# OPERATING MANUAL

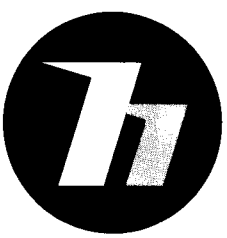
# FOR

## GASOLINE POWERED

# MODEL HF & HFH PAYLOADERS®

BEGINNING WITH SERIAL NUMBER 85061

FORM HF-C-5



MANUFACTURED BY

## THE FRANK G. HOUGH CO.

LIBERTYVILLE, ILLINOIS

LITHO. IN U. S. A.

DEC. 1954

## 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.

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## AVOID ACCIDENTS

Most accidents, whether they occur in industry, on the farm, at home or on the highway are caused by failure of some individual to follow simple and fundamental safety rules or precautions. For this reason most accidents can be prevented by recognizing the real cause and doing something about it before the accident occurs.

Regardless of the care used in the design and construction of any type of equipment, there are many conditions that can not be completely safe gaurded against without interferring with reasonable accessibility and efficient operation.

A CAREFUL OPERATOR IS THE BEST INSURANCE AGAINST AN ACCIDENT.

THE COMPLETE OBSERVANCE OF ONE SIMPLE RULE WOULD PREVENT MANY THOUSAND SERIOUS INJURIES EACH YEAR. THAT RULE IS:

*"Never attempt to clean, oil or adjust a machine while it is in motion!"*

"National Safety Council"

# SPECIFICATIONS AND SERVICE DATA

ENGINE:

| | |
|---|---|
| Hercules | QXD-3 |
| No. of Cylinders | 6 |
| Bore | 3-7/16" |
| Stroke | 4-1/8" |
| Displacement, cu. in. | 230 |
| Engine Speed - Governed | 2000 R.P.M. |

TIRES:

| | |
|---|---|
| Front | 9:00x20 |
| Rear | 13:00x24 |

TIRE PRESSURES:

| | |
|---|---|
| Front | 75 lbs. (air) |
| Rear | 25 lbs. air and 3/4 full of calcium chloride solution |

DIMENSIONS:

| | HF | HFH |
|---|---|---|
| Approx. Weight - Empty Bucket - Less Attachments | 10750 lbs. | 12250 lbs. |
| Overall Width - At Rear Tires | 76-1/4" | 76-1/4" |
| Overall Length - Bucket in Carry Position | 16'-2-1/2" | 20'-2-1/2" |
| Dumping Clearance | 7'-11" | 10'-6" |
| Reach - at 84" Clearance | 34" | 40" |
| Ground Clearance | 11-1/4" | 11-1/4" |
| Turning Radius - Tip of Bucket in Carry Position | 16'-6" Approx. | 18'-8" Approx. |
| Digging Depth | 4" | 5" |
| Angle of Bucket in Carry Position | 36° | 36° |
| Angle of Bucket in Dump Position (fully raised) | 50° | 50° |
| Height over Air Cleaner Stack | 6'-8-1/4" | 6"-8-1/4" |
| Wheelbase | 68-1/2" | 68-1/2" |
| Struck Bucket Capacity - Standard Bucket | 3/4 cu. yd. | .9 cu. yd. |
| Heaped Bucket Capacity - Standard Bucket | 1 cu. yd. | 1-1/4 cu. yd. |

CAPACITIES:

| | HF | HFH |
|---|---|---|
| Cooling System | 20 qts. | 20 qts. |
| Fuel Tank | 16-1/2 gal. | 16-1/2 gal. |
| Transmission Grease | 22 lbs. | 22 lbs. |
| Differential Grease | 5 lbs. | 5 lbs. |
| Engine Crankcase with Filter | 6 qts. | 6 qts. |
| Hydraulic System | 11-1/2 gal. | 12 gal. |
| Axle Reduction Gear Case (each side) | 5 lbs. | 5 lbs. |
| Torque Converter - Initial Fill | 17 qts. | 17 qts. |

## 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 at the factory.

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, and for service instructions.

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.

2. Check the Oil Level in the engine crankcase by removing the oil dipstick 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.

8. Be sure the oil level in the torque converter is up to correct height. Refer to the lubrication chart for servicing instructions of the torque converter - This is important.

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

10. Check the drive axle wheel nuts several times during the first day's operation and thru the first 48 hours of operation. They must be kept forced tight by using a long handled wrench.

11. Be sure the cooling system is full. Use clean soft water, free from alkaline to fill; never at anytime run the engine without the full quantity of cooling fluid in the radiator. Be sure to use a permanent type anti-freeze solution in the cooling system when expecting to operate the "PAYLOADER" in freezing temperatures.

12. 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 the proper fuel.

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

14. 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.

15. Grease all lubrication points of the entire unit. Use the lubrication chart in this manual and the Hercules Engine Operation manual as a guide. Grease and check the "PAYLOADER" daily (every 8 to 10 hours of operation).

16. Carefully read the instructions as set forth in this manual before attempting to operate the "PAYLOADER". The function and location 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.

17. Do not operate the machine to capacity during the first weekly period of operation (first 36 to 50 hours of actual use). Operate with light loads during this initial break-in period.

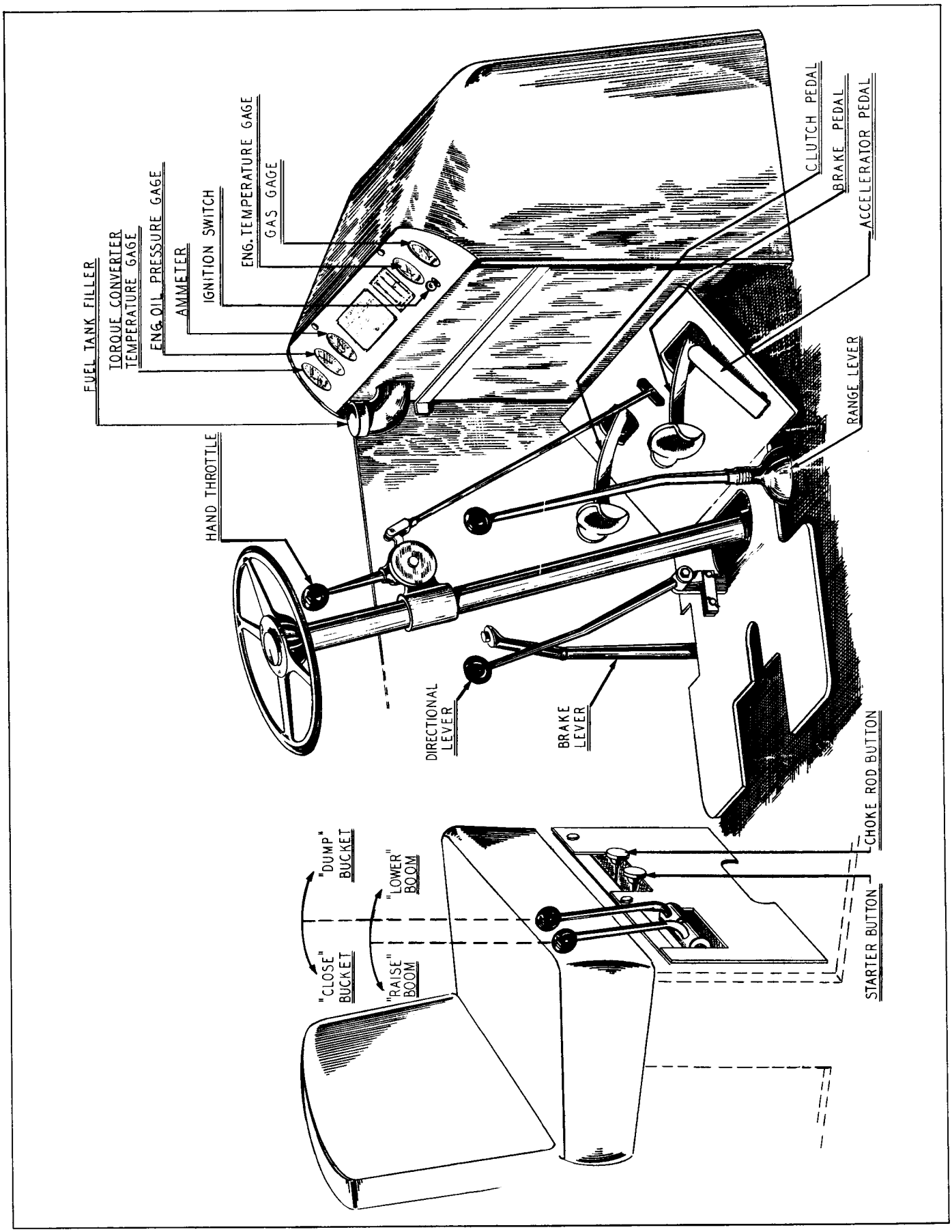

FUEL TANK FILLER
TORQUE CONVERTER TEMPERATURE GAGE
ENG. OIL PRESSURE GAGE
AMMETER
IGNITION SWITCH
ENG. TEMPERATURE GAGE
GAS GAGE
CLUTCH PEDAL
BRAKE PEDAL
ACCELERATOR PEDAL
HAND THROTTLE
RANGE LEVER
DIRECTIONAL LEVER
BRAKE LEVER
"DUMP" BUCKET
"LOWER" BOOM
"CLOSE" BUCKET
"RAISE" BOOM
CHOKE ROD BUTTON
STARTER BUTTON

**Fig. 2**

## OPERATING THE "PAYLOADER"

The important thing for an operator learning to use a machine of this type, is to start easily at slow speeds, thus attaining skill gradually. The time used in learning to get the "feel" of a machine will be well spent in preventing possible accidental damage to the machine or operator or to safeguard other personnel.

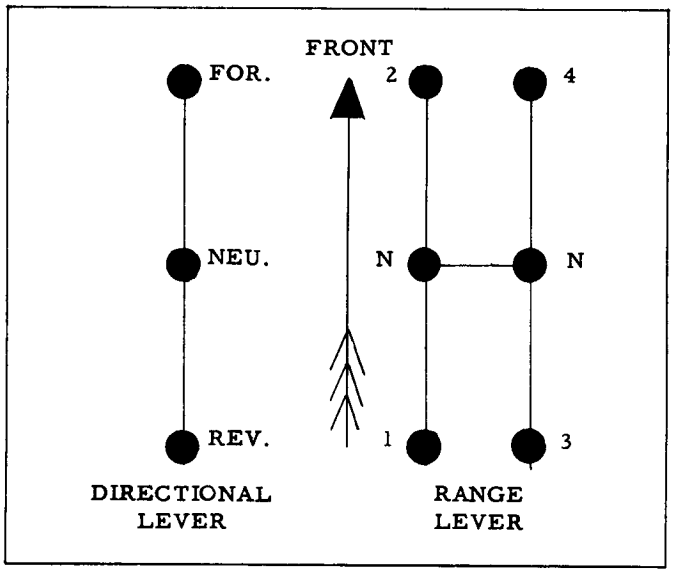
A study of the following pages will acquaint the operator with the various controls of the "PAYLOADER" and their proper use. Refer to the Operations Control Picture.

This "PAYLOADER" is equipped with a four speed forward and four speed reverse transmission. The speeds and direction of travel is selected by shifting a Range Lever and Directional Lever. Always be sure these levers are in neutral position before starting the engine.

RANGE LEVER is located on the right side of the floorboard and has five positions as shown on chart. This lever is in neutral when in vertical position. Shift this lever to the left of the neutral and backward for the lowest speed range. One of the low speed ranges is used for working conditions where more power is needed. One of the high speed ranges is used primarily for transporting loads to various locations. See the Gear Shift Diagram for the speed range positions of this lever.

DIRECTIONAL LEVER is located between the steering column and the seat. The "PAYLOADER" will travel forward when this lever is pushed forward or away from the operator. Pull the lever backward toward the operator to move the "PAYLOADER" backward or in reverse.

Always depress the clutch when shifting these levers to any of their positions.

