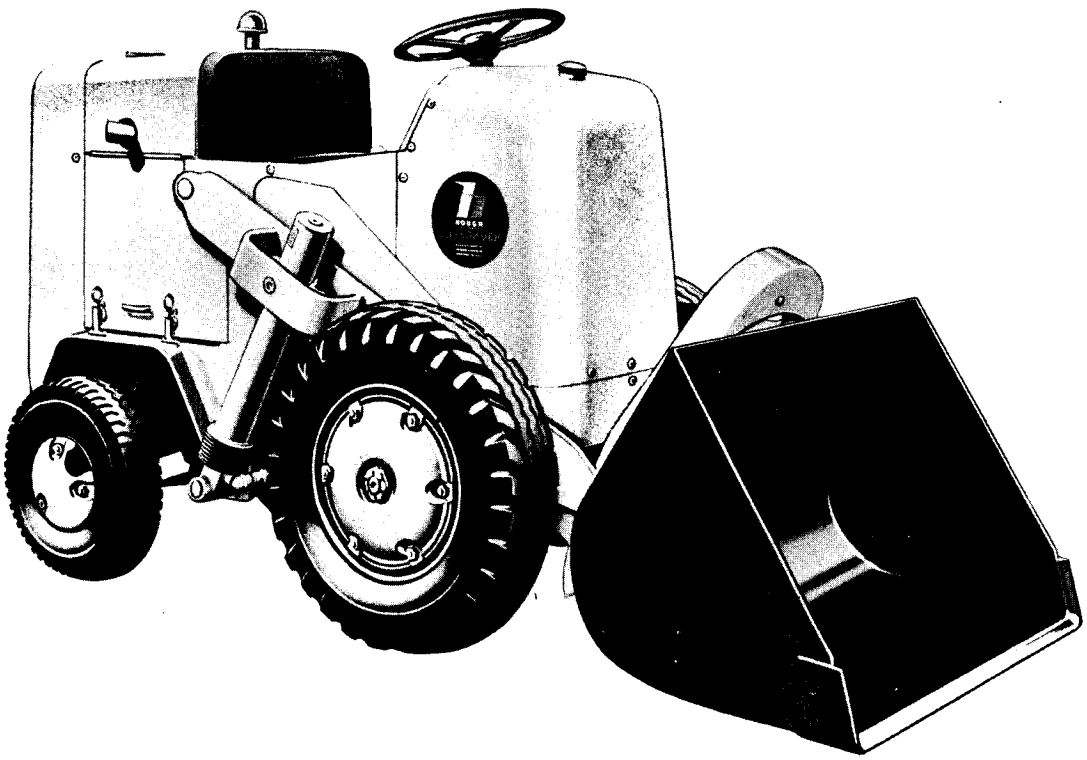
OPERATING MANUAL

FOR

MODEL HA PAYLOADER®

BEGINNING WITH SERIAL NUMBER 23500

FORM HA-50-A



MANUFACTURED BY

THE FRANK G. HOUGH CO.

LIBERTYVILLE, ILLINOIS

LITHO. IN U. S. A.

JAN. 1952

TO THE OWNER

It has been our aim to build the most reliable and serviceable shovel on the market.

Hough shovels have, since 1920, built a reputation for dependable and economical service in the material handling field. This "PAYLOADER" includes all these features which have made possible long, dependable service, together with the latest engineering knowledge and design.

The purpose of this manual is to explain maintenance requirements and routine adjustments which are necessary for the most efficient operation of your "PAYLOADER". To protect your "PAYLOADER" investment, study this manual before starting or operating your "PAYLOADER".

If you should need information not given in this manual, or require the services of a trained mechanic, we urge you to use the extensive facilities offered by THE FRANK G. HOUGH CO. "PAYLOADER" dealers. Dealers are kept informed on the best methods of servicing and are equipped to provide prompt, dependable, service in the field or in an up-to-date service shop.

Dealers carry ample stocks of THE FRANK G. HOUGH CO. essential "PAYLOADER" parts.

Listed below you will find the name of THE FRANK G. HOUGH CO. dealer with whom your parts orders should be placed and who should be called upon for any required information concerning proper operating and maintenance procedure.

OUR "PAYLOADER" DEALER IS:_____

_____

_____

When ordering parts always give THE FRANK G. HOUGH CO. "PAYLOADER" dealer both the name and part number of the part required, and also the serial number of the "PAYLOADER".

IT IS THE POLICY OF THE FRANK G. HOUGH CO. TO IMPROVE ITS PRODUCTS WHENEVER POSSIBLE AND PRACTICAL TO DO SO. WE RESERVE THE RIGHT TO MAKE CHANGES OR ADD IMPROVEMENTS AT ANY TIME WITHOUT INCURRING ANY OBLIGATION TO MAKE SUCH CHANGES ON MODELS PREVIOUSLY SOLD.

WARRANTY

This Model HA "PAYLOADER" is warranted free from defects of material or workmanship for a period of six months from date of sale: it is further warranted to be mechanically practical for the purpose advertised by THE FRANK G. HOUGH CO.

Parts claimed to be defective are to be reported to us promptly and returned to us with transportation charges prepaid. If we find the parts defective upon our examination, credit will be issued or the parts replaced.

This warranty will not apply to machines that have been misused, loaded beyond factory rated capacity, neglected, or damaged through accident.

Any expense incurred without authorized consent for repairs or replacements will not be allowed. The use of any but THE FRANK G HOUGH CO. parts nullifies this warranty.

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CONDENSED SPECIFICATIONS & SERVICE DATA

ENGINE:

No. Cylinders	4
Bore	3-1/4"
Stroke	4"
Displacement	133 cu. in.
Speed (Governed)	1800 R.P.M.
Horse Power	29

Complete with electrical starting equipment, oil bath air cleaner with centrifugal type precleaner and engine oil filter.

TRANSMISSION:

Two speeds forward and two speeds reverse, completely equipped with anti-friction bearings.

FINAL DRIVE:

Heavy duty double reduction spiral bevel and spur gear design. First reduction spiral bevel with differential ahead of final drive. Full floating axle shafts. Completely equipped with ball and roller bearings.

CAPACITIES:

Cooling System	3-1/2 gal.
Fuel Tank System	6-1/2 gal.
Transmission Case	4-1/2 pints
Final Drive Differential Case	5-1/2 pints
Crankcase	5-quarts
Hoist Reservoir	6 gal. approx.

BUCKET: STANDARD

Width	48
Capacity, Volume	12 cu. ft.
Capacity, Weight	1000 lbs.

CLUTCH:

12" Spring Loaded, Single Plate Dry Disc.

CONDENSED SPECIFICATIONS & SERVICE DATA - CONCLUDED

BRAKES:

12" x 1-3/4" - INTERNAL EXPANDING HYDRAULIC BRAKES ON BOTH FRONT DRIVE WHEELS.

STEERING:

Heavy Duty Truck Recirculating Ball Type Steering Mechanism.

PNEUMATIC TIRES:

Front (Drive Wheels)	7.50 x 16	8 Ply - 50 lbs. Air Pressure
Rear (Steering Wheels)	6:00-9	6 Ply - 55 lbs. Air Pressure

"PAYLOADER" DIMENSIONS: Bucket in carry position.

Overall Height	5' - 1-1/8"
Overall Width	4' - 2-1/4"
Overall Length	10' - 1"
Turning Radius	6' - 11"
Wheelbase	3' - 10-1/4"
Floor Clearance	0' - 5"

WEIGHT:

"PAYLOADER" EMPTY	"PAYLOADER" WITH 1000 LBS. IN BUCKET
Front 2590	Front 4560
Rear 1970	Rear 1000
Total 4560	Total 5560

Variations in bucket sizes can be supplied to meet special conditions.

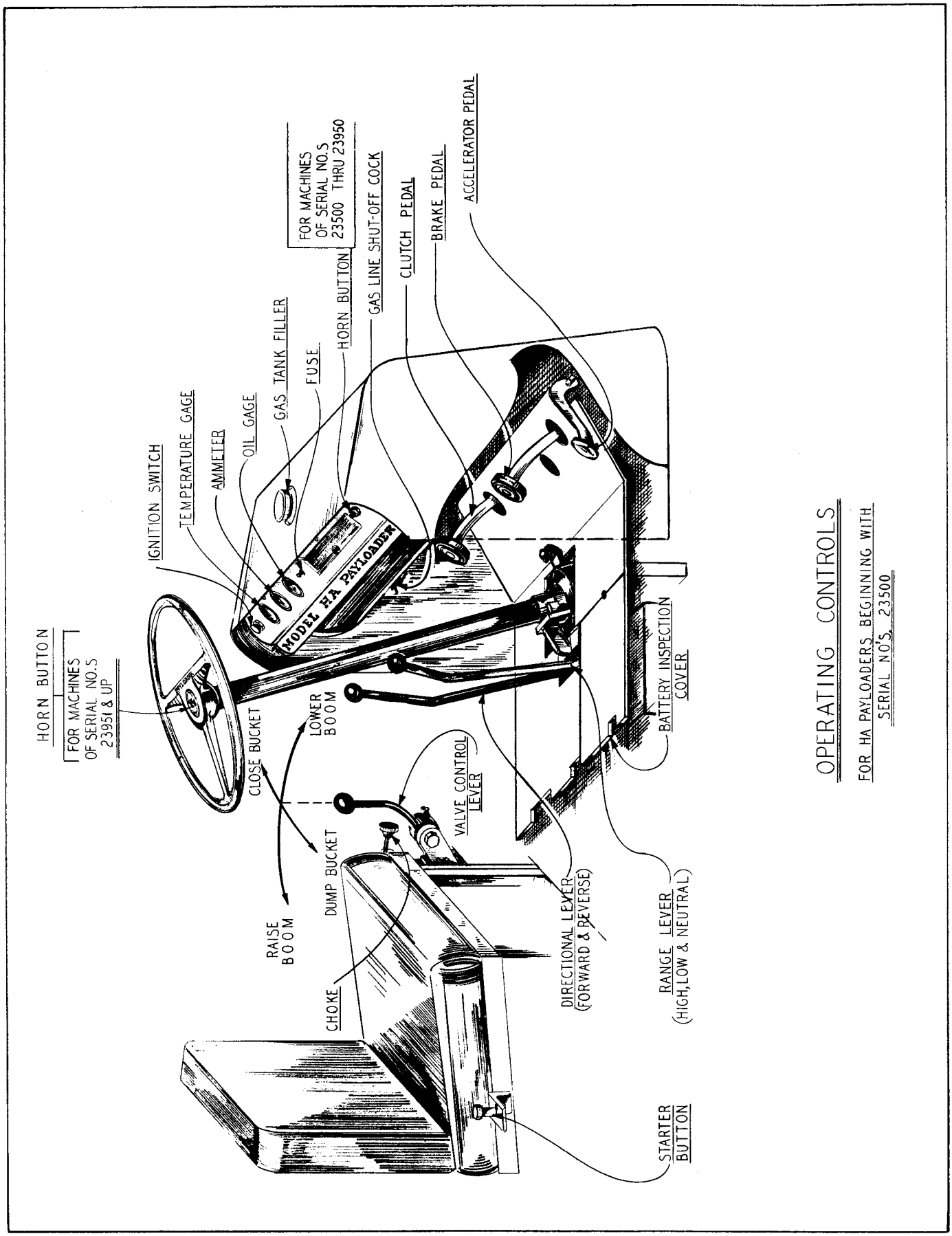


Fig. 1
Operating Control

PREPARATION OF THE "PAYLOADER" FOR OPERATION

Before operating this "PAYLOADER", even to unload, check the entire unit to make sure nothing has become loose or damaged in transit or storage.

Battery cables have been disconnected at the factory, and the gasoline shut-off cock closed before shipment. Machines sent outside the United States are shipped with a dry battery, and the fuel tank and fuel lines drained.

DO NOT ATTEMPT TO START THE ENGINE BEFORE THE FOLLOWING POINTS HAVE BEEN CHECKED OR DAMAGE MAY RESULT.

Refer to the Lubrication Chart, to locate the following points.

1. Check the oil level in the Hydraulic System Reservoir to make sure it is up to the petcock. The engine MUST NOT be started without oil in the Hydraulic System. Use SAE #10 Motor Oil to refill. Drain the hydraulic system after the first 32 to 48 hours of operation and refill with clean oil. Be sure to clean the suction outlet strainer at this time.

2. Check the Oil Level in the engine crankcase by removing the oil dip stick from the side of the engine.

3. Check the Oil Level in the transmission to be sure it is to the height of the oil level plug.

4. Check the Oil Level in the differential and both final drive gear cases. Differential oil level plug is located in the rear of the housing. Final drive gear case level plugs are located on the inside surfaces of both rear wheel housings.

5. Check the oil in the air cleaner cup. Clean and refill daily or oftener as required. This is important.

6. Check the Master Brake Cylinder to make sure it is filled with brake fluid. If not, fill with Hydraulic Brake Fluid.

7. Be sure all hoses and connections are tight to prevent hydraulic oil from leaking out, and to keep air or water from entering the system. Water entering the system will cause pump erosion at high velocities. Air or water in the system will cause the oil to foam and the hoist to operate in a slow, jerky manner.

8. Check the Tire Pressures. Be sure they are up to pressures recommended in the Specifications and Service Data Lists.

9. Check the cooling system. Refill with clean, soft water, free from alkaline; never at any time run the engine without the full quantity of cooling fluid in the radiator. Be sure to add a permanent type anti-freeze solution to the cooling system during freezing weather.

10. Be sure to open the fuel line shut off cock located on the fuel line at the fuel tank. The fuel tank is mounted under the front cowl. Fill the tank with gasoline of minimum octane rating of 70-72. Use a clean container.

11. Be sure all drain plugs, drain cocks, filler openings and fuel line connections are tight and do not leak.

12. Connect battery cables and check the dash instruments to be sure they function properly. Check the batteries to be sure the plates are covered with water. If not, add distilled water or clean rain water.

13. Do not operate the "PAYLOADER" to capacity during the first weekly period of operation. Operate the machine with light loads for the first 36 to 50 hours of actual use.

14. Read the instructions as set forth in this book carefully before attempting to operate this "PAYLOADER". The functions and application of hand levers, foot pedals, and other controls, differ between various types of similar machines, and their use should be understood by the operator before attempting to start the engine.

15. Grease the "PAYLOADER" daily (every 8 to 10 hours of operation). Use the lubrication chart and the Engine manual as a Guide. When it is properly serviced and checked, and its method of operating understood, the machine may be put to work.

OPERATING THE "PAYLOADER"

Before starting the engine, read the following paragraphs carefully to become acquainted with the location and the functions of the instruments and controls. Always be sure all levers are in neutral position before pressing the starter button. Since the hydraulic pump is coupled directly to the engines, the boom and bucket may be operated as soon as the engine is started.

Refer to the Operation Controls picture to note the location of the levers and pedals.

When learning to use a machine of this type, it is well for the operator to work carefully, taking his time, to gradually become accustomed to the machine. Operating speed and skill will be sttained easier by slowly acquiring the "feel" of the "PAYLOADER". The time used in learning may be well spent in preventing possible accidental damage to the machine or operator, and to safe guard other personnel. The main factor in the performance of any machine of this type lies with the operator.

A careful operator is the best insurance against an accident. Never leave the machine without first lowering the bucket so it rests on the ground, and making sure all control levers are in neutral position.

Never reach between the boom and guide bar to lower the bucket. The bucket may be lowered to the ground although the engine has been shut off.

The term "right hand" or "left hand" as used in these pages, are determined by the operator's position when sitting in the seat and facing the bucket.

HAND LEVERS:

This "PAYLOADER" is equipped with a two speed forward and two speed reverse transmission. The speed and direction of travel is selected by shifting a RANGE LEVER and a DIRECTIONAL LEVER. These levers are located at the right side of the steering column. See the Operating Controls picture.

