taking off the cap (NA). Then the valve can be taken out through the cap opening and the seat can be cleaned by revolving the valve while being pressed to its seat in the casing. To reseat, grind with emery and oil by revolving valve on seat until it will hold compression; carefully clean both valve and seat before starting engine. When replacing cap use gasket of asbestos, soaked in boiled linseed oil, to insure tight joint

To Reseat Exhaust Valve

Fuel Pump (E). **(See page 3.)**

The small fuel pump (E) which supplies the reservoir (P) through pipe (N) is operated from the large gear shaft, taking supply from fuel tank (H) through pipe (O). The proper height of fuel is maintained in the reservoir by an overflow pipe, which returns to fuel tank. Keep oil in cup on cap of pump to lubricate packing; never screw cap down hard or the packing will cut the pump plunger.

Fuel Pump

Air Suction. **(See page 3.)**

The suction action of piston draws air through the pipe (I). By the swift velocity of this in-going air, sufficient fuel is picked up and drawn through a small nozzle, which extends into the passage, to form an explosive mixture.

Mixture

The Governor. **(See page 3.)**

The governor on the fly wheel controls exhaust valve and also locks the inlet valve in its seated position by the rock shaft (L) and arms (M) and (S).

Governor

The speed of the engine can be varied by adjusting the tension in the governor springs, but we do not advise speeding above the catalogue speed.

Throttle Valve (K). **(See page 3.)**

Throttle valve (K) has a stuffing box like the pump, but in this case the gland should be kept drawn up tightly so the valve will not turn from a set point while the engine is running. The function of this valve is to shut off the supply of fuel, when engine is stopped, and for regulating by set point the proper quantity to be fed to engine to obtain the best results while running.

Throttle Valve

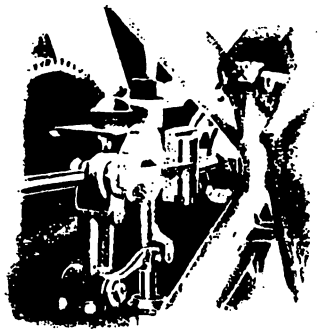


Fig. 1201—Hit and Miss Governor

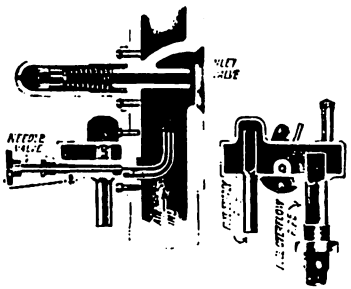


Fig. 663M-A—Sectional Views Showing Double Tube Fuel Reservoir for Liquid Fuels

Water Reservoir.

Engines of 20 and 25 H. P. sizes are fitted with a water reservoir having its nozzle or opening extending into the air suction passage. This is for the purpose of letting a fine spray of water be drawn in with the mixture. The amount of water admitted is regulated by the needle valve attached to this reservoir. It should not be opened until the engine has been running some time, and then must be set so as not to admit too much. The correct setting can be easily seen from the action of the engine.

Water Reservoir

The effect of this water spray is to moderate the force of the explosions. Yet it does not diminish the power nor economy, but the reverse. Too much water, however, will reduce the power.

The cock on the supply pipe to this reservoir should be set so as to let a very small amount of water run to waste constantly. This is to make sure that the reservoir is always full up to the level of the overflow pipe opening.

When using the water reservoir the circulating water should be kept somewhat hotter than regular. The temperature should be about 180 degrees. The spigot on this reservoir should be closed a few minutes before stopping engine in order to shut off the water and leave the interior surface of cylinder dry and clean.

Water Cooling

The water spray is only of service when the engine is running at about full load. When the engine load falls to about one-half of its power, or below, the water should be entirely cut off to prevent the suction valve from rusting, and also to prevent a sediment from being deposited upon the points of igniter, which might be caused by an excess of water.

In some cases the water used through the water reservoir causes a troublesome deposit, particularly about the engine exhaust valves. In such cases, rain water may be supplied or some simple arrangement may be made for distilling enough water for use with this water reservoir by using heat of the exhaust pipe

Rain Water

Instructions for Starting the Engine.

IMPORTANT. BEFORE starting engine examine carefully and be sure that the nuts on studs holding cylinder head to cylinder and those holding exhaust shell to cylinder are turned tight.

Tighten Nuts

REPEAT this the first few times the engine is allowed to become cold, and whenever it has stood idle a considerable time. Attention to these points will prevent annoyances from leaks which otherwise result from unequal expansion and contraction of metal and the drying and shrinking of gaskets.

Avoid Leaks

How to Start the Engine.

Suppose the engine to be so set, connected and ready to start. First see that all outside grease is removed and engine clean, fuel in the tank, and all parts properly oiled, especially the inside of cylinder and outside of piston (see page 7); oil freely and use hand oil-can frequently for a time on all working joints. The pipes between the fuel tank and engine are now filled with air, which must be removed by working the pump handle until fuel is up in reservoir. Engine is now ready to start. Open the throttle valve to a point indicated by a mark "1" on disc. This is found to be about the best point to start.

Properly Oiled

Fuel in Reservoir

The machine to be driven must be detached from the engine until engine is in motion, either by shifting of belt to loose pulley, by slacking of belt by means of tightener or by friction clutch pulley.

Set igniter at late spark. (See page 15.)

Close switch on battery.

Close damper in air suction pipe, and start engine as follows:

Starting by Hand.

If to start by hand, hook open the exhaust valve by placing the detent catch under the catch on end of exhaust rod. Always have the cam set below the roller, which will allow two revolutions before compression is reached, turn the fly wheel quickly several revolutions, being sure to come against the compression quickly and over the center where ignitions occur. Sufficient help should be at the wheel until you get familiar with it, when one man will start all engines up to fifteen horse-power.

To Start by Hand

Starting with Priming Cups.

Gasoline engines of 5 and 8 H. P. sizes are fitted with small priming cup attached to engine cylinder. Set engine with piston just beginning its suction stroke. Set igniter at late spark. Fill the priming cup about two-thirds full of gasoline; open the cock and turn fly wheel in the direction it runs, enough to advance piston about two inches and draw in the gasoline from priming cup. Close the cock and continue turning the fly wheel, bringing it over the compression stroke, when the charge will be ignited by the action of the igniter. Succeeding charges will be drawn into the cylinder and ignited in the regular manner.

Priming Cup

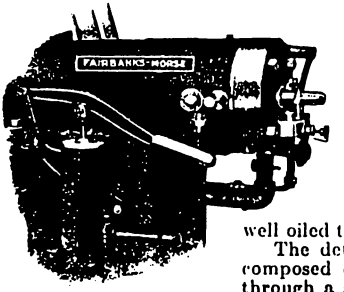


Fig. 1185G
Self-Starter Pump

Directions for Operating Self-Starter.

The small charging pump attached to the base of engines 10 H. P. and larger is fitted with a small receptacle in the base of the pump, which holds a small quantity of gasoline. When sufficient gasoline has been poured into the small funnel-shaped opening in the left-hand side of the pump base, it will overflow through the hole drilled in the face of the casting, indicating that sufficient gasoline has been retained to charge the self-starter; keep pump plunger well oiled through openings in top of cap.

Charge Starter Pump

The detonating device for 10 H. P. and larger is composed of the round steel plunger, which is inserted through a screw plug in the cylinder. By unscrewing the brass disc, the plunger can be withdrawn and the small hole, or slotted opening, on one side at

Charge Detonator

the end of plunger charged with a parlor cracking match. A portion of the wood should be broken off and only the short head of the match inserted in the slot. Replace the same in cylinder. Screw down the brass disc; open the combination valve interposed in the pipe leading from self-starter pump to the cylinder; set the engine crank in such a position that the piston is toward the head end of the cylinder, having slightly advanced, say, about one-half inch. This puts the position of your crank slightly above the dead center. Care must be taken that this stroke is the stroke which would be the explosion stroke. This can be determined by the location of the exhaust cam, which would be just above the roller on the end of exhaust rod. Now, with the left hand hold the fly wheel of the engine and give the self-starter pump several full, quick strokes. This should make the engine pull strong on the fly wheel, and when the power is sufficient so that engine begins to move slightly, quickly strike the detonator, which will ignite the match previously inserted into the cylinder. This fires off the charge which you have just pumped into the engine cylinder. This will drive the engine forward with sufficient velocity to draw in a charge through the regular channels, and be ignited by means of the permanent igniting device. Close the combination valve between the cylinder and starter pump.