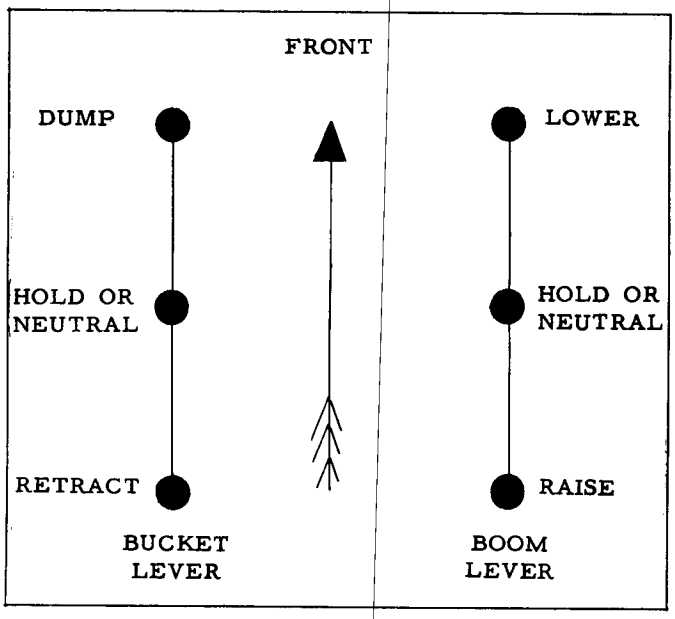



GEARSHIFT DIAGRAM

### VALVE CONTROL LEVERS:

This machine has dual valve control levers, located on the right hand side of the seat. Always be sure these levers are in neutral position before starting the engine.

The longer, outer lever controls the "Raising" and "Lowering" of the bucket and the inner lever controls the "Dumping" action of the bucket.




VALVE LEVER POSITIONS

When moving the longer outer lever the positions can be felt by the operator as the poppets fall in place. Placing this lever in the centralized or neutral position will stop the movement of the boom and "hold" the bucket at any height in its arc of travel.

Pull this lever backward, toward the operator and the booms and bucket will "raise" in proportion to the engine speed.

Push this lever forward, ahead of neutral to "lower" the boom and bucket.

CAUTION: NEVER REACH BETWEEN THE BOOM AND GUIDE BARS TO OPERATE THESE LEVERS. THE BUCKET MAY BE LOWERED EVEN THOUGH THE ENGINE HAS BEEN SHUT OFF.

The shorter inner valve control lever is used to "dump" the bucket. Push this lever forward, away from the operator to "dump" the bucket. Merely release pressure on this lever and it will automatically return to neutral, "stopping" the bucket at any

point of its dumping arc. Pull the lever backward to "close" or "retract" the bucket. Merely release the lever to return it to neutral and the bucket will be "held" in the "retracted" position.

## PARKING BRAKE HAND LEVER:

The parking brake hand lever is located on the left side of the floorboard. Pull the lever backward to apply braking pressure on the drive shaft brake drums. Press down the top button and push forward to release braking pressure on the drive shaft. This lever is used when parking the "PAYLOADER" on slopes. Do not fail to release this lever before putting the machine in motion.

## 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. Habitual intermittent declutching to govern engine speed when loading defeats the purpose of the torque converter and results in low output and rapid clutch wear.

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. 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. Decrease accelerator pressure to diminish drive thrust on the bucket when loading instead of intermittent declutching.

The HAND THROTTLE lever on the steering column is used to adjust idling speed of the engine. Raise this lever to increase engine idle speed. Lower to decrease it.

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

## DASH INSTRUMENTS:

IGNITION SWITCH is mounted on the right side of the dash and is a key type. This switch completes the electric circuit to the coil, and to the dash instruments, when in the "on" position.

FUEL GAUGE, with its companion tank gauge, registers the fuel level in the fuel tank.

ENGINE TEMPERATURE GAUGE registers the temperature of the liquid in the engine cooling system. Temperature may indicate as high as 190° F. when operating in confined quarters. Do not confuse this gauge with the torque converter temperature gauge.

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

OIL PRESSURE GAUGE indicates the pounds pressure of the oil circulating through the engine. If this gauge fails to register, stop the engine immediatley and determine the cause.

TORQUE CONVERTER TEMPERATURE GAUGE: This gauge is mounted on the left hand side of the dash panel and indicates the temperature of the oil in the torque converter. It in no way relates to engine temperature.

Do not allow the torque converter gauge to exceed 285° F. If the horn blows automatically the converter is in danger of being overheated. Remove the load from the machine and idle the engine until the oil temperature drops below 225° F.

The horn will emit a continuous sound when the torque converter is in danger of being overheated. This warning signal is operated by a thermal switch coupled to the torque converter and wired to the horn relay.

Do not attempt to remove any plugs or connections from the converter system if the gauge registers above 150° F., as hot oil may be under pressure and be forcibly ejected causing personal injury.

STARTER BUTTON is in the center of the seat kickplate and when pressed in, it completes the electrical circuit between the battery and the starting motor. Release the pressure on this button as soon as the engine starts.

The CHOKE ROD for the gasoline engine is located near the center of the seat kickplate. 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.

## 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.

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

1. Place the ignition switch in "on" position.
2. Press the starter button. Pull out the choke slightly to close the choke valve for easier starting if necessary.
3. 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.

## STOPPING THE ENGINE:

To stop the engine merely turn off the ignition switch. Be sure all levers are in neutral position before leaving the seat. NOTE: The bucket can be lowered even though the engine has been stopped. Never attempt to operate the hand levers by reaching between or under the boom and guide bars.

## DRIVING THE "PAYLOADER":

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

1. When the engine 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 lever controlling the boom 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:

The technique of loading the bucket with machines fitted with torque converters differs from that of ordinary machines.

The torque converter increases the normal thrust on the drive wheels to such extent that the bucket can be crowded or "wedged" into the face of the cut with a force greater than can be overcome by the hydraulic power generated to raise the bucket out of the cut.

To overcome the excessive "crowding" action imparted to the bucket by the drive wheel thrust, the operator should decrease pressure on the accelerator pedal. This will diminish torque output resulting in less drive thrust.

Avoid habitual intermittent declutching or "slipping the clutch," to cut out the engine to decrease the drive thrust. Cutting out the engine to control the drive thrust defeats the purpose of the torque converter resulting in lower production output and unnecessary wear on the gear train.

By Manipulation of the accelerator the operator will be able to govern the torque output and control the rate of advance into the stock pile. Proficiency in the use of accelerator technique on torque converter machines will result in production rates in excess of those oridinarily obtained.

Shift to one of the slow speed ranges for the best average speed when loading the bucket. When stripping, digging a pit or foundation, it is better to take a shallow cut and let the forward movement of the machine fill the bucket. Have the bucket fully closed or retracted and hold the cutting edge at digging level. The operator may manipulate the boom control lever slightly, raising or lowering the bucket, to hold a good grade as the machine travels forward.

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 travel. Rough terrain calls for slow speed.

After the bucket has been filled, operate the valve lever to raise the boom and bucket sufficiently so the bucket will clear the terrain over which the load will be moved. Never transport loads with the

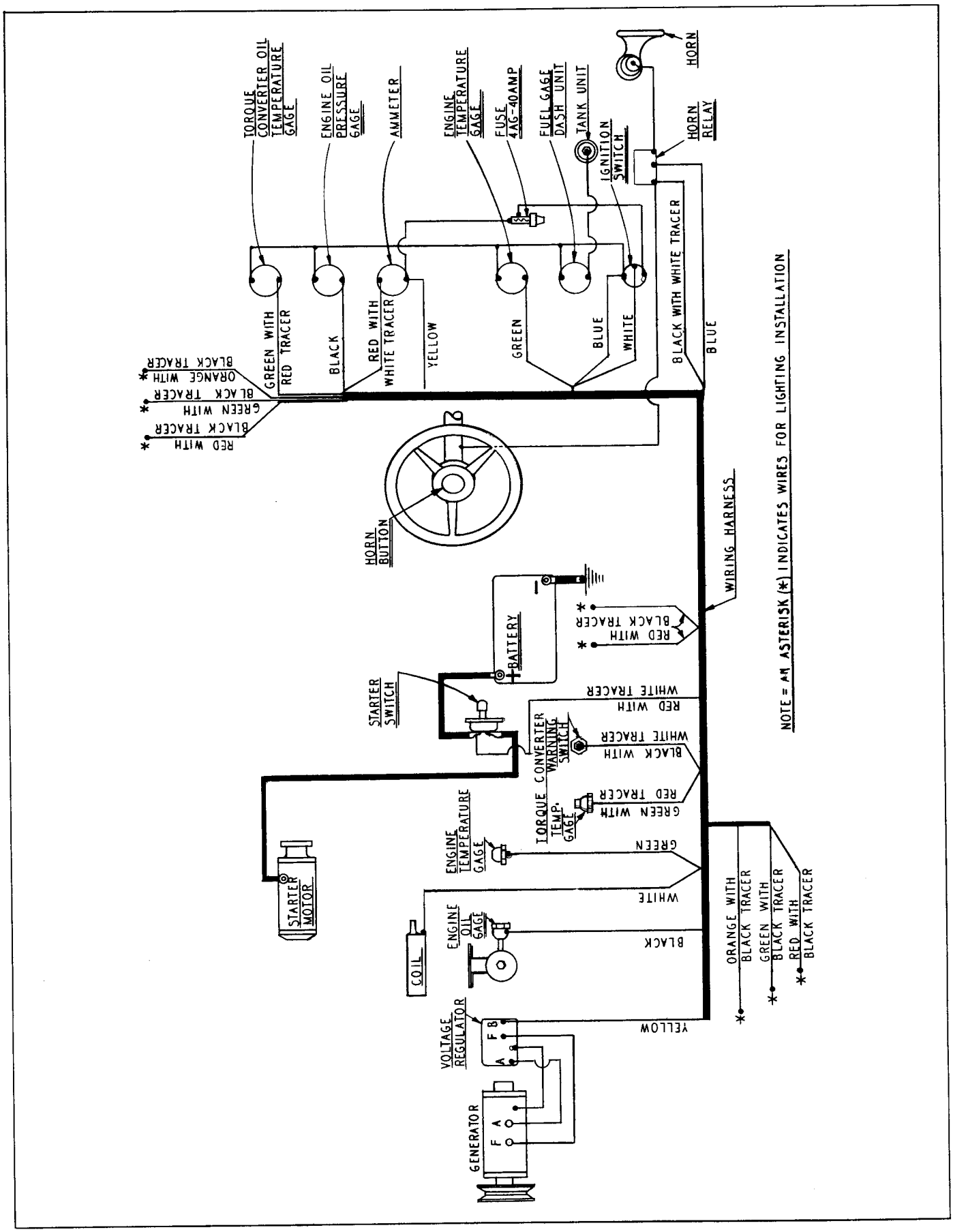

TORQUE CONVERTER OIL TEMPERATURE GAGE
ENGINE OIL PRESSURE GAGE
AMMETER
ENGINE TEMPERATURE GAGE
FUSE 4AG-40AMP
FUEL GAGE DASH UNIT
TANK UNIT
IGNITION SWITCH
HORN
HORN RELAY
GREEN WITH RED TRACER
BLACK
RED WITH WHITE TRACER
YELLOW
GREEN
BLUE
WHITE
BLACK WITH WHITE TRACER
BLUE
RED WITH BLACK TRACER
GREEN WITH BLACK TRACER
BLACK TRACER ORANGE WITH
HORN BUTTON
WIRING HARNESS
NOTE = AN ASTERISK (*) INDICATES WIRES FOR LIGHTING INSTALLATION
BATTERY
STARTER SWITCH
RED WITH BLACK TRACER
RED WITH WHITE TRACER
BLACK WITH WHITE TRACER
GREEN WITH RED TRACER
TORQUE CONVERTER WARNING SWITCH
TORQUE TEMP. GAGE
ENGINE TEMPERATURE GAGE
GREEN
WHITE
BLACK
STARTER MOTOR
COIL
ENGINE OIL GAGE
VOLTAGE REGULATOR
F B A
GENERATOR
F A
ORANGE WITH BLACK TRACER
GREEN WITH BLACK TRACER
RED WITH BLACK TRACER
YELLOW

**Fig. 3**

bucket fully raised. The nearer the ground the bucket is held, the better the stability, especially on side slopes or when turning the machine.

## 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 the 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 before returning the machine for another load.

## BACKFILLING AND BULLDOZING:

The bucket can be removed and replaced with a backfiller blade for bulldozing operations. Use the backfiller blade to spread material, strip, level, or to backfill ditches and foundations. Again, one of the slow speed ranges is best when working with a backfiller blade since backfilling requires more power and slow speed.

The backfiller blade pivots at the same points as on the bucket, and may be dumped and retracted similarly. This feature will be helpful when working wet clay or other stickly material.

## 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 responsibility. 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 to 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. Read the instructions as set forth in the maintenance section of this book for points requiring periodic adjustments.

## COLD WEATHER OPERATION:

When operating, or storing, 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 solution of distilled glycerine or ethylene glycol, as they will not damage the radiator, pump, or other parts thru corrosion.

