FOREWORD

This instruction booklet is not a service manual, but a booklet prepared for the express purpose of conveying to the IRON HORSE owner such information as will enable him to thoroughly understand the operation of his engine and the necessary procedure for its proper maintenance.

Dependability and Long Life are built into every IRON HORSE shipped from our factory—this is OUR RESPONSIBILITY. You will no doubt want to take full advantage of these valuable features and to obtain year after year—that DEPENDABILITY, which can be realized only if the engine is properly cared for. That is YOUR RESPONSIBILITY.

The instructions contained in this booklet are essential and, if closely adhered to, will assist in obtaining the utmost from your JOHNSON IRON HORSE.
TROUBLE CHART

Fuel Supply
- Tank empty.
- Fuel line clogged.
- Dirt in screen—tank.
- Dirt in screen—top of carburetor float chamber.
- Water or foreign substance in gas tank.
- Engine will not start if flooded. Allow to settle 10 or 15 minutes before cranking again.

Carburetor
- Choke not functioning.
- Clogged jets and screen.
- Needle valve worked loose.
- Needle valve improperly adjusted.
- Loosely mounted.

Spark Plug
- Ignition lead detached.
- Fouled (carbon or oil).
- Improperly adjusted points.
- Porcelain cracked or broken.
- Porcelain covered with moisture or residue.

Magneto
- Pitted or improperly adjusted breaker points.
- Loose electrical connections.
- Defective condenser.
- Defective ignition coil.
- Key sheered off in flywheel.

Uneven Running
(Surging) Is
Frequently
Caused by:
- Defective spark plug.
- Improperly adjusted carburetor.
- Gasoline low in tank.
- Water or foreign substance in gas tank.
- Governor pin injured—bent or twisted, causing excessive drag on governor arm and carburetor lever. Should be straight with no indication of binding.
- Loose electrical connections.
- Accumulation on magneto breaker points—pitted or corroded.
- Weak condenser, or ignition coil.

Overheating
- Oversize pulley on flywheel side.
- Oil level in crankcase too low.
- Carburetor adjusted too lean.
- Belt too tight.
- Restricted air flow around engine.
- Engine over-loaded.
- Leaky valves.
- Piston rings seized in ring grooves.
- Excessive carbon accumulation.

Knocking
- Engine not properly mounted (loose).
- Engine over-loaded.
- Belt too tight.
- Carburetor adjustment too rich.
- Excessive accumulation of carbon.
- Flywheel loose.
- Connecting rod loose.
- Wrist pin and piston loose.

Engine
- Loss of compression—
  - Leaky valves.
  - Sticky valves.
  - (Valve stem and guide carboned.)
  - Piston rings inactive.
  - (Ring grooves filled with carbon)
  - Governor spring broken or detached.
grade of S.A.E. No. 20 oil (Mobiloil or equivalent). IF ENGINE IS TO BE OPERATED PERMANENTLY OUTSIDE AT TEMPERATURES BELOW FREEZING—USE S.A.E. No. 10 OIL.

2. AIR CLEANER IS OF THE OIL BATH TYPE. Read instruction label on side of cleaner and proceed as follows:
   a. Remove wing nut on top of cleaner.
   b. Lift out top half and fill bottom half to line marked "oil level" with same oil as used in crankcase.
   c. Replace top and wing nut, making sure wing nut is tight.

NOTE: Air cleaner should be removed and cleaned once a week, (daily under very dusty conditions) wash parts in gasoline, add new oil and replace as instructed above.

3. Fill gas tank with regular grade gasoline. (Do not use high test gasoline.)

4. Open gasoline shut-off valve.

WARNING: Be sure a "fresh" supply of gasoline is used at all times. "Old" gasoline or gasoline left standing over a period of time will form a "gum" deposit which will gather in the gasoline tank, gasoline tank screen, carburetor inlet screen, and all small carburetor passages such as jets, needle valves, etc. This may cause hard starting or erratic performance. Should this condition exist, the deposit can be removed by washing the affected parts in alcohol or lacquer thinner. If left standing too long, parts may have to be soaked for an hour or so in order to soften the gum formation before washing.