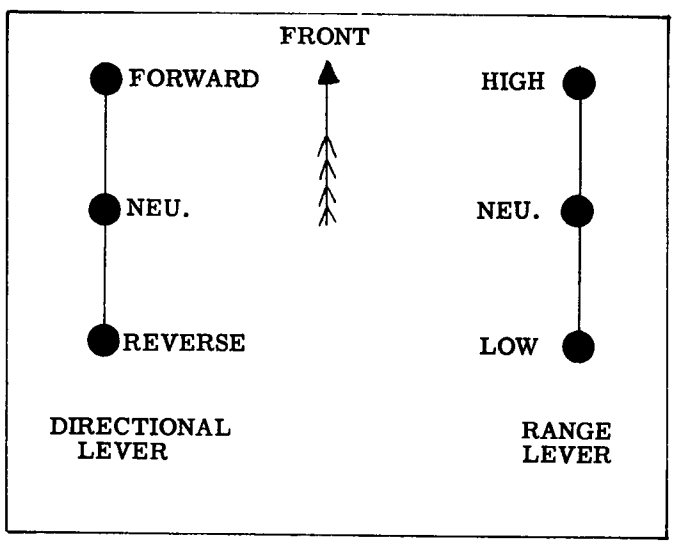
DIRECTIONAL LEVER is the longer lever adjacent to the right side of the steering column. Shift this lever to drive the machine in a forward or reverse direction. Push it forward to shift the transmission into forward gear. Pull it backward toward the operator to shift the transmission into reverse gear. This lever is in neutral when in its central position.

RANGE LEVER is the shorter lever next to the directional lever on the right side of the steering column. The speed of travel is selected by shifting the range lever. The transmission is in neutral when this lever is in its central position. Push this lever forward, ahead of neutral, to shift the transmission gears into low speed range. Pull it backward from neutral to shift into high speed range. The low speed range is used for working conditions in which more power is needed. The high speed range is used primarily for transporting loads to various locations.

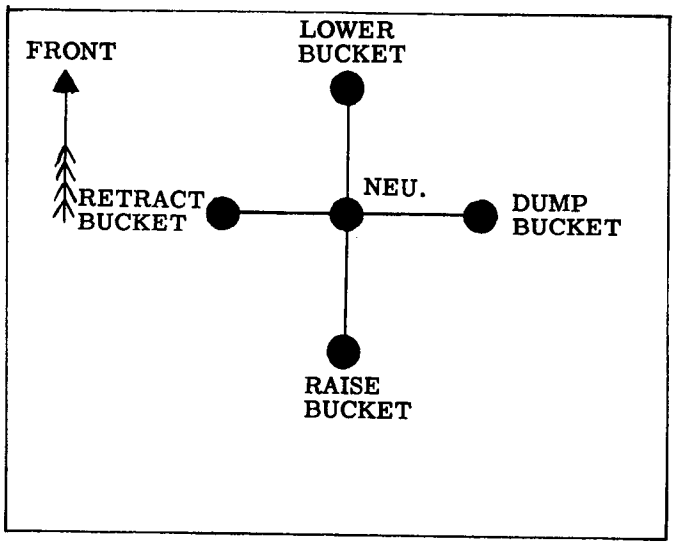
Always be sure the range lever is in neutral before the engine is started or when leaving the machine.

NOTE: Always depress the clutch pedal when shifting either the range lever or the directional lever. Do not attempt to shift the transmission gears while the machine is in motion.

VALVE CONTROL LEVER is located on the left hand side of the seat. By use of this lever, the operator controls a valve which regulates the flow of oil to the bucket and boom hoist cylinders to activate the bucket.



GEARSHIFT DIAGRAM



VALVE LEVER POSITION

The valve control lever has five positions to RAISE, LOWER, HOLD (or neutral), DUMP, and RETRACT the bucket. The valve spools are spring loaded, causing the lever to automatically return to "hold" position when the lever is released.

Pull the valve control lever backward, toward the seat, and the boom and bucket will raise upward, in direct proportion to the engine speed. Simply release the lever to stop and hold the bucket at any height of its travel.

Move the valve control lever inward, toward the operator, to dump the bucket. Release the lever to allow it to return to hold position to stop and hold the bucket in any point of its dumping arc.

Move the valve control lever outward, away from the operator, to retract the bucket from its dumping position. When the bucket is fully retracted, allow the lever to return to neutral.

Move the valve control lever forward, away from the seat, to lower the bucket.

The faster the engine speed, the faster the bucket will raise or retract.

FOOT PEDALS:

The CLUTCH PEDAL is located on the left side of the floorboard. When pushed down, the transmission is disengaged from the engine. Always keep the clutch pedal depressed when shifting either the range lever or the directional lever. Do not engage the clutch suddenly, thus allowing the "PAYLOADER" to jerk with the load.

CAUTION: DO NOT DRIVE THE "PAYLOADER" WITH THE FOOT RESTING ON THE CLUTCH PEDAL. THIS WILL CAUSE UNDUE WEAR ON THE CLUTCH FACING AND THROWOUT BEARING.

The BRAKE PEDAL is located on the right side at the floorboard and is used to bring the "PAYLOADER" to a stop. Depress the brake firmly when braking. It is good practice to keep the clutch engaged until the "PAYLOADER" has been slowed down and nearly brought to a halt by depressing the brake. Then disengage the clutch and stop the motion of the machine completely. This allows the engine compression to assist the brakes and saves wear on the brake linings.

The ACCELERATOR PEDAL is mounted on the floorboard to the right of the brake pedal. Applying pressure on this pedal increases the flow of fuel to the engine cylinders by opening the carburetor intake. This increases the engine speed, thereby accelerating the motion of the "PAYLOADER". Apply a slight increasing pressure on the accelerator pedal while releasing pressure on the clutch pedal to allow the machine to start evenly, without jerking.

The raising speed of the booms and bucket is also governed by the accelerator.

DASH INSTRUMENTS:

The IGNITION SWITCH is on the left side of the dash panel and is a push-pull type. Pull this switch out, to "on" position, before pressing the starter button. When in "on" position, this switch completes the electrical circuit to the starter switch, to the coil, and the dash gauges. Always be sure this switch is in "off" position before leaving the machine to avoid draining the battery.

Push the ignition switch in, to "off" position, to stop the engine.

The AMMETER indicates whether the battery is being charged or discharged. If the needle registers in the discharge range continuously with the engine running, or when the ignition switch is in "off" position, the cause should be investigated to avoid draining the battery.

The TEMPERATURE gauge indicates the temperature of the cooling fluid circulating through the engine. Never operate the engine when this gauge registers the temperature of the engine coolant to be at the boiling point. Shut off the engine and check the water circulation to prevent damage to the engine by over-heating.

The OIL PRESSURE gauge indicates the pounds pressure of the lubricating oil circulating through the engine. If this gauge fails to register, stop the engine IMMEDIATELY and determine the cause, or damage to the engine may result.

The FUSE RETAINER is located near the center of the dash, and provides a fuse to protect the wiring system. Inspect this fuse if the ignition system fails to operate.

The HORN BUTTON, on some machines, is located on the dash panel. On other models the horn button switch is located in the hub of the steering wheel. Depress the horn button to operate the horn.

STARTING CONTROLS:

The CHOKE ROD for the gasoline engine is located to the right of the seat. Pull out this rod to close the choke valve, thereby enriching the fuel mixture for easier starting. Open the choke valve by pushing in the rod as soon as the engine starts. Do not run the engine with the choke valve closed. When starting a hot engine, do not use the choke, as it will make starting difficult.

The STARTER BUTTON is located at the right side of the seat, and when pressed in, it completes the electrical circuit to the starting motor. Release pressure on this button as soon as the engine starts. Do not run the starting motor more than 1/2 minute at a time, alternating between 1/2 minute intervals of rest.

STARTING THE ENGINE:

With the "PAYLOADER" properly inspected and checked as explained in the preceding pages, the engine may be started. Be sure the engine crankcase oil is up to the "full" mark on the oil dipstick and the cooling system is full of cooling fluid. Be sure the hydraulic reservoir contains the correct amount of oil. Be sure the fuel line shut-off cock is open and the fuel tank contains a sufficient supply of fuel.

1. Be sure the speed range lever and the valve control lever is in neutral position before attempting to start the engine. Since the hydraulic pump is coupled directly to the engine, the hydraulic hoist may be operated as soon as the engine is started. To start the engine proceed as follows:

2. Place the ignition switch in "on" position.

3. Press the starter button. Pull out the choke slightly to close the choke valve for easier starting if necessary.

4. When the engine starts, watch the oil gauge on the dash to be sure it is registering. Allow the engine to idle for a time, running without load until it becomes warmed up. Push in the choke rod to open the choke valve as soon as the engine will run on a less enriched mixture. Follow this procedure whenever the engine is started.

STOPPING THE ENGINE:

To stop the engine, merely push in the ignition switch to "off" position.

Be sure the valve control lever and the gearshift levers are in neutral position before leaving the seat of the machine.

DRIVING THE "PAYLOADER"

Skill in the use of the machine is acquired by practice and by intelligent observation of the performance of the machine. For instance, correct loading of the bucket can be judged by the sound of the engine, and the speed of the tractor.

1. Start the engine; when it has been running long enough to warm up partially, and oil pressure has been built up as indicated on the dash gauge, the "PAYLOADER" may be put to work.

2. Draw backward on the valve control lever to raise the boom and bucket about two or three feet above the ground.

3. Depress the clutch and shift the directional lever and the speed range lever into one of their positions, depending on direction and speed of travel wanted.

4. Release the pressure on the clutch pedal while increasing pressure on the accelerator pedal and drive to the working area.

LOADING THE BUCKET:

Shift to the low speed range when loading the bucket. Have the bucket fully retracted and hold the cutting edge at digging level. Drive the machine forward into the bank or stock pile, letting the forward movement of the machine fill the bucket.

The loading operation is best done on level or slightly up-hill terrain. The inherent tendency is to 'dig in" when working down grade. Also, backing up-hill with a heavy load is difficult due to the increased weight on the drive wheels.

When the bucket is full or the end of the cut is reached, pull backward on the boom lever to raise the bucket out of the cut. As the bucket raises it will crowd forward, into the face of the cut, exclusive of the forward travel of the machine. This is especially noticeable when cutting into a bank or stock pile. The forward movement of the tractor and the bucket tip-back feature will give a scooping action, similar to a "dipper stick" shovel, as the bucket raises out of the stock pile or face of the bank being cut. As the bucket raises, it tips back to hold a full load with minimum spillage.

TRANSPORTING LOADS:

When transporting loads, the travel speed of the machine will depend on the length of haul and the kind of surface over which the machine must pass. Rough terrain calls for slow speed.

When the bucket is full, raise the boom to carry the cutting edge of the bucket about four (4) feet above the ground. Never transport the machine, loaded or empty, with the bucket fully raised. The nearer the ground the bucket is held, the better the stability, especially on slopes or when turning the machine. Shift the gears into position for speed and direction of travel desired, and drive the machine to the dumping location.

DUMPING THE BUCKET:

When dumping into a truck or bin, raise the bucket so it clears the top edge safely. Move the machine up so the bucket is inside the dumping area. With the boom lever in the hold or neutral position, push forward slowly on the bucket control lever, thus causing the bucket to tip forward and spill its load. The load may be dumped entirely or part at a time, by manipulating the bucket lever. Dumping the load slowly will ease the shock of suddenly added weight to a truck body. Releasing pressure on the bucket control lever will allow it to return to neutral, holding the bucket in dumped position. Pull backward on the bucket control lever, to return the bucket to closed position, before backing the machine away from the dumping area. Back the machine well away from the truck or bin and lower the bucket to carry position (about four (4) feet above the ground) before returning the machine for another load.

ROUTINE SERVICE:

The operator's job does not consist of merely working the "PAYLOADER". The mechanical and operating condition, as well as the general appearance and maintenance of the machine, is also a part of his responsiblity. It is to the operator's advantage to become familiar with the functions of each working part, and a study of the information and suggestions as set forth in this manual will help him do so.

The operating life of the "PAYLOADER" may be considerably extended if the machine is properly serviced at regular intervals. Often major repairs or shut downs are avoided if the machine is inspected regularly, and minor trouble corrected at this time.

Refer to the LUBRICATION CHART for major points requiring periodic service and inspection.

COLD WEATHER OPERATION:

When operating the "PAYLOADER" in temperatures of 32° F. (0° C.) or lower, there is danger of the water freezing in the cooling system, and an anti-freeze solution must be used. To avoid freeze ups in the cooling system, use a permanent type anti-freeze solution such as distilled glycerine or ethylene glycol.

There are several standard reliable anti-freeze solutions on the market which may be used in the cooling system. They should be added to the radiator according to the manufacturer's instructions found on the container. See Specification Data list for cooling system capacities.

Do not use a calcium chloride solution or any alkaline solution as an anti-freeze, as they are injurious to metal. Do not use fuel oil or kerosene as an anti-freeze as they are injurious to rubber hoses.

Do not use alcohol as an anti-freeze solution, as it tends to boil away at average operating temperatures of the "PAYLOADER". If alcohol is used, test the strength of the solution with a hydrometer several times a day. It will be necessary to add alcohol frequently to replace that lost by evaporation.

If no anti-freeze solution is used in freezing temperatures, there is danger of the water freezing in the cooling system, although the engine may be running, and damage to the engine block, radiator and the water pump may result.

Never pour cold water in a hot engine, as the sudden contraction may cause the engine block to crack.

DRAINING THE COOLING SYSTEM:

To drain the cooling system first remove the radiator cap, then open the radiator drain cock and the engine block drain cock. The radiator cap is a pressure type and must be removed to permit draining.

The cooling system should be flushed out seasonally, before adding anti-freeze solution and when draining out the anti-freeze solution, to avoid accumulations of dirt and gum in the radiator tubes.

GASOLINE TANK:

The gasoline tank is located at the front end of the "PAYLOADER", under the front cowl. Use a gasoline of minimum octane rating - 70 to 72 - wher filling the tank. Be sure to use a clean container.

The gasoline shut-off cock is located on the underside of the tank, approximately midway between the foot pedals. It is good practice to close this cock when the machine is to stand idle over night or longer.

The gas tank filler cap protrudes above the front cowl at the forward end of the "PAYLOADER".

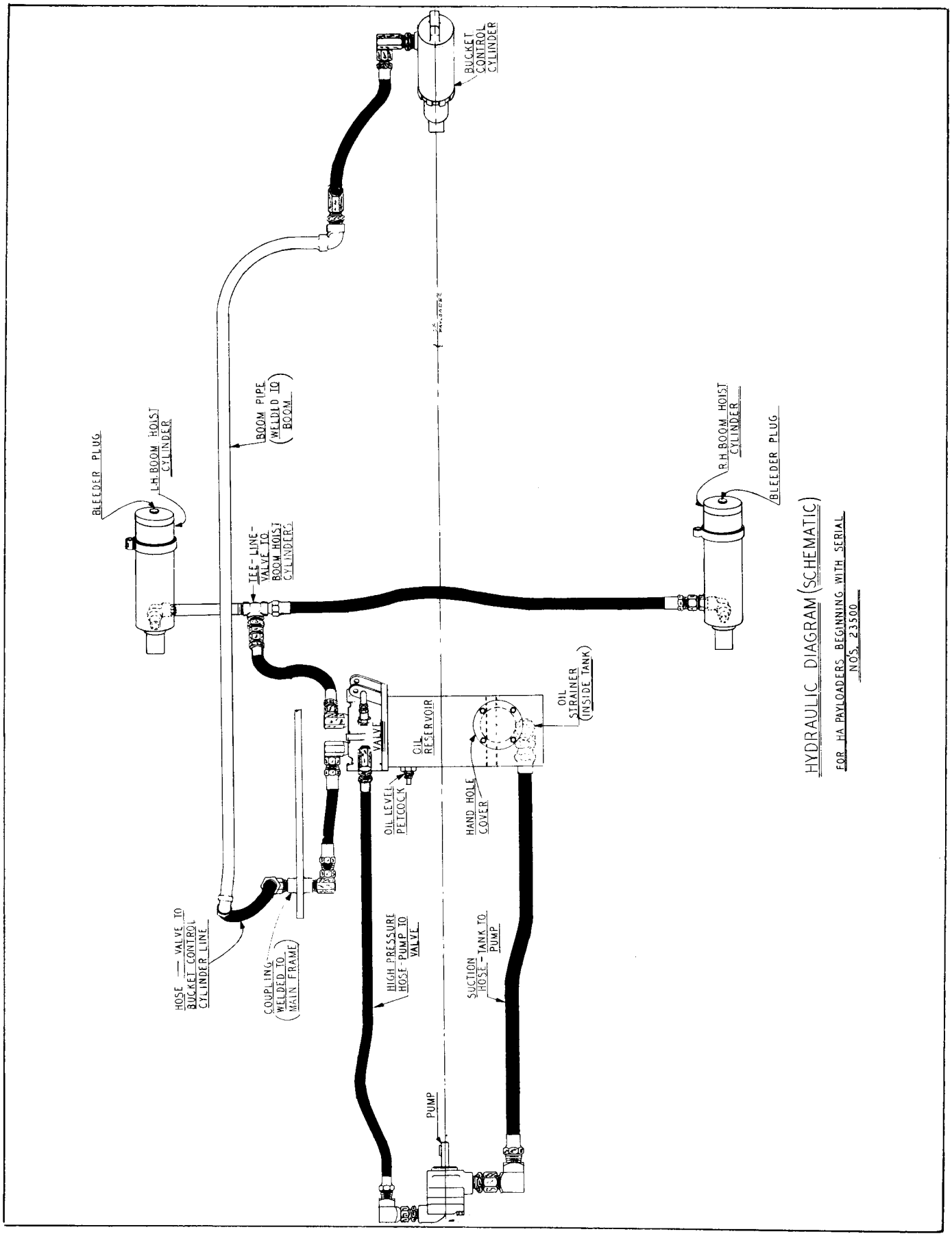


Fig. 2
Hydraulic Diagram

MAINTENANCE SECTION

Regardless of the care used in the design and construction of any type of equipment, there are many conditions that cannot be completely safeguarded against without interfering with reasonable accessibility and efficient operation. The complete observance of one simple rule would prevent serious injuries each year. That rule is --

"NEVER ATTEMPT TO CLEAN, OIL, OR ADJUST A MACHINE WHILE IT IS IN MOTION."