Do not use a calcium chloride solution or any alkaline solution in the cooling system, as they are injurious to metal. Do not use alcohol as an anti-freeze solution as it will boil away at average operating temperatures.

If alcohol is used as an anti-freeze solution, use a hydrometer daily to check the strength of the solution, and add an amount of alcohol daily to replace that lost by evaporation, otherwise the engine, the water pump and radiator will be unprotected against damage due to freeze-ups.

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

NOTE: Never pour cold water in a hot engine, as the sudden contraction may result in a cracked engine block.

## 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.

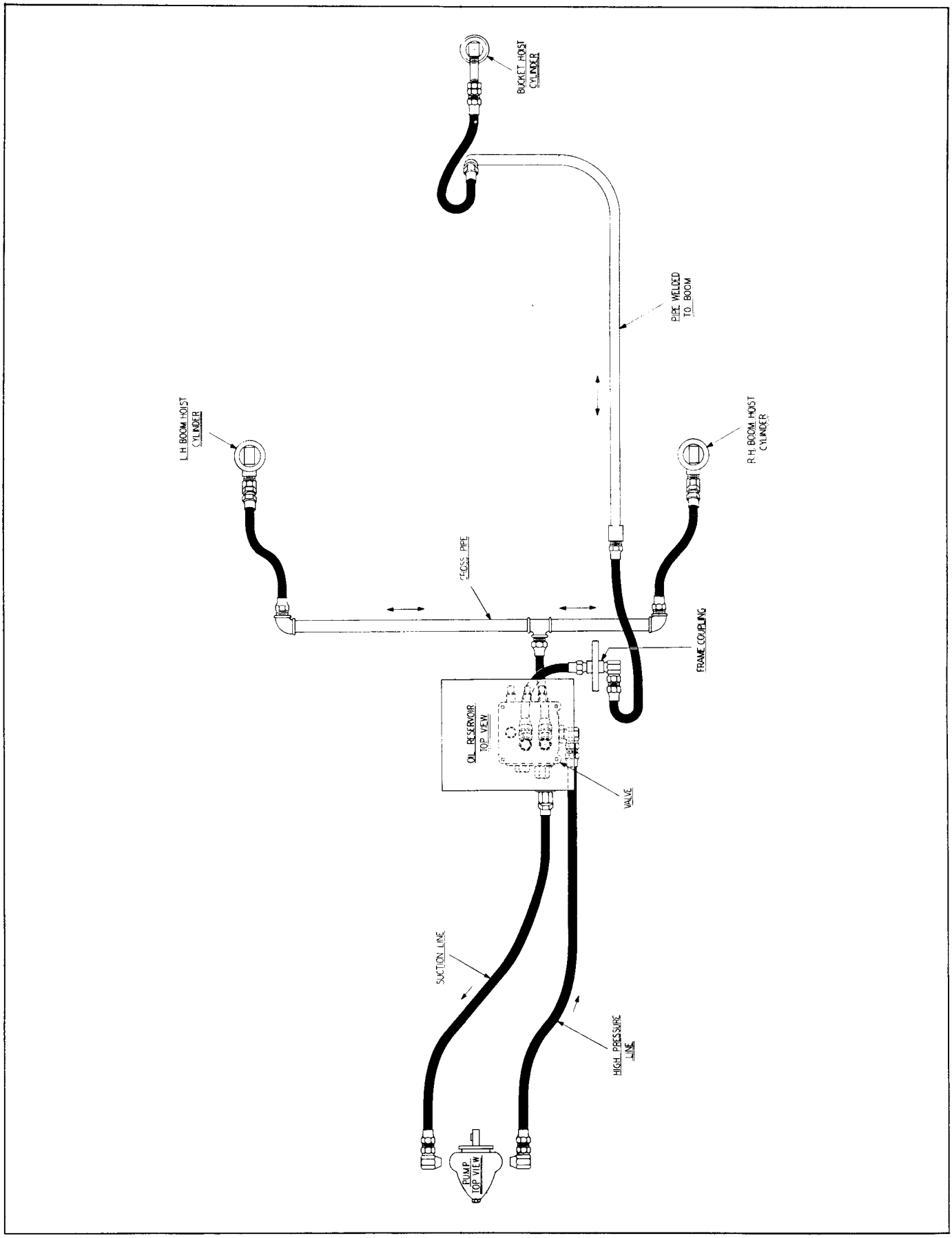

BUCKET HOIST CYLINDER
PIPE WELDED TO BOOM
L.H. BOOM HOIST CYLINDER
R.H. BOOM HOIST CYLINDER
CROSS PIPE
FRAME COUPLING
OIL RESERVOIR TOP VIEW
VALVE
SUCTION LINE
HIGH PRESSURE LINE
PUMP TOP VIEW

**Fig. 4**

## 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 services 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 thru the suction line, and forces it under pressure into the control valve which regulates the flow of oil to the hoists. The valve is manually controlled by the Operator by means of valve control levers.

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 level should be up to the oil level petcock. 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. The oil level must be to petcock level to maintain a sufficient amount of oil to displace the hoist plungers and supply constant lubrication to the pump.

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

   NOTE: Air may be sucked into the system thru a faulty connection, although oil will not leak out. Air or water 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.

3. The very small amounts of water in the system thru condensation will evaporate when the oil becomes warm by operation. However, water sucked into the system must be removed by draining the system. Moisture causes excessive foaming of the oil and causes damage to all parts of the system. Foaming oil will cause the unit to chatter and be noisy, since the pump cannot deliver a steady volume of oil. Drain the system thoroughly to remove moisture.

4. Drain the hydraulic system only after the "PAY-LOADER" 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.

5. Drain the oil from the system, clean 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. Thereafter, drain the system and clean it every 1000 hours, or oftener if working conditions are unusually dirty and dusty.

   In hot weather or where 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. Check the hydraulic pressure relief valve setting at each monthly inspection period. Keep the hydraulic relief valve set properly as instructed, to maintain the hydraulic oil pressure within the limits specified. SEE "VALVE PRESSURE RELIEF."

   Correct hydraulic oil pressure is an aid to efficient operation of the machine.

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

8. The system must be "bled" or purged of air after any work has been done on it, or after it has been drained. Air in the system will retard the operation of the hoists.

### 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.

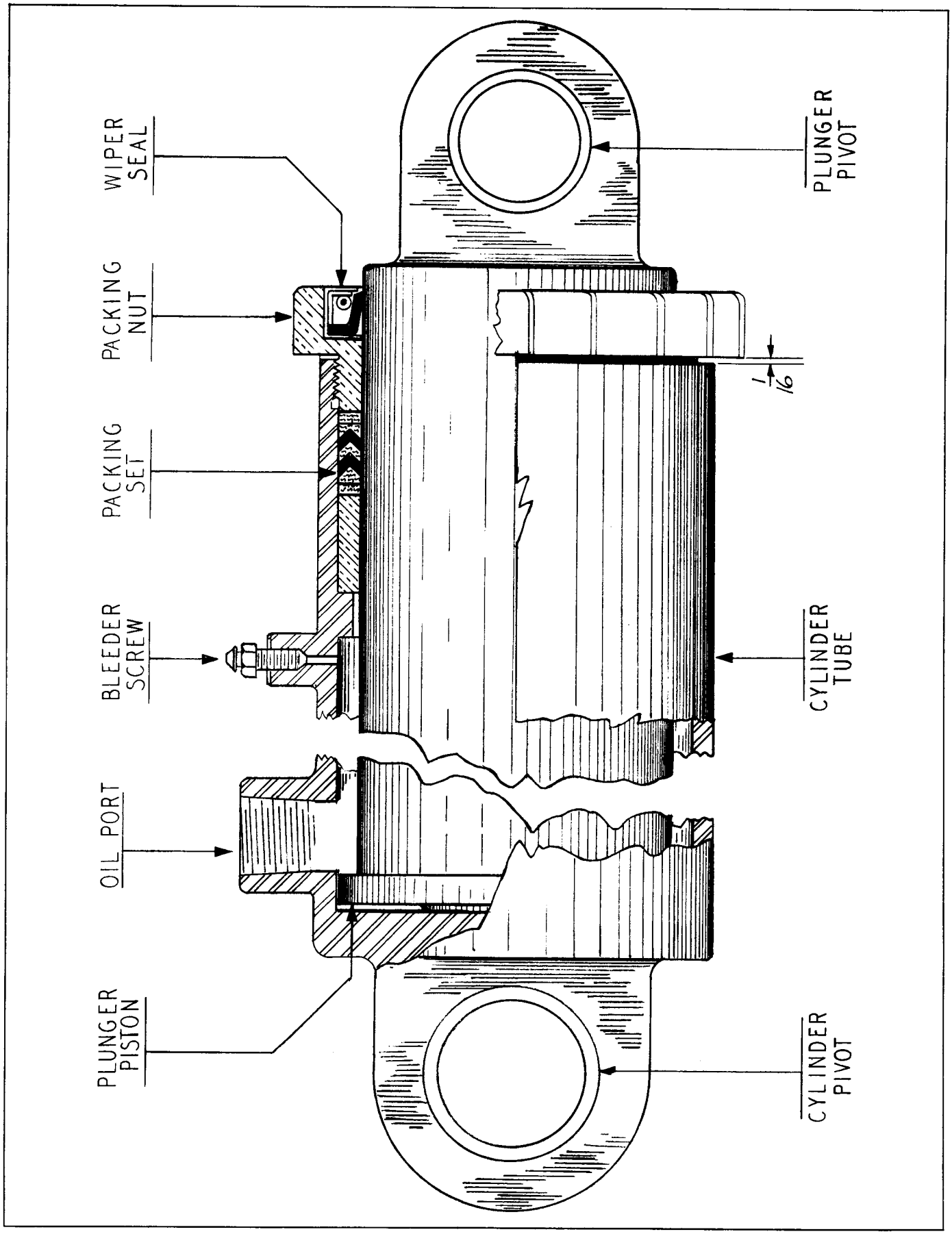

WIPER SEAL
PACKING NUT
PACKING SET
BLEEDER SCREW
OIL PORT
PLUNGER PISTON
PLUNGER PIVOT
CYLINDER TUBE
CYLINDER PIVOT
1/16

Fig. 5

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 15 gallon container near the reservoir drain plug, procure a funnel and hose to direct the oil from the reservoir into the container, then remove the drain plug.

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

3. After the reservoir has drained, break the hose connections at the pump to drain the pump and pump hoses.

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

5. Break the boom pipe hose connection at the frame to drain the bucket control cylinder and the boom pipe.

6. Remove the reservoir clean-out cover, and remove the cap from the reservoir breather and wash it in gasoline to clean the air passages.

7. 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.

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

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

10. 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 thru its dumping cycle 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.

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

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

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

14. After the system has been drained and refilled, or any work done on it, the system must be "bled" or purged of air.

## BLEEDING THE SYSTEM:

1. Start the engine, raise the bucket to nearly full height, slowly open the bleeder screws in the upper end of the boom hoist cylinders. Operate the bucket thru its dumping cycle slowly several times.

2. As soon as air bubbles cease to escape from around the bleeder screws, tighten the screws securely. Clean the hoist cylinders of oil that escaped thru the bleeder screws.

## HYDRAULIC HOIST CYLINDERS:

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 compensates 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.

## BOOM HOIST PACKING:

1. To replace the boom hoist cylinder packing, have the bucket resting on the ground, place the valve levers in neutral position to close off the reservoir oil from the hoist, and shut off the engine.

2. Disconnect the hose to the hoist cylinder and cork the opening on the valve side. The oil in the hoist will drain out when the line is disconnected from the hoist.

3. Remove the hoist upper pivot pin to free the cylinder from the boom bar. Support the cylinder to hold it from falling when the pivot pin has been removed.

4. Attach a chain hoist or crane to the boom to raise it slightly to allow the cylinder to swing downward and rest on the front axle bar.