Explosion Stroke

Begins to Move

Starting in Cold Weather

In cold weather, or when the engine is very cold, especially on such engines as Portables that are located in the open, the overflow hole in the base of starter pump should be plugged with a wooden plug, as it takes more gasoline to get the explosion. It would be better practice not to turn on cold cooling water until after engine is started and to shut it off just before stopping, were it not for the danger of forgetting to turn on the water.

Another Way to Start with Pump

Another way to start with pump. Charge the base of the pump with gasoline and the detonator with the head of a parlor match as directed before. Also set the engine with piston just ready to begin its power or explosion stroke. Now work the hand pump, at the same time turning the fly wheel slowly forward by hand until piston is near end of its stroke. This fills the cylinder full of a charge of gasoline and air. Next turn *backwards* on the fly wheel as *strongly* as *possible*, compressing the mixture and at the moment when the fly wheel is stopped by the compression, strike the detonator. A very strong explosion will result, if a good mixture and considerable compression have been obtained.

This method requires more skill, and there is danger of injury if one does not let go of the fly wheel *before* striking the detonator. It is used on our own testing floor as our men prefer it to the method first described.

If no detonating matches are available the charge may be fired by having an assistant snap the electric igniter at the proper time, using a screw driver or other instrument against the loose catch "WL6" on the movable igniter electrode.

Start Without Matches

One man can start all of our larger horizontal engines without matches by means of the self-starter pump. Set the engine crank in position same as before so that the piston is near the head end of the cylinder and advanced about one-half inch on its explosion or power stroke. This will bring the crank a little above its inner center and the high part of the cam will be above its roller ready to open the exhaust near the end of the power stroke. Set the igniter to spark late and see that this brings it ready to snap as soon as the engine moves forward.

Another Way to Start Without Matches

Now turn on the battery switch and pump in a charge with the self-starter hand pump. Soon as pump works hard, indicating considerable compression, start the engine forward by hand. When igniter snaps, an explosion will take place if mixture is right, which will carry engine over several revolutions. In case it fails to start the first trial be careful to throw off the battery switch while preparing to try again and not to throw it on again until just ready to start. The battery may be short circuited while the switch is on, thus wasting the strength of the battery.

When Engine Starts.

Running Point

Proper Mixture

In any case, as soon as engine starts set igniter at early spark (see page 15), open damper in air suction pipe and partly close throttle valve to point marked "2", as this is the running point, as tested at the factory. The conditions under which the engine operated in the field may somewhat differ from those prevailing on the test floor. The operator will, therefore, use some discretion as to the exact point at which the throttle valve will give the best results. If point "2" does not seem to afford just the right supply of fuel, turn the throttle a trifle, using a very little less or a very little more, and with a little experience the operator will soon determine what is the best setting for the valve If too much fuel is used a slow burning mixture is formed, which does not develop the power that the proper explosive mixture gives; and if too little fuel is used, the mixture is too weak to

develop the power required. Should any back ignition occur, which can be detected by a peculiar popping noise in the air-suction pipe, the cause is that not quite sufficient fuel is turned on.

Should your work be of intermittent character, the engine may be stopped as the engine can be started at any time without delay.

To Stop Engine

To stop engine, close the throttle valve, open switch on battery and in cold weather the cooling water should always be drained from engine cylinder and pipes to prevent freezing and bursting.

Directions for Cleaning and Taking Apart.

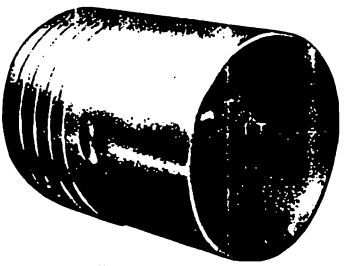


Fig. 664M-A—Piston

Cleaning Pistons and Rings.

To Remove Piston Rings

Occasionally it is necessary to remove the piston for the purpose of cleaning the rings, which may become baked fast and prevent the engine from holding its compression if the proper amount of lubricating oil has not been used.

To remove the piston set engine crank in vertical position, loosen nuts and remove bolts (CD) (page 8), turn crank forward, and remove brasses (CB) and (CC,) and turn crank down. Draw piston from cylinder by means of connecting rod. Oil the piston generously before replacing and take special care to replace all parts in exactly same position as before.

The rings should be soaked with kerosene oil (for this is found best) and loosened up and grooves cleaned. The rings can be removed by taking three strips of tin one-half inch wide and six inches long, slip one strip under each end of a ring, then take the third strip and slip it under the middle of the ring; the rings may now be slipped out of the way of the groove and both cleaned, and the rings replaced.

Setting Governor Gear and Electric Igniter.

The approximate setting of the gear can most readily be secured by setting engine with crank straight up. Then place the governor gear so that the cam also stands in a vertical position and mesh the gear and pinion. A more accurate setting can be obtained by taking note of the following points: The crankshaft of the engine and the gear cam should be in such positions relative to each other that when the crank AB on Fig. 1 of the accompanying Chart 267ND is in the position as shown on the cut, the cam will just begin to open the exhaust valve. The cam should close the exhaust valve when the crank is just above the dead center on the in-stroke, or in about the position as shown on Fig. 2 of the chart. The clearance between the ends of the exhaust rod and exhaust valve should be about $\frac{1}{32}$".

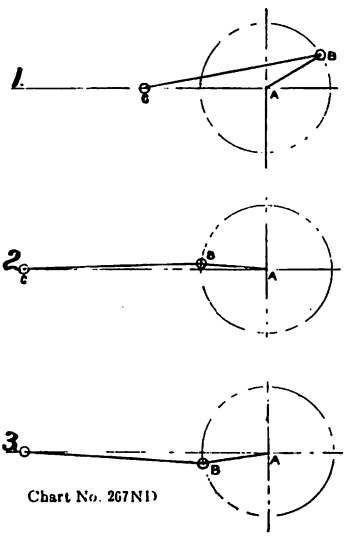
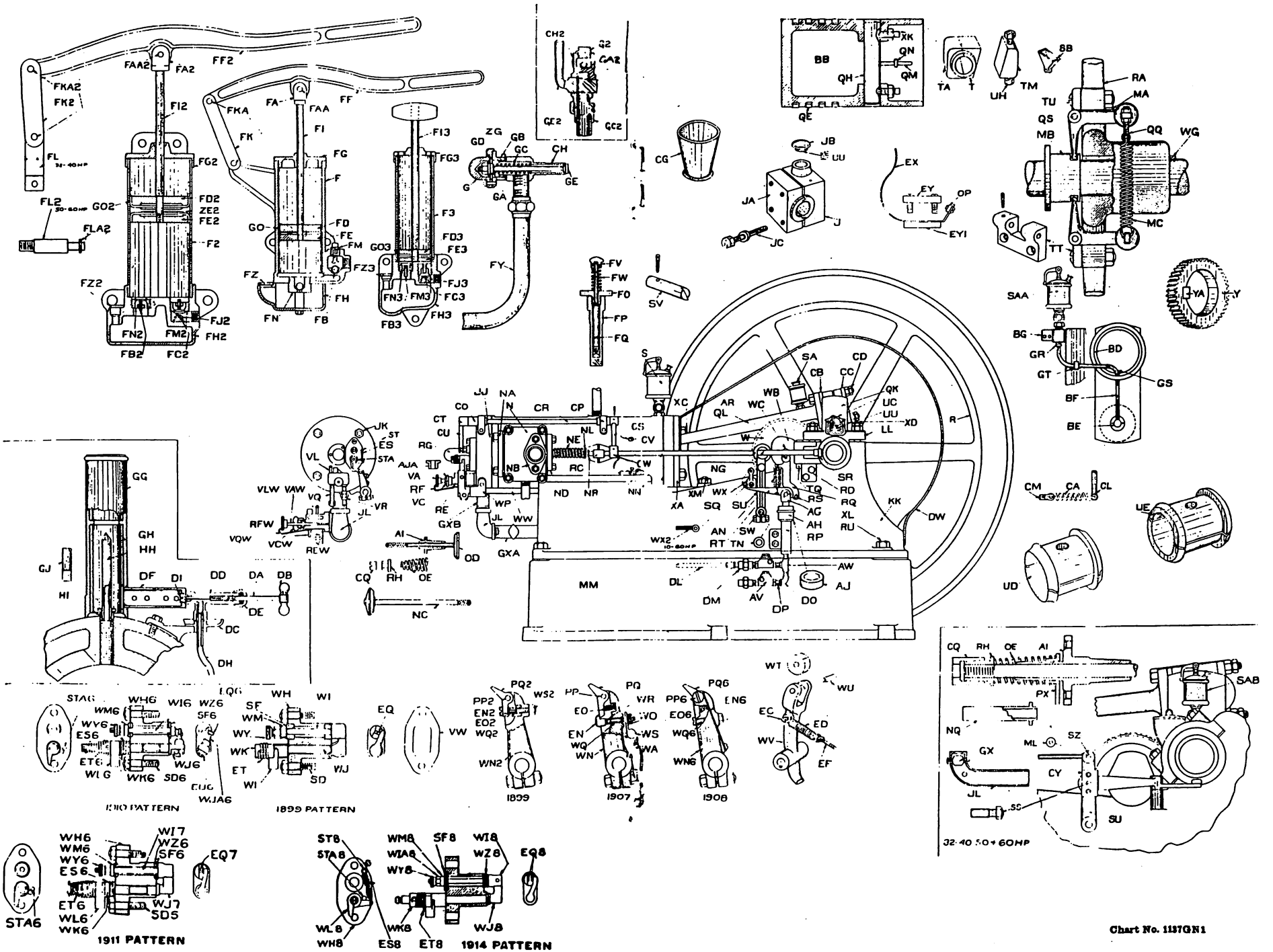


