

BELL SYSTEM PRACTICES
Outside Plant Construction
and Maintenance

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AT&T Co Standard

PE DIGGER

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1. GENERAL

1.01 The PE digger is a portable machine for boring holes and anchors and can be used with an auger as large as 16 inches in diameter.

1.02 This section replaces Section J6.150.

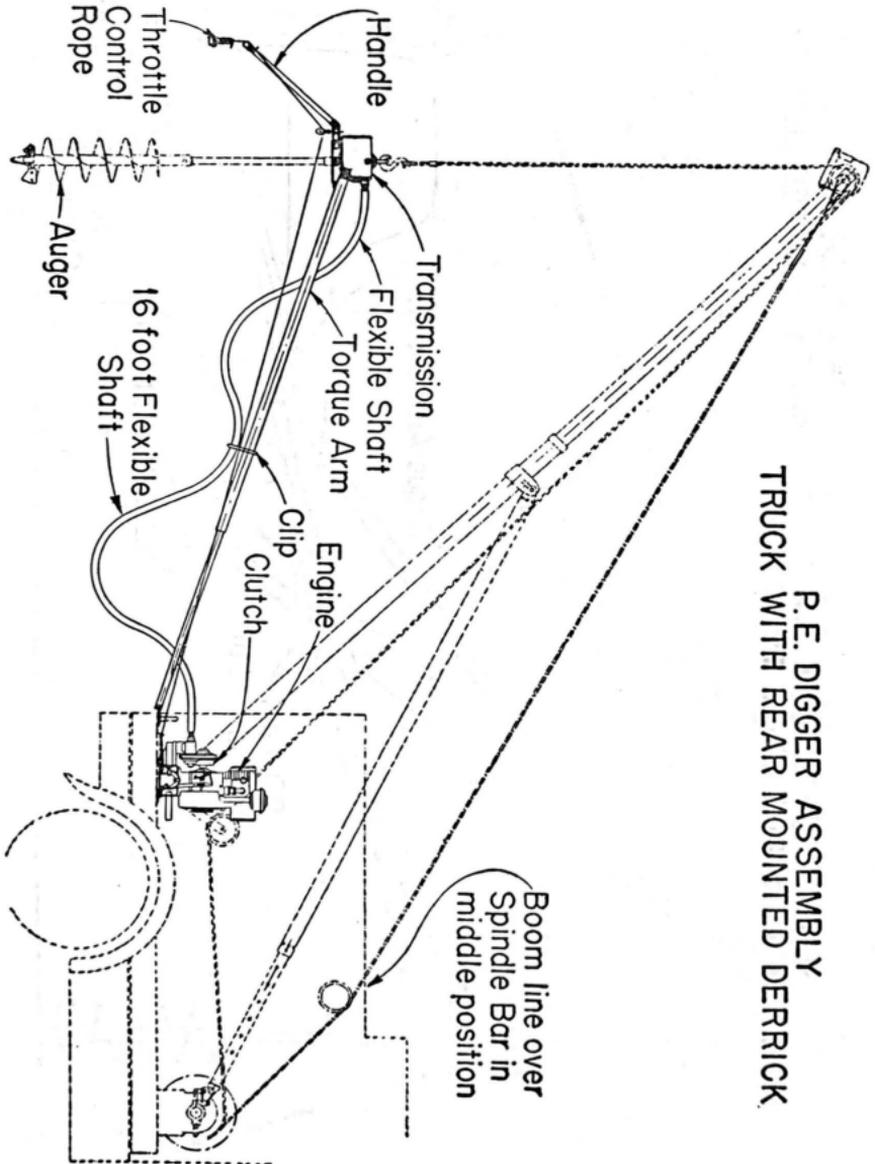
1.03 Information concerning the PE Anchor Adapter, B Anchor Wrench Adapter, Frost Point and Frost Blades is included in this section.

- 1.04 The PE digger is not designed for use where hard shale or rock will be encountered.
- 1.05 The MA-40, T45 or LTF pole derrick may be used with the digger. The derrick practices, therefore, shall be considered as supplementary instructions.
- 1.06 Maintenance and repair of the PE digger is covered in the section on the PE digger in the Practices on Motor Vehicles and Construction Apparatus. Only the adjustments to be made by the Plant Construction forces are included in this practice.