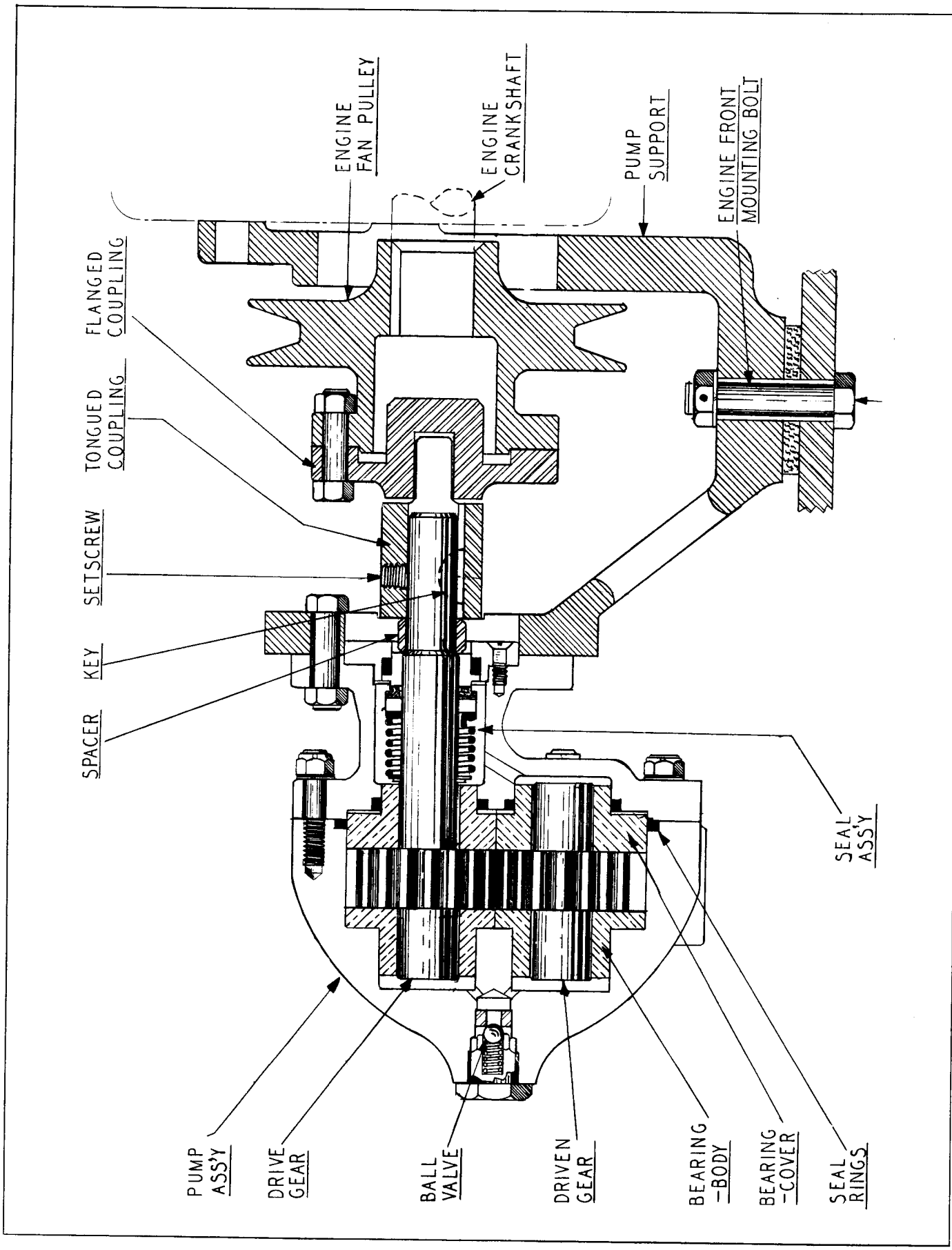

ENGINE FAN PULLEY
ENGINE CRANKSHAFT
PUMP SUPPORT
ENGINE FRONT MOUNTING BOLT
FLANGED COUPLING
TONGUED COUPLING
SETSCREW
KEY
SPACER
SEAL ASS'Y
PUMP ASS'Y
DRIVE GEAR
BALL VALVE
DRIVEN GEAR
BEARING -BODY
BEARING -COVER
SEAL RINGS

**Fig. 6**

5. Unscrew the packing nut out of the cylinder. Using an ice pick or similar tool remove the worn packing paying attention to the way the old packing rings were arranged. Be careful not to mar or scratch the plunger surface with the pick.

   Clean out the packing recess thoroughly before inserting the new rings.

6. Insert the new packing by first placing one of the flat sided rings in the bottom of the recess, flat side down. Tamp it firmly but gently in place with a blunt instrument. Be careful not to damage the rings while placing them in the recess. Be careful not to scratch or mar the plunger rod when tamping in the rings. Insert the "V" rings on the first ring, then add a flat ring on top.

   NOTE: If any of the rings are damaged when being placed in the recess, discard them for another. A damaged ring will not seat properly and will permit oil to escape.

   If the new packing is coated with wax, it must be removed by light scraping and then powdered with graphite. If a ring is damaged by scraping, it must be discarded. Leather rings may be soaked in hot oil to soften them.

7. When the packing has been assembled properly and the nut pulled down snuggly, a light film of oil should adhere to the plunger as it is drawn from the cylinder at all times. Adjust the packing nut from time to time to maintain this condition.

8. Raise the cylinder and lower the boom to reinsert the upper pivot pin to connect the hoist to the boom. Reconnect the hose to the cylinder being sure to remove the plug placed in the hose to hold the oil. Made the connection tight.

9. Start the engine, raise and lower the boom several times, then shut off the engine with the bucket resting on the ground.

10. Inspect the connections for leaks. Add oil to the reservoir to bring the oil level up to the petcock to replace the oil lost from the cylinder. Then "bleed" the system of air.

## BUCKET CONTROL CYLINDER:

The packing is replaced in the bucket control cylinder similar to the boom hoist. The pivot pins must be removed to free the cylinder from the bucket and carrier. Disconnect the hose and unscrew the pipe nipple from the cylinder plunger end. Then remove the plunger shield to expose the packing nut. Unscrew the packing nut and follow the procedure outlined for the boom hoist packing replacement.

## HYDRAULIC OIL RESERVOIR:

The oil reservoir is located just in back of the operator's seat and up under the engine hood. 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. The tank breather should be washed out with clean gasoline periodically. Remove the hand hold cover to inspect the vents in the breather pipe.

To remove the reservoir, first remove the engine hood. Drain the reservoir, and then disconnect the hoses. Remove the bolts holding the reservoir to the frame and lift out the reservoir along with the valve which is bolted to the underside of the reservoir.

## HYDRAULIC PUMP: For Hoist Cylinders.

The pump is coupled directly to the engine crankshaft and must not be operated without sufficient oil circulating thru 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 gear type, assembled for counter-clockwise rotation viewing the head end. There are no adjustments to be made on the pump.

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.

## PUMP REMOVAL:

To remove the pump from the machine, first remove the engine hood sides. Disconnect the pump hoses and plug or cork the hoses on the valve side. Remove the six bolts, holding the pump to the pump mounting bracket, and draw the pump away from the bracket. The pump coupling is a tongue and groove type and will slide apart as the pump is drawn backward. Remove the tongued coupling from the end of the pump shaft. The coupling is fastened with a setscrew and key to the pump shaft. Removing the coupling allows the pump to be moved backward away from its bracket sufficiently so it can be taken out from the machine.

All the pump mounting bolts and pump hose connections can be reached without removing the radiator grille casting or the radiator. Be sure to lubricate the pump coupling with a good grade of high temperature grease before reassembling the pump to its support bracket.

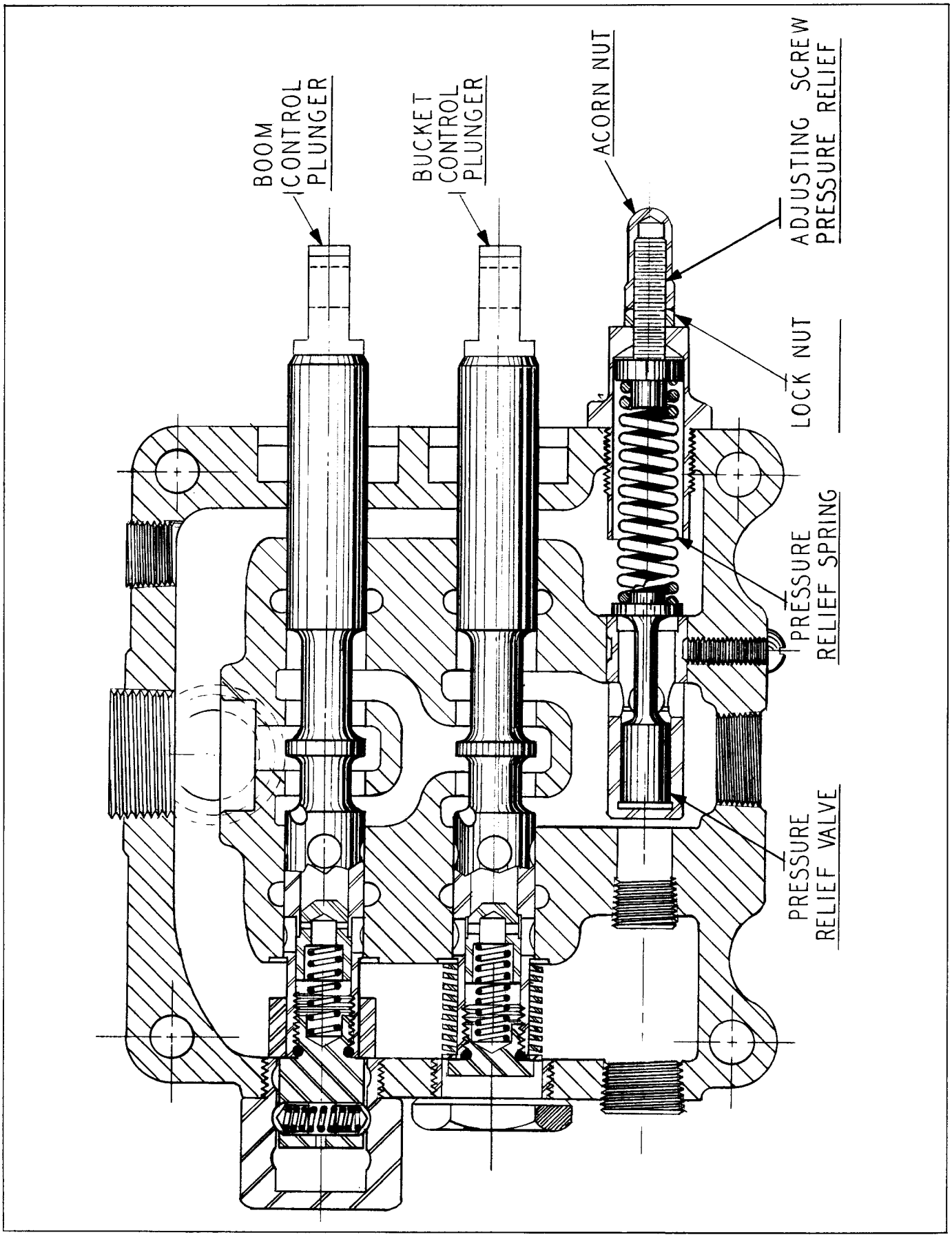

BOOM CONTROL PLUNGER
BUCKET CONTROL PLUNGER
ACORN NUT
ADJUSTING SCREW PRESSURE RELIEF
LOCK NUT
PRESSURE RELIEF SPRING
PRESSURE RELIEF VALVE

Fig. 7

## PUMP DISASSEMBLY:

The manufacturer does not normally recommend replacement of the gears or bearings in the field; however, springs, seals, or the ball valve may be replaced. To inspect and replace the pump drive shaft seal, remove the pump from the machine. Remove the coupling and drive key from the end of the pump drive shaft. Remove the four counter sunk head screws holding the seal retainer ring to the pump cover. There are two threaded holes in the retainer ring to assist in removing the ring. Turn two of the countersunk head screws into these holes until they bear on the pump body. This will tend to push the ring out. Care must be used in taking out this ring, since the seal springs exert considerable pressure against the inside of the seal and ring and may cause the ring to pop out suddenly as it is being loosened. When the retainer ring is removed, the pump shaft seal and spring assembly will be exposed and may be removed.

To inspect the bore valve ball seat and ball, remove the hex head retainer from the pump body. The gasket, spring and ball may then be taken from the valve bore of the body. The ball seat is a press fit in the valve bore and should not be replaced unless damaged. If the ball seat is only slightly scratched, place the ball in the seat and tap the ball with a soft hammer or mallet. To remove the seat, thread a suitable pipe tap into the seat and heat the body to 200° F. The seat can then be pulled out, using the tap as a puller.

Before removing the pump cover from the pump body to inspect and replace gears, bushings, or seals, put match marks opposite each other on both parts so they can be reassembled for correct rotation. Then remove the bolts holding the cover to the body to expose the gears and bushings. These gears and bushings are fitted to the pump body at the time of manufacture and should only be replaced as matched sets and fitted by a trained mechanic.