Chart No. 267ND

In setting the electric igniter, the igniter pawl PQG (Chart 1380GN, page 14) on the rocker arm WNG at the cylinder head should begin to press against the catch WLG carried on the movable electrode of the igniter when the crank is straight down. This is the position at which the points of the electric igniter should be brought into contact. The igniter should "snap" or spark when the crank is below the dead center coming up and in about the position shown on Fig. 3 of the chart.



Parts List for Fairbanks-Morse Type "N" Horizontal Gasoline Engines with Hit and Miss Governor

REPAIR LIST

For Fairbanks-Morse Type "N" Horizontal Gasoline Engines

When ordering parts for repairs, give the description as given in this list by both letters and names of parts wanted; also the style, number, which is stamped on top of the cylinder and cylinder head, and horse power of the engine for which the parts are wanted. Too much care cannot be taken in giving these particulars.

The symbol at the head of each paragraph covers all items mentioned in that paragraph.

Before ordering a complete group of parts by the symbol in heavy type at head of paragraph, carefully check over such paragraph to make sure that all parts included therein are wanted, as they will all be furnished unless otherwise specified.

MM-C Lower Base (20 to 40 H. P.)

MM Lower Base fitted with XL and XM Studs.

LL-C Pillow Block Cap.

LL Pillow Block Cap, fitted with Oil Tube (Governor side).
UC Pillow Block Cap Oil Cover.
Pillow Block Cap Oil Cover Rivet (5 to 40 H. P.).
UU Pillow Block Cap Oil Cover Spring (5 to 40 H. P.).
Pillow Block Cap Oil Cover Spring Screw (5 to 40 H. P.).

KK-C Engine Crank Base.

Crank Base, always fitted with following parts:
XD Crank Base to LL Cap Studs. Nuts for XD Studs. Half Nuts for XD Studs.
XB Crank Base to X Cylinder Studs.
SW Exhaust Rocker Arm Pin.
Exhaust Rocker Arm Pin Nut (32 to 60 H. P.).
TN Exhaust Rocker Arm Pin Collar.
KK Exhaust Rocker Arm Pin Collar Taper Pin (all sizes except 32 and 40 H. P.).
Exhaust Rocker Arm Pin Collar Dowel (32 and 40 H. P.).
Exhaust Rocker Arm Pin Collar Machine Screw (32 and 40 HP).
LL-C Pillow Block Caps with UC Covers, etc.
Oil Drain Pipe in Base (10, 12, 15, 50 and 60 H. P.).
UD Main Bearing Brasses (opposite Governor Side).
UE Main Bearing Brasses (Governor Side).

BB-C Piston.

BB Piston fitted with XK Piston Pin Set Screws and Nuts, Piston Ring Stop Pins, QM Oil Tube and QN Eyebolt.
QE Piston Rings.
QH Piston Pin.

XC-C Engine Cylinder.

X Engine Cylinder fitted with JK Cylinder Head Studs, XC Cylinder Ring Studs (5 to 10 H. P.) and Exh. Shell Studs (5 to 25 H. P. only).
Nuts for XC Cylinder Ring Studs (5 to 10 H. P.).
XA Ring at Open end of Cylinder (5 to 25 H. P.)
Cylinder Ring Gasket.
Cap Screws for Cylinder Ring (12 to 25 H. P.).
BB-C Piston, complete with QE Rings, QH Pin, etc.

XAA-C Evaporator Cylinder (5 to 25 H. P.

XAA Evaporator Cylinder fitted with Splash Cover, Cylinder Oil Piping, JK Cylinder Head Studs, XC Cylinder Ring Studs (5 to 10 H. P.) and Exh. Shell Studs.
Nuts for XC Cylinder Ring Studs (5 to 10 H. P.).
XA Ring at Open end of Cylinder.
Cylinder Ring Gasket.
Cap Screws for Cylinder Ring (12 to 25 H. P.).
BB-C Piston complete with QE Rings, QH Pin, etc.

QL-C Connecting Rod.

QL Connecting Rod.
CB, CC Connecting Rod Crank Brass and Cap.
CD Connecting Rod Bolts and Nuts, Half Nuts and Cotters (two).
T, TA Connecting Rod Piston Pin Brasses (Wedge Half and Back Half).
TM Piston Pin Brass Wedge.
UH Piston Pin Brass Wedge Bolt.
Piston Pin Brass Wedge Bolt Nut.
SB Connecting Rod Oiler.

QLC-C Connecting Rod, with Crank Brasses (only).

QL Connecting Rod.
CB, CC Connecting Rod Crank Brass and Cap.
CD Connecting Rod Bolts with Nuts, Half Nuts and Cotters (two).

QLT-C Connecting Rod, with Piston Pin Brasses (only).

QL Connecting Rod.
T, TA Connecting Rod Piston Pin Brasses (Wedge Half and Back Half).
TM Connecting Rod Piston Pin Brass Wedge.
UH Connecting Rod Piston Pin Brass Wedge Bolt.
Connecting Rod Piston Pin Brass Wedge Bolt Nut.

QK-C Crankshaft (for Engines without Oil Rings).

QK Crankshaft fitted with Y Pinion and YA Key.

QKB-C Crankshaft, with Oil Ring.

QK-C Crankshaft, fitted with Y Pinion and YA Key.
BF-C Oil Ring as attached to Crankshaft.

BF-C Oil Ring as attached to Crankshaft.

BD Oil Ring on Crankshaft.
Oil Ring to Crankshaft Machine Screws.
BF Oil Ring Brass Tube from BD to BE.
BE Oil Ring Flange for BF Tube.
Oil Ring Flange to Crankshaft Machine Screws.

BD-C Ring Oiler Parts.

BG Oiler Bracket on Engine Base.
Oiler Bracket to Engine Cap Screws.
GS, GR Brass Oil Tube with Bushing in BG Bracket.
GT Oil Tube Eye-Screw in base.
BF-C Oil Ring as attached to Crankshaft.

TT-C Governor Bracket (One).

TT Governor Bracket.
TU Governor Bracket to RA Fly Wheel Bolts (5 to 15 H. P.).
Governor Bracket to RA Fly Wheel Cap Screws (20 to 60 H. P.).
Nuts for TU Bolts (5 to 15 H. P.).
MA Governor Weight.
QS Governor Weight Pin in TT Bracket.
Governor Weight Pin Taper Pin.

MA-C Governor Parts.

TT-C Governor Brackets with TU Bolts, MA Weights and QS Pins (two of each).
MC Governor Springs (two).
QQ Governor Spring Eyebolts (two).
Nuts for Governor Spring Eyebolts (four).
MB Governor Sleeve.
R **Plain Fly Wheel (opposite Governor Side with WG Keys.**
RA **Governor Fly Wheel with Keys.**

RA-C Governor Fly Wheel with Governor Parts.

RA Governor Fly Wheel.
TT-C Governor Brackets with TU Bolts, MA Weights and QS Pins (two of each).
MC Governor Springs (two).
QQ Governor Spring Eyebolts (two).
Nuts for QQ Eyebolts (four).