- - National Safety Council - -

NEVER WORK UNDER THE BOOMS OR BUCKET UNLESS THEY ARE BLOCKED AND CANNOT BE LOWERED ACCIDENTLY.

The following paragraphs are not intended to cover all repair problems that may confront the operator. They are merely intended to assist the mechanic or operator in routine adjustments and maintenance which may be done in the field for the most efficient operation of the machine.

For major repairs, refer your problems to THE FRANK G. HOUGH CO. DISTRIBUTOR to obtain the service of a trained mechanic.

HYDRAULIC SYSTEM - CARE OF:

The hydraulic system consists of an oil reservoir, a pump, a control valve, two boom hoists, one bucket control cylinder and the connecting hoses and fittings.

The pump draws oil from the reservoir through the suction line and forces it under pressure into the control valve which regulates the flow of oil to the hoists, which activate the bucket. The valve is manually controlled by the operator by means of the valve control lever.

The pump is protected against severe overloads by a pressure relief built into the valve.

1. Check the oil level in the reservoir daily. The bucket should be fully retracted and resting on the ground when checking the oil level. Low oil level will cause cavitation and the unit will operate in a slow, jerky manner and the pump will howl. Proper oil level must be maintained to displace the hoist pistons when the bucket is operated and to provide constant lubrication to the pump gears.

2. Check the hoses and connections daily to prevent oil from leaking out and air or water from being sucked into the system.

   Air or water may be sucked into the system through a faulty connection, although oil will not leak out. Air in the system will cause the oil to foam and interfere with the smooth action of the boom and bucket. The unit will be noisy and the pump will howl.

   The very small amounts of water in the system through condensation will evaporate when the oil becomes warm by operation. However, water sucked into the system must be removed by draining the system, or it will cause corrosion and erosion of the pump and hoist plungers.

   Moisture causes excessive foaming of the oil, and causes damage to all parts of the system. Foaming will cause the unit to chatter and be noisy. Drain the system thoroughly to remove moisture.

3. A dirty suction line strainer will retard the flow of oil, causing cavitation, and the pump will be noisy. It will prevent the "PAYLOADER" from operating smoothly, similar to air in the system.

4. Check the hydraulic oil pressure at each monthly inspection period. Keep the pressure relief valve set to maintain hydraulic oil pressure within specified limits. This is important for efficient operation and relieves strain on the machine. See "VALVE PRESSURE RELIEF".

5. Drain the oil from the system, clean the suction line strainer in the reservoir, and refill the system with a good grade of SAE-10 Motor Oil after the first 32 to 48 hours of actual operation. There-after, drain the system and clean the suction line strainer every 1,000 hours or oftener if working conditions are unusually dirty and dusty. Dirt in the hydraulic system is a common cause of failure of the pump or valve.

   In hot weather or when the "PAYLOADER" will operate in temperatures above 90° F., it may improve the operation by refilling the system with a good, clean grade of SAE-20 Motor Oil. Do not use SAE-20 oil in moderate temperatures.

6. Drain the hydraulic system only after the "PAYLOADER" has been operated for a time and while the oil is still warm. Warm oil will drain more freely and carry more impurities out with it.

7. Use a good clean grade of white lead, Aviation Permatex or isoluble plastic lead seal, on the male threads only, when reconnecting a fitting or joint. Do not allow the thread sealer to enter the valve or pump.

8. The system must be "bled" or purged of air after any work has been done on it, or after it has been drained.

DRAINING THE HYDRAULIC SYSTEM:

NOTE: DRAIN IMMEDIATELY AFTER THE "PAYLOADER" HAS BEEN OPERATED FOR A TIME AND WHILE THE OIL IS STILL WARM. WARM OIL WILL CARRY MORE DIRT AND SLUDGE WITH IT.

To drain the entire hydraulic system proceed as outlined.

1. Raise the boom to full height with the bucket in dumped position. Block or chain the booms up in the raised position so they cannot fall when the oil drains from the hoist cylinders. Then shut off the engine.

2. Place a 6 gallon container under the reservoir drain plug, then remove the drain plug.

   The drain plug is a magnetic type and must be thoroughly cleaned before replacing.

3. After the reservoir has drained, break the suction hose connection at the reservoir, and break the pump pressure hose at the valve, to drain the pump and pump hoses.

4. Break the boom hoist hoses at the tee to drain the boom hoist cylinders.

5. Break the boom pipe hose connection at the rear end of the pipe, to drain the bucket control cylinder and the boom pipe.

6. Remove the reservoir clean-out cover; reach into the reservoir to remove the suction line strainer. The strainer must be washed thoroughly in clean gasoline to remove all particles of dirt and lint.

7. Remove the cap from the reservoir breather, and wash it in gasoline to clean the air passages.

8. Flush and clean all sludge and dirt from the bottom of the reservoir, being careful not to force sludge or dirt into the valve. If the reservoir is very dirty, or if dirt is forced into the valve, it must be removed and the valve washed out in clean gasoline. Dirt in the valve may result in wear and failure.

9. After the system has been drained and cleaned, replace the drain plug, the strainer, and the valve, and remake all broken connections. Be sure the connections are tight and will not leak oil or suck air. See "CARE OF THE HYDRAULIC SYSTEM".

10. Refill the system to the top of the reservoir with a good grade of SAE-10 Motor Oil.

11. Start the engine; allow it to operate at idle speed until it partially warms up and giving it time to pump oil into the cylinders. Operate the bucket cylinder through its dumping cycles several times. Remove the blocks or chains holding the boom in raised position. Do not stand or work under the bucket when the blocking is removed. Operate the boom by raising and lowering it several times, then allow the bucket to rest, fully closed, on the ground and shut off the engine.

12. Inspect all connections and the drain plug for leaks at this time.

13. After all work has been completed, refill the reservoir to the proper level. This is necessary as oil will have been pumped into the hoist cylinders and hoses, thereby reducing the oil level in the reservoir.

14. Replace the clean out cover and the breather cap. Be sure the cover gasket is in place and the breather is clean.

15. After the system has been drained and refilled, or any work done on it, the system must be "bled" or purged of air, to insure smooth operation of the hoist cylinders.

BLEEDING THE SYSTEM:

1. Start the engine, raise the bucket and hold it to nearly full height, slowly open the bleeder screw in the upper end of either boom hoist cylinder, to allow the air to escape.

2. As soon as air bubbles cease to escape from around the bleeder screw, tighten the screw securely. Clean the hoist cylinder of oil that escaped through the bleeder screw. Repeat this operation on the opposite boom hoist.

   Then operate the bucket by dumping and retracting it to bleed the bucket control cylinder.

HYDRAULIC HOIST CYLINDERS: SEE FIG. 3.

The Hydraulic Cylinders are so constructed that no adjustments are necessary other than to tighten the packing if oil escapes excessively.

IMPORTANT: ADJUST THE PACKING, BY TURNING THE PACKING NUT, SO A SLIGHT FILM OF OIL ADHERES TO THE PLUNGER, AT ALL TIMES, AS IT EMERGES FROM THE CYLINDER.

This comprensates for packing wear and allows the wiper seal to remove dirt and other foreign matter from the plunger as it is drawn into the cylinder.

The hydraulic hoist packing is the chevron type and is made up in sets of special rings. When the packing and wiper seals become worn, as evidenced by oil escaping excessively, they must be replaced. To replace proceed as follows:

1. Place a container under the tee on the hydraulic line "valve to boom hoist", and break the hose connection at the tee to drain the boom hoists.

2. Remove the boom hoist cylinder from the "PAY-LOADER" and place it in an upright position with the stuffing box up. To remove the boom hoist, take out the bolts holding the cylinder to the boom trunnion. With a chain hoist, lift up the boom and bucket until the hoist cylinder slips free of the trunnion. Then remove the cylinder from its lower frame pivot. Remove the boot to expose the packing nut.

   The bucket control cylinder can be taken from the machine by removing both the upper and lower pivot pins which hold this cylinder to the bucket and to the carrier. Then remove the elbow, nipple and boot from the cylinder inlet connection.

3. Unscrew the packing nut and remove the old packing using a blunt instrument. Be careful not to damage the threads in the packing recess or scratch the plunger rod surface. Pay special attention to the order in which the old packing was arranged so that the new packing can be inserted similarly.

   Clean out the packing recess thoroughly before inserting new packing.

4. Replace the rubber wiper ring in the packing nut at this time. Do not damage the "O" ring oil seal found behind the rubber wiper ring.

5. Insert the new packing rings carefully, in the same order in which the old packing has been removed. The end ring is a "V" type to fit into the chevron type rings.

6. Work each ring down smoothly, without distortion or damage. A damaged ring must be discarded. Use a blunt ice pick or similar tool to work in the new rings. Do not damage the stuffing box threads.

7. There should be 1/16 to 3/32 compression when the packing nut is screwed in tightly. A properly adjusted nut will allow a slight film of oil to remain on the plunger rod each time it emerges from the hoist cylinder.

8. Reassemble the hoist cylinders to the machine; make sure the hose connections are tight.

9. Refill the oil reservoir with proper oil. Start the engine, let it run at idle speed for a time, then check the hose connections to be sure they are tight.

10. Bleed the system of air. After all work is completed, lower the bucket to the ground and check the oil level in the reservoir to see that it is to the correct height before putting the machine to work.

BOOTS - Hydraulic Hoists

Boots have been provided to protect the hoist plungers from nicks, pits and scratches caused by flying material from the wheels. The boots prevent the accumulation of sand, slush or other foreign material from sticking to the plungers, thereby lengthening the life of the wiper rings and the packings.

It is recommended that the boots always be kept in place, and torn or damaged boots be replaced promptly.

HYDRAULIC OIL RESERVOIR:

The oil reservoir is located just under the operator's seat. The oil level must be maintained up to the petcock level when the bucket is resting on the ground. This will insure a quantity of oil sufficient to displace the cylinder plungers in order to raise the boom and bucket.

There are no adjustments on the reservoir; however, it should be drained, cleaned of dirt and sludge and refilled with clean oil every 1000 hours or oftener if working conditions are very dirty and dusty. The suction line strainer is inside the tank at the suction line outlet to the pump. This strainer must be kept clean. A dirty strainer will retard the flow of oil to the pump and cause cavitation, the pump will howl, and the boom will raise in a slow jerky manner. The tank breather should be washed out with clean gasoline periodically. Remove the hand hole cover to reach into the tank to remove the strainer and to inspect the vents in the breather pipe.

The oil reservoir may be removed without draining the oil. If draining the oil is necessary, place a five or six gallon container under the reservoir drain plug and remove the plug. To take out the reservoir without draining, remove the hand hole cover, reach into the tank, and take out the suction line strainer. Then, using a cork of approximately 31/32 dia. at the small end, insert it into the suction line outlet of the reservoir.

To remove the reservoir, proceed as follows:

1. Remove the seat cushion. Disconnect the suction line hose at the reservoir. Disconnect the pump pressure hose at the valve. Disconnect the hose to the boom hoist cylinders at the pipe "Tee". Disconnect the hose to the bucket control cylinder at the coupling welded to the frame. The hose openings may be corked on the valve side to prevent leakage of oil.

2. Remove the choke rod from the machine. Remove four bolts holding the seat frame to the upper and lower cross members.

3. Remove the three bolts holding the oil reservoir to the frame. One is at the rear, right corner, and the remaining two bolts are in the front, holding the tank to the frame cross member. The reservoir may now be lifted from the machine along with the valve.

HYDRAULIC VALVE:

The hydraulic valve receives oil under pressure from the pump and directs it to the hoists. When the