If after filling gasoline tank, gasoline is noted dripping from carburetor manifold, (air jet hole, see Fig. 4) tap carburetor inlet connection lightly with screw driver handle. This should reseat float needle valve or loosen float should it be sticking.

5. Before attempting to start engine, reduce the applied load as much as possible. The Iron Horse engine is equipped with a flywheel magneto, therefore the easier it is to spin the flywheel when cranking, the easier it is to start the engine.

6. Pull choke knob out as far as it will go.

7. Push starting pedal firmly down with a quick thrust. Do this once or twice. If the engine doesn't start, push the choke knob half way in and try again, remembering to push the starter pedal down quickly. When the engine starts, keep choke knob out far enough to keep engine running. As the engine warms up, the choke knob should be pushed in until it is in as far as it will go.
If after grinding, valves stems are found to protrude beyond the base of the cylinder, simply grind off end of valve stems until they are flush. (Make certain face of valve stem is square with stem.) Tappets are adjusted flush at the factory and should require no attention other than inspection.

Reassemble valves, springs and retainers in reverse order in which they were disassembled.

CAUTION: It is IMPORTANT that all traces of carbon have been removed from valve stems and guides. Failure to do so will result in sluggish valve action, likewise interfere with efficient operation of the engine and starting qualities.

Place gasket in position on crankcase (coat both sides lightly with grease). NOTE: Oil piston and rings before installing cylinder.

Install cylinder — compress piston rings slightly to permit piston entering cylinder. Be careful not to break or bend rings. A sprung ring will never seal properly.

CAUTION: When pushing cylinder down over piston, be very careful not to bend connecting rod by applying too much side pressure on it. If the rod is strained there is danger of throwing the piston out of alignment.

Replace cylinder bolts—draw up evenly and tightly. Install cylinder head. Replace armature plate, flywheel and shroud as already explained. IMPORTANT: Be sure flywheel nut is tight. Operate engine ten or fifteen minutes, then retighten nut.

Timing

IGNITION: Since set ignition timing with no advance or retard is employed on the IRON HORSE, timing of the ignition is done at the factory and cannot be altered unless engine is disassembled and improperly reassembled. Width of the breaker point
Adjustment of Float Feed Carburetor

Since all IRON HORSE engines are thoroughly tested before leaving the factory, the carburetor is properly adjusted and should require no further adjustment; however, in the event the original adjustment has been altered, proceed as follows:

1. Close low speed adjusting needle (turning right) until it rests gently on its seat. (See Fig. 4)
2. Close high speed adjusting needle (turning right) until it rests gently on its seat. (See Fig. 4)

**NOTE:** Under no circumstances screw adjusting needles down tightly on seats—to do so, will injure both the seat and the needle and result in failure thereafter to obtain satisfactory carburetor adjustment.

3. Open slow speed adjusting needle (turning left) approximately ¾ turn.
4. Open high speed adjusting needle (turning left) approximately ¾ turn.
5. Start engine as instructed and operate until thoroughly warmed up.
6. Apply full load.
7. Turn high speed adjusting needle to right or left as desired to obtain best performance.
8. To adjust low speed—remove load, hold throttle lever at closed position, move to left facing starter side of engine. (See Fig. 2) Adjust throttle adjusting screw to permit engine to run at 800-1000 R.P.M. (See Fig. 4) Turn low speed adjustment needle to right or left as required to obtain best performance. After altering low speed adjustment, reset high speed adjustment for final setting after permitting engine to operate on governor.

Be sure all governor link connections are free and that there are no indications of binding.

**NOTE:** If at any time gas is seen dripping from carburetor body when engine is in operation, carburetor float may be sticking. In this event, tap float chamber inlet with screw driver handle and also check gas line connections, etc.

Carburetion

Some of the IRON HORSE engines are equipped with the Vacuum Lift Carburetor, a simple device, drawing gasoline from the gas tank and mixing it with air to form a combustible mixture as the piston progresses downward on the suction or intake stroke. (See Fig. 5)

For starting purposes, a choke arrangement is built into the carburetor which when
To Remove Magneto

After the flywheel has been removed, proceed as follows:

1. Remove the flywheel key located in crankshaft.
2. Remove four mounting bolts (See Fig. 10), two bottom short bolts holding plate only and two long bolts at top holding coil laminations as well as magneto back plate.
3. Tap magneto back plate loose with soft hammer.
   CAUTION: Be sure not to damage the gaskets located between magneto mounting plate and crankcase.
4. Pull magneto off crankshaft making sure not to damage bearing oil seal on crankshaft threads.