## HYDRAULIC VALVE:

The hydraulic valve receives oil under pressure from the pump and directs it to the hoists. When the valve plungers are in "Hold" position, the oil already in the hoists is retained therein, but oil from the pump flows thru 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, thru the valve and into the reservoir along with oil coming from the pump.

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.

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.

## VALVE REMOVAL:

The hydraulic valve is mounted to the underside of the reservoir. To remove the valve, proceed as follows:

1. Drain the oil reservoir. It is not necessary to drain the entire system.

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 rebolted 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. Refill the reservoir with the proper oil to the petcock level.

   Start the engine and operate the hoists several times. Then shut off 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.

## THE VALVE PRESSURE RELIEF:

To safeguard the pump, the relief valve pressure must be set at not more than 1250 lbs. oil pressure.

To adjust the relief pressure, insert a gauge of at least 2500 lbs. capacity into the high pressure line to the bucket hoist cylinder by means of a pipe tee. Start the engine keeping it at idle throttle, and raise the boom high enough to clear the ground when operating the bucket through its dumping cycles. Remove the acorn nut from the right side of the valve. Operate the bucket by alternately dumping and retracting the bucket while opening the engine throttle gradually. Note the oil pressure indicated and do not allow it to exceed 1250 lbs. Adjust the screw found under the acorn nut, turning it counter-clockwise to reduce the pressure. Turning it clockwise increases the pressure.

When the valve is set at 1250 lbs. relief pressure, at full open throttle with the bucket being oper-

ated in its dumping cycle, the screw may be locked with the jam nut and the acorn nut replaced.

## THE ENGINE:

Refer to the Hercules Operation and Maintenance Manual for QXD series (gasoline) engines. Engine repair, maintenance and operation of the engine is thoroughly discussed in the Hercules manual which should be read and studied.

## ENGINE REMOVAL:

1. To remove the engine first remove the hood side, disconnect the muffler at the engine and the muffler support under the right side of the hood top. Remove the hood. Disconnect the air cleaner pipe at the engine.

2. Remove the radiator grille casting. There are four bolts holding the grille to the frame. They can be reached by extending the arm backward between the engine and the sides of the frame. It is not necessary to remove the radiator.

3. Disconnect the pump hoses at the pump, and cork the openings, to prevent draining the reservoir. Unbolt the pump and remove it from the machine. It is not necessary to remove the reservoir.

4. Disconnect the battery ground strap before disconnecting the wiring from the engine to safeguard against short circuiting the high voltage system. Disconnect cables and wires at the engine. Remove wire clamps if necessary.

5. Disconnect the choke rod, accelerator control rods and clutch rod at the engine. Disconnect the fuel lines at the engine. Be sure all clips, hoses and accessories are disconnected to free the engine.

6. The engine is mounted on rubber pads at three points, two at the flywheel housing and one at the rear under the pump support. Remove these bolts.

7. With chain slings under and around the engine at front and rear, hoist the engine so the rear end is slightly higher than the flywheel end. Move the engine upward and backward to slide off the drive shaft yoke.

8. To reassemble the engine to the machine it will 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 engine shaft when reassembling the engine to the machine.

## FAN BELT REMOVAL:

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 period when not subjected to normal action.

To replace the fan belt proceed as follows:
(See picture - Pump Mounting)

1. Shut off the engine with bucket resting on the ground and remove hood sides.

2. Remove the capscrews holding the pump to the mounting bracket and pull the pump to the rear as far as it will go. It will not be necessary to disconnect pump hoses.

3. Then loosen generator bracket adjusting nut and push the generator in toward the engine and tighten the nut.

4. Remove the fan belt from generator pulley and lower fan belt pulley; then slip the belt over the fan.

## FAN BELT ADJUSTMENT:

Install the new fan belt by reversing the method of removal. With the fan belt on all three pulleys, reset the generator so the belt may be flexed sideways by hand. This is the proper tension of the belt when the generator adjusting bolt is tightened. Never have the belt adjusted so tight that it feels stiff and taut.

## OIL FILTER:

The purpose of the crankcase oil filter is to retard dilution of the engine oil with harmful substances and to remove 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 filter element renewed whenever the crankcase oil is changed.

Read and follow the instructions on the box containing the new filter element when replacing a used element.

After replacing a filter element, tighten the cover securely, start the engine, and let it operate 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 a new element has become saturated with oil, since oil drawn into the retained in the filter will reduce the oil level in the crankcase.

## AIR-CLEANER SERVICE:

A regularly serviced and properly working air cleaner contributes considerable to the long life of an engine. Surprising amounts of foreign particles are

present in most atmospheres, and the abrasive action of such dust and dirt particles causes rapid wear on the valves, bearings, and cylinder walls when it is carried into the engine. The purpose of the precleaner is to collect grit and dirt before it reaches the engine. Thus the cleaner itself must be cleaned as often as dirt accumulationa start to build up. Sometimes the cleaner must be cleaned and the oil in it changed several times a day if conditions are especially bad. Daily servicing of the air cleaner is important. To service, wash out the oil cup in clean gasoline and refill the cup to the oil level bead with clean oil of the same grade as is being used in the engine crankcase.

Examine the air cleaner tube periodically for leaks. Poor connections or minute leaks can permit the passage of abrasive dust more freely than a poorly serviced air cleaner and will surely offset any effort to maintain an efficient air cleaner.

## THE TORQUE CONVERTER:

The purpose of the torque converter is to multiply within itself the torque generated by the engine and transmit this increased torque thru the transmission and into the final drive. Further it reduces shock normally imposed upon the gear train by sudden surges of power required to overcome loads at a constant engine torque input, the torque multiplication of the converter varies with the load imposed. When full load is imposed upon the tractor the converter develops maximum multiplication of the engine torque. As the load diminishes (such as breaking from a cut) the torque multiplication diminishes at a rate inversely proportional to the speed ratio, until the free wheel point is reached.

Refer to the Lubrication Chart for instructions on servicing the torque converter and its oil filter.

Do not allow the temperature of the torque converter oil to exceed 285° as indicated on the oil temperature gauge. If it approaches this reading remove the load from the machine and idle the engine until the oil temperature gauge registers 225° F.

A thermal switch is attached to the torque converter and wired to the horn relay which causes the horn to automatically sound a continuous note when the torque converter oil is in danger of being overheated.

Do not remove any plugs from the converter or work upon it until the oil temperature is below a 150° F. as the oil being under pressure may be forcibly ejected causing personal injury.

## 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. Never "slip" the clutch to govern drive thrust by cutting out the engine.

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.

The clutch pedal must have 2 to 2-1/2 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 or fingers.

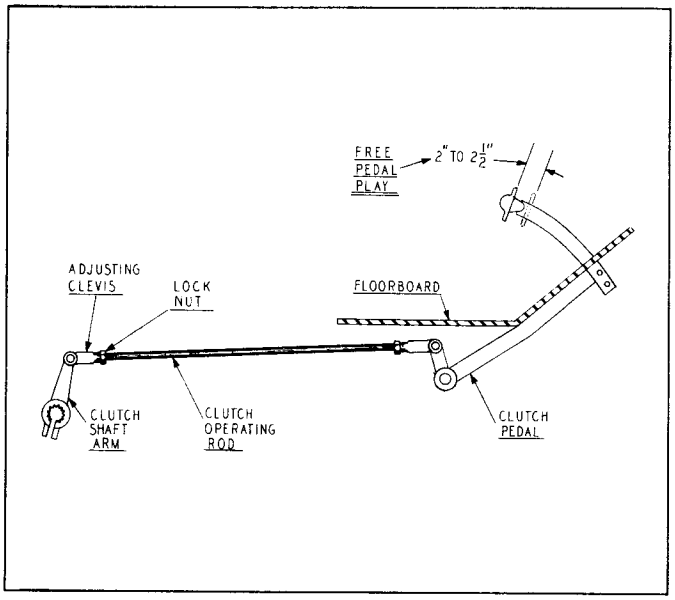



Fig. 8

## CLUTCH PEDAL ADJUSTMENT:

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

Be sure to tighten the adjusting nut against the clevis end to lock it in place.

## CLUTCH AND POWER TAKE-OFF REMOVAL:

To remove the power take-off housing and the clutch follow the suggestions as listed in the following outline.

1. From underneath the machine break the upper drive shaft at the clutch by removing the cap-

screws holding the center cross bearings to the yokes.

2. Remove the clutch pedal return spring and disconnect the clutch operating rod from the clutch shifter lever at the clutch housing.

3. Place the valve control levers in neutral. The hose nearest the power take-off housing must be turned outward against its neighboring hose by turning the hose fitting at the valve.

4. Remove the "U" clamps bolted to the lower frame channels so the boom hoist cross pipe can be moved forward and down.

5. Remove the capscrews fastening the power take-off housing to the flywheel housing. Pry the P.T.O. housing away from the flywheel housing and lower it to the floor under the machine. The clutch will now be exposed.

6. With the power take-off housing removed, the clutch may be dismantled from the flywheel.

7. Insert three (3) 3/8" - 16 N.C. capscrews x 1-1/2" long with 3/8" std. flatwasher into the clutch cover and screw in finger tight; then turn them in one complete turn to compress the clutch pressure plate.

8. Remove the capscrews holding clutch pressure plate to the engine flywheel and lift complete pressure plate out of the flywheel housing along with the clutch drive plates. 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.

9. To reassemble proceed in reverse order of removal. Check the clutch foot pedal for free pedal play when the clutch operating rod is connected to the clutch shifter lever and adjust the rod for correct amount of free pedal play.

## 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.

There are no adjustments to be made on the drive shafts except to keep them lubricated and to check the bolts to see that they remain tight. Always tighten the capscrews at the upper joint to 20 to 30 ft. lbs. and those of the lower joint to 45 to 55 lbs. using a torque wrench.

To "break" or separate the joint, remove the capscrews and the lock holding the center cross bearings to the yoke and tap apart.

## TRANSMISSION:

This is a four speed forward and four speed reverse transmission completely equipped with anti-friction bearings. For major repairs to the transmission consult THE FRANK G. HOUGH CO. DISTRIBUTOR for the services of a trained mechanic.

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

To remove the transmission proceed as follows:

1. Fashion a "vee" shaped clamp with legs extending outward from the end of each leg. Drill a 9/16 diameter hole in the legs to match two of the diagonally opposite bolts holding the reverse shifter housing to the top of the transmission. Bend the vee clamp from 1/8 thick steel strip by 1" wide stock. Remove two diagonally spaced capscrews from the reverse shifter shaft housing and mount the clamp upright in these holes.

2. Disconnect the directional lever linkage from the transmission reverse shifter shaft.

3. From underneath the machine, remove the cotter pins and pivot pins connecting the speed range shifter rails to the transmission.

4. Separate the two drive shafts by removing the capscrews holding the transmission shaft yokes to the center cross of the upper and lower universal joint.

5. Connect the crane hook to the "vee" clamp to hold the transmission in place, remove the bolts holding the transmission mounting brackets to the frame, one on each side. Remove the left side bracket from the transmission to allow greater clearance to lower the transmission to the floor under the machine.

6. By twisting the transmission sideways, it can now be lowered to the floor and pulled out from underneath the machine.

7. Reassemble in reverse order of removal.

## 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 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 housings.

To remove the drive axle as a unit, disconnect the brake fluid lines at the wheels. Break the universal joint by removing the bolts holding the yoke to

the centercross bearings. Remove the bolts holding the axle housing to the frame. Hoist up the machine high enough so the axle will clear the counterweight casting under the frame. Block the machine in this position securely and roll the axle out from under this machine.

NOTE: Check the drive axle wheel nuts periodically. These nuts should be forced tight, using a long handled wrench. If the nuts work loose, damage to the hub and axle will result.

## BRAKES: "BLEEDING"

The foot brakes are hydraulically operated, internal expanding, two 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.

2. Carefully clean off all dirt from around the master cylinder filler plug, remove the plug, and fill the master cylinder with hydraulic brake fluid.

3. Have one man slowly pump the brake pedal while another man opens the breather screw each time the pedal is pushed down and closes the screw just before the brake pedal is returned upward. Opening the breather screw when the pedal is depressed forces air and fluid from the line. Closing the breather screw when the pedal is released prevents air from being sucked back into the line.

4. Continue the slow pumping of the brake pedal and alternately opening and closing the breather screw until air bubbles are no longer seen escaping with the fluid from the line. Be careful not to pump all the fluid from the master cylinder. Refill as necessary until the line is free of air.