QKR-C Crankshaft, fitted with Fly Wheels and Governor Parts.

QK-C Crankshaft fitted with Y Pinion and YA Key (for Engines without Oil Rings).
QKB-C Crankshaft fitted with Y Pinion and YA Key, and with Oil Ring attached.
RA-C Governor Fly Wheel with Governor Parts.
MB Governor Sleeve on Crankshaft.
R Plain Fly Wheel (opposite Governor Side).
WG Fly Wheel Keys.

WH-C Igniter as attached to Head (1899 Pattern).

WH Igniter Body always fitted with STA Stop Pin and ST Catch Spring Pin.
WI Fixed Electrode fitted with EQ Point.
WIA Fixed Electrode Nut.
SF Fixed Electrode Lava Insulation.
Fixed Electrode Asbestos Gaskets.
WM Fixed Electrode Collar.
WY Fixed Electrode Thumb Nut.
WJ Movable Electrode fitted with WK Collar, Taper Pin and EQ Point.
WL Movable Electrode Catch.
ES Movable Electrode Catch Spring
ET Movable Electrode Spring.

WH6-C Igniter as attached to Head (1910 Pattern).

WH6 Igniter Body with STA6 Stop Pin.
WI6 Fixed Electrode, fitted with EQ6 Contact Disc.
WIA6 Fixed Electrode Nut.
SF6 Fixed Electrode Large Mica Insulation.
WZ6 Fixed Electrode Small Mica Insulation.
WM6 Fixed Electrode Collar.
WY6 Fixed Electrode Thumb Nut.
WJ6 Movable Electrode fitted with WK6 Collar and Taper Pin.
WJA6 Movable Electrode Arm fitted with EQ6 Contact Disc and EU6 Nut.
WL6 Movable Electrode Catch.
ET6 Movable Electrode Catch Spring
Movable Electrode Catch Spring Pin.
ES6 Movable Electrode Return Spring.

WH7-C Igniter as attached to Head (1911 Pattern).

WH6 Igniter Body with STA6 Stop Pin.
WI7 Fixed Electrode fitted with EQ7 Contact Point.
WIA6 Fixed Electrode Nut.
SF6 Fixed Electrode Large Mica Insulation.
WZ6 Fixed Electrode Small Mica Insulation.
WM6 Fixed Electrode Collar.
WY6 Fixed Electrode Thumb Nut
WJ7 Movable Electrode fitted with EQ7 Contact Point, WK6 Collar and Taper Pin.
WL6 Movable Electrode Catch.
ET6 Movable Electrode Catch Spring
Movable Electrode Catch Spring Pin.
ES6 Movable Electrode Return Spring.

WH8-C Igniter as attached to Head (1914 Pattern)

WH8 Igniter body always fitted with: ST8 Movable Electrode Stop Pin, ST8 Movable Electrode Pawl Return Spring Pin, Igniter Contract Screw.
WI8 Igniter Fixed Electrode always fitted with EQ8 Fixed Electrode Contact Point.
WIA8 Igniter Fixed Electrode Nut.
SF8 Igniter Fixed Electrode Large Mica Insulation.
WZ8 Igniter Fixed Electrode Small Mica Insulation.
WM8 Igniter Fixed Electrode Collar.
WY8 Igniter Fixed Electrode Thumb Nut.
WJ8 Igniter Movable Electrode always fitted with: WK8 Igniter Movable Electrode Collar, Igniter Movable Electrode Collar Taper Pin, EQ8 Igniter Movable Electrode Contact Point, Igniter Movable Electrode Contact Screw.
WL8 Igniter Movable Electrode Pawl.
ES8 Igniter Movable Electrode Pawl Return Spring.
ET8 Igniter Movable Electrode Collar Spring
WJB Igniter Duplex Connector. Igniter Duplex Connector Lock Washer.

OD-C Suction Valve.

OD Suction Valve.
RH Suction Valve Collar Nut.
CQ Suction Valve Lock Nut. Suction Valve Lock Nut Cotter.

JJ-C Cylinder Head.

JJ Cylinder Head fitted with SD6 Igniter Studs and Studs for N Exhaust Shell on 32 to 60 H. P. Nuts for SD6 Igniter Studs.
WH8-C Igniter as attached to Head.
VW Igniter to Cylinder Head Gasket
OD-C Suction Valve with RH and CQ Nuts and Cotter.
OE Suction Valve Spring.
RG Suction Valve Cap. Suction Valve Cap to JJ Head Machine Screws.
AI Suction Valve Stem Bushing. Suction Valve Stem Bushing to JJ Head Screws.
PX Suction Valve Spring Adjusting Nut (32 to 60 H. P.).

JJO-C Cylinder Head, with Suction Valve (only).

JJ Cylinder Head fitted with SD6 Igniter Studs and Studs for N Exhaust Shell on 32 to 60 H. P.
OD-C Suction Valve with RH and CQ Nuts and Cotter.
OE Suction Valve Spring.
RG Suction Valve Cap. Suction Valve Cap to JJ Head Machine Screws.
AI Suction Valve Stem Bushing. Suction Valve Stem Bushing to JJ Head Screws.
PX Suction Valve Spring Adjusting Nut (32 to 60 H. P.).

JJW-C Cylinder Head, with Igniter (only).

JJ Cylinder Head fitted with SD6 Igniter Studs and Studs for N Exhaust Shell on 32 to 60 H. P. Nuts for SD6 Igniter Studs.
WH8-C Igniter as attached to Head.
VW Igniter to Cylinder Head Gasket

WN6-C Igniter Rocker Arm at Head (1908 Pattern).

WN6 Igniter Rocker Arm. Igniter Rocker Arm Cap Screw. Igniter Rocker Arm Cap Screw Nut.
PQ6 Igniter Rocker Arm Pawl.
PP6 Igniter Rocker Arm Pawl Pin.
WQ6 Igniter Rocker Arm Pawl Bolt. Igniter Rocker Arm Pawl Bolt Nut.
EN6 Igniter Rocker Arm Pawl Pin Stop. Igniter Rocker Arm Pawl Pin Stop Machine Screws.
EO6 Igniter Rocker Arm Pawl Spring

WN-C Igniter Rocker Arm at Head (1907 Pattern).

WN Igniter Rocker Arm. Igniter Rocker Arm Cap Screw. Igniter Rocker Arm Cap Screw Nut.
PQ Igniter Rocker Arm Pawl.
PP Igniter Rocker Arm Pawl Pin. Igniter Rocker Arm Pawl Pin Nut.
WQ Igniter Rocker Arm Pawl Bolt.
WO Igniter Rocker Arm Pawl Bolt Nut.
WS Igniter Rocker Arm Pawl Bolt Lever.
WA Igniter Rocker Arm Pawl Bolt Lever Stop Pin.
EN Igniter Rocker Arm Pawl Bolt Head.
WR Igniter Rocker Arm Pawl Bolt Spring.
EO Igniter Rocker Arm Pawl Spring

WN2-C Igniter Rocker Arm at Head (1899 Pattern).

WN2 Igniter Rocker Arm. Igniter Rocker Arm Cap Screw. Igniter Rocker Arm Cap Screw Nut.
PQ2 Igniter Rocker Arm Pawl.
PP2 Igniter Rocker Arm Pawl Pin. Igniter Rocker Arm Pawl Pin Nut.
WQ2 Igniter Rocker Arm Pawl Bolt.
WS2 Igniter Rocker Arm Pawl Bolt Nut.
EO2 Igniter Rocker Arm Pawl Bolt Spring.
EN2 Igniter Rocker Arm Pawl Bolt Spring Washer.

WV-C Igniter Rocker Arm at Gear.

WV Igniter Rocker Arm fitted with EC Spring Stud.
WT Igniter Rocker Arm Roller working against Gear.
WU Igniter Rocker Arm Roller Pin. Igniter Rocker Arm Roller Pin Nut.

WVW-C Igniter Arm at Gear on WW Shaft.

WV-C Igniter Rocker Arm with EC stud, WT Roller, WU Pin and Nut.
WW Igniter Rocker Shaft. Igniter Rocker Arm to Shaft Key.

WW-C Igniter Rocker Shaft Mechanism.

WV-C Igniter Rocker Arm with EC Stud, WT Roller, WU Pin and Nut.
WW Igniter Rocker Shaft. Igniter Rocker Arm to Shaft Key.
ED Igniter Rocker Arm Spring.
WP Igniter Rocker Shaft Bracket. Igniter Rocker Shaft Bracket to JJ Head Cap Screws.