To Replace Magneto

1. Make sure crankshaft thrust washer is in place. This is a hardened steel washer slipped over crankshaft and lays next to crankshaft timing gear. (See Fig. 13)
2. Replace the same gaskets found between magneto mounting plate and crankcase (upon magneto removal) on pilot found on back of magneto mounting plate.
3. Install one of the long mounting bolts pushing it all the way through the back plate and gaskets.
4. Slip the magneto assembly over the crankshaft (making sure not to damage the bearing oil seal by scraping it over the crankshaft threads), until the mounting bolt can be started in the crankcase threads.
5. After the bolt is started, push the magneto assembly into place and install the other three mounting bolts. Tighten all four bolts.

Spark Plug

Remove spark plug for occasional inspection, cleaning and adjustment of points.
Correct setting of gap .030".
Be sure porcelain insulator is dry and clean before replacing. Wipe off with dry cloth to remove traces of moisture or residue.
Examine for cracked or broken porcelain. (Hard starting, missing and faulty operation are often caused by a defective insulator.)
Test plug by placing body of plug on cylinder head with ignition lead attached—crank engine to observe spark between points. (The spark may not be visible in bright light, nevertheless, a pronounced "snap" is audible if sparking takes place.)
   CAUTION: When testing plug do not hold plug in hand but rather lay plug on engine so that base of plug makes contact with engine and terminal end clears any part of engine at least 1/2 inch. Under no circumstances crank engine with spark wire detached. Doing so may injure coil or condenser.

IMPORTANT: In event of requiring the installation of a new spark plug, BE SURE TO INSTALL A CHAMPION NO. J-8 (14MM).

Removing Carbon and Care of Valves

After a long period of operation, it may be necessary to detach the cylinder head to remove carbon from combustion chamber, head of piston and valves.
Governor Throttle Control

Since the IRON HORSE is designed to operate normally at 2250-2350 R.P.M. the carburetor is constructed with a shutter valve which is controlled by a mechanical governor as the engine load varies.

The governor is built on to the crankshaft and is of the flyweight centrifugal type (See Fig. 6), connected to the carburetor valve by means of a small crank arm and link. (See Fig. 2)

As long as the engine remains motionless, the butterfly valve is held open by a small spring attached to the control link; however, upon having been started, the governor weights are thrown outward due to centrifugal force, causing movement of the governor arm resulting in partial closing of the shutter valve, thereby reducing the charge admitted to the cylinder. Further increase in engine speed has a considerable effect on the governor weights—causing greater action of the governor arm, consequently, closing the shutter valve to a point where a constant speed of 2250 to 2350 revolutions per minute is maintained.

Any increase in the load applied will cause a drop in revolutions—reducing the effect of centrifugal force on the governor weights, resulting in the shutter valve being opened to admit a larger charge until normal engine speed has been reached.

To Adjust Engine Speed

Speed of the engine is controlled by action of the governor and tension of the governor spring, therefore any change in the tension of this spring will effect the speed at which the engine is running. It will therefore be seen that normal engine speed may be adjusted to a lower or somewhat higher speed to conform to requirements. (See Fig. 7)

Since the spring acts to hold the shutter valve open to admit a full charge to the
cylinder, a decrease in tension will result in slower engine speed. An increase in engine speed is then obtained by increasing the tension on this spring.

Various spring tensions can be obtained by hooking the spring in one of the several holes in the control link for this purpose. (See Fig. 7)

If you have reason to assume that the engine is not turning at its recommended R.P.M. (2250 to 2350), apply a speed indicator to the end of the crankshaft to determine definitely at what speed it is operating. If higher than recommended, reduce tension of spring by hooking in one of small holes closer to the governor arm. To increase engine speed, simply increase tension of the spring by attaching it to one of the holes further distant from the governor arm as indicated by the arrows. (See Fig. 7)

CAUTION: Do not attempt to stretch the governor spring. Any change in length will render it useless so far as obtaining correct speed and speed variation concerned.