5. Tighten valve, and repeat the operation on the right wheel.

6. Refill master cylinder when both wheels have been bled and replace the plug.

## BRAKE: ADJUSTING

Inspect the brake linings periodically for wear.

To adjust lining clearance, proceed as follows:

1. Jack up the rear axle and remove the wheel.

2. Remove the 5/16 bolt to loosen the inspection cover on the brake drum.

3. Use a .010 feeler gauge thru the slot in the brake drum until .010 clearance is obtained on the top and bottom of the front shoe. It is necessary to turn the anchor screw to adjust the shoe. Loosen the anchor screw lock nut to turn.

4. Turn the brake drum slot to opposite shoe and adjust top and bottom until .010 clearance is obtained. Note there are two anchor screws, one for each shoe. When adjustment is correct, the
b brake shoes will impose no "drag" on the drum as the wheel is turned.

5. Lock the anchor screw when adjustment is satisfactory and try the feeler gauge in top and bottom of each shoe again to make sure the adjustment was not upset when locking the anchor screws. Replace the wheel.

6. Repeat above on the other wheel.

## PEDAL ADJUSTMENT - BRAKES:

Free pedal play must be apparent at the top of the stroke of the brake pedal, so that approximately 1/8" clearance is maintained between the master cylinder plunger and the end of its actuating rod. See Fig. 9.

Lack of free pedal play results in the master cylinder plunger being depressed, causing undue wear on the brake lining. Free pedal play is the amount of movement of the pedal before the actuating rod contacts the cylinder plunger. To obtain the correct amount of free brake pedal play, adjust the operating rod clevis at the brake pedal.

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

## HAND BRAKE ADJUSTMENT:

The hand brake operates independently of the foot brakes. Pulling backward on the hand brake lever causes an inner and an outer brake shoe to grip a small drum on the lower drive shaft. The hand brake drum is integral with the drive shaft axle yoke.

Adjustment for lining clearance of these shoes can only be made by turning the nut at the brake shoe lever arm.

## STEERING ADJUSTMENTS:

### LUBRICATION OF STEERING GEAR:

The steering gear is filled at the factory with a special steering gear lubricant developed for both

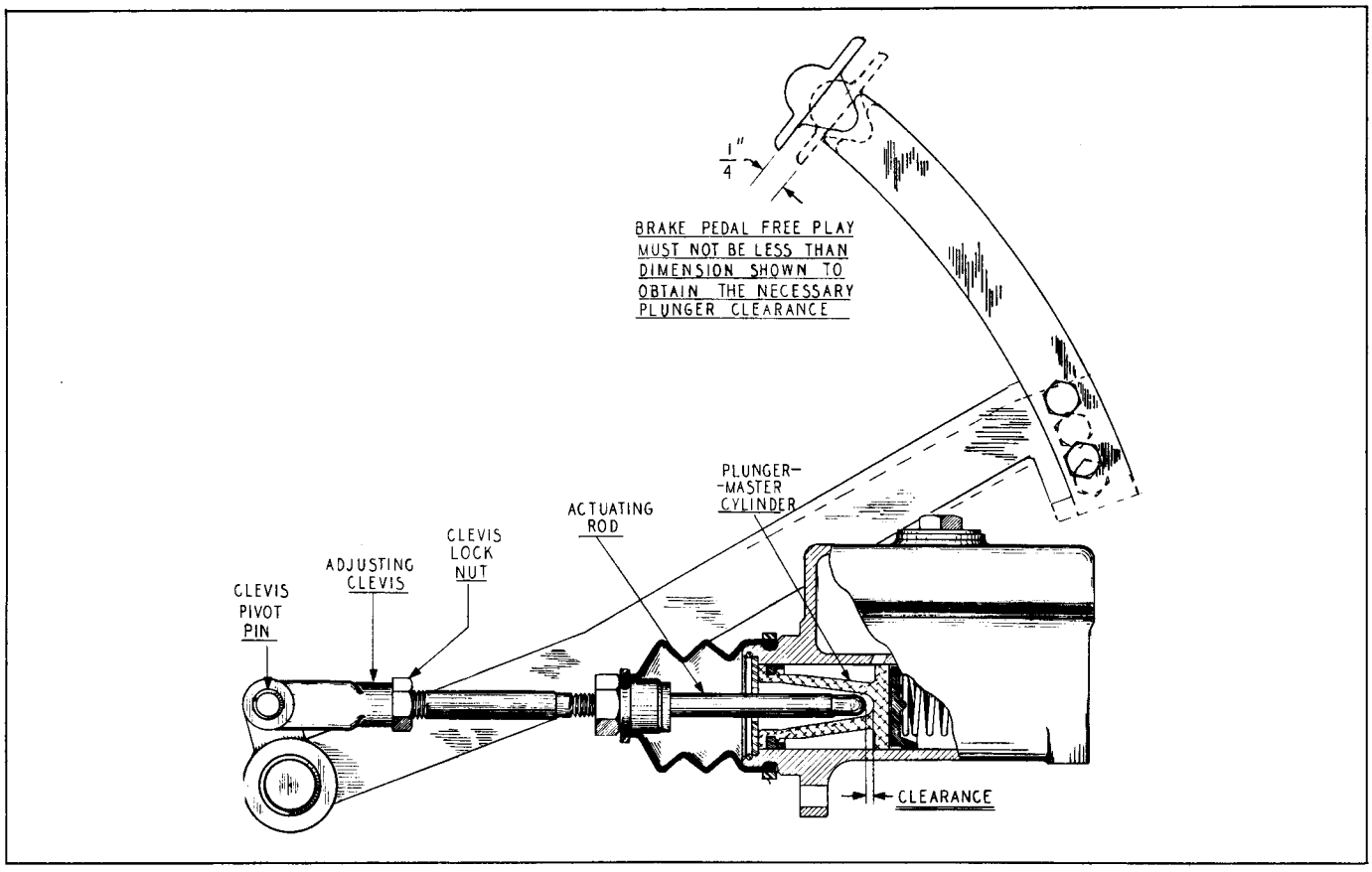

1/4"
BRAKE PEDAL FREE PLAY
MUST NOT BE LESS THAN
DIMENSION SHOWN TO
OBTAIN THE NECESSARY
PLUNGER CLEARANCE
PLUNGER-
-MASTER
CYLINDER
ACTUATING
ROD
CLEVIS
LOCK
NUT
ADJUSTING
CLEVIS
CLEVIS
PIVOT
PIN
CLEARANCE

**Fig. 9**

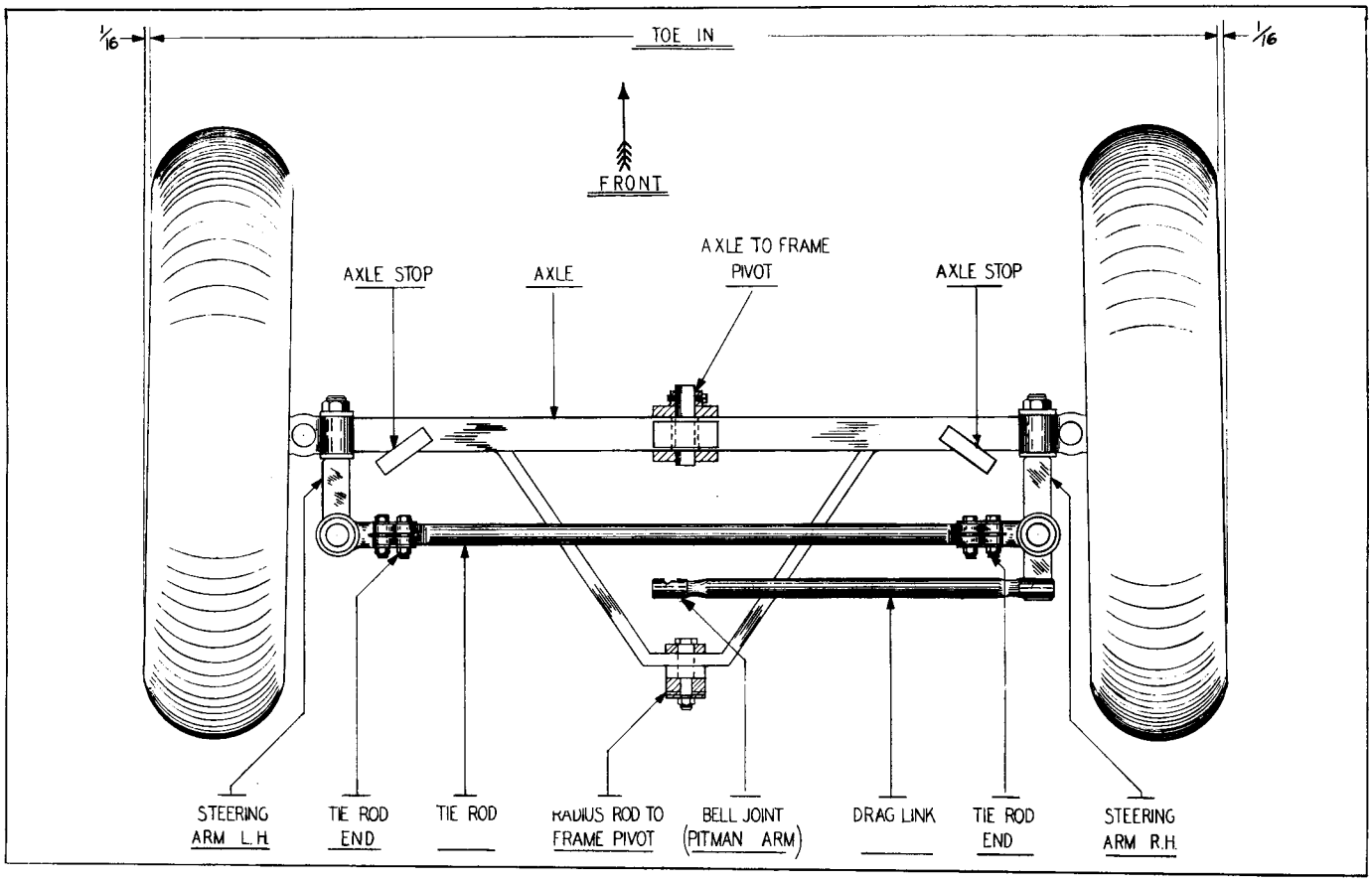

1/16
TOE IN
1/16
FRONT
AXLE TO FRAME
PIVOT
AXLE STOP
AXLE
AXLE STOP
STEERING
ARM L.H.
TIE ROD
END
TIE ROD
RADIUS ROD TO
FRAME PIVOT
BELL JOINT
(PITMAN ARM)
DRAG LINK
TIE ROD
END
STEERING
ARM R.H.

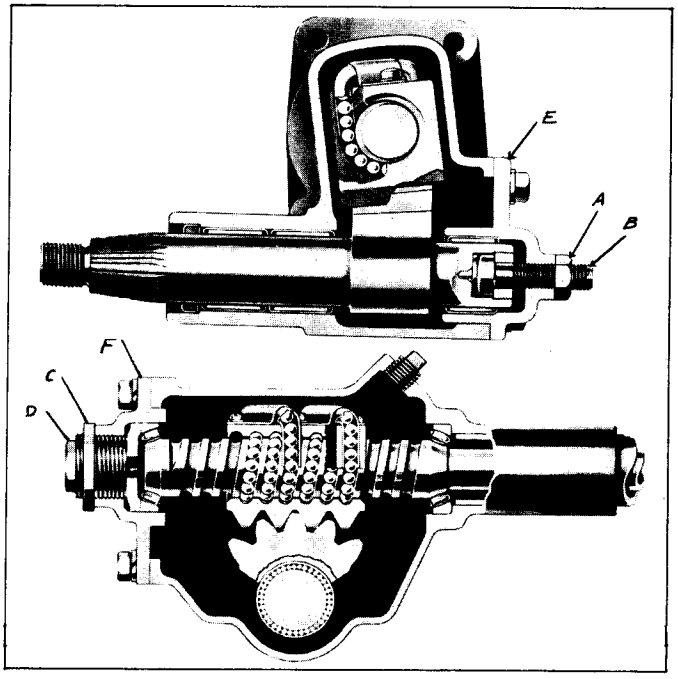
**Fig. 10**

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. See the Lubrication chart.

## 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 locknut "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 dept 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 adjustment, 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.

## TOE-IN ADJUSTMENT: STEERING WHEELS

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

For continuous work requiring short hauls, where the machine will operate as much in reverse gear as in forward gear, the steering axle wheels toe-in may be adjusted to "O" inches so all four wheels are in line.