WX-C Igniter Rocker Arm Spring Bracket.

WX Bracket on Engine Base for ED Spring (5 and 8 H. P.).
WX2 Eyebolt on Engine Base for ED Spring (10 to 60 H. P.). Cap Screw for WX Bracket (5 and 8 H. P.). Nut for WX2 Eyebolt (10 to 60 H. P.).
EF Eyebolt in WX or WX2 for ED Spring. Nuts for EF Eyebolt.

WC-C Gear, Shaft and Cam.

W Gear.
WC Cam and Gear Shaft fitted with WB Cam.
AR Fuel Pump Wrist Pin with Cotter.

EX-C Circuit Breaker.

EX Contact Arm fitted with EY1 Bottom Insulation Block and Brass Contact Screw.
EY Insulation Block (Top Half).
OP Thumb Nut on Brass Contact Screw. Machine Screws for attaching to Engine.

CU-C Valve Lock Mechanism.

CR Valve Lock Shaft fitted with CT Collar Hub, Taper Pin and CU Spring Blade.
CS Valve Lock Operating Arm fitted with Pin for CV Roller and Taper Pin.
CV Valve Lock Roller.
CW Valve Lock Block for NN Exhaust Rod, fitted with Taper Pin and Brass Contact Screw.
CO Valve Lock Shaft Bracket on Cylinder Head.
CP Valve Lock Shaft Bracket on Cylinder. Cap Screws for CO and CP Brackets.

NC-C Exhaust Valve.

NC Exhaust Valve.
NL Collar on Exhaust Valve for NE Spring.
NR Exhaust Valve Nut. Exhaust Valve Cotter (5 to 40 H. P.). Exhaust Valve Taper Pin (50 and 60 H. P.).

NA-C Exhaust Shell (5 to 25 H.P.)

N Exhaust Shell fitted with Studs for NB Flange. Nuts for NB Flange Studs.
NA Exhaust Shell Cap. Exhaust Shell Cap Asbestos Gasket. Exhaust Shell Cap to Exhaust Shell Cap Screws.
NB Exhaust Shell Pipe Flange. Exhaust Shell Pipe Flange Asbestos Gasket.
ND Exhaust Shell Valve Guide. Exhaust Shell Valve Guide to Exhaust Shell Cap Screws.
NC-C Exhaust Valve fitted with NL Collar, NR Nut and Cotter.
NE Exhaust Valve Spring.

NAD-C Exhaust Shell, Fitted with Valve Guide (5 to 25 H. P.).

N Exhaust Shell fitted with Studs for NB Flange.
ND Exhaust Shell Valve Guide. Exhaust Shell Valve Guide to Exhaust Shell Cap Screws.

NA-C Exhaust Shell (32 to 60 H. P.).

N Exhaust Shell fitted with NQ Valve Guide Bushing, Studs for NB Flange and Pipe Plugs. Nuts for NB Flange Studs (32, 40 and 60 H. P.). Machine Bolts for attaching NB Flange to Exhaust Shell (50 H. P. only).
NA Exhaust Shell Cap. Exhaust Shell Cap Asbestos Gasket. Exhaust Shell Cap to Exhaust Shell Cap Screws.
NB Exhaust Shell Pipe Flange. Exhaust Shell Pipe Flange Asbestos Gasket.
NC-C Exhaust Valve fitted with NL Collar, NR Nut and Cotter or Taper Pin.
NE Exhaust Valve Spring.

SU-C Exhaust Rocker Arm (5 to 40 H. P.).

SU Exhaust Rocker Arm.
SV Exhaust Rocker Arm Catch Pin. Exhaust Rocker Arm Catch Pin Taper Pin.
NG Exhaust Rocker Arm Roller on SV Pin.

SU-C Exhaust Rocker Arm (50 and 60 H. P.).

SU Exhaust Rocker Arm fitted with Studs for CY Catch Plate. Nuts for CY Catch Plate Studs.
SZ Pin through SU Arm and NN Rod.
ML Collar for SZ Pin. Taper Pin through ML Collar.
SS Pin in SU Arm for NG Roller. Nut for SS Pin.
NG Exhaust Rocker Arm Roller on SS Pin.
CY Detent Catch Plate on SU Arm.

SW-C Exhaust Rocker Arm Pin in KK Base.

SW Exhaust Rocker Arm Pin.
Exhaust Rocker Arm Pin Nut (32 to 60 H. P.).
TN Exhaust Rocker Arm Pin Collar.
Exhaust Rocker Arm Pin Collar Taper Pin (all sizes except 32 and 40 H. P.).
Exhaust Rocker Arm Pin Collar Dowel (32 and 40 H. P.).
Exhaust Rocker Arm Pin Collar Mach. Screw (32 and 40 HP).

NN-C Exhaust Rod.

NN Exhaust Rod.
RC Exhaust Rod Guide.
Exhaust Rod Guide to X Cylinder Cap Screws.

JA-C Gear Box.

J, JA Gear Box and Cap fitted with Oil Tube.
JC Gear Box to KK Base Collar Studs.
Nuts for JC Collar Studs.
Half Nuts for JC Collar Studs
JB Gear Box Oil Cup Cover.
Gear Box Oil Cup Cover Rivet (10 to 40 H. P.).
UU Gear Box Oil Cup Cover Spring (10 to 40 H. P.).
Gear Box Oil Cup Cover Spring Screw (10 to 40 H. P.).

RP-C Fuel Pump.

RP Fuel Pump Body.
Fuel Pump Body to Engine Cap Screws.
AH Fuel Pump Packing Nut.
AJ Fuel Pump Follower in AH Nut
AG Fuel Pump Plunger.
RS Fuel Pump Handle Pin and Cotters.
RQ-C Fuel Pump Link with RT Handle, RU Pin and Cotters and AN Spring.

RQ-C Fuel Pump Link.

RQ Fuel Pump Link.
RT Fuel Pump Lever Handle.
RU Fuel Pump Link Pin and Cotters
AN Fuel Pump Spring.

AV-C Fuel Pump to Reservoir Connections.

AV Swing Check Valves.
AW Malleable Iron Tee (32 to 60 HP).
DP Brass Nipples.
DM Brass Unions.
DO Malleable Iron Elbow (5 to 25 H. P.).
DL Pipe and Fittings from Union on Fuel Pump Discharge to Union on Reservoir Suction Pipe.

RE-C Fuel Reservoir.

RE Fuel Reservoir Body fitted with Brass Tube Nozzle.
Fuel Reservoir Body to JJ Head Cap Screws.
VC Fuel Reservoir Packing Nut.
AJA Fuel Reservoir Packing Gland.
VA Fuel Reservoir Throttle Valve Stem with VD Dial Handle.
RF Fuel Reservoir Throttle Valve Pointer.
Fuel Reservoir Throttle Valve Pointer Machine Screw.
VL Fuel Reservoir Vent Pipe.
ZJ Fuel Reservoir Drain Plug.
VQ Suction Pipe and Union, as attached to Reservoir.
VR Overflow Pipe and Union, as attached to Reservoir.

JL-C Air Suction Pipe (5 to 25 H.P.).

JL Air Suction Elbow.
GXA Air Suction Nipple fitted with Damper.
GXB Air Suction Nipple (Plain).

JL-C Air Suction Pipe (32 to 60 H.P.).

JL Cast Iron Air Suction Elbow.
GX Air Suction Damper in JL Elbow

REW-C Water Reservoir (20 to 60 H.P.).

REW Water Reservoir Body fitted with Brass Tube Nozzle.
Water Reservoir Body to JL Suction Elbow Cap Screws.
VCW Water Reservoir Packing Nut.
VAW Water Reservoir Throttle Valve Stem with VDW Dial Handle
RFW Water Reservoir Throttle Valve Pointer.
Water Reservoir Throttle Valve Pointer Machine Screw.
VLW Water Reservoir Vent Pipe.
ZJW Water Reservoir Drain Plug.
Water Reservoir Brass Bushing ½" x ¼".
Water Reservoir Brass Bushing ¾" x ½".
VQW Water Reservoir Pipe and Fittings.

SQ-C Governor Detent.