Care of Fuel System

No difficulty should be experienced with the fuel system if a good clean grade of gasoline is used and poured into the tank from a clean container and funnel. Be sure funnel is clean. Use fresh gasoline—gasoline left standing for any length of time will result in the formation of gum, which clings to the walls of the gas tank, clogs small carburetor passages and jets as well as the screen installed at the top of carburetor float chamber.

Gasoline gum, we are told, is present in all gasoline and as long as it remains in suspension, it causes no particular harm, but as the gasoline ages, gum commences to accumulate and settles out.

This gum has the appearance of a "varnish-like" substance and can be detected very easily by sticking a screw driver into the tank through the filler opening and scraping along the bottom. WARNING: Be careful not to damage strainer screen in bottom of tank over outlet. If gum is present, a sticky formation will be noted. It clings to the inner walls and bottom of tank where it can be detected very easily, however, it does not confine itself to the walls of the tank only, but also collects on the small screen attached at the top of carburetor float chamber to obstruct free passage of gasoline through the carburetor. In extreme cases, it clogs the small passages in the carburetor and the fuel line as well.
Excessive gum accumulation will naturally interfere with starting and running of the engine. If the fuel supply is shut off by this gummy formation, the engine simply cannot be started. **IT MUST HAVE GASOLINE TO START AND RUN.**

Gasoline gum is not readily soluble in gasoline, therefore, little good will come of attempting to remove it by washing the affected parts in gasoline. To remove-rinse inside of tank and the check valve assembly with ALCOHOL or LACQUER THINNER. (Lacquer thinner is highly INFLAMMABLE—use with caution)

**NOTE:** In cases where gum deposits are bad, soak affected parts until gum formation is softened to a point where it is easily removed.

Gum accumulation in the gas tank and other parts can be reduced to a minimum by always using fresh gasoline. Since the IRON HORSE uses but very little, gasoline should not be stored in large quantities—keep only a small supply on hand to insure freshness. **BE SURE THERE IS NO WATER IN THE GASOLINE TANK AND THAT SCREENS IN THE TANK AND CARBURETOR (end of gas line above float chamber) ARE CLEAN.**

**NOTE:** The gasoline tank and all the connections should occasionally be removed and cleaned thoroughly as moisture, dirt and foreign matter may collect, clogging passages, causing hard starting and faulty operation.

**Lubrication**

**NOTE:** Oiling instructions on engine name plate. Crankcase holds approximately 3/4 of a pint of oil and should be carefully checked after each eight hours of running to make sure oil level is maintained. Crankcase should be completely drained after each 25 hours of operation and filled with new oil.

Lubrication of moving parts is accomplished by the SPLASH system. The cam gear operates in a small oil sump, into which the proper amount of oil is metered at all times, in such a manner that oil is picked up between the teeth of the gear and forced out with considerable pressure as the teeth of this gear and the crankshaft gear mesh. The spray of oil from the gears is then picked up by the revolving crankshaft and distributed throughout the crankcase and cylinder, thus an ample supply of oil reaches all bearings and bearing surfaces. (See Fig. 8).

There are no additional moving parts required to circulate the oil — if the crankcase has been filled to the proper level, oil circulation commences the instant the engine is started.
closed, restricts flow of air through it on the intake stroke—consequently, a comparatively high suction is created, resulting in the gasoline being drawn or lifted into carburetor where it is mixed with air and passed on into the cylinder in the form or a dense vapor.

Since three strokes of the piston intervene between each suction stroke (Compression, power and exhaust), a check valve is installed in the gas tank to prevent gasoline in the carburetor and gas line flowing back into the tank during this period, thereby, maintaining proper fuel level in the carburetor while the engine is in operation.

This check consists merely of a small disc resting on a seat in such a manner that suction in the gas line will cause it to rise and permit flow of gasoline to the carburetor; however, as suction is diminished, return of gasoline to the tank is prevented by the disc resting firmly on its seat, due to weight of the gasoline in the gas line.