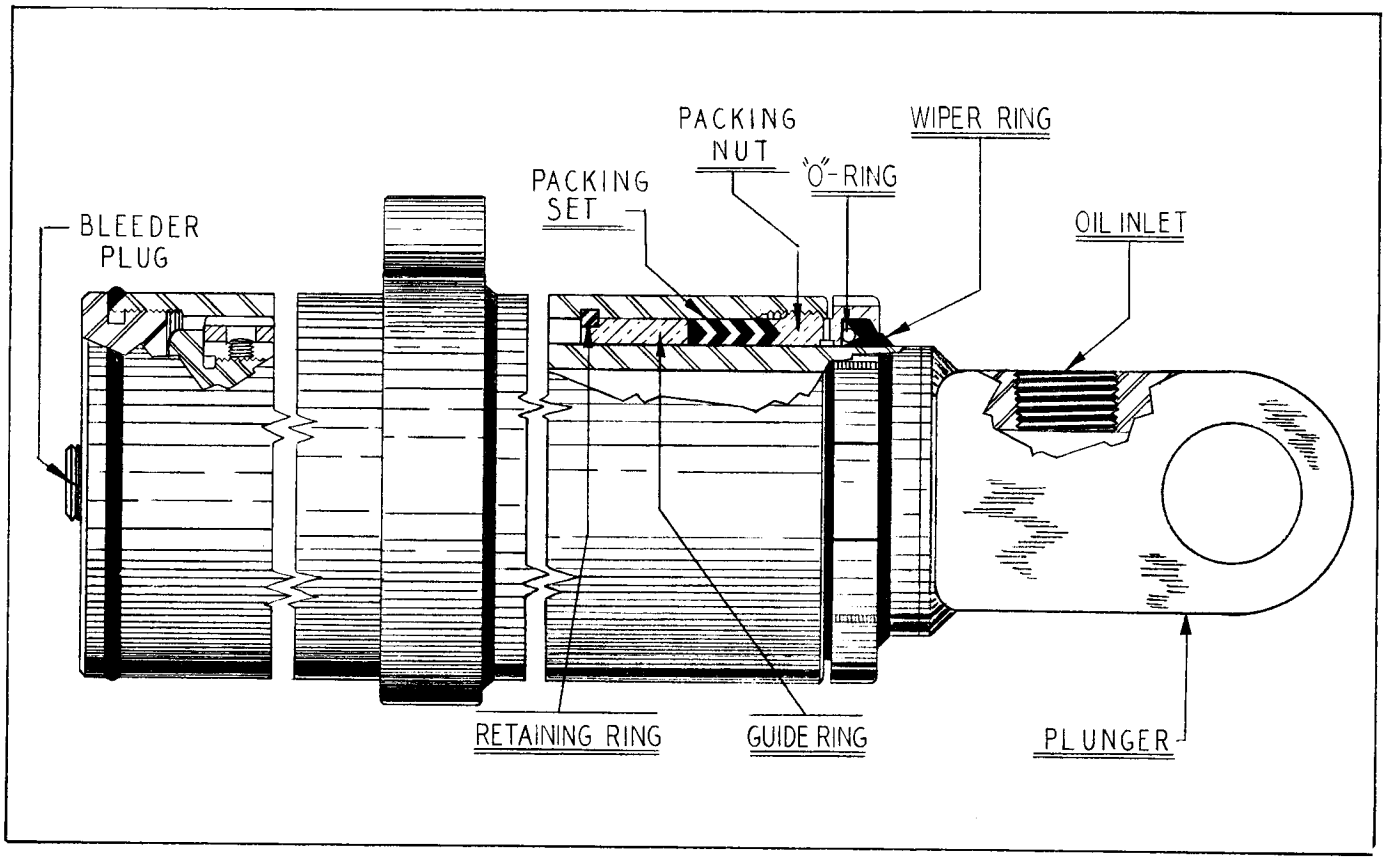


Fig. 3
HOIST PACKING DETAILS

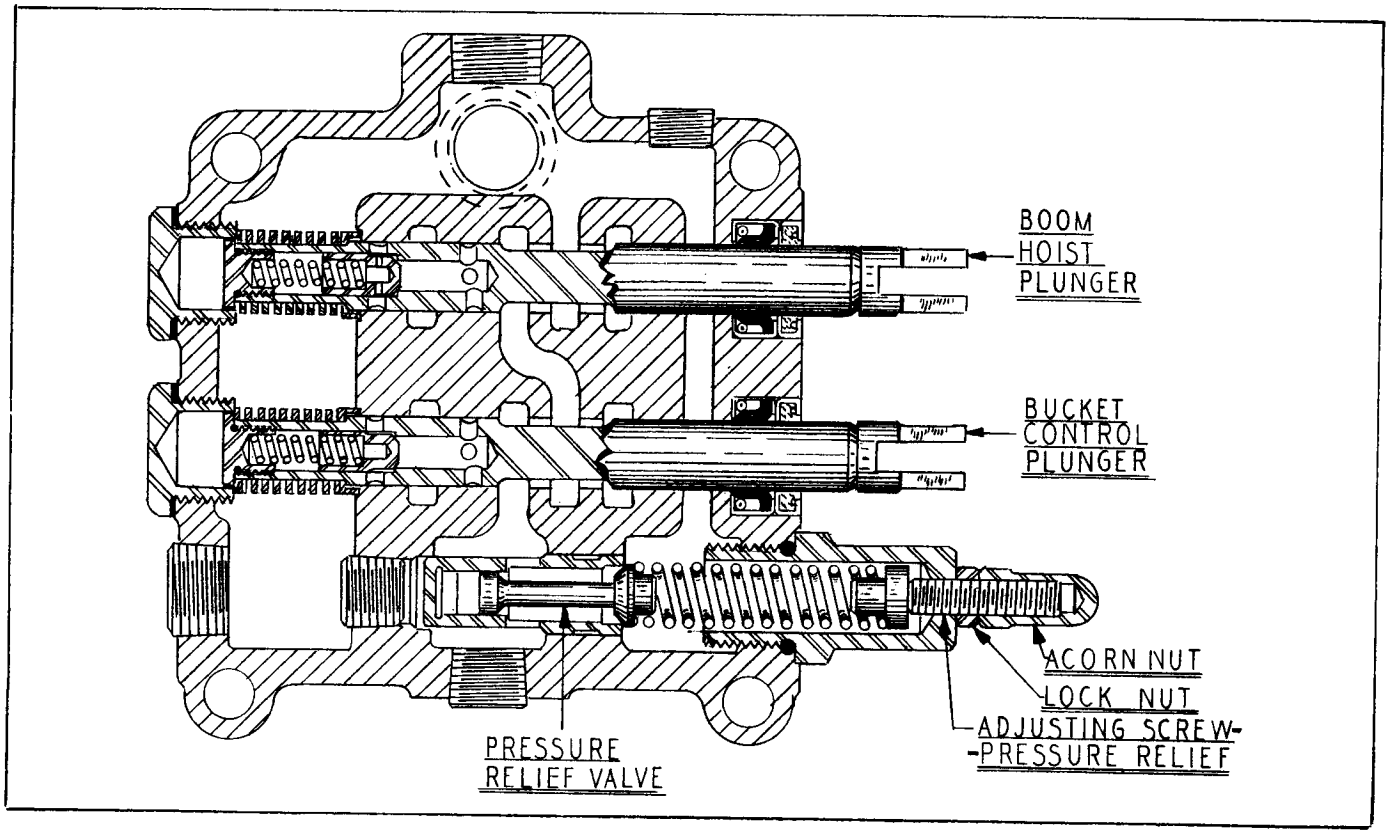


Fig. 4
HYDRAULIC VALVE

valve plungers are in "Hold" position, the oil already in the hoists is retained therein, but oil from the pump flows through the valve back to the reservoir. In "Raise" and "Close" positions, the oil from the pump is directed into the respective hoist cylinders. In "Lower" or "Dump" positions the oil returns from the hoist cylinders, through the valve and into the reservoir along with oil coming from the pump.

No adjustments are to be made other than to remove the valve from the oil reservoir and wash it out with clean gasoline every 1000 hours of operation. Whenever the oil in the reservoir is very dirty or dirt is forced into the valve when cleaning the reservoir, the valve must be removed and washed out. Premature valve failure or excessive wear is frequently the result of dirt getting in the valve because of dirty oil.

Springs and seals may be replaced when necessary, but the manufacturer does not recommend replacement of the plungers as they have been fitted to the body at the factory to maintain close tolerances.

The hydraulic valve is mounted to the left hand side of the reservoir. To remove the valve proceed as follows:

1. Drain the oil reservoir. Then remove the reservoir and valve from the machine.

2. Disconnect the hoses from the valve.

3. Unscrew the capscrews holding the valve to the valve mounting plate and the valve will come away from the reservoir.

4. Note the "O" ring oil seal at the valve discharge opening into the reservoir. This ring must be in good condition, otherwise discard it for a new ring. Be sure to replace this "O" ring carefully when reassembling the valve to the reservoir to avoid pinching the ring because of a poor seat.

5. After the valve is bolted to the reservoir, connect the hoses. Refer to the hydraulic diagram to note the proper connection points. Be sure the connections are tight and will not leak oil. Replace the reservoir and valve in the machine. Refill the reservoir with the proper oil to oil level petcock. Operate the hoists several times. Shut the engine with the bucket on the ground. Inspect the connection points, then recheck the oil level in the reservoir and "bleed" the system of air.

VALVE PRESSURE RELIEF: SEE FIG. 4

To safeguard the pump and to maintain efficient operation of the machine, the valve pressure relief must be set to operate at 1200 lbs. pressure at full open engine throttle.

Check the valve pressure relief setting to each monthly inspection period.

To check, carefully follow the instructions as outlined.

1. Insert a hydraulic gauge of approx. 2500 lbs. capacity into the air bleeder hole in the top of either boom hoist. The bleeder hole is threaded with 1/2" standard pipe threads.

2. Remove the acorn nut from the valve to expose the valve pressure adjuster screw. Loosen the hex lock nut on the adjuster screw. To reduce the valve pressure relief, turn the adjuster screw counter-clockwise.

3. Start the engine, being careful to keep it at idle throttle. Raise the bucket and booms to full height. Then, holding the valve lever in "raise" position, gradually increase the engine speed while noting the increase of oil pressure. Do not allow the oil pressure to exceed 1200 lbs.

   If the oil pressure tends to reach 1200 lbs. pressure before the engine is running at full open throttle, slack off the engine speed and adjust the pressure adjuster screw for lower pressure to avoid damage. Repeat this process of gradually increasing the engine speed while adjusting the pressure relief screw until the gauge registers 1200 lbs. pressure at full open engine throttle with the bucket fully raised and the valve lever held in raise position.

   When the pressure relief reaches 1200 lbs. pressure consistently, under conditions as instructed, the adjuster screw may be locked in place and the acorn nut replaced.

HYDRAULIC PUMP: For Hoists Cylinders: See Fig. 5.

The pump is coupled directly to the engine crankshaft and must not be operated without sufficient oil circulating through the hydraulic system to provide constant lubrication in the pump gears. The pump draws oil from the reservoir and forces it, under pressure, into the valve.

The pump is a Vickers Rotary vane type, assembled for left hand operation, and has no volume adjustment. An arrow stamped on the body indicates direction of rotation. Shaft packing is not subject to pressure and normally does not require replacement. Vanes, being subject to centrifugal force, automatically compensate for any normal wear.

If the pump does not develop sufficient pressure and the cause cannot be determined, see THE FRANK G. HOUGH CO. DISTRIBUTOR for details on the repair or replacement of the pump.

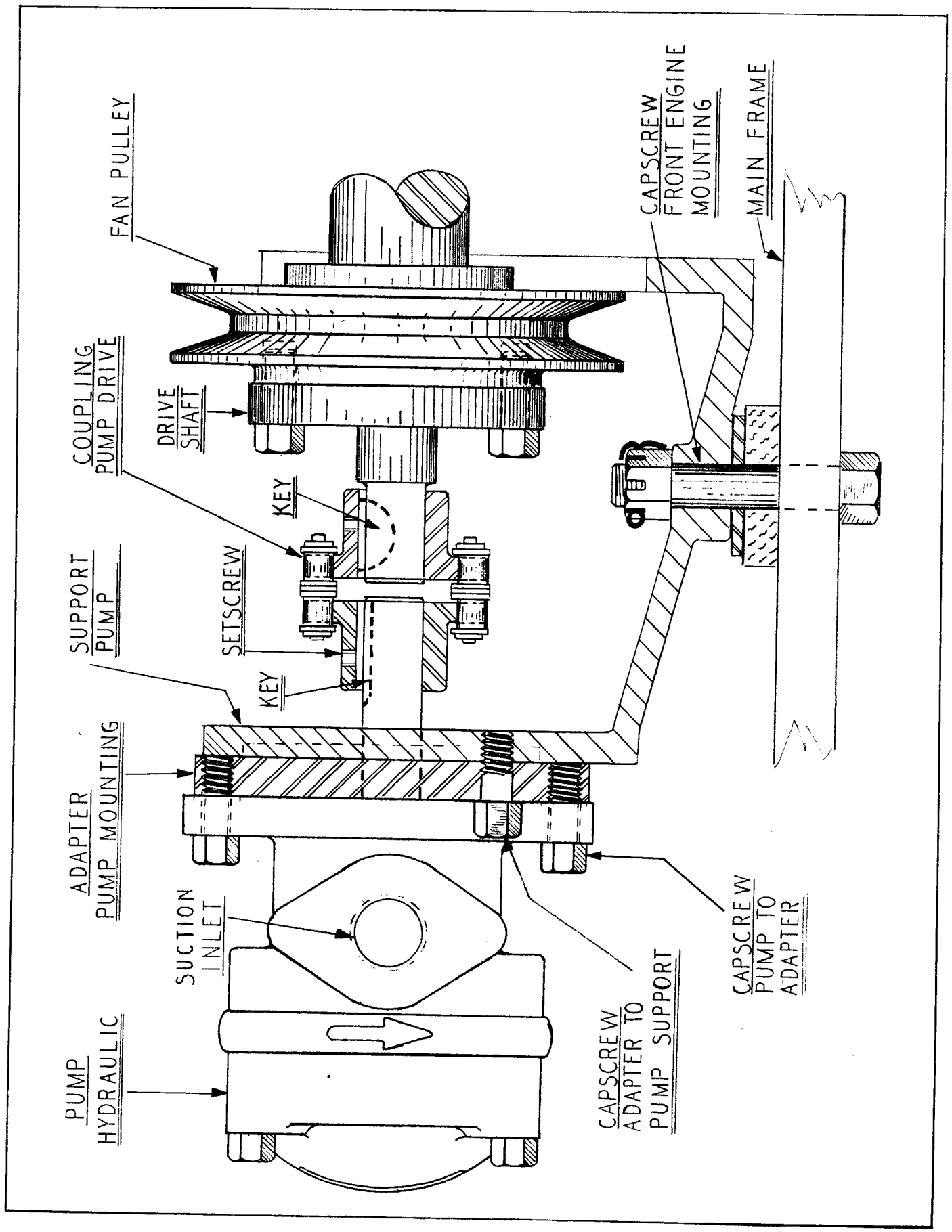


Fig. 5
HYDRAULIC PUMP MOUNTING

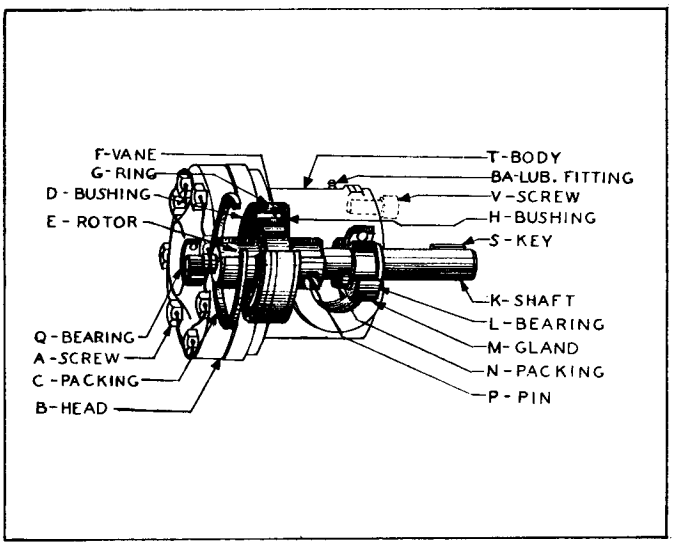
The hydraulic pump is mounted just under the radiator and connected to the engine crankshaft by a flexible chain coupling. To remove the pump proceed as follows:

1. Remove the pump cover from the lower, rear of the grille casting by loosening the jam nut and turning the clamp with a screwdriver. Place the screwdriver in the slotted end of the clamp stud and give it a quarter turn to free the cover from the grille casting.

2. Disconnect the pump hoses at the pump by loosening the straight adapter unions holding the elbows to the pump.

3. By using an extension box wrench for a 3/8 bolt, reach into the grille casting recess and unbolt the pump adapter plate from the pump mounting casting. There is one bolt on each side of the pump, diagonally across from each other.

4. When the pump is loose, draw it straight backward to allow the flexible coupling to slip off the shaft. If the pump is cocked when drawing it out the flexible coupling may jam on the shaft, making it difficult to remove the pump. The flexible coupling is keyed to the crankshaft and to the pump shaft. Be sure these keys are in place when reassembling the pump. The coupling keyslot and the crankshaft key must be in line to reassemble the pump to the machine.



PUMP ASSEMBLY - SIDE VIEW

DISMANTLING AND REASSEMBLING PUMP:

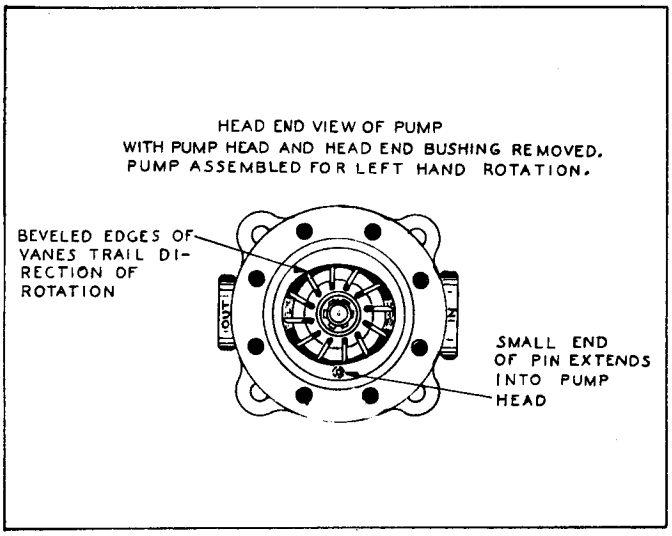
Inspection of the pumping cartridge parts in the vane type single pump can be made as follows:

The pumping cartridge consists of a rotor "E", vane "F", valve plate bushings "D" and "H", and cam ring "G". All moving parts, except shaft and shaft bearings, operate within this cartridge assembly. No moving parts, therefore, are in contact with the body "T".

Remove the head screws "A" and the head "B". The head end valve plate bushing "D" can then be pulled out, leaving exposed the rotor "E", vane "F" and the cam ring "G".

Be particularly careful to note the position of the rotor and vanes, also the position of the ring pin "P". These parts may all be reassembled incorrectly if not carefully checked, because of the fact that provision is made in the design for either right hand or left hand assembly. The position of cam ring "G" should also be noted carefully.

These parts can all be removed for inspection, and the shaft end valve plate bushing "H" will then be exposed. It can be removed by a hook-shaped tool. Parts that show damage or excess wear should be replaced. The vanes can be turned end-for-end so that the inside edge is now against the cam ring, thus renewing the vanes for future service. Worn edges must be stoned so vanes move freely in rotor slots and beveled edges must trail direction of rotation.