For work which includes long hauls in forward gear or for highway transportation, the steering axle wheels should be adjusted to 1/16" toe-in for each steering axle wheel, or approximately 1/8 inch total for both wheels.

To adjust the toe-in, loosen the nuts clamping the tie rod end to the tie rod. Turn the tie rod so the toe-in is adjusted toward the front of the machine to dimensions as instructed. Have the machine standing level when measuring the amount of toe-in. When the adjustment is correct, lock the tie rod ends to the rod by tightening the nuts.

Check the toe-in at each monthly inspection period to maintain the correct adjustment. This is an aid to longer tire service.

## TURNING RADIUS ADJUSTMENT:

To safeguard the steering gear from excessive

strain when turning, stop blocks are provided on the axle bar to limit the turning arc of the tractor wheels. Be sure the machine is standing level when adjusting the turning radius.

Care must be exercised in locating a new pitman arm. Under no circumstances should the pitman arm 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. When the pitman arm is correctly located on the steering gear shaft, the total turns of the steering gear are "centered" with the turning arc of the tractor wheels.

If the pitman arm is about to be removed for some reason, put match marks on the arm and the shaft so the arm can be relocated in its original position.

To install a new pitman arm, proceed as follows:

1. With the machine standing level, check and adjust for correct axle wheel toe-in. Place the axle wheels in the straight-away position.

2. Connect the drag link to the steering arm ball and connect the pitman arm to the drag link, but do not connect the pitman arm to the steering gear.

3. From within the operator's seat turn the steering hand wheel gently to the right all the way until stopped by resistance within the gear. Place a chalk mark or piece of string on the rim of the wheel.

4. 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.

5. Then turn the hand wheel back toward the right, exactly one-half the number of total turns. This should place the pitman gear in its "central" position.

6. With the axle wheels in straight-away position, the steering hand wheel centered and the pitman arm connected to the drag link, the pitman arm may now be attached to the serrated shaft of the steering gear.

7. Place a jack under the steering axle radius rod pivot and jack up the end of the machine high enough to allow the axle wheels to oscillate up and down fully, and at the same time permit them to rotate thru their full turning arc.

8. Tilt the right wheel upward and hold it up against the frame stop. Swing the axle wheels as in making a right turn. The spindle arm should rest against the axle stop block when the wheels are in this position. Repeat this procedure on the left axle wheel and check to be sure the turning arc in a left turn is stopped by the left spindle arm resting against the axle stop block.

If the pitman arm has been properly installed on the steering gear, the turning arc of the axle wheels will be stopped by the axle blocks instead of resistance within the gear.

9. It may be possible that thru use and wear on the assembly, the axle stops are no longer adequate. In this event the length of the axle stops must be increased so they stop the turn on the axle wheels before resistance within the gear itself stops the turning of the axle wheels.

10. If the turning arc is stopped by the steering gear mechanism instead of the axle stop blocks, the bearings, the ball nut, and ball guide within the gear may be damaged.

    It is good practice to check the turning radius adjustment at each monthly inspection period. To check, raise the steering end of the machine, tilt the axle to one side, and turn the wheels for both a right turn and a left turn, checking contact with the axle stop blocks. Then tilt the axle to the opposite side and again check the contact with the axle blocks for both right and left turn.

## TIRE PRESSURES:

Front tires are 9.00 x 20 - 10 ply. The front tires should be inflated to 75 pounds air pressure.

Rear tires are 13.00 x 24 - 8 ply and should be three-fourths (3/4) full of calcium chloride solution with 25 pounds air pressure.

## CALCIUM CHLORIDE - TIRES

Secure a "bleeder" adapter from an authorized tire dealer to allow air in the tire to escape when being replaced by liquid. Jack up the "PAYLOADER" and turn the tire so the valve stem is on top. Turn out the valve core, screw in the adapter and attach the water hose to the adapter. Place the container holding the calcium chloride solution somewhat higher than the tire (about 5 or 6 feet). Put the solution in the tire tube by using a hand pump or by using compressed air and a pressure tank filled with liquid. Fill the tube until the liquid level is slightly below the valve stem level. Remove the hose and adapter, replace the valve core and inflate the tire with air until the tire gauge registers 25 pounds.

To make the proper calcium chloride solution for one tire, be sure to put 38 gallons of water in the container first. Then add 120 pounds of calcium chloride. Stir the solution until thoroughly mixed and allow to cool before using.

NOTE: Calcium chloride solution is injurious to metal and should never be used in the cooling system.

## CUTTING EDGE-BUCKET:

TO REPLACE THE CUTTING EDGE FOLLOW THE PROCEDURE OUTLINED BELOW:

1. Lay a straight edge in the bucket to line up with the front edge of the stiffner and clamp it in

place. If there is no stiffner on the bottom of the bucket, line the straight edge with the front edge of the bucket sheet.

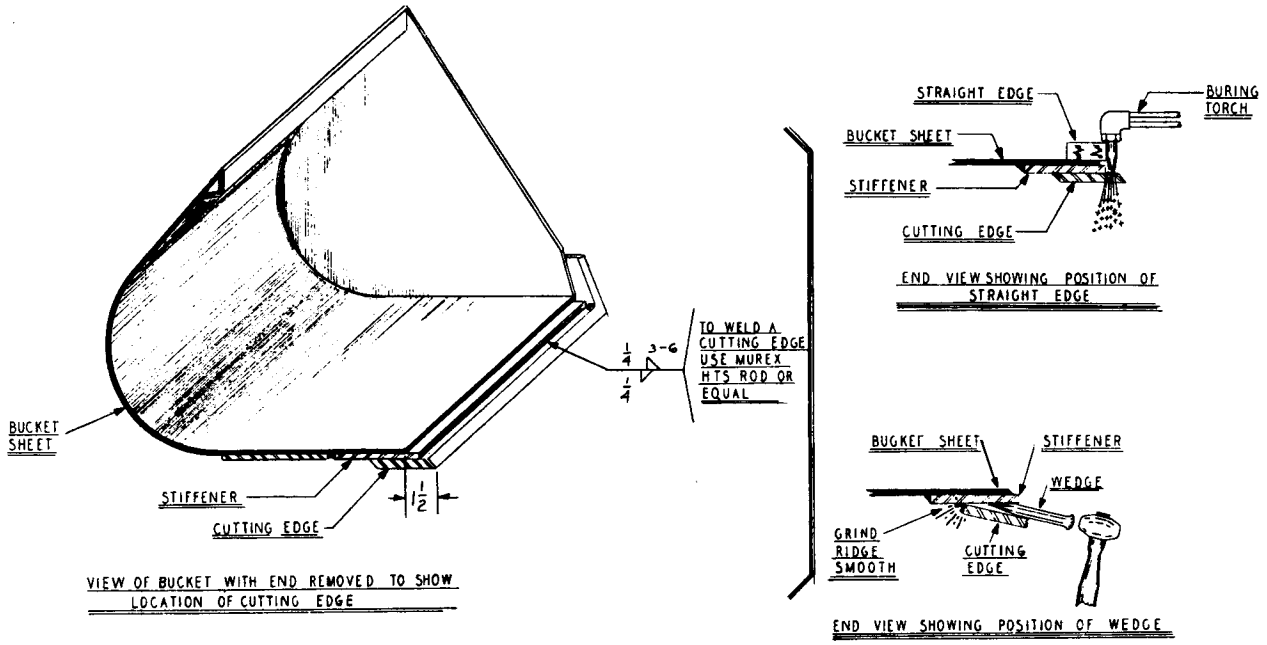
2. Guide the burning torch along the straight edge to cut through the cutting edge and the weld along the front edge.

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 stiffener 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.

5. Clamp the new cutting edge in place, 1-1/2 inch 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 bucket sheet upwards 1/4" for every 4 feet of bucket length. An 84 inch bucket would be bowed upward approx. 1/2 inch. 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, lay a stout bar on the blocks so it lays parallel to the outer edge of the bucket sheet. By means of a "C" clamp, 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 continous 1/4 fillet weld on the front, joining the cutting edge to the stiffener and to the bucket sides. If the 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 rods 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.




METHOD OF CUTTING EDGE REPLACMENT

**Fig. 8**
**METHOD OF CUTTING EDGE REPLACEMENT**

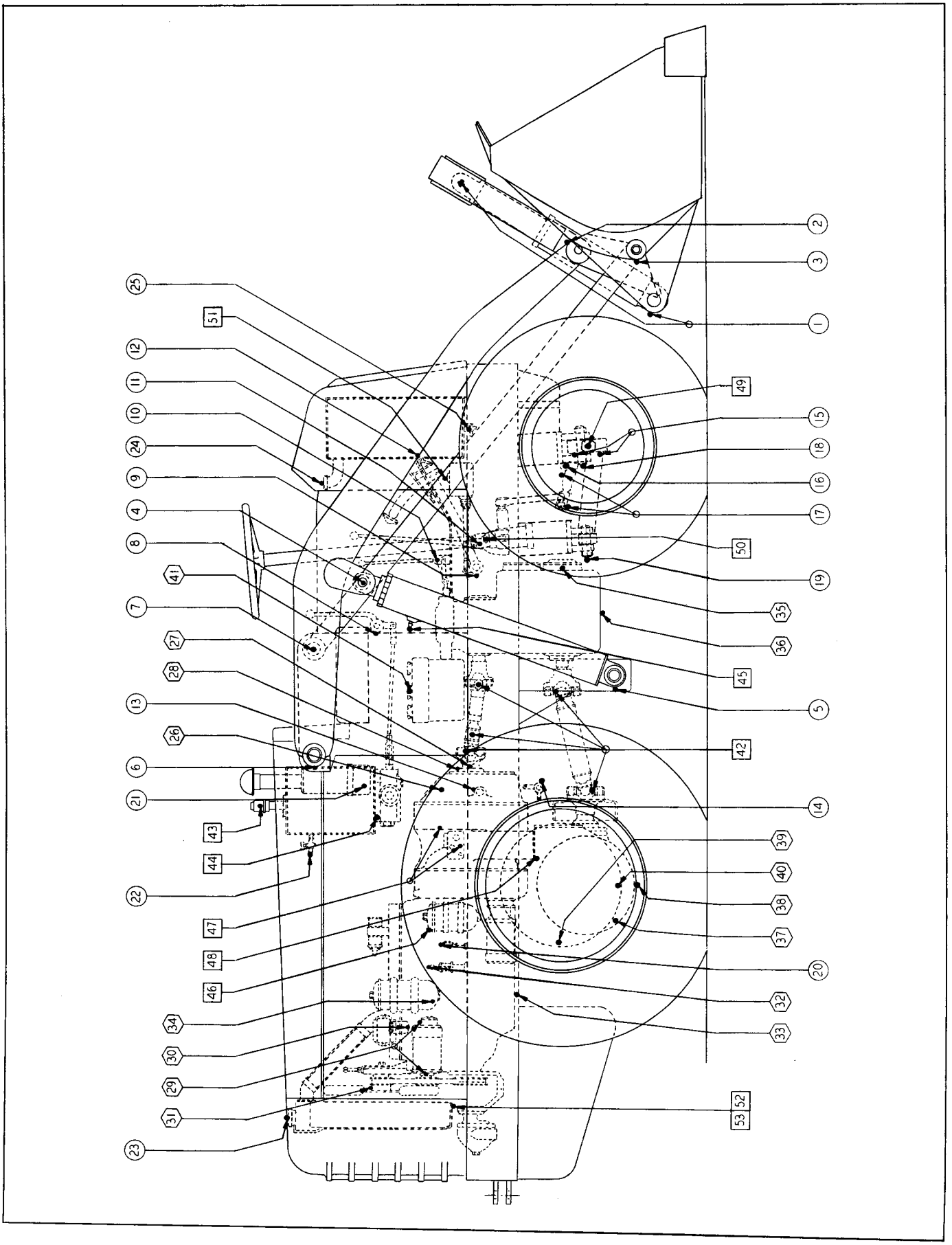



**Fig. 12**
**LUBRICATION CHART**

## LUBRICATION INSTRUCTIONS

Before servicing, always wipe the dirt from around the grease fittings, cups, or plugs, to prevent grit, dirt, or other foreign matter from entering.