Adjustment Vacuum Lift Carburetor

1. Turn needle valve (Fig. 5) to right until it rests gently on its seat. (Under no circumstances screw it down tightly as this will injure both needle and seat—resulting in difficulty to obtain satisfactory adjustment thereafter).

2. Uncrew needle valve approximately ¾ turn.

3. Start engine as instructed — allow to run with load until normal operating temperature is reached.

4. Turn needle valve slowly to right until engine loses speed due to lean mixture—note position of marker; then, turn slowly to left until engine appears to labor and speed drops slightly — note position of slot in needle valve. Finally, slowly turn needle to right to position midway between the lean and rich settings. (Average should be about ½ turn open under full load when engine is warm).
the coil to break down instantly—and electrical current of exceptionally high voltage is induced in the fine secondary winding of the coil, which is carried to the spark plug where it jumps the gap between the points to ignite the compressed charge in the cylinder.

Due to its rugged construction, the magneto will perform efficiently throughout the entire life of the engine. It requires no lubrication, therefore no attention other than an occasional inspection of the breaker points and spark plug connections.

**Care of Ignition System**

**MAGNETO—CAUTION—**Do not crank the Iron Horse engine unless the ignition wire is attached to the spark plug or held within 1/8" of a cylinder head fin or spark plug body. If you do otherwise, you may damage either the ignition coil or condenser.

Under no circumstances should the magneto be tampered with unless it is evident that hard starting or fault operation can be traced to some irregularity in it.

Before attempting to make adjustments, remove ignition lead from the spark plug—hold it within 1/8" of a cylinder head fin or a corner on the spark plug body (the part that screws into the cylinder head). Crank engine by pushing starting pedal down quickly and observe spark. If the light is too bright where this is being done, it will be hard to see the spark, but you should hear a distinct snap. If the spark is weak or does not appear, the difficulty is most likely due to improperly adjusted, pitted, or corroded breaker points.

In this event it is necessary to remove the flywheel as follows: Remove shroud covering flywheel. Remove flywheel nut and pulley. Have someone grasp rim of flywheel to absorb shock. Strike end of crankshaft a firm blow with soft hammer or mallet. (Be careful not to injure end of crankshaft.) One or two applications is all that should be necessary.

Upon removal of flywheel, notice the breaker points are operated by a flat surface machined on the crankshaft. Examine condition of points by spreading with blunt instrument. If pitted or corroded, turn crankshaft until points close. Insert small flat file between points—draw back and forth gently to dress down points. **INSERT NEW POINTS IF BADLY PITTED.**

To check breaker point gap—turn crankshaft slowly until points have opened and are wide apart. Insert feeler gauge between points—correct gap setting .018" . .020. If necessary to make corrections, loosen breaker plate adjusting screw. (See Fig. 10) Increase gap by moving breaker assembly toward crankshaft — reduce by moving opposite direction.

Tighten breaker plate adjusting screw. Recheck for proper gap spacing.

Replace flywheel, pulley and nut. Make certain flywheel key is properly placed in keyway. **THIS IS IMPORTANT.** Tighten nut with large wrench.

Replace shroud. Attach lead to plug—start engine as instructed. Operate ten to fifteen minutes—**STOP AND RETIGHTEN FLYWHEEL NUT.**

**CAUTION:** The flywheel is keyed to the tapered end of the crankshaft by a soft aluminum Woodruff key. If the flywheel nut is not properly tightened in assembly with the crankshaft, without injury to either the crankshaft or zinc flywheel, fly or should loosen, the power strokes of the engine will cause the key to shear off. Ignition timing, however, will be affected and in this event the engine will commence to run irregularly and ultimately stop. **BE SURE THE FLYWHEEL NUT IS TIGHT.**
NOTE: Some engines are equipped with rope starters and some with hand sta:
With a hand starter you pull quickly on handle.

The rope starter may be on either side of the engine. If on the flywheel side, wind counter clockwise. If on opposite side, wind clockwise. Pull quickly to start.

8. If engine is over choked, gasoline will drip from a small hole drilled in the carburetor manifold for this purpose. See Fig. 4. Allow engine to stand until excess gasoline has drained off. Start engine as instructed above.