SQ Governor Detent Catch fitted with QF Roller Pin and CL Eye Screw.
SR Governor Detent Roller on QF Pin.
RD Bracket with CM Eye Screw (5 to 40 H. P.).
CM Eye Screw in KK Base for CA Detent Spring on 50 and 60 HP (Detent Bracket Cast on KK Base).
Flat Head Screw for attaching RD to KK (5 to 40 H. P.).
Hex. Head Cap Screws for attaching RD to KK (5 to 40 H. P.).
TQ Pin in RD Bracket for SQ Detent Catch.
Cotter for TQ Pin (5 to 40 H.P.).
Nut for TQ Pin (50 and 60 H.P.).
CA Governor Detent Catch Spring.

FH3-C Brass Barrel Starter Pump (5 and 8 H. P.).

F3 Starter Pump Cylinder.
FH3 Starter Pump Base.
FG3 Starter Pump Cap.
Starter Pump Cap to Cylinder RHM Screws.
FZ3 Starter Pump Filling Hole Cover
Starter Pump Filling Hole Cover Machine Screw.
FE3 Starter Pump Piston (Lower Half).
FD3 Starter Pump Piston (Upper Half).
GO3 Starter Pump Piston Leathers.
FI3 Starter Pump Piston Rod and Handle.
FB3 Starter Pump Admission Valve.
FN3 Starter Pump Admission Valve Seat.
FC3 Starter Pump Discharge Valve.
FM3 Starter Pump Discharge Valve Seat.
FJ3 Starter Pump Discharge Valve Spring.
Starter Pump to Engine Cap Screws.

FG-C Cast Iron Starter Pump with Lever Handle (10 to 25 H. P.).

F Starter Pump Barrel.
FH Starter Pump Base.
Starter Pump Base to Pump Barrel Cap Screws.
FG Starter Pump Cap.
Starter Pump Cap to Pump Barrel Machine Screws.
FZ Starter Pump Filling Hole Cover
Starter Pump Filling Hole Cover Machine Screws.
FE Starter Pump Piston (Lower Half).
FD Starter Pump Piston (Upper Half).
GO Starter Pump Piston Leathers.
FI Starter Pump Piston Rod.
FA Starter Pump Piston Rod End.
FAA Starter Pump Piston Rod End Pin and Cotters.
FF Starter Pump Lever Handle.
FK Starter Pump Link.
FKA Starter Pump Link Pin and Cotters.
FB Starter Pump Suction and Discharge Ball Valves.
FN Starter Pump Suction Valve Seat
FM Starter Pump ¾" Pipe Plug fitted with Machine Screw to hold Discharge Valve in place.
Cap Screws for attaching Starter Pump to Engine.

FH-C Brass Barrel Starter Pump with Lever Handle (32 to 60 H. P.).

F2 Starter Pump Barrel.
FH2 Starter Pump Base.
Starter Pump Base to Engi Cap Screws.
FG2 Starter Pump Cap.
Starter Pump Cap to Engine Cap Screws.
FZ2 Starter Pump Filling Hole Cover
Starter Pump Filling Hole Cover Machine Screw.
FD2 Starter Pump Piston (Top Section).
ZE2 Starter Pump Piston (Middle Section).
FE2 Starter Pump Piston (Bottom Section).
GO2 Starter Pump Piston Leathers.
FI2 Starter Pump Piston Rod.
FA2 Starter Pump Piston Rod End.
FF2 Starter Pump Lever Handle.
FAA2 Starter Pump Lever Handle Pin and Cotters.
FK2 Starter Pump Lever Handle Link.
FKA2 Starter Pump Lever Handle Link Pin and Cotters.
FL Starter Pump Lever Handle Link Bracket (32 and 40 H.P.).
FL2 Starter Pump Lever Handle Link Stud (50 and 60 H. P.).
Starter Pump Lever Handle Link Bracket Cap Screws (32 and 40 H. P.).
FLA2 Starter Pump Lever Handle Link Stud Collar (50 and 60 H. P.).
Starter Pump Lever Handle Link Stud Cotter (50 and 60 H. P.).
FM2 Starter Pump Discharge Valve Seat.
FC2 Starter Pump Discharge Valve.
FJ2 Starter Pump Discharge Valve Spring.
FB2 Starter Pump Admission Valve.
FN2 Starter Pump Admission Valve Seat.

FY Pipe and Fittings to Connect Starter Pump with Engine.

CH-C Combination Valve.

(Relief Valve for 5 and 8 H. P.)
(Check Valve for 10 to 60 H. P.)
GE Combination Valve
Combination Valve Nut.
Combination Valve Nut Taper Pin.
CH Combination Valve Body.
G Combination Valve Body Cap.
GB Combination Valve Sleeve.
Combination Valve Sleeve to Valve Body Cap Machine Screws.
GA Combination Valve Stem Nut.
GD Combination Valve Galvanized Steel Washers.
ZG Combination Valve Red Fibre Washer (10 to 60 H. P.).
Combination Valve Rubber Gasket.
GBV Combination Valve Spring (10 to 60 H. P.).

CH2-C Brass Combination Cock (Old Style).

CH2 Brass Combination Cock Body.
G2 Brass Combination Cock Plug.
GA2 Brass Combination Cock Ball Valve.
GB2 Brass Combination Cock Half Union Nut.
GC2 Brass Combination Cock Half Union Coupling.
GE2 Brass Combination Cock Lever Handle.
GD2 Brass Combination Cock Lever Handle Washer.
GN2 Brass Combination Cock Lever Handle Nut.
CJ2 Brass Combination Cock Nipple (Cock to Engine).

FQ-C Detonator.

D	Detonator Tube.
P	Detonator Plunger.
PV	Detonator Plunger Cap.
PW	Detonator Plunger Spring.
FO	Detonator Screw Cap.

TC-C Exhaust Pot.

TC	Exhaust Pot with Pipe Plug.
TD	Exhaust Pot Cover fitted with Studs for TX Gland; also includes Studs for NB Flange on 32 to 60 H. P.
	Nuts for TX Gland Studs.
	Nuts for NB Flange Studs (32 to 60 H. P.).
	Cap Screws for attaching NB Flange (5 to 25 H. P.).
	Exhaust Pot to Cover Mach. Bolts and Washers.
	Exhaust Pot to Cover Asbestos Gasket.
TX	Exhaust Pot Gland.
	Exhaust Pot Gland Asbestos Wick Packing.
NB	Exhaust Pot Pipe Flange.
	Exhaust Pot Pipe Flange Asbestos Gasket.

DD-C Bunsen Burner.

DA	Needle Valve Stem with DH Handle.
DD	Burner Body.
DE	Burner Packing Nut
DI	Burner Nozzle.
DF	Burner Perforated Air Sleeve.

GG-C Bunsen Burner Outfit with Pipe and Fittings.

DD-C	Bunsen Burner.
DC	Burner Bracket and Pan.
	Mach. Screw to hold DH Wick Pipe in DC Bracket.
	Burner Bracket to Cylinder Cap Screw.
GG	Burner Chimney.
GJ	Burner Chimney to Cylinder Studs.
GH	Burner Chimney Asbestos Lining
DH	Burner Wick Pipe.
	Burner Wick Pipe Candle Wicking
HH	Burner Tubes (Six).
HI	Brass Bushings for HH Tubes (Three).
TF	Burner Fuel Tank.
	Burner Fuel Tank Piping (not including wick pipe).

DW-C Oil Shield.

DW	Oil Shield.
	Cap Screws, for attaching Oil Shield to Engine.
	Additional Mach. Screws for attaching Oil Shield to Engine (32 to 60 H. P.).

SP-C Engine Pulley (5 to 40 H. P. only).

SP	Engine Pulley, fitted with Key and Set Screws.

HP-C Engine Power Plate.

HP	Power Plate.
	Power Plate to Engine Mach. Screws.

NP-C Engine Patent Plate.

NP	Patent Plate.
	Patent Plate to Engine brass Mach. Screws.
NPW	Patent Plate Mach. Screw Rubber Washers.

503-C Lubricating Oil Reservoir (32 to 60 H. P.).

503	Lubricating Oil Reservoir.
508	Lubricating Oil Reservoir Thumb Pipe Plug.
509	Lubricating Oil Reservoir Gauge Glass.
	Cork Washers for Gauge Glass.
510	Lubricating Oil Reservoir Gauge Glass Screw Cap.
505	Lubricating Oil Reservoir Strainer.
506	Lubricating Oil Reservoir Cover.
507	Lubricating Oil Reservoir Cover Handle with Washer and Cap Screw.

CG-C Water Overflow Pipe and Funnel.