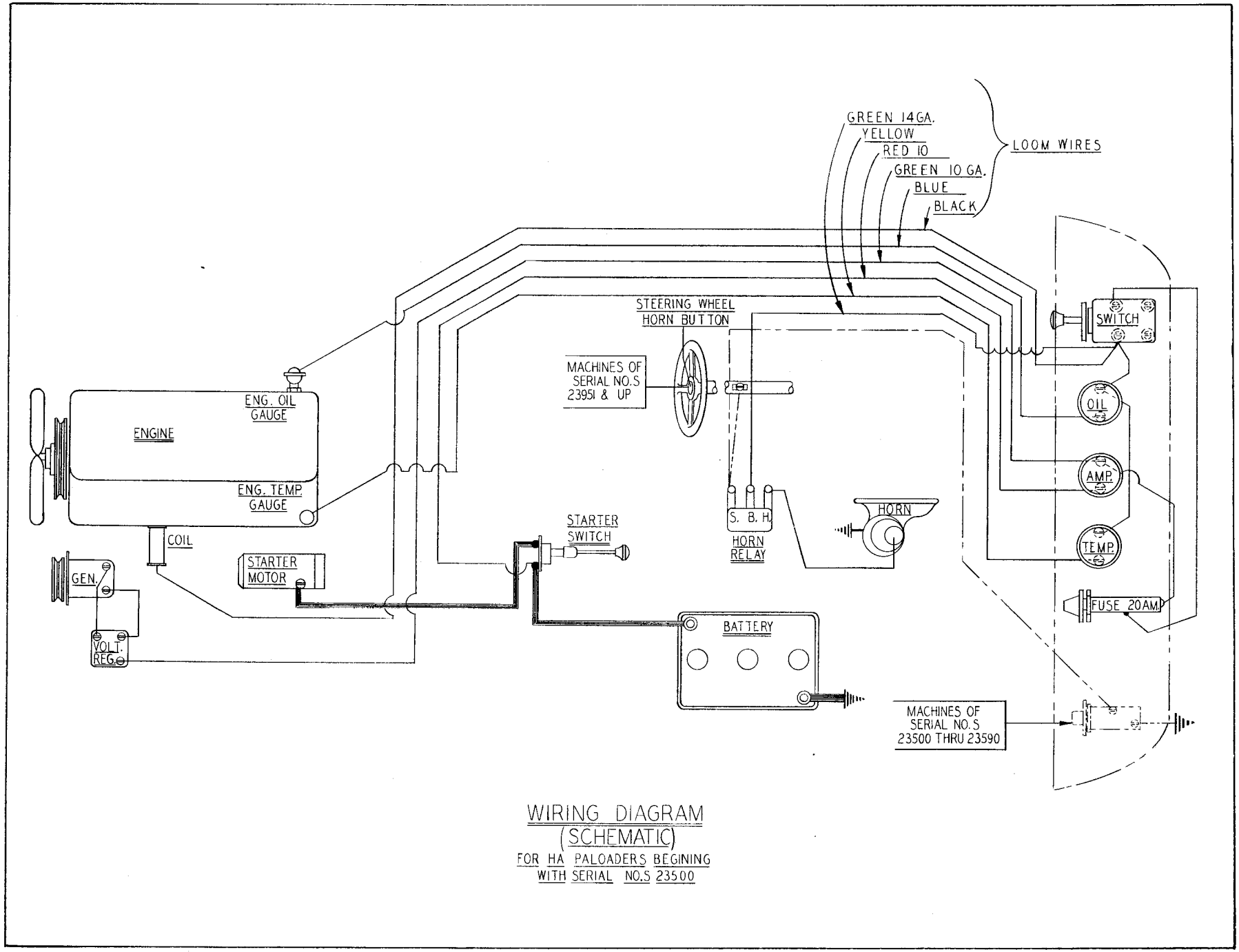


PUMP ASSEMBLY - END VIEW

Reassemble in reverse order with parts replaced in original positions, using parts drawing as a supplementary guide. Renew head ring packing "C" if it has become compressed or damaged, otherwise air will be drawn in when the pump is running or oil will leak out when not running. Assemble the pump head so that ring hole registers with protruding end of ring pin "P".

Extreme caution must be taken when reassembling parts to make certain that no grit or lint gets into the vane slots or between assembled parts. Not only may this cause a vane to stick, but it may also cause damage to valve plate bushings. A small amount of foreign matter also will give a false indication of head screw adjustment, thereby impairing pump efficiency. Wash parts in kerosene and use every precaution against dirt.

When reassembling a pump, the head takeup screws, if tightened excessively, can cause binding



WIRING DIAGRAM
(SCHEMATIC)
FOR HA PALOADERS BEGINING
WITH SERIAL NO.S 23500

Fig. 6
WIRING DIAGRAM

between the rotor "E" and the two valve plate bushings "D" and "H". It is very important that these take-up screws be drawn up moderately and evenly. Rotate the pump shaft by hand while gradually tightening opposite head screws until all have been pulled up evenly without causing the shaft to bind. Sometimes an additional 1/8 turn is given after the pump has been run a short period. Insert wire through screwheads so that adjustment will be maintained.

The opposite end of the pump must be opened to gain access to the shaft parts, making it possible to then remove the shaft "K" and bearing "L". The stamped steel packing gland "M" and the special cork packing "N" can then be inspected. The cork packing should be renewed to prevent air leakage into the pump or oil leakage out when the pump is not running. When replacing the gland, make certain that its outside diameter bears on the outer ball bearing race, and its inside diameter against the cork shaft packing. All of this work may be accomplished without disturbing the head of the pump.

See THE FRANK G. HOUGH CO. Dealer for details on repair and replacements of these pumps.

ENGINE:

The HA "PAYLOADER" engine is a Waukesha FC Industrial. Engine specifications are listed in the Condensed Specifications & Service Data pages of this manual.

Consult a Waukesha Engine Operating Manual for proper repair, maintenance, and operation of the engine. Many important points, pertinent to longer engine life are discussed in the engine manual.

The engine, radiator, hydraulic pump, clutch, and transmission may all be removed as a single unit from the machine. To remove follow as instructed.

1. Remove the oil reservoir - see paragraph on oil reservoir removal. Remove the engine hood assembly from the machine.

2. Remove the bolts holding the grille casting to the frame, hook a chain hoist to the casting to prevent it from falling, then remove the tie bars holding the upper portion of the grille to the main frame uprights, and remove the casting.

3. Disconnect the choke rod and the accelerator rod at the engine. Disconnect the exhaust muffler from its support on the grille tie bar. Disconnect the air cleaner tubing at the engine. Disconnect the gearshift lever linkage at the transmission. Disconnect the clutch operating rod at the clutch. Disconnect the clutch grease hose at the clutch housing. Disconnect the pump hoses at the pump and remove the hose clamp securing the pressure hose to the clutch housing. Disconnect the fuel line at the engine. Disconnect the wiring from the engine.

4. The engine is mounted at three points and rides on rubber cushions. The cushions are protected by steel caps. Two bolts hold the front end to the main frame at the flywheel housing and one bolt at the rear end of the engine under the hydraulic pump bracket.

5. Pass cable slings under each end of the engine, loosen the mounting bolts, and raise the engine slightly. Then with a slight twisting and tipping movement, the engine can be moved backward and upward out of the frame.

6. After work is completed, do not run the engine unless the hydraulic pump has been disconnected or until the hydraulic pump is again connected to the hydraulic system with a sufficient supply of oil.

   Be sure of oil in the engine crankshaft and of cooling fluid in the radiator before running the engine.

7. To reassemble the engine to the machine it may save time if the drive shaft is separated before hand. While the engine can be removed without unbolting the drive shaft yokes, it will be difficult to slide the yoke onto the shaft when reassembling the engine to the "PAYLOADER".

FAN BELT REMOVAL: SEE FIG. 5.

Untimely shutdowns or damaged radiators may be avoided by frequent replacement of the fan belt. The fan belt should be inspected at each monthly service period and replaced if it shows signs of deterioration. If the machine is laid up for a time, it is good practice to ease the fan belt tension. Belts will deteriorate if allowed to remain taut for prolonged periods when not subjected to normal action.

1. To remove the fan belt, shut off the engine with the bucket resting on the ground. Then loosen the hydraulic pump adapter from the pump bracket and pull the pump outward, to the rear, as far as it will go. It is not necessary to disconnect the pump hoses - see Pump Removal.

2. From inside the engine shrouding, loosen the generator bracket adjusting screw and push the generator in toward the engine and retighten the screw slightly.

3. The fan belt may now be removed from the generator pulley and the lower fan belt pulley, then slip the belt over the fan.

4. Install a new fan belt by reversing the method of removal. Replace the pump. Be sure the pump drive shaft keys are in place and in line. The pump can then be pushed in place easily. Bolt the pump securely. Adjust the fan belt tension. Replace the pump cover in the grille.

FAN BELT TENSION:

Check and adjust the fan belt tension at each regular monthly inspection period.

To adjust the fan belt tension, loosen the generator adjusting bracket bolt, and move the generator in or out as required. The proper tension is obtained if

the center section of the belt can be pressed inward, by hand, to approximately 3/4 inch. Use a straight edge and scale to measure this amount of flexibility when adjusting the belt. Lay the straight edge across the pulleys. Measure the distance from the belt to the bottom edge of the straight edge when the belt is pressed inward. Be sure to tighten the generator adjusting bolt securely to maintain the fan belt tension.

AIR CLEANER SERVICE:

The purpose of the air cleaner is to collect dirt and dust before it reaches the engine. Considerable amounts of dust are found floating in the air and the abrasive action of such particales will cause rapid wear on the cylinders, valves, and bearings, when drawn into the engine. The air cleaner must be serviced regularly, to clean out, and remove its accumulation of dust and dirt to promote efficient operation of the cleaner. Daily servicing of the air cleaner is very important and contributes considerably to longer engine life. It is good practice to clean the air cleaner and change the oil in it several times a day if working conditions are very dusty.

To clean, wash out thoroughly with clean kerosene and refill the oil cup to the oil level bead with clean oil; use the same grade of oil as used in the engine crankcase.

NOTE: It is very important to examine the air cleaner tubing periodically for defective connections and leaks. Considerable amounts of abrasive material can be drawn into the engine through minute openings, or loose connections, in the tubing between the air cleaner and the engine. Such openings can permit passage of dust more freely than a poorly serviced air cleaner, and will surely offset any effort to maintain an efficient cleaner.

OIL FILTER:

The purpose of the crankcase oil filter is to retard dilution of the engine oil with harmful substances, and by removing abrasive particles which may have gotten into the oil. The sump in the bottom of the filter should be thoroughly cleaned of sediment, and the element replaced whenever the crankcase oil is drained.

Do not fail to read and follow instructions on the box containing the new filter element when replacing the used element.

After replacing a filter element, tighten the cover securely, start the engine, and let it operate for about 10 minutes to fully saturate the new filter element. Then shut off the engine and inspect the filter cover for leaks. Always check the crankcase oil level after the new element has become saturated with oil, since oil drawn into, and retained in the filter, will reduce the oil level in the crankcase.

CLUTCH:

The clutch is a spring loaded, dry disc, foot operated type. The importance of proper use of the clutch pedal during Loader operation will save considerable wear on the clutch release bearing and the clutch disc. "Riding" the clutch causes rapid wear on the clutch release bearing and the tendency to "feather" the clutch results in premature wear on the clutch disc. The clutch pedal should never be depressed except during the time required to shift gears. Work requiring numerous short runs brings the clutch into constant use which increases the rate of wear on the clutch facings.

The clutch release fingers are adjusted and locked at the factory and are NOT to be adjusted to compensate for facing wear. An adjustment for facing wear and free pedal play is provided in the clutch operating rod.

CLUTCH PEDAL PLAY - SEE FIG. 7.

The clutch pedal must have 1 - 1-1/2 inches of free play. Clutch wear decreases this clearance. It is imperative that the pedal be readjusted at frequent intervals to obtain this clearance. Free pedal play is the amount of movement of the clutch pedal before the clutch release bearing contacts the clutch release levers. Lack of free pedal play causes undue wear on the clutch facings and the bearings.

To readjust the clutch pedal remove the clevis pin and turn the clevis on the clutch control rod until the necessary free movement of the pedal is obtained. It may be necessary to adjust the clevis several times to reach the proper amount of free play.

Be sure to tighten the lock nut against the clevis to maintain adjustments.

CLUTCH REMOVAL:

1. To remove the clutch, remove the seat, cushion oil reservoir, and the transmission - see Oil Reservoir Removal and Transmission Removal.

   The power take-off shaft with the release bearing and sleeve, will be withdrawn from the clutch when the transmission is pulled away from the engine.

2. Remove the capscrews holding clutch pressure plate to the engine flywheel and lift complete-pressure plate out of the flywheel housing to free the clutch drive plate. Do not mix the capscrews used in the flywheel with ordinary capscrews. These capscrews often are a special type to locate the clutch pressure plate to the flywheel. Be sure to check the clutch pilot bearing before replacing the clutch. Remove the bearing, and clean it and the bearing recess. Apply a small amount of high temperature grease to the bearing before replacing it in the flywheel.

When installing the clutch to the flywheel, make sure the cover plate will fit freely before inserting the driven disc. Then follow the suggested procedure below:

1. Place the driven disc assembly against the flywheel. Place the cover assembly over the facing disc and bolt it to the flywheel by screwing in each bolt finger tight. Insert a spare splined pilot shaft through the clutch to hold the facing disc hub on center while bolting the cover in place. Care must be used to avoid bending or misalignment of the disc, to prevent clutch drag.

2. With the driven disc in line with the pilot bearing and the clutch assembly, the bolts in the flywheel may be tightened by alternately drawing up opposite bolts, until the clutch is securely and evenly fastened. Then the spare splined shaft may be withdrawn.

3. Bring the clutch housing into position carefully, that the transmission power take-off shaft can be slipped gently into place through the clutch, the driven disc, and into the pilot bearing, without bending the driven disc or otherwise disturbing the alignment of the assembly.

4. Bolt the housing securely in place, replace the clutch operating rod to the clutch arm and reassemble the drive shaft. Reassemble the oil reservoir, seat, and seat frame, and replace the hose and wiring clips. Replace the clutch grease hose.

5. After all parts are reassembled properly, the clutch rod must be adjusted to obtain the correct amount of free clutch pedal play - see Clutch Pedal Play.

TRANSMISSION

This is a two speed forward and reverse transmission. For major repairs to the transmission use the extensive facilities offered by THE FRANK G. HOUGH CO. dealers.

Breathers must be cleaned and kept open to protect grease seals and gaskets.

Be sure to check and service the transmission regularly as specified in the Lubrication Chart.

Greases should not be mixed. Use the same when adding grease.

TRANSMISSION REMOVAL:

1. Place the machine under a crane or hoist and remove the seat cushion and seat frame.

2. Remove the oil reservoir - see Oil Reservoir Removal.

3. Remove the body side shields, the two rear portions of the floorboard, the rear floorboard support cross member, the battery, and the battery box.

4. Disconnect the gearshift levers at the transmission. Disconnect the clutch operating rod at the clutch. It may be necessary to release the clutch return spring to disconnect the rod. Disconnect the clutch grease hose at the clutch housing. Free the pump hose from the clutch housing. Free the wiring loom from the clutch housing.

5. Break the universal joint drive shaft at one of the yokes by removing the bolts holding the yoke to the center cross - see Drive Shaft Removal.

6. To free the transmission remove all bolts holding the clutch housing to the flywheel housing. Use the crane hoist to support the transmission when removing the bolts. Pull the transmission away from the engine carefully to avoid damage to the clutch disc. The clutch discs and the flywheel will then be exposed.

7. If it is merely desired to expose the clutch, the transmission housing can be lowered to the floor to rest under the machine temporarily. In this case it isn't necessary to remove the battery, battery box, and the floorboard support cross member.

DRIVE AXLE:

Service the drive axle periodically as specified in the lubrication chart. The differential carrier and each wheel housing must be serviced independently of each other. There is no provision made in the axle to permit oil to pass from the differential carrier to either of the final drive wheel housings. Oil filler plugs are located at three points, one in each of the wheel housings, and one for the differential housing.

Breathers must be cleaned and kept open to protect the grease seals and gaskets.