The above is assuming the carburetor adjustments have not been tampered with. If they have, refer to “carburetor adjustment” for resetting.

9. To stop, press button on side of flywheel housing. (See Fig. 2 for location of stop button.) Hold until engine stops running.

10. After engine has been stopped, close shut-off valve on the underside of gas tank, Fig. 2.

NOTE: When engine is completely warmed up or hot, choking should not be necessary when starting.

IMPORTANT: During extremely cold weather, the oil in the crankcase congeals, becomes thick and "sticky". No effort should be made to apply load without first warming up engine, as severe damage may result. Be sure engine can be turned over FREELY before attempting to start.

NOTE: If possible when engine is new, operate at reduced load for the first five hours to assist breaking in.

Carburetion

Carburetion on the IRON HORSE is provided by a conventional float-feed downdraft carburetor. Correct fuel level at the high and low speed jets in the mixing chamber is maintained at all times by a float valve in the float chamber—gasoline is gravity fed from the tank located directly above the engine.

The float valve is operated, through a simple lever arrangement, by a small hollow metal float, consequently, when the float chamber is empty, the float is at rest near the bottom of the chamber. The float valve is then off its seat (open) and permits gasoline to flow into the float chamber. As this chamber begins to fill, the float rises and gradually closes the float valve—when the proper level is reached, the float valve closes completely.

On suction impulses of the engine, air is drawn through the mixing chamber of the carburetor, where air and gasoline are mixed to form a combustible vapor which is conducted into the cylinder by way of the manifold and intake valve.

The carburetor is provided with a high and low speed adjustable jet to insure correct fuel mixture throughout the entire speed range of the engine.
Remove carbon by scraping with blunt instrument being careful not to scratch head of the Lynite piston. Wash cylinder head, head of piston, valves and gasket with gasoline.

Unless the valves and seats are pitted they need not be ground in—since it is necessary to remove only the excess carbon accumulation. This can be accomplished by turning the flywheel slowly until one of the valves has opened—apply a small quantity of kerosene on the valve and valve seat. Turn flywheel until valve closes—make sure it has seated. Turn valve back and forth with valve grinding tool to work carbon off head and valve seat. Repeat same on both valves.

TO GRIND VALVES: If advisable to grind valves due to blow-by and loss of compression it becomes necessary to remove cylinder. (NOTE: Cylinder is detachable from the crankcase and held in position by five bolts; also, that valve stems and springs are entirely inclosed and accessible only upon removal of the cylinder as shown in Fig. 11.

To remove the cylinder proceed as follows:
1. Remove shroud and flywheel and five bolts holding cylinder in position.
2. Lift cylinder from crankcase.
3. Compress each valve spring to withdraw retainer pins.

NOTE: Before removing, mark one valve and seat with a prick punch to make certain valves are replaced in original locations.

4. Remove valves, retainers and springs.
5. Scrape excess carbon from valve heads, stems, valve guides and seats in cylinder block. Wash with gasoline.
6. Coat face of valves with medium fine valve grinding compound.
7. Replace valves and grind by turning back and forth with valve grinding tool. Be sure valves are seated. One or two minutes of grinding should be sufficient. (A small spring placed under the valve heads will simplify this operation.)

Wash valves and seats thoroughly with gasoline being careful that none of the compound is washed into the cylinder.

Insert valves in original position. Check valve stem clearance. This is accomplished by seeing that the valve stems (with valves seated) are flush with the base of the cylinder and tappets flush with crankcase bolting face as shown in Fig. 11 and 12. Actual valve clearance is obtained by installing a gasket of suitable thickness—should be .012".
EXHAUST

THE IRON HORSE ENGINE SHOULD NOT BE OPERATED INSIDE A BUILDING UNLESS THE EXHAUST IS PIPED OUTSIDE NOR WITH THE EXHAUST OUTLET LOCATED IN SUCH A MANNER THAT THE FUMES WILL BE BLOWN INTO LIVING QUARTERS THROUGH AN OPEN WINDOW OR DOOR. The exhaust pipe should be absolutely leakproof, as short and straight as possible and should be made of 3/4" pipe or flexible tubing.