CG	Water Overflow Pipe Funnel.
	Water Overflow Pipe and Fittings.
S	Cylinder Oiler.
SA	Crank Pin Oiler (for engines without oil rings).
SAA	Crank Pin Oiler (for engines with oil rings).
SAB	Main Bearing Oiler (32 to 60 H. P.).

Complete Set of Springs for Engine.

XE	Spring for Exhaust Valve.
OE	Spring for Suction Valve.
MC	Springs for Governor Weights (Two).
CA	Spring for Governor Detent Catch.
ED	Spring for Igniter Rocker Arm at Gear.
EO	Spring for Pawl on Igniter Rocker Arm at Head.
ES8	Spring for Igniter Movable Electrode Return.
ET8	Spring for Igniter Movable Electrode Catch.
AN	Spring for Fuel Pump Handle.
GC	Spring for Check Valve (10 to 60 H. P.).
FJ3	Spring for Starter Pump Discharge Valve (5 and 8 H. P.).
FJ2	Spring for Starter Pump Discharge Valve (32 to 60 H. P.).
FW	Spring for Detonator Plunger (10 to 60 H. P.).
UU	Spring for Main Bearing Oil Cup Covers (Two), 5 to 40 H. P.).
UU	Spring for Gear Box Oil Cup Cover (10 to 40 H. P.).

Complete Set of Gaskets for Engine.

	Cylinder Head Gasket.
	Cylinder Ring Gasket (5 to 25 H. P.).
VW	Igniter Gasket.
NWA	Exhaust Shell Gasket.
	Exhaust Shell Cap Gasket.
	Exhaust Flange Gasket.
	Exhaust Pot Cover Gasket.
	Exhaust Pot Pipe Flange Gasket.
GBV	Combination Valve Rubber Gasket.
BEA	Oil Tube Flange to Crank Shaft Paper Gasket.

Lubricating Oil.

Never start engine without having first oiled the piston and all parts well with hand oil-can, and see that there is plenty of oil in the cups located on cylinder, and on the base for the ring oiler and journal of the large gear.

With these conditions the engine is sure to work easily.

Mineral Oil

The oil used for lubricating the piston must be strictly MINERAL OIL (we recommend Hytest Oil), free from vegetable or animal matter, of a high fire test, and fluid enough to be fed by the oiler. Steam engine cylinder oil is too thick. To start cylinder oiler, adjust the small nut on top of oiler so that when the lever is raised you get about six drops per minute on small engines, and more for larger ones; close when engine is not running; open oil cup before engine is started to allow oil to reach the parts.

Directions for Taking Apart.

Ciphers on Gears

If it becomes necessary to take engine apart, the fly wheel and crank should be removed together, removing caps on pillow-blocks and upper brasses and disconnecting the connecting rod from crankshaft. Also loosen the large gear to prevent breaking the teeth in lifting out shaft. In replacing the crankshaft on which is the small gear, be careful to have the three gear teeth marked with ciphers on their face come together, or engine will not be timed right. See that gear teeth do not bind. Also be careful not to screw caps of bearing down so tight that the parts will heat while the engine is running, and do not put the brasses and caps on wrong. The packing of paper between brasses should be carefully taken off and replaced in putting engine together.

Wick Pillow Blocks

Always see that the wicks in the pillow-blocks are pushed down through the tubes so that they come in contact with the crankshaft, which they supply with oil by capillary attraction. A piece of wire with flat end is suitable for this.

Note the following conditions required to assure perfect working of engine:

Pump.

Fuel Pump

See that the fuel pump on engine works perfectly, and that lubricating oil is always kept in cup on top of pump. Each time before starting, operate fuel pump by hand until fuel flows into reservoir and back to tank; this is evidence that check valves and piping are all right. If the pump delivers fuel too freely to reservoir, close slightly the stop-cock on top of fuel tank.

Inlet and Exhaust Valves.

Valves

Be sure that these valves are working properly. In turning the engine by hand if compression is strong, the valves are tight. After the engine has been standing some time it is advisable to insert a wire nail in the small hole drilled in the shield (D) (page 3) and lift the suction valve off the seat to insure its working free.

Gaskets

If necessary to put in any new gaskets be sure to soak the gasket in boiled linseed oil. This will insure a tight joint, whereas if gasket is put in dry, it is almost sure to blow out.

Gears.

Gears

Examine bearings of large gear W occasionally and see to it that caps and box are tight. Also see that gearshaft lines up with crankshaft, that the teeth of the gears do not seat or bind, and that there is no play in the bearings. A loose bearing, a bad line-up or gear-teeth that bind will often cause broken gears.

Combination Valve.

Combination Valve

The combination check valve located where the starter pump pipe enters the cylinder may be unscrewed from the cylinder if it fails to work perfectly and examined and cleaned. If it leaks the valve may be ground tight with emery while it is out of the cylinder. This check valve should be locked shut while engine is running, but released by turning the knurled cap before pumping a charge into the cylinder for starting.

Clean and Oil

Clean and oil detonator; always remove when engine is not in use. Oil piston of starter pump occasionally through holes in top of cap on pump barrel.

Strainers

Connections to reservoir are provided with a fine wire screen located in union close to reservoir to stop any foreign substances from entering reservoir. A wire screen is also attached to end of suction pipe in gasoline tank. These may become clogged and require cleaning.

Instructions for Adjusting, Cleaning and Operating Electric Igniter.

The Igniter.

Action of Igniter

The accompanying cut represents our two-pole electric igniter, which is attached to the cylinder head of the engine by two studs. The casting

WII6 is provided with a thin asbestos gasket, acting as a packing between the igniter and head. The fixed electrode WI7 is held between mica washers placed at each end—a nut clamps this electrode firmly in position. The nut should be kept set tight to prevent the electrode from turning. When the electrode WI7 is in its proper position the point in the end of this electrode and also in the arm of the movable electrode WJ7 will be in line with each other, and as the movable electrode is moved into position by the operating mechanism, the two points are brought together, and as the catch releases outside of the engine, the points inside of the engine also separate, and the spark is formed between the two points referred to. The end movement of the movable electrode should be about $\frac{1}{64}$".

The Circuit

The movable electrode WJ7 is in circuit with the engine; contact is made by means of circuit breaker placed on the engine frame and acted upon by the exhaust rod; the movement of the rod is such that the circuit is completed previous to the closing of igniter points, and is held closed sufficiently long to permit the electrode points to separate and form the spark, when the circuit is again opened by movement of the exhaust rod. The circuit breaker spring EX should be kept clean, and in such position as to form an electrical connection with the engine as above described.

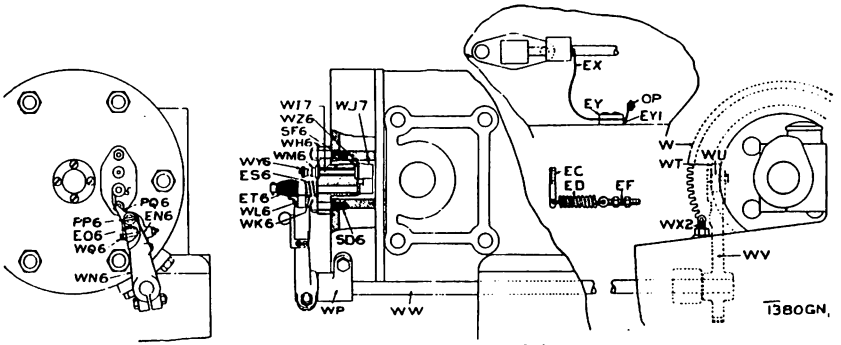


Chart No. 1380GN

The Movement.

The movement of the loose catch on the movable electrode is about one-fourth of an inch, or sufficient to bring the points together inside of the engine and hold them for a short period, permitting the current to start to flow, and then by continued motion of the arm WN6, the igniter pawl PQ6, which is carried in the arm, snaps off, allowing the movable electrode WJ7 to be returned to its normal position by means of the spring ES6. As this movement takes place, and at the instant the points separate, the spark is produced. Motion is given to the rocking arm WN6 by means of a rocker shaft WW, which is actuated by a rocker lever WV, which follows an incline cam on the large gear marked W. This cam is made with the gear, and requires no setting other than the regular setting of the gear. The teeth on the gear are marked with a cipher, giving them correct position. (See page 7, Chart 267ND.)

The Spark

It is easy to determine at what point the ignition takes place by turning the engine slowly in the direction in which it runs and noting the position of the crank at the moment the pawl PQ6 snaps off from the loose catch (WL6) on the movable electrode. Ordinarily the position of the crank will be slightly lower than straight in dead center. (See page 7, Chart 267ND.)