For major repairs to the drive axle, refer your problems to the "PAYLOADER" dealer, to obtain the services of a trained mechanic.

DRIVE AXLE REMOVAL:

1. Raise the boom and bucket to almost full height. Block them in this elevated position and shut off the engine.

2. Disconnect the brake fluid lines at the wheels. Break the universal joint by removing the bolts holding the yoke to the center cross bearings. Remove the bolts holding the axle housing to the frame. Hoist up the machine high enough so the axle will be clear of the frame. Block the machine in this position securely and roll the axle out from under this machine.

DRIVE SHAFTS:

The drive shafts are Mechanics double universal joints of roller bearing design with each bearing retainer held in place by an integral key and pilot and two capscrews. The roller bearings are protected by a cork dirt seal which is held in place by a steel retainer ring. The cork seal and its retainer act as grease seals to keep lubrication in the bearings and prevent dirt from entering.

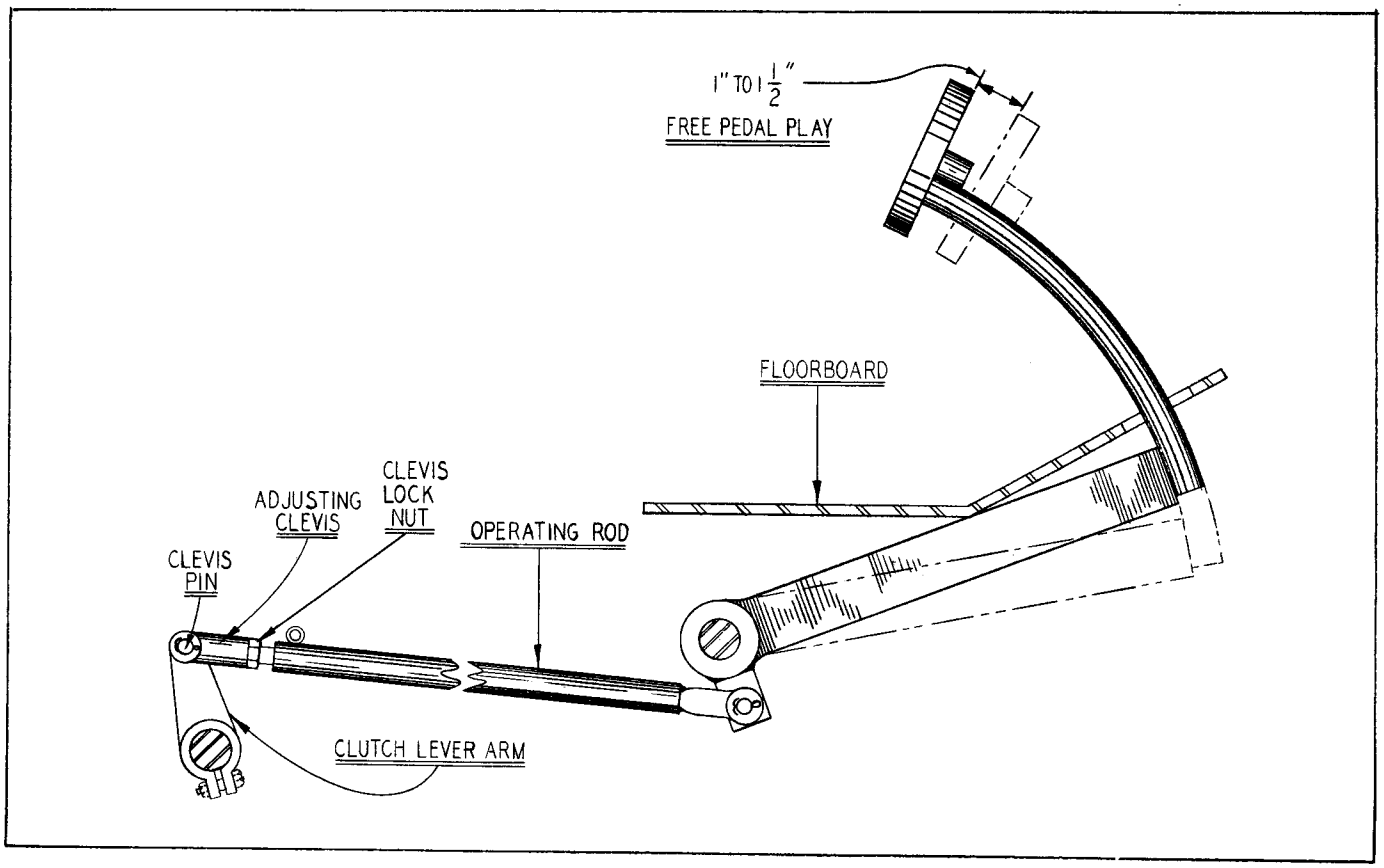


Fig. 7
CLUTCH PEDAL FREE PLAY

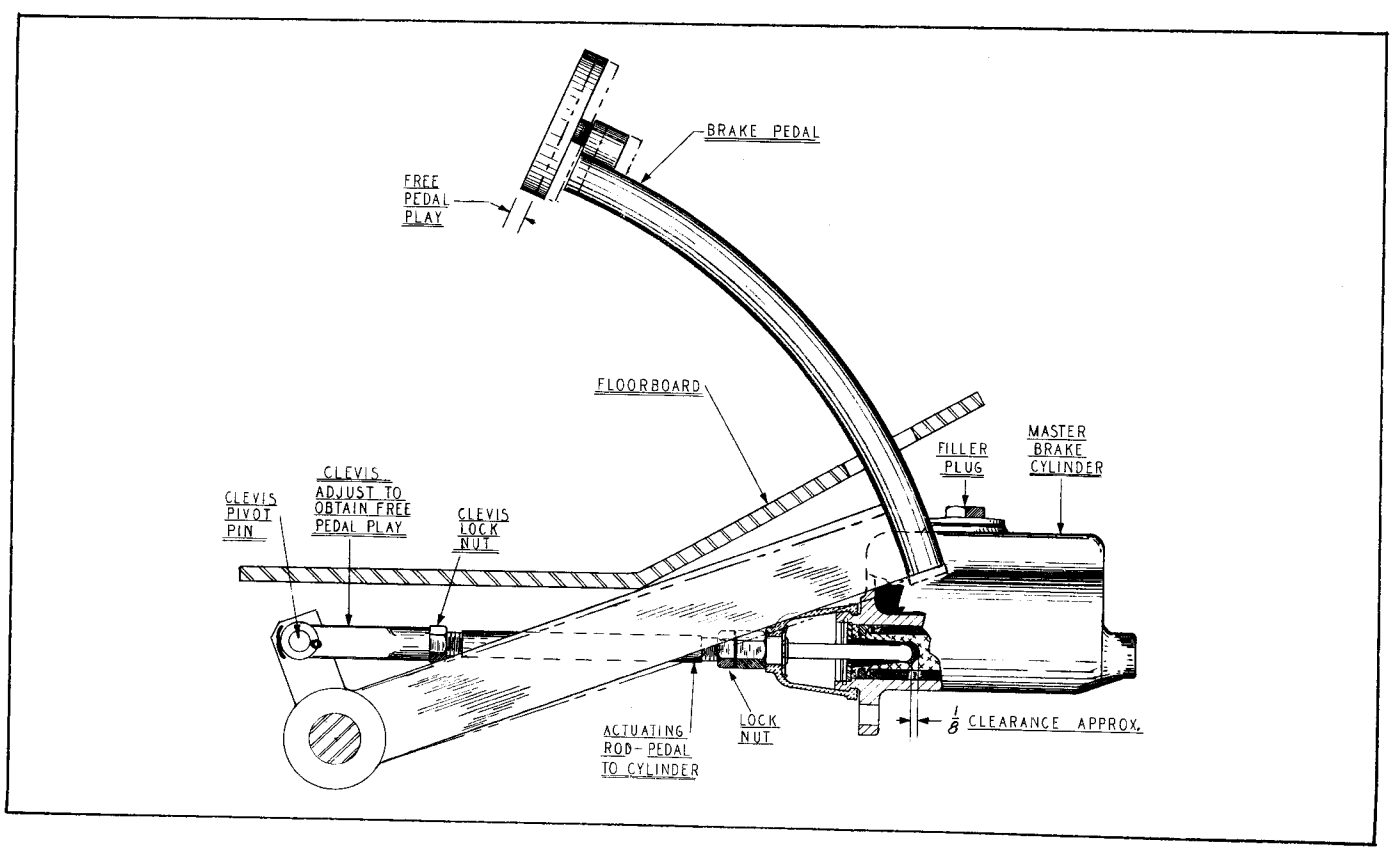


Fig. 8
BRAKE PEDAL FREE PLAY

There are no adjustments to be made on the drive shafts except to keep them lubricated as instructed in the Lubrication Chart.

To "break" or separate the joint, remove the capscrews and the lock holding the center cross bearings to the yoke and tap apart. The needle bearings and the cork seals can then be inspected. The transmission yoke slides onto the splined transmission output shaft, whereas the drive axle yoke is keyed and tapered to fit into the drive axle pinion shaft.

Always use the special capscrews provided with the joints when bolting the bearings to the yokes. Ordinary heat treated capscrews may prove inadequate. Use a torque wrench to tighten the capscrews. Pull them up to 20 to 30 lbs. torque reading.

BRAKE PEDAL ADJUSTMENTS:

Adjustment of the brake pedal must be made periodically to compensate normal lining wear, or whenever repairs have been made on the brake mechanism.

Free pedal play must always be apparent at the top of the brake pedal stroke. Free play is the amount of movement of the pedal before the brake activating rod contact the plunger in the master cylinder. Lack of free play results in the master cylinder plunger being depressed which induces rapid wear of the brake linings.

To adjust the brake pedal, disconnect the master cylinder operating rod at the brake pedal. Loosen the clevis lock nut. Turn the operating rod clevis so that 1/8" to 3/16" clearance is obtained between the end of the rod and the plunger in the master cylinder. The brake pedal must be up against the floorboard to insure that clearance is measured from the top of the pedal stroke. Replace the clevis pivot pin and flip the pedal lightly by hand to determine free play. When the adjustment is satisfactory tighten the lock nut against the clevis to maintain this clearance.

Always check the brake return spring tension to make sure it is strong enough to hold the weight of the brake pedal up against the bottom of the floorboard, and to prevent this weight from closing the clearance between the end of the operating rod and the plunger in the master cylinder.

BRAKES - "BLEEDING":

The foot brakes are hydraulic operated, internal expanding, 2 shoe type in both rear wheels.

The hydraulic brake system must be "bled" whenever air gets in the system through a leak or when a line has been disconnected.

Air trapped in the system gives a "spongy" feel to the brake pedal and, being compressible, does not allow pressure applied to the brake pedal to be transmitted solidly through the lines to the brakes. The system must be free of air at all times.

To bleed the brakes proceed as follows:

1. The longest fluid line from the master cylinder should be bled first. Proper sequence is bleeding the left wheel and then the right. Fill the master cylinder with brake fluid before bleeding the lines. Clean off all dirt from around the master cylinder plug before removing the plug to fill the cylinder.

2. Loosen the wheel cylinder bleeder valve about 1/8 turn. Have one man pump the brake pedal slowly, while another man opens the bleeder screw each time the pedal is pushed down and closes the screw just before the pedal is returned upward. Opening the screw on the down stroke of the brake pedal forces air and fluid from the line. Closing the screw before the return stroke of the pedal prevents air from being sucked back into the line.

3. Continue this procedure until air bubbles are no longer seen escaping with the brake fluid from the bleeder hole. Be careful not to pump all the fluid from the master cylinder. Refill and pump as necessary until the line is free of air. Then tighten the bleeder screw securely.

4. Repeat the bleeding operation on the right wheel.

5. When both brakes lines have been bled of air, refill the master brake cylinder with brake fluid and screw in the plug.

BRAKE SHOE ADJUSTMENT:

When the brake lining has become worn, as evidenced by the brake pedal nearly reaching the floorboard when depressed, the shoes must be adjusted to overcome this wear on the linings.

To adjust the shoes, remove the pipe plug from the outside of the drive hub. Insert a feeler gauge of .010 thickness through this opening to pass between the forward brake lining and the surface of the brake drum. Adjust the eccentric screw found on the back of the brake dust shield until .010 clearance is felt between the lining and the shoe. By turning the wheel, the feeler gauge slot can be made to pass along the entire arc of the brake shoe. Turning the eccentric screw outward and down will decrease the clearance. Turn it opposite to increase the clearance. When the forward shoe has been adjusted, swing the feeler gauge slot to the rear brake shoe and insert the feeler gauge. Turn the rear shoe eccentric adjusting screw outward and down to decrease the clearance, opposite to increase it. When properly adjusted, this wheel should turn freely without any brake shoe "drag" being felt as the wheel is turned. Repeat above procedure on the opposite wheel. The brake lining clearance should be adjusted the same for each shoe so that the pressure will be equal in each wheel when the brake pedal is depressed. This will bring the wheels to a halt evenly. Otherwise a sudden stop will tend to draw the machine sideways slightly when the brakes are applied.

BRAKE SHOE INSPECTION:

Good brakes are an important factor in the safe operation of any vehicle and they should be kept in good repair. We suggest the brake linings be inspected periodically. Operations requiring short runs with the "PAYLOADER" increases the rate of wear on the linings.

To expose and inspect the brake shoes inside the wheel, follow the procedure outlined below.

1. Jack up the front end of the "PAYLOADER" and block it in position so the front drive wheel tires just clear the floor.

2. Loosen the tire rim lugs and remove the tire and rim from the drive hub.

3. Remove the cotter pin and nut holding the drive hub to the drive axle. It may be necessary to apply pressure on the brake pedal to hold the wheel stationary in order to loosen the hub nut.

4. Remove the drive hub from the axle. Two tapped holes are provided in the hub to mount a wheel puller to start the hub off the splined end of the drive wheel axle shaft. The brake drum is located on the drive hub by the rim lug studs and will come off with the hub. A smart blow with a soft hammer on the ends of opposite studs will separate the brake drum from the hub.

5. When the hub and brake drum are taken off the drive axle, the brake shoes and brake cylinder will be exposed so the linings can be inspected, and work done on the brake mechanism.

6. It is good practice to overhaul the brake wheel cylinders and the master brake cylinder whenever the brake shoes are relined.

STEERING ADJUSTMENTS:

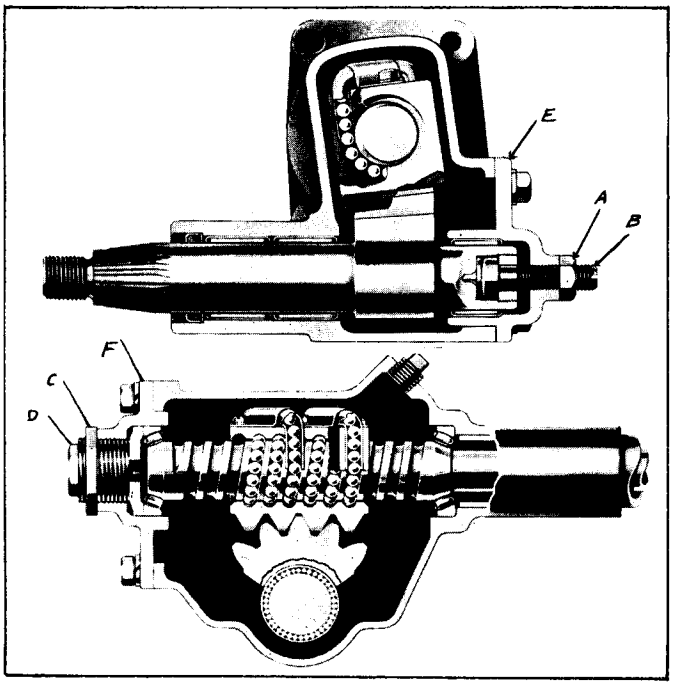
LUBRICATION OF STEERING GEAR:

The steering gear is filled at the factory with a special steering gear lubricant developed for both summer and winter operation. Seasonal change of lubricant and draining of gear case is not necessary.

Gear should be kept filled to level of filler plug with correct lubricant. Add GMC #4567-M Lubricant to keep full.

STEERING GEAR ADJUSTMENT:

Correct steering gear adjustment is very important. There are only two adjustments to be made, but the following procedure must be adhered to, step by step. See picture Steering Gear Adjustment.