If the exhaust pipe rises above the engine a condensation trap should be provided to prevent moisture from getting into the engine which might result in serious damage. (See Fig. 3.) This is easily accomplished by installing an ordinary pipe T in the exhaust pipe at the lowest point, with a short length of pipe installed in the side opening of the T pointing downward and provided with a drain plug to permit the accumulated moisture to be drained out. This should be done at regular intervals to prevent the trap from becoming full and overflowing into the engine.

DO NOT support more than one foot of exhaust pipe from the exhaust opening in the cylinder, any length of pipe over this amount should be provided with additional support to prevent breakage of the cylinder casting.

If the exhaust pipe passes through a wall constructed of wood or other combustible material, plenty of clearance should be provided at this point and the necessary precautions taken to eliminate a fire hazard. The muffler furnished with the engine should be installed at the end of the exhaust pipe outside the building to silence the exhaust.

REMEMBER: THE EXHAUST FROM ANY GASOLINE POWERED ENGINE CONTAINS DEADLY POISONOUS CARBON MONOXIDE FUMES AND FOR THIS REASON SHOULD NOT BE OPERATED INSIDE A BUILDING UNLESS THE EXHAUST GASES ARE PIPED OUTSIDE AS OUTLINED ABOVE.

Keep the exhaust pipe as short and straight as possible and DO NOT use elbows but make long pipe bends where necessary, to eliminate back pressure and prevent excessive accumulation of carbon.

HOW TO START ENGINE

1. OIL HAS BEEN DRAINED from the crankcase of this engine for shipping purposes. DO NOT ATTEMPT TO START UNTIL CRANKCASE HAS BEEN FILLED WITH OIL. Remove large oil filler plug (See Fig. 2), pour oil in crankcase to point of over-flow. Crankcase holds approximately 3/4 pint. Use a good
gap, of course, has some effect on timing; nevertheless, if the breaker points are adjusted as instructed, timing is correct.

**VALVES:** The valves are properly timed on every IRON HORSE before it leaves the factory, therefore it should cause no concern. However, if the engine has been completely disassembled and the valves thrown out of time, proceed as follows: (Note punch marks on cam and crankshaft gears.)

Install crankshaft in motor with punch marked tooth down as shown in Fig 13. Then insert the camshaft in proper relation with respect to the two punch marks. The punch marked tooth on the crankshaft gear should be placed between the two punch marked teeth on the cam gear.

Complete reassembly of engine.
INSTRUCTIONS FOR THE CARE AND MAINTENANCE OF THE IRON HORSE ENGINE

The Four (Stroke) Cycle

The IRON HORSE operates on the 4 (stroke) cycle principle—requiring four strokes of the piston to complete the event of the cycle—INTAKE, COMPRESSION, POWER, and EXHAUST.

Admission of fresh fuel charges and discharges of the burned gases is by way of two poppet valves (intake and exhaust), operated by cams and timed to open and close at predetermined positions of the piston as follows:

INTAKE:
1. Piston moving downward.
2. Intake valve opened by cam.
3. Suction created by downward movement of piston draws fuel vapor from carburetor into cylinder.

Fig. 1-A

Fig. 1-B

COMPRESSION:
1. Piston moving upward.
2. Valves closed.
3. Fuel charge compressed.

Fig. 1-C

Fig. 1-D

POWER:
1. Both valves closed.
2. Spark ignites compressed fuel charge.
3. Fuel charge burns and expands rapidly — forcing piston down to deliver power impulse. (Piston moving downward.)

EXHAUST:
1. Piston moving upward.
2. Exhaust valve opened by cam.
3. Exhaust gases forced out of cylinder into atmosphere.
Iron Horse Master Service Stations
From whom services on the IRON HORSE and service parts may be obtained

Masters Motor Co.
422 South 20th St.
Birmingham, Alabama

*B. H. Habgen Co., Ltd.
326 Market Street
San Francisco, Calif.