END PRACTICE

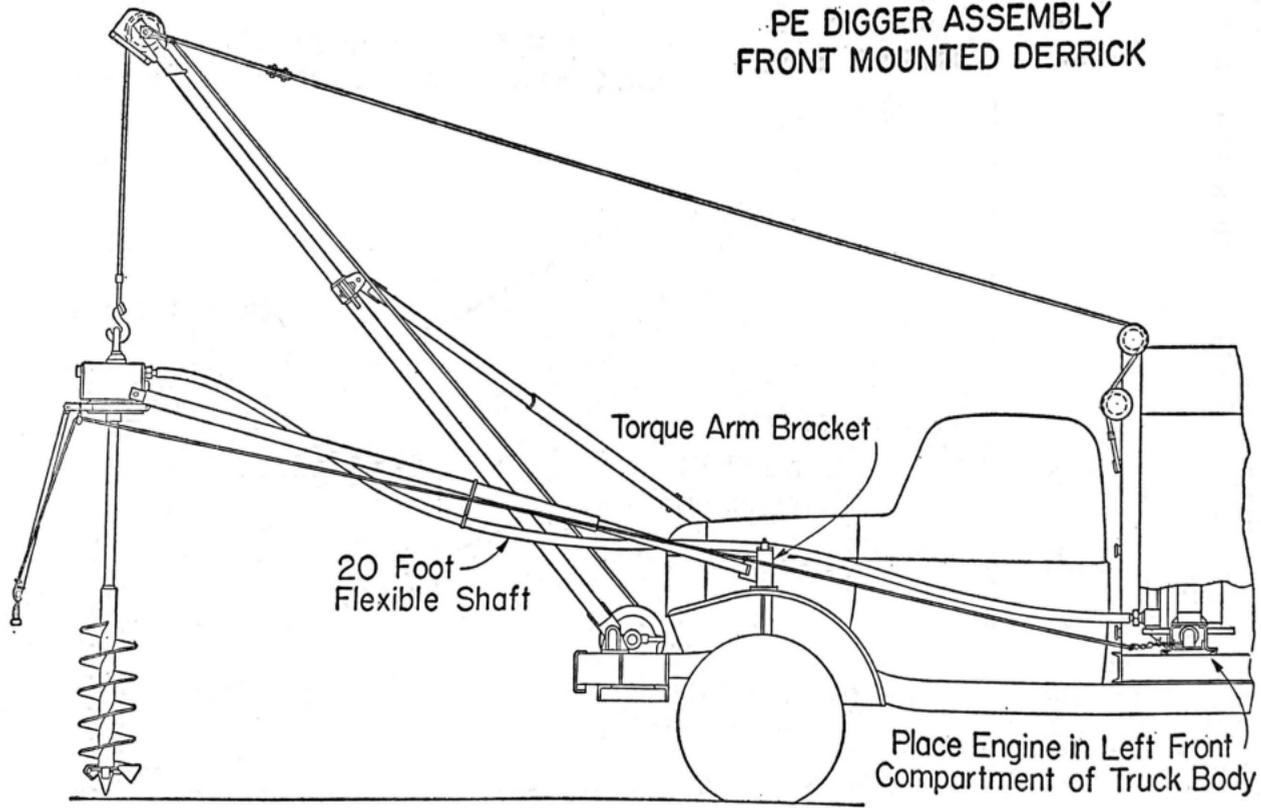
2. DESCRIPTION

2.01 The PE digger consists primarily of an auger driven by a gear reduction transmission connected to a small portable engine by means of a flexible drive shaft. The following illustrations show the digger assembly for a truck with rear mounted derrick and also for a truck with a front mounted derrick.



P.E. DIGGER ASSEMBLY
TRUCK WITH REAR MOUNTED DERRICK

PE DIGGER ASSEMBLY
FRONT MOUNTED DERRICK



2.02 The portable engine is a 7-horsepower, 4-cycle air cooled gasoline engine. It is mounted on a base which carries a small countershaft connected to the engine by a V belt.

2.03 A centrifugal clutch, mounted on the crankshaft of the engine, provides a power limiting device to protect and prevent stalling the engine.

2.04 The shaft, available in 16 and 20 foot lengths, is a flexible type consisting of an outer reinforced case and a flexible driving core. The ends of the case are reinforced to prevent sharp bends and are equipped with ferrules for attaching it to the countershaft and the transmission. The 16-foot shaft is used with the rear mounted derrick. The 20-foot shaft is required with the front mounted derrick.

2.05 The transmission contains spur gears and a worm gear to reduce the speed and change the direction of power transmission from horizontal to vertical. It has a total reduction of approximately 75 to 1.

2.06 The torque arm consists of two telescoping tubing members and absorbs the turning reaction which results when the auger is digging. The arm allows a maximum overhang of 15 feet and a minimum of 9 from the front or rear of the truck to the center line of the auger.