Early and Late Ignition—1908 Pattern.

The time of ignition or the separating of the electrode points, which produces the ignition, can be varied by merely turning the eccentric pin PP6, by means of the flattened handle, with thumb and finger. The turning of this pin, so as to bring the spring EN6 into the notch provided, which brings the letter "E" into most prominent view, has the effect of making the ignition earlier, and when the letter "L" shows, it has the effect of making the ignition later

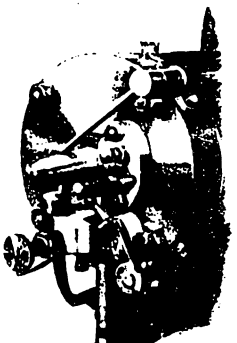


Fig. 1876G—"Early and Late" Igniter Mechanism

Ignition Point

This early and late spark device is used in starting, and when the handle of the pin shows the letter "L," the ignition is so set that it will not spark until the engine is past dead center, and this avoids the possibility of the engine suddenly turning backward, as it might otherwise do, because of an early ignition when being slowly turned forward. Be sure to turn the eccentric pin so as to show the letter "E" for an early spark, as soon as the engine speeds up. If this is forgotten, the ignition will be too late, causing loss of power and a waste of fuel. The time of ignition can be permanently changed by moving the nut on the bolt WQ6.

Early and Late Spark

Testing Electric Circuit.

To test the electric circuit turn the engine to a point slightly before the ignition should occur, leaving the igniter pawl in a position which has closed the electrodes, then loosen the wire from the insulated electrode and by striking same on the binding nut a spark should be produced, thus showing that the current passes through the timer spring EX and through the engine, returning through the insulated electrode; turn the engine in the direction in which it runs until the pawl snaps off, then again strike the wire on the nut, and no sparks should occur, but if the wire is struck on any part of the engine a spark should take place, showing that the current is still passing through the timer spring, which does not separate from the exhaust rod until the engine has turned a considerable distance after the ignitions occur. The switch on the battery box should be closed when testing or when the engine is running, but open at all times when the engine is not running.

Battery Switch

Keep Igniter Clean.

The igniter will require cleaning from time to time; the conditions will vary this period; ordinarily we would say that cleaning would be required each thirty days. In order to remove the igniter for cleaning, loosen the two nuts retaining the igniter casting to the engine cylinder head and withdraw igniter. All carbon or corrosion which would interfere with the proper contact of the electrode points should be removed, and any deposit on the mica or lava washers should be brushed off, and washers separated and thoroughly washed with gasoline. The hole or opening through the cylinder head will require scraping to remove the deposit of carbon at the inner end, thus preventing short circuiting due to carbon.

To Remove Igniter

The Electric Battery and Connections.

Directions for renewing the battery will be found in the box. One binding post of the first cell should be connected with the binding post on spark coil, which is packed in the box. The other post on the spark coil has a long conductor wire attached which should lead to the binding post WY6 on the insulated fixed electrode of the igniter at the cylinder head, and from the binding post of the last cell in the battery the wire should lead to the switch attached to the battery box, and from the other binding post of the switch, the second long conductor wire should lead to the second binding post (OP) on the side of the engine. Always see that the binding posts are clean and turned tight, so as to hold the connecting wires firmly in position, and that no foreign material of any kind gets between the wires and metal of binding posts and nuts. If the above directions have been carefully followed the arrangement is such that battery is required to operate only at such times as the engine requires an ignition, while at all other times the circuit is broken and the battery is at rest, thus adding to its durability and perfect operation.

Battery Connections

Inside the battery box will be found a small switch block with lever for opening and closing the circuit. When the switch is open no current can pass. Care should be taken when the engine is at rest for any length of time to open the battery switch in box, so that in case the engine has stopped at the point where the electric circuit is closed, it will be broken by opening the switch, thereby saving the drain on the battery while the engine is idle.

Open Switch When Engine Stops

Testing Electric Parts.

Test Battery.

The long conductor wires between battery and engine may be safely handled by the insulation, but avoid touching the bare copper. Having all connections made, close the switch, hold one of the long conductor wires in each hand and strike their ends together. The efficiency with which the battery is working will be indicated by intensity of the spark produced when the wires are separated quickly. If no spark is produced, either the connections are not perfect or short circuit is caused at some point by dirt or foreign material or the cell is not right. Ascertain the cause and remove it.

Testing Electric Parts

If the engine stops for any cause, test the battery immediately to see if you are still getting a good spark. When the battery is nearly exhausted it soon ceases to give a spark after the engine is started, and should be renewed.

If Engine Stops

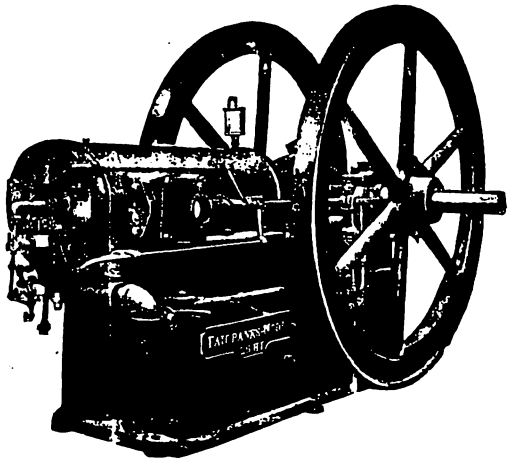


Fig. 1317G

Fairbanks-Morse Type "NB" Engine for Liquid Fuel and Gas Combined

For operating Directions, see Supplementary Instructions No. 2048

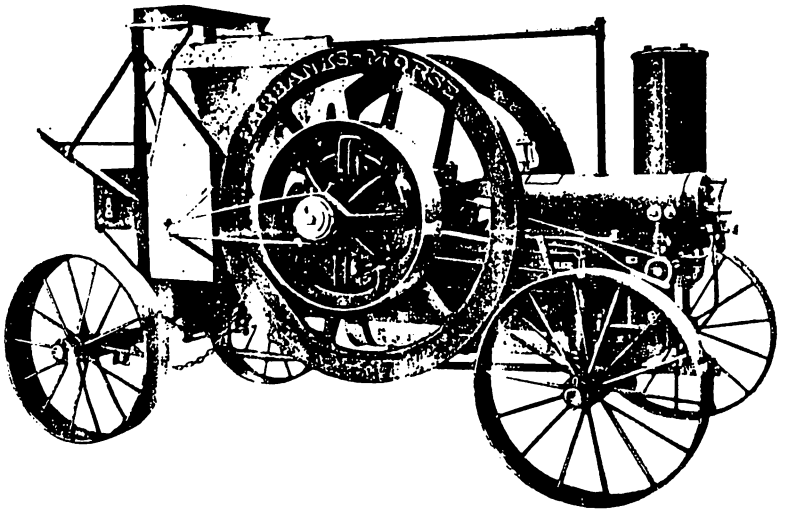


Fig. 2125G

Fairbanks-Morse 12 H. P. Portable Type "NB" Engine with screen cooling tank

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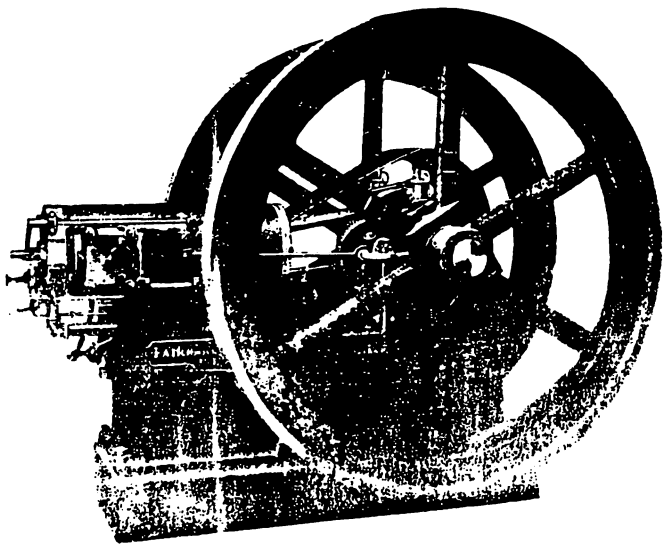

Fig. 1355G

15 H.P. Type "N" Special Electric Gasoline Engine

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