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

1. Bucket Cylinder - Upper and Lower Pins . . . . . 2 points
2. Boom to Carrier - 1 each, R.H. and L.H. Sides. . . . . 2 points
3. Hinge Pin - Guide to Carrier - 3 each, R.H. and L.H. Sides . . . . . 6 points
4. Boom Hoist to Boom - 1 each, R.H. and L.H. Sides . . . . . 2 points
5. Boom Hoist to Frame - 1 each, R.H. and L.H. Sides . . . . . 2 points
6. Boom to Frame - 1 each, R.H. and L.H. Sides . . . . . 2 points
7. Guide to Frame - 1 each, R.H. and L.H. Sides . . . . . 2 points
8. Valve Control Levers - R.H. Side of Seat . . . . . 2 points
9. Foot Pedals - Brake and Clutch - 1 each, R.H. and L.H. Floorboard . . . . . 2 points
10. Directional Lever - Center Floorboard . . . . . 1 point
11. Range Lever Housing - Under R.H. Side Floorboard . . . . . 1 point
12. Accelerator Cross Rod Bearing - 1 each, R.H. and L.H. Floorboard . . . . . 2 points
13. Clutch Cross Shaft - 1 each, R.H. and L.H. PTO Housing . . . . . 2 points
14. Bell Crank - Hand Brake - L.H. Side of Frame . . . . . 1 point
15. King Pin - Steering Wheels - 2 each, R.H. and L.H. Hub . . . . . 4 points
16. Tie Rod Ends - 1 each, R.H. and L.H. End . . . . . 2 points
17. Drag Link - 1 each, R.H. and L.H. End. . . . . 2 points
18. Axle Pivot - Front Bolster, Front End of Frame . . . . . 1 point
19. Axle Pivot - Radius Rod, Front End of Frame . . . . . 1 point

**SERVICE DAILY:** Items 20 through 25. Check and service these points every 8 to 10 hours of operation, or oftener, as required by individual operating conditions.

20. ENGINE OIL LEVEL: Check the engine crankcase oil level daily, or oftener as required. Add oil to maintain the oil level up to the proper mark on the dipstick. Do not check the oil level while the engine is running. See Item No. 32.
21. AIR-CLEANER: Clean and refill, daily or oftener, as required. This is important. To clean, remove the cup and wash it out in clean kerosene. Refill the cup with clean oil to the height of the oil level bead. Use the same grade of oil as is used in the engine crankcase.
22. HYDRAULIC OIL RESERVOIR: Check the hydraulic oil level in the oil reservoir daily. Add oil to keep it full to the petcock level. The engine must be shut off and the bucket resting on the ground when checking the oil level in the reservoir. See Item 43.
23. RADIATOR FILLER CAP: Located at rear end of the machine. Do not run the engine without the full quantity of fluid in the cooling system. Use clean, soft water, free from alkaline, to refill the radiator, daily. Be sure to add a permanent type anti-freeze solution to the cooling system when the temperature is 32° F. or lower, and there is danger of the water freezing in the cooling system. Use a known, reliable brand of anti-freeze solution. Add it ot the radiator according to the manufacturer's instructions.
24. FUEL TANK FILLER: Fill with engine fuel here. Be sure the fuel is clean and handled in a clean container.
25. FUEL LINE SHUT-OFF COCK: It is good practice to close the fuel line shut-off cock when leaving the machine stand idle over night or longer.

**GREASE AND SERVICE WEEKLY:** Items 26 thru 41. Lubricate, check and service these items every 40 to 60 hours of operation or as specified in the following instructions.

26. CLUTCH RELEASE BEARING: Throwout - 1 point, L.H. side of power take-off housing. Use the best obtainable grade of a high temperature lubricant, such as "LUBRICO M-24" or equal.

Give one or two shots weekly using a hand gun. Never over-lubricate this bearing.

27. PILOT BEARING: 1 point on power take-off shaft. Use the best obtainable grade of a high temperature lubricant such as "LUBRICO M-24" or equal. Give one or two shots weekly, using a hand gun. Never over-lubricate this bearing.

28. CLUTCH POWER TAKE-OFF BEARING: Front of the power take-off housing, 1 point. Use the best obtainable grade of high temperature grease such as "LUBRICO M-24" or equal. Give one or two shots weekly using a hand gun. Do not over-lubricate this bearing.

29. GENERATOR: 2 cups - Give 2 or 3 drops of light lubricating oil to each cup weekly.

30. DISTRIBUTOR: 1 cup - Give 2 or 3 drops of light lubricating oil weekly.

31. FAN PULLEY: Upper - Remove the plug and give 2 or 3 drops of light lubricating oil to the pulley bearings weekly. Replace the plug to maintain fan shaft balance.

32. CRANKCASE FILLER PIPE: Located on the right hand side of engine. Drain and refill the engine crankcase weekly or oftener as required, with a good grade of clean oil. Refer to the Hercules Engine Manual for engine maintenance requirements. In general, use SAE-30 motor oil when operating in hot summer temperatures. Use SAE-20 motor oil when operating in moderate temperatures. Use SAE-10 motor oil when operating in cold, winter temperatures. It must be remembered that oil specification of various oil 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 type and grade of engine oil.

    The crankcase breather must be removed, cleaned, and serviced according to the manufacturer's instructions on the breather, whenever the crankcase oil is changed, or oftener if operating conditions are very dusty and dirty.

33. CRANKCASE DRAIN PLUG: Remove the plug to drain the crankcase oil from the engine. Be sure to replace the plug securely after draining.

34. CRANKCASE OIL FILTER: Located on the right hand side of the engine. Drain, clean the container, and insert a new filtering element weekly, or when changing the engine crankcase oil. Follow instructions printed on the box containing the new element when replacing a used element. Be sure the filter cover gasket is in place and the cover securely tightened after replacing the element. Then start the engine and let it run at idle speed for about 10 minutes to fully saturate the new element with oil. Then shut off the engine and recheck the oil level in the engine crankcase as it will have been lowered by oil being retained in the filter container and element. Add oil to bring the oil level up to the full mark on the crankcase oil level dipstick. Then inspect the filter for oil leaks due to a faulty gasket, loose cover, or poor connections.

35. TRANSMISSION FILLER AND OIL LEVEL PLUG: Front of Transmission case. Keep the transmission housing oil level up to the height of the oil level plug. Use SAE-140 transmission oil when operating in summer temperatures and SAE-90 transmission oil when operating in winter temperatures. Check the oil level weekly. Drain and refill monthly.

36. TRANSMISSION DRAIN PLUG: Underside of housing. Remove this plug to drain the transmission housing oil. Clean the plug before replacing, this is a magnetic plug and it requires thorough cleaning.

37. DRIVE AXLE DIFFERENTIAL FILLER AND OIL LEVEL PLUG: Located on the side of differential carrier housing. Keep the oil level up to the height of the oil level plug. Use SAE-140 differential gear oil when operating in summer temperatures, and SAE-90 oil when operating in winter temperatures. Check the oil level weekly. Drain, refill monthly.

38. DIFFERENTIAL DRAIN PLUG: Located on the underside of the housing. Remove this plug to drain the differential carrier housing. Clean the plug before replacing it. Always clean the housing breathers when draining the oil.

39. FINAL DRIVE FILLER AND OIL LEVEL PLUGS: Located on the inside surface of the right hand and left hand drive wheel gear housings. Keep the oil level in each drive wheel gear housing up to the level of these plugs. Use SAE-140 when operating in summer temperatures and SAE-90 oil when operating in winter temperatures. Check weekly. Drain and refill monthly.

40. FINAL DRIVE DRAIN PLUGS: Located on the underside of each drive wheel gear housing. Remove these plugs to drain the wheel gear housings. Clean the plug before replacing. Always clean the housing breathers when changing the oil.

41. BATTERY: It is good practice to check the battery at each weekly inspection period, or oftener, if operating in hot temperatures. Add distilled water or clean rain water to keep the plates covered.

**SERVICE PERIODICALLY:** Items 42 thru 53. Ser-

vice these items periodically as specified in the following instructions.

42. UNIVERSAL DRIVE SHAFTS: (One from engine to transmission and one shaft from the transmission to the axle - 4 points). Dirt in these joints will shorten their life considerably. Use a hand gun sparingly and apply grease every 1000 hours of operation. Use a good grade of general purpose lubricant. To grease, remove the plugs and insert grease fittings. Be sure to remove the fittings and replace the plugs after servicing to maintain balance.

    NOTE: To prevent damaging the cork grease seals by gun pressure and to guard against dirt being forced into these joints. It is recommended that the joint be disassembled and greased by hand instead of using the grease gun. A damaged cork seal will allow grease to escape and dirt to enter the bearing retainers, and considerably shorten the life of the universal joints. Use the special capscrews and retighten to correct torque reading. Much universal joint trouble is due to loose capscrews and yoke nuts.

43. HYDRAULIC OIL RESERVOIR FILLER: Drain, clean, and refill the hydraulic oil system every 1000 hours of operation, unless operating in dusty and dirty areas, in which case the hydraulic system should be cleaned and refilled with clean oil oftener. Excessive wear or premature failure of the valve and pump is commonly caused by dirt in the hydraulic oil.

    Refill the hydraulic system with a good clean grade of SAE-10 motor oil when operating in moderate temperatures. When operating in hot temperatures, it may improve the performance of the machine if SAE-20 motor oil is used in the hydraulic system. Do not use SAE-20 motor oil in the system when operating in moderate temperatures.

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

45. HYDRAULIC HOIST BLEEDER SCREWS: Located on each boom hoist cylinder. Unscrew the bleeder screws to "bleed" the system of air after draining and refilling the reservoir, or after any work has been done on the hydraulic system.

46. TORQUE CONVERTER FILTER: Change the filter element every 500 hours of operation. When the torque converter oil temperature is at 150° F. or below, remove the filter container cover and take out the used element. Read the instructions on the box containing the new element before inserting it into the container. Follow the manufacturer's instructions when inserting a new filter element.

    After the new element is in place and the cover and its gasket are secure, start the engine and let it run for about 10 minutes, or until the converter oil temperature reaches 100° F. to fully saturate the new filter element with oil. Then recheck the torque converter oil level while at this temperature. Add oil to bring the level up to proper height as it will have been lowered by oil being retained in the filter container.

    WARNING: DO NOT REMOVE THE FILTER COVER OR ANY PLUGS OR HOSES FROM THE CONVERTER, WHEN THE CONVERTER OIL TEMPERATURE IS ABOVE 150° F. AS INDICATED ON THE DASH GAGE, AS HOT OIL IS LIKELY TO BE UNDER PRESSURE AND WILL BE FORCIBLY EJECTED CAUSING PERSONAL INJURY. ALWAYS ALLOW THE TORQUE CONVERTER OIL TEMPERATURE TO COOL BELOW 150° F. BEFORE STARTING ANY WORK ON THE CONVERTER OR ANY PART OF ITS SYSTEM.

47. TORQUE CONVERTER OIL FILLER: Change the torque converter oil every 2000 hours of operation. Use SAE-10 heavy duty motor oil to refill.

    To fill the converter, first remove the 1/8" oil level plug located under the cooler line connection, in the plate on the left side of the housing. Next remove the 1-1/2" filler plug located on the left side back face of the housing.

    Pour approximately 8 quarts of SAE-10 heavy duty motor oil into the converter housing.

    Then start the engine and lock the parking brake. Shift the transmission gears in the lowest speed range and engage the clutch. Open the throttle to full open position and maintain this operation until the torque converter oil temperature reaches 100° F. Then shut off the engine and add oil to the converter housing until it begins to run out of the 1/8" oil level hole. The oil level plug and the filler plug may now be replaced.

    NOTE: When refilling and checking the converter oil level always be sure that the oil temperature is between 100° F. and 140° F. for accurate checking. Low oil level impairs the efficiency of the converter. High oil level allows no room for the expansion of the oil when it becomes heated

during operation, and may result in excessive pressure. Correct oil level must be up to the height of the oil level plug when the oil temperature is between 100° F. and 140° F.

48. TORQUE CONVERTER DRAIN PLUG: This plug is located on the underside of the right hand corner of the housing. Do not remove any plugs from the converter housing while the oil temperature is at 150° F. or above. See warning in item **.

    To drain the converter of oil, first remove the 1-1/2" filler plug, then remove the drain plug. Clean the drain plug before replacing it. Be sure to replace this drain plug securely after the converter oil is drained.

49. FRONT WHEEL HUBS: Repack monthly. Use a good grade of wheel bearing grease.

50. STEERING GEAR FILLER CAP: Keep full to height of filler pipe cap. Use G.M.C. #4673-M lubricant - summer and winter.

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

52. RADIATOR DRAIN COCKS: To drain the radiator, remove the radiator cap, as it is a pressure type; then open both the radiator and the engine block drain cocks to drain the fluid from the cooling system.

53. 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.