STEERING GEAR ADJUSTMENT

1. Disconnect drag link from pitman arm, taking care to note relative position of drag link to pitman arm, before disturbing them.

2. Disconnect upper steering column brace to make sure there is no bind in the column due to anchorage.

3. Loosen lock nut "A", then turn lash adjuster "B" a few turns counterclockwise. This relieves the load upon the screw bearings imposed by the rack and sector teeth. Turn steering wheel GENTLY in one direction until stopped by gear, then back one turn. Do not turn steering wheel hard against stops when gear is disconnected. Damage to ball guides may result.

4. Measure the pull at the rim of the wheel which is required to keep the wheel in motion. This pull can be measured by attaching a spring scale to the rim of the wheel with a piece of cord, then pulling on the spring scale to turn the wheel. The line of the scale should be kept tangent to the rim of the wheel. The proper value of the pull at the wheel rim under these conditions is 1-1/2 to 2 lbs. If the actual value does not lie between these limits specified, adjustment of the screw bearings is necessary.

5. To adjust screw bearings, loosen locknut "C" and turn screw bearings adjuster "D" clockwise until there is no perceptible end play in screw. Check pull at wheel rim as above, readjusting, if necessary, to obtain proper pull. Set up locknut "C" and recheck pull, as it must lie within the specified limits AFTER the locknut is set up. If gear feels "lumpy" after adjustment of screw bearings, there is probably damage in the bearings due to severe impact or to improper adjustments, and the gear must be torn down for replacement of damaged parts.

6. After proper adjustment of screw bearings is obtained, and all mounting bolts securely tightened, adjust lash adjuster "B". First turn steering wheel GENTLY from one stop all the way to the other, carefully counting the total number of turns. Then turn wheel back exactly half way to center position. Mark wheel at top or bottom center with piece of tape. Turn lash adjuster "B" clockwise to take out all lash in gear teeth, and tighten locknut "A". Check pull at wheel rim as before, taking the highest reading of the spring scale as the wheel is turned through center position. Proper value of pull is 2-1/2 to 3 lbs. Readjust, if necessary, to obtain proper pull. Set up locknut "A" as it must lie within the limits specified AFTER the locknut is set up.

7. Reassemble steering connecting rod to pitman arm. (See Pitman Arm - Steering.)

TOE-IN ADJUSTMENT - SEE FIG. 9

The steering arrangement is a twin tie rod type and the steering axle wheel toe-in should be adjusted to best suit the kind of service to which the machine is normally subjected.

For continuous work, requiring the machine to be operated as much in reverse gear as in forward gear, the steering axle wheel toe-in should be adjusted to "O" inches so the steering axle wheels are straight in line with the drive wheels.

For work which includes long hauls in forward gear, the steering axle wheels may be adjusted to 1/8 inch toe-in for each wheel. Care must be used to adjust the toe-in equally for each wheel.

To adjust, loosen the nuts clamping the tie rods to the tie rod ends. Center the ends of the axle bell crank tie rod arms equidistant from the axle. Keep the bell crank arms centered while turning the tie rods so the steering axle wheels are exactly at right angles to the axle bar. This should place the steering axle wheels in line with the drive wheels. With the bell crank arms properly centered, the distance measured at front and rear points between the wheel rims should be the same when the adjustment is complete. If 1/8" toe-in is desired, adjust as instructed above, except the distance measured at the front and rear points between the wheels should be 1/4" shorter at the front point than the measurement at the back point.

TURNING RADIUS ADJUSTMENT:

If, for any reason, the steering gear pitman arm must be removed, put match marks on both the pitman arm and the end of the pitman shaft so the arm can be relocated in its original position.

Care must be exercised in locating a new pitman arm. Under no circumstances should the pitman be so located on the serrated pitman shaft so that the turning of the front wheels is stopped by resistance within the steering gear, before being halted by the axle stop blocks. The axle stop blocks safeguard the steering gear from excessive strain by limiting the degree of turn.

Suggested pointers in locating a new pitman arm on the pitman shaft are as follows:

1. Check and adjust front wheels for correct toe-in. (See TOE-IN ADJUSTMENT).

2. Connect the drag link to the steering arm ball; connect pitman arm ball to the drag link ball joint.

3. Place the machine on a level floor. Center the steering axle wheels in the straight away position. If the toe-in adjustment has been properly made, the ends of the steering bell crank tie rod arms will be equidistant from the axle bar. Check to be sure.

4. Center the steering gear. This can be done by turning the steering gear hand wheel gently, all the way to the right until stopped by resistance within the gear. Place a chalk mark or piece of string on the rim of the hand wheel. Now, carefully counting the number of revolutions, turn the hand wheel gently all the way to the left until stopped by resistance within the gear. Then turn the hand wheel back to the right, exactly one-half the total turns. This should place the pitman gear in its central position.

5. With the steering bell crank centered, the axle wheels in straight way position, and the steering gear centered, the pitman arm may be attached to the serrated end of the pitman gear in the steering gear. Be sure to tighten the pitman gear nut securely.

6. To check the turning radius adjustment, jack up the steering end of the machine so the steering axle wheels are free to turn easily by using hand pressure.

7. Turn the steering axle wheels gently all the way to the right as in making a right turn. Check to see that contact is made against the axle stop block. Then turn the axle wheels all the way to the left, again checking to be sure the turn of the axle wheels is stopped by contact with the stop blocks.

8. IMPORTANT: Under no circumstances should the turning arc of the steering axle wheels be halted by resistance within the steering gear before contacting the axle stop blocks, when the axle is either in level or tilted positions.

9. Check the turning radius adjustment at each monthly inspection period. This should be done to protect the steering gear from damage due to excessive strain in turning and to add to tire life.

TIRES:

Tires and tubes are not sold by THE FRANK G. HOUGH CO. for replacement, but must be purchased from a local authorized tire dealer.

Proper inflation of the tires is a considerable aid to traction and enhances the life of the tire.

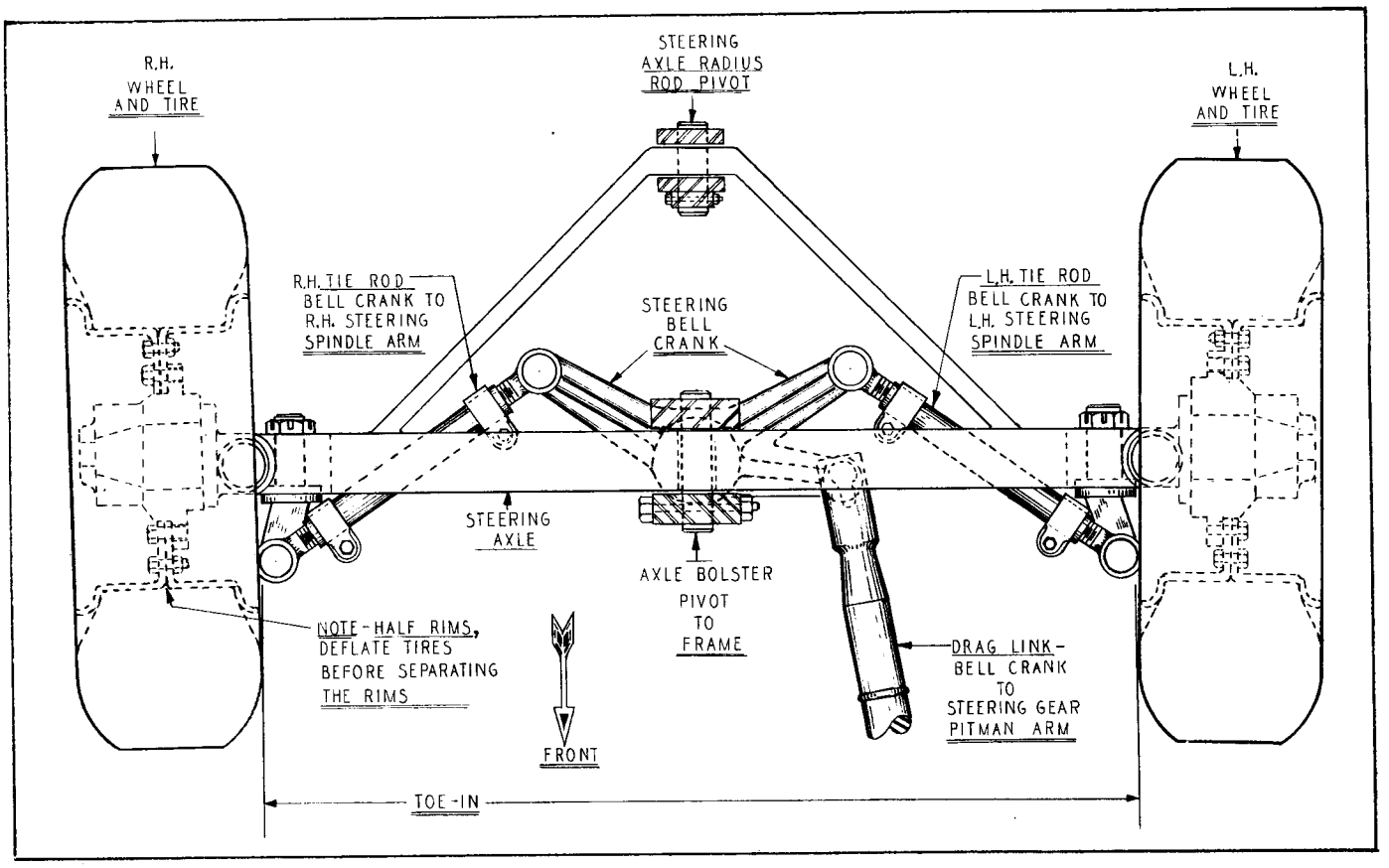


Fig. 9
STEERING WHEEL LINKAGE

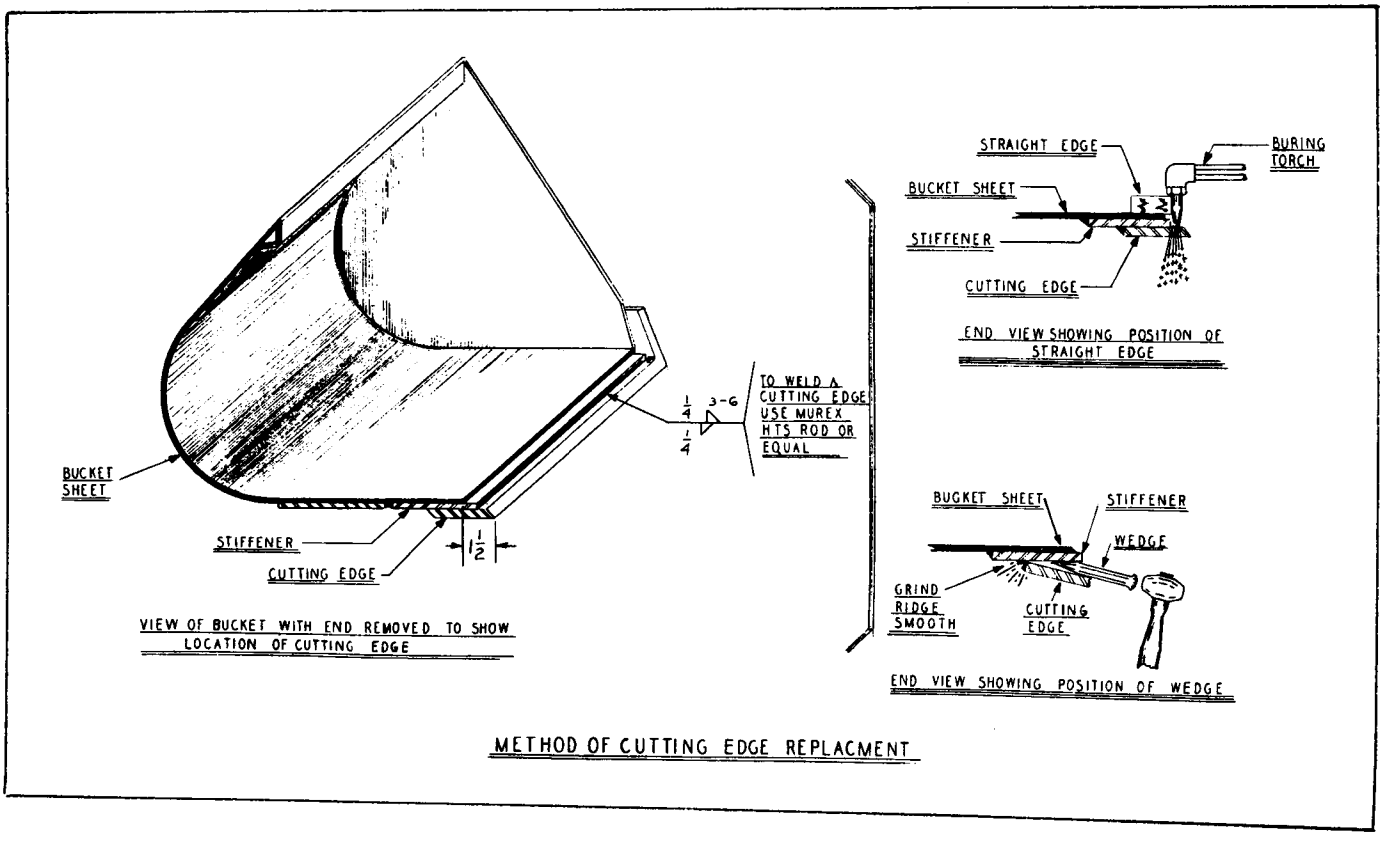


Fig. 10
CUTTING EDGE REPLACEMENT

The front or drive wheel tires are 7.50 x 16 - 8 ply non-directional tread type. Tubes are fitted with hand bendable valve stems. Inflate the drive tires to 50 lbs. air pressure.

The rear or steering wheel tires are 6.00 x 9 - 6 ply pneumatic industrial type. Tubes are fitted with a TR50 hand bendable valve stem of 3/8" offset. Inflate the rear tires to 55 lbs. air pressure.

CHANGING TIRES:

When changing the rear wheel tire, raise the rear end of the machine and remove the hub cap. Then deflat the tire and remove the grease cap.

CAUTION: DO NOT ATTEMPT TO TAKE THE REAR WHEEL APART UNTIL THE AIR PRESSURE HAS BEEN LET OUT OF THE TUBE AND THE TIRE IS DEFLATED.

The rear tire is mounted on a wheel which consists of two half rims bolted together. After the tire is deflated, remove the five bolts holding the wheel to the axle hub, then remove the bolts holding the rim halves of the wheel together. This frees the tire.

To change the drive wheel tires, merely jack up the front wheel, deflate the tire, and remove the lug nuts and rim lugs. Then remove the tire.

TO REPLACE THE CUTTING EDGE FOLLOW THE PROCEDURE OUTLINED BELOW. SEE FIG. 10.

1. Lay a straight edge in the bucket to line up with the front edge of the stiffener and clamp in place. If there is no stiffener on the bottom of the bucket, line the straight edge with the front edge of the bucket sheet.

2. Guide the burning torch along the straight edge to cut through the cutting edge and the weld along the front edge.

3. Follow a similar method for the upright ends of the cutting edge. Burn through the width of the cutting edge at the bends. Burn off the top weld of the ends with a gouging tip.

4. Drive a cold chisel or wedge between the stiffening and the cutting edge to break the back weld. Force the chisel between the bucket sides and the side portion of the cutting edge to remove the remaining ends. Grind off the remaining ridges of weld before placing the new cutting edge in position.

5. Clamp the new cutting edge in place 1-1/2 inches beyond the edge of the bucket sheet as shown in the picture.

   Tack weld only the ends of the cutting edge to the bucket to hold it in place, and remove the clamps. Before finish welding the edge to the sheet, bow the cutting edge and the bucket sheet upwards 1/4" for every 4 feet of bucket length. This must be done to overcome weld pull which will draw the edge in a downward bow. To bow the bucket upward, place blocks in the corners of the bucket and lay a stout bar on the blocks so it lies parallel to the outer edge of the bucket sheet. By means of "C" clamps, draw the center of the cutting edge and the bucket sheet upward against the bar. Then proceed to finish weld the cutting edge.

6. Back step a continuous 1/4 fillet weld on the front joining the cutting edge to the stiffener and to the bucket sides. If bucket has no stiffener, weld the edge to the bucket sheet. Join the back edge to the stiffener or bucket sheet with 1/4 fillet welds 3 inches long on 6 inch centers. Use "Murex" 7/32 HTS rod or equal at no more than 200 amperes. Try to get most of the weld penetration into the bucket sheet so as not to upset the temper of the cutting edge.