*Spitzer Electrical Co.
43 West 9th Avenue
Denver, Colorado

*Law Hewes
541 1/2 Biscayne Blvd.
Miami, Florida

*Atlanta Outboard Marine
311 Spring Street
Atlanta, Georgia

Stubb's Hardware Co.
121 Congress St., W.
Savannah, Georgia

*Voss Brothers
419 S. Adams
Peoria, Illinois

George N. Meyer
Lake James
Angola, Indiana

*Lally's Service, Inc.
12th and Mulberry Sts.
Des Moines, Iowa

Standard Bat. & Elec. Co.
Waterloo, Iowa

Arthur Duvic's Sons
122 Chartrres Street
New Orleans, Louisiana

*S & L Service & Storage Co.
Edwards and Travis Street
Shreveport, Louisiana

*Crandall-Hicks Company
959 Commonwealth Avenue
Boston, Massachusetts

*Henry H. Smith & Company
338 E. Jefferson Avenue
Detroit, Michigan

Shand's
Plainwell, Michigan

Felkey Automotive Service
Jackson, Minnesota

*Motor Power Equipment Co.
Ford Road and River Blvd.
St. Paul, Minnesota

*Star Boat & Motor Co.
7414 East 15th Street
Kansas City, Missouri

Auto Electric Station
106 West Main
Bozeman, Montana

City Lock & Gun Company
317 South 14th Street
Omaha, Nebraska

Outboard Motors Parts Co.
40 West 62nd Street
New York, N. Y.

Syracuse Boat Company
935 S. Salina Street
Syracuse, New York

Minot Machine Co.
14 First Street, S. E.
Minot, North Dakota

*Zucker Marine Supply
5300 St. Clair Avenue
Cleveland, Ohio

725 North Broadway
Oklahoma City, Okla.

*The Beebe Company
504 S. W. First Ave.
Portland, Oregon

*Johnson & Towers, Inc.
113 Market Street
Philadelphia, Penn.

Johnson Outboard Motor Ser.
603 Main Street
Columbia, South Carolina

Semm's Magneto Shop
209 West 8th Street
Sioux Falls, S. Dak.

Lechenger Marine Store
1713 Main Street
Houston, Texas

*S. X. Callahan
425 Flores
San Antonio, Texas

*Pacific Marine Supply Co.
1223 Western Avenue
Seattle, Washington

JOHNSON MOTORS
WAUKEGAN, ILLINOIS
WARRANTY

We warrant each new IRON HORSE ENGINE to be free from defect in material and workmanship under normal use and service, our obligation being limited to repairing or replacing at the factory or service station any part or parts thereof which shall, within the warranty period, be returned to us with transportation charges prepaid, and which our examination shall disclose to our satisfaction to have been thus defective; this warranty being expressly in lieu of all other liabilities in connection with the sale or use of any IRON HORSE ENGINE.

The warranty period is one (1) year in washing machine service; and ninety (90) days in other service, after delivery of the engine to the original purchaser, except where other special provisions have been arranged.

This warranty shall not apply to any IRON HORSE ENGINE which shall have been repaired or altered outside the factory in any way so as to affect its stability, or which has been subject to misuse, negligence or accident. Warranty does not include "no charge" replacement of parts because of wear occasioned by operation of the unit, nor any labor in connection with the same.

Claims—ALL IRON HORSE ENGINES or parts returned to the factory for inspection, repair or adjustment must be shipped transportation prepaid. Be sure to write a letter advising what is being shipped, how shipped and when arrival at our factory can be expected—also, advise the condition under which the ENGINE is being operated and from whom it was purchased.

By closely following this procedure any delay in handling the claim can be eliminated.

NATION-WIDE SERVICE

In order that the IRON HORSE ENGINE owner can receive the utmost in performance, we have an already established nation-wide network of Master Service Stations that are not only equipped with special tools to properly service your unit, but also carry a complete stock of parts to immediately fulfill your requirements should the need arise.

These Master Service Stations are ably assisted by the local IRON HORSE ENGINE Dealer who carries a stock of first-aid repair parts which enables him to make minor and emergency repairs.

In addition to this extensive Service Organization, JOHNSON MOTORS maintains a complete Service Department at the factory to make more complete this service to the IRON HORSE ENGINE owner.

The factory Service Department will gladly do their best to answer any inquiries that may arise in connection with the installation, operation, maintenance, or any trouble that may be encountered with the IRON HORSE ENGINE.

A complete list of Master Service Stations will be found in the back of this Manual.

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