2.07 A handle which may be rotated and locked in any one of five positions is attached to the transmission to stabilize and guide the auger.

2.08 Two types of augers, PE type and C type, are used with this machine. Attachment is made directly to the transmission.

3. SAFETY PRECAUTIONS

3.01 Only those employees required for the proper and safe conduct of the work shall be permitted close to the digging operations.

3.02 All signals used shall be thoroughly understood by any person who may have occasion to interpret them.

3.03 At the beginning of each day's operation the various items of the digger assembly should be given a visual inspection to determine that they are in good working condition.

3.04 When starting the engine with the rope starter make sure that the rope is properly wound on the starting pulley, that there are no objects which will interfere with the free movement of the workman who is starting the engine and

that no person is within range of the end of the starter rope after it leaves the pulley. The workman starting the engine should also make sure that his footing is secure and there will be no danger of slipping. He should also place a part of his weight on the engine base to avoid the possibility of upsetting the engine from the pull on the starter rope.

3.05 Avoid burns from contact with heated parts of the engine particularly the muffler and short exhaust pipe.

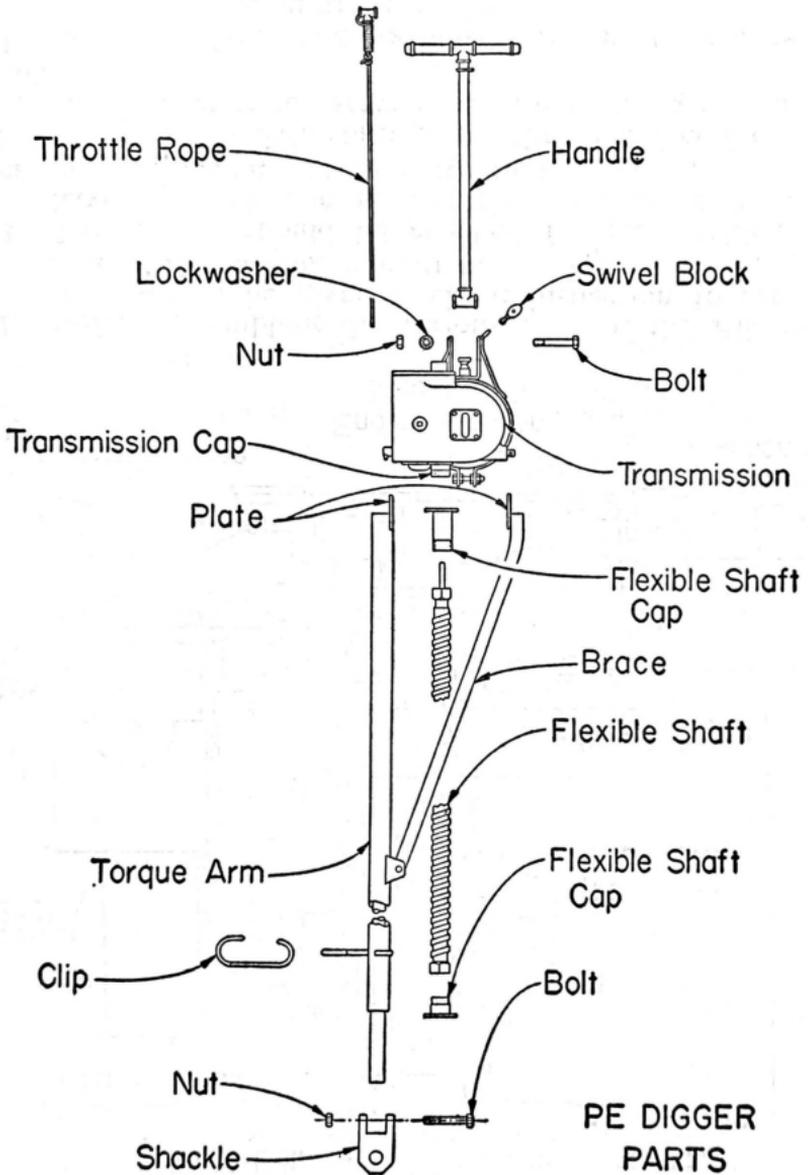
3.06 Avoid spilling gasoline on the engine or on the truck floor because of the fire hazard. Fill the engine tank only when the engine is stopped. Carry gasoline in approved safety cans. Do not start the engine, if gasoline has been spilled, until it has been wiped dry and vapors allowed to dissipate.