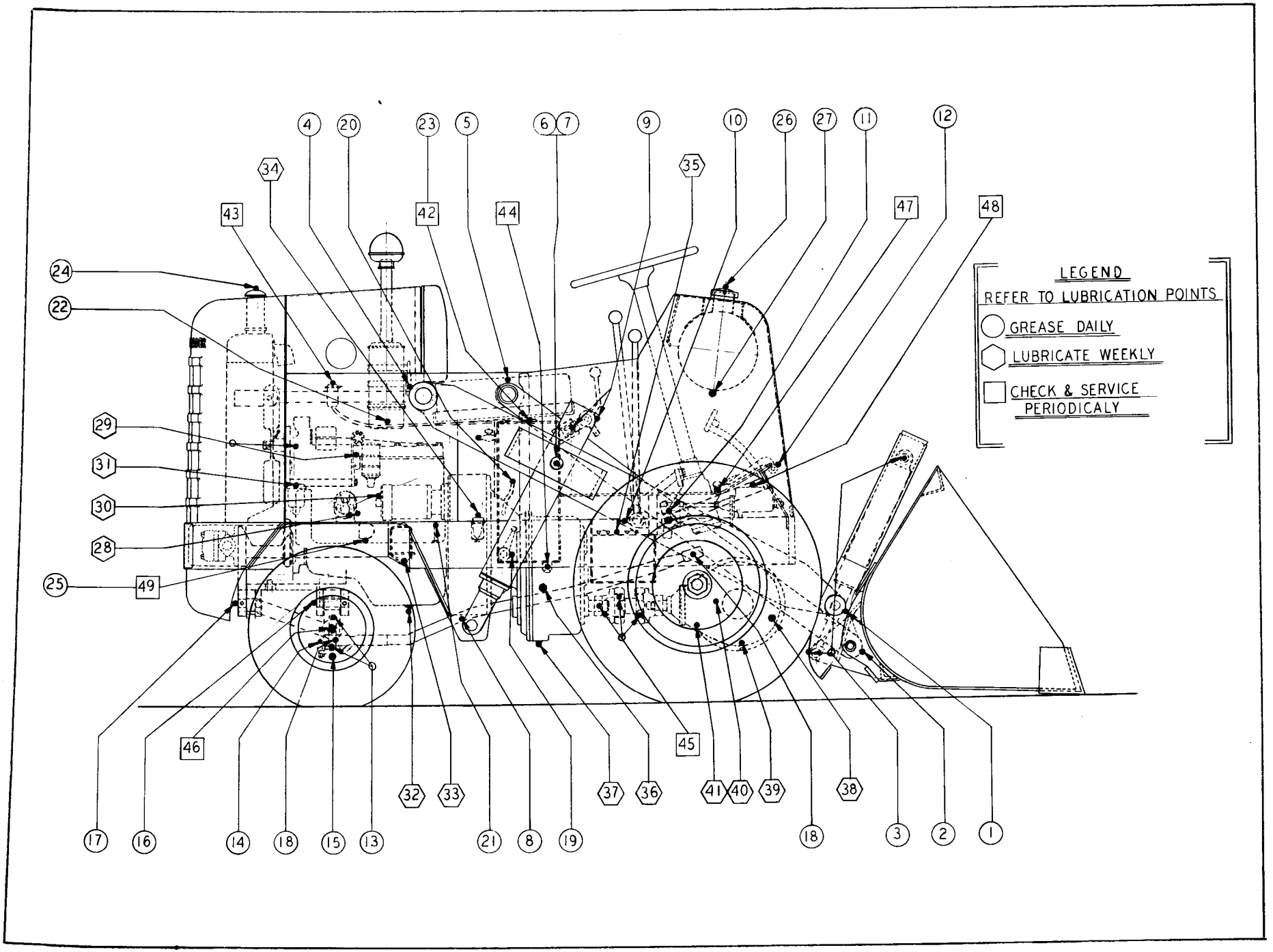

LEGEND
REFER TO LUBRICATION POINTS
GREASE DAILY
LUBRICATE WEEKLY
CHECK & SERVICE PERIODICALY

Fig. 11

LUBRICATING POINTS

Refer to the lubrication chart to locate the following points. Before servicing, always wipe the dirt from around the grease fittings, cups, or plugs to prevent grit and dirt or other foreign matter from entering.

GREASE DAILY: Items 1 through 19. Use a good grade of general purpose pressure gun grease every 8 to 10 hours of operation. Give 3 or 4 strokes daily to each fitting to force out old grease and dirt.

1. Boom to Carrier - 1 each, R.H. & L.H. Sides . . . . . 2 points
2. Guide to Carrier to Bucket - 1 each, R.H. & L.H. Sides. . . . . 2 points
3. Bucket Hoist Pivots - 1 each, Upper & Lower Pins . . . . . 2 points
4. Boom to Frame - Housing - 1 each, R.H. & L.H. Sides. . . . . 2 points
5. Guide to Frame - 1 each, R.H. & L.H. Sides . . . . . 2 points
6. Boom Hoist Trunnion - Outer - 1 each, R.H. & L.H. Sides. . . . . 2 points
7. Boom Hoist Trunnion - Inner - 1 each, R.H. & L.H. Sides (Raise the boom to grease from inside) . . . . . 2 points
8. Boom Hoist to Frame - 1 each, R.H. & L.H. Sides. . . . . 2 points
9. Valve Lever & Swivel - L.H. side of seat . . . . . 2 points
10. Gearshift Levers - 1 each lever pivot . 2 points
11. Foot Pedal Pivots - 1 each - R.H. & L.H. Floorboard . . . . . 2 points
12. Accelerator Cross Shaft - 1 each - R.H. & L.H. Floorboard. . . . . 2 points
13. King Pin Bushing - Upper & Lower - 2 each - R.H. & L.H. Spindles. . . . . 4 points
14. Tie Rod Ends - both ends - R.H. & L.H. Tie Rods . . . . . 4 points
15. Steering Bell Crank - Center of Steering Axle. . . . . 1 point
16. Rear Axle Bolster Pin - Steering Axle to Frame . . . . . 1 point
17. Rear Axle Radius Rod Pin - Radius Rod to Frame . . . . . 1 point
18. Drag Link Ball Sockets - 1 each end of rod . . . . . 2 points
19. Clutch Cross Shaft - 1 each, R.H. & L.H. Clutch Housing . . . . . 2 points

LUBRICATE AND SERVICE DAILY: Items 20 through 27. Check and service these points every 8 to 10 hours of operation, or oftener if necessary, as instructed.

20. CLUTCH RELEASE BEARING: The grease fitting is located on the left side of the frame under the guide bar pivot. It can be reached from the outside, and is a "Lubriguard" grease fitting to protect the grease seals from excessive gun pressure. Apply one shot daily with a hand gun, using the best obtainable grade of high temperature lubricant such as LUBRIKO M24 or equal. Never over-lubricate, never use ordinary chassis lubricant, and never use a pressure gun when servicing the clutch release bearing.

21. ENGINE OIL LEVEL DIPSTICK: Located on the L.H. side of machine at flywheel housing. Check the engine crankcase oil level daily or oftener if required. Add oil as required to maintain the oil level up to the "full" mark on the dipstick. Do not check the crankcase oil level with the engine running. See item 31.

22. AIR-CLEANER CUP: Clean and refill daily, or oftener if working conditions are very dusty and dirty. This is important. To service, remove the cup and wash it out in clean gasoline or kerosene and refill the cup to the oil level bead with the same grade of oil as is used in the crankcase. The air cleaner is provided to prevent dust and grit from being drawn into the engine. The abrasive action of such dust will cause premature wear on the valves and cylinders. Inspect the air-cleaner tubing and connections for leaks. Small holes or loose connections will allow dust to enter and will surely offset the protective feature of a clean and properly working air-cleaner.

23. HYDRAULIC OIL RESERVOIR: Located under the operator's seat. Check the oil level daily and keep it filled up to the oil level petcock. The engine must be shut off and the bucket resting on the ground when checking the oil reservoir content. There must be sufficient oil to provide constant lubrication to the pump gears and to displace the hoist cylinder plungers when operating the bucket. See item 42.

24. RADIATOR FILLER: Located at the rear end of the machine. Do not run the engine without the full quantity of coolant in the cooling system. Check daily. Use clean soft water to refill. When operating in freezing temperatures, add a good, known, permanent type anti-freeze solution to the cooling system. Add it to the cooling system according to the manufacturer's instructions.

25. RADIATOR DRAIN COCK: To drain the cooling system, first remove the radiator cap as it is a pressure type, then open the radiator drain to drain the fluid from the cooling system. The radiator drain cock is located on the underside of the water hose elbow.

26. GASOLINE TANK FILLER: Located in the front cowl. Fill the gasoline tank here. Use a gasoline of a 70-72 octane rating. Handle the fuel in clean containers.

27. GASOLINE SHUT-OFF COCK: Located on the underside of the fuel tank on the fuel line. It is

good practice to close the shut-off cock when leaving the machine stand idle over night or longer. Be sure to open the shut-off cock before attempting to start the engine.

LUBRICATE AND SERVICE WEEKLY: Items 28 through 41. Lubricate, check, and service these points every 40 to 60 hours of operation as instructed.

28. DISTRIBUTOR CUP: One point, located on the right hand side of the machine. Give the distributor cup 2 or 3 drops of light lubricating oil weekly.

29. GENERATOR CUPS: Two cups, one at each end, located on the R.H. side of the machine. Give each cup 2 or 3 drops of light lubricating oil weekly.

30. STARTER MOTOR: One cup, located on the R.H. side of the machine. Give each cup 2 or 3 drops of light lubricating oil weekly.

31. ENGINE CRANKCASE OIL: Drain and refill the engine crankcase weekly. Engine crankcase oil should be drained while the oil is warm, as after a day's operation, since warm oil will flow more freely and carry out more dirt and sediment. Do not use kerosene to flush out old crankcase oil as traces of it will remain to dilute clean oil. Refill with the best obtainable grade of engine oil. Be sure to keep the oil level up to the full mark on the oil dipstick. Refer to the Waukesha Operating Manual for instructions on lubrication and maintenance of the engine.

    In general, use SAE 30 motor oil when operating in hot summer temperatures, and SAE 20 motor oil in moderate temperatures. Use SAE 10 motor oil when operating in cold winter temperatures. It must be remembered that oil specifications of various companies may differ, although the oils are designated by the same SAE number. Consult the sales department of a reliable oil manufacturer to obtain assistance in selecting the proper engine oil to best suit individual operating conditions.

32. CRANKCASE DRAIN PLUG: Located on the underside of the engine crankcase pan. Remove this plug to drain the engine oil. Be sure the plug has been replaced and tightened securely after the engine oil has been drained.

33. OIL FILTERS - CRANKCASE: Service the crankcase oil filter weekly or oftener, whenever the crankcase oil is changed. The gasoline engine crankcase oil filter cartridge must be replaced with a new element whenever the engine oil is changed. Clean the filter container before inserting a new element. Read and follow the instructions on the box containing the new element before replacing the used element. The gas engine oil filter is located on the right side of the engine. Be sure the filter cover and cover gasket is in place and securely tightened after servicing the filter. When the crankcase oil has been changed and the filter properly serviced, start the engine and let it run at idle speed for about 10 minutes to fully saturate the filter element with oil; then shut off the engine. Recheck the oil level in the engine crankcase as it will have been lowered by oil being retained in the filter. Add oil to bring the crankcase oil level to proper height. Inspect the oil filter and oil lines for leaks due to a faulty gasket or cover before again starting the engine.

34. FUEL LINE STRAINER: Located on the L.H. side of the machine. Inspect the fuel strainer weekly. Clean the sediment bowl and the fuel filter weekly to insure clean fuel to the engine.

35. BATTERY: Remove the rear, right hand section of the floorboard to service the battery. Inspect the battery weekly. Add distilled water or clean rain water in each section to keep the battery plates covered with water.

36. TRANSMISSION OIL LEVER PLUG: Located on the right side of the transmission housing. Fill the transmission housing with oil to height of the oil level plug. Use a good grade of SAE 90 transmission oil summer and winter. Check the transmission oil level weekly. Drain and refill with clean oil monthly.

37. TRANSMISSION DRAIN PLUG: Located on the underside of the transmission housing. Remove the drain plug to drain the oil from the transmission housing. Clean the transmission housing breather vents when draining the oil. Be sure to clean the plug before replacing it. Replace the drain plug securely after draining out the oil.

38. DIFFERENTIAL OIL LEVEL PLUG: Located on the side of the drive axle differential housing. Keep the differential housing full of differential oil to the height of the oil level plug. Use SAE 140 oil in summer and SAE 90 oil in winter. Check the differential oil level weekly. Drain and refill monthly.

39. DIFFERENTIAL DRAIN PLUG: Located on the underside of the differential housing. Remove the drain plug to drain the housing. Clean the breather vents when draining the oil. Clean the drain plug before replacing it. Replace the drain plug securely after the oil has drained.

40. FINAL DRIVE OIL LEVEL PLUG: Located on the inside surface of both the R.H. and L.H. drive wheel housings. Keep both final drive housings full of oil to the height of the oil level plugs. Use SAE 140 in summer and SAE 90 in winter. Check the oil level in both final drive housings weekly. Drain and refill with clean oil monthly.

41. FINAL DRIVE DRAIN PLUG: Located on the underside of both the R.H. and L.H. final drive wheel housings. Remove the drain plugs to drain the final drive housings. Clean the breather vents when draining the oil. Clean the drain plugs before replacing them. Replace the drain plugs securely after draining.

LUBRICATE & SERVICE PERIODICALLY: Items 42 through 48. Service and lubricate these items every 1000 hours of operation or as specified in the following instructions.

42. HYDRAULIC OIL RESERVOIR FILLER and clean out cover: Drain, clean, and refill the hydraulic oil reservoir every 1000 hours of operation. Clean the suction line strainer by washing it in clean gasoline when the oil has drained. This strainer can be removed by reaching inside the tank. Clean all dirt and sludge from inside the reservoir being careful not to force dirt into the valve or hoses. Refill the reservoir with a good, clean grade of SAE 10 motor oil. Be sure the oil is handled in a clean container. Dirt in the hydraulic oil is a common cause of failure of the pump or valve.

43. Be sure to remove the reservoir breather tube and breather cap and clean them of accumulations of dirt when servicing the oil reservoir.

44. HYDRAULIC OIL RESERVOIR DRAIN: Located under the oil reservoir sump. Remove this plug to drain the reservoir. This is a magnetic tube plug, and it must be cleaned before replacing. Replace the plug securely. See "Draining the Hydraulic System".

45. UNIVERSAL DRIVE SHAFT: Located between the transmission and the drive axle. There are three points to be greased on the drive shaft - one on the yoke splines and one on each center cross. Be sure to carefully wipe the dirt from around the grease plugs, then remove them and insert the grease fitting. Remove the grease fittings and replace the plugs after servicing so as not to upset the balance of the drive shaft. Grease the drive shaft sparingly not oftener than every 1000 hours of operation. Use a general purpose lubricant applied with a hand gun. Dirt forced into these joints will shorten their period of usefulness considerably.

NOTE: To prevent damaging the center cross cork grease seals by gun pressure, thus allowing dirt to enter and grease escape, it is recommended that the joint be disassembled and greased by hand instead of using the grease gun. It is a simple operation to disassemble these joints, and a little care will prevent premature wear and failure. Replace all faulty cork seals before reassembling the joints. Use the special capscrews provided when reassembling, as ordinary heat treated capscrews will fail. Tighten the capscrews, using a torque wrench. Refer to the paragraph on drive shafts in this book, to tighten the capscrew to correct torque reading.

46. WHEEL HUBS: Rear steering wheels - Repack the rear wheel hubs monthly. Use a good grade of wheel bearing grease.

47. STEERING GEAR FILLER: Keep full to height of the housing filler pipe cap. Use G.M.C. #4567M steering gear lubricant or equal - summer or winter.

48. MASTER BRAKE CYLINDER: Keep full with hydraulic brake fluid.

49. The cooling system should be drained thoroughly, cleaned out, and refilled seasonally, before adding anti-freeze solution and when draining out the anti-freeze, to avoid accumulations of dirt and gum in the water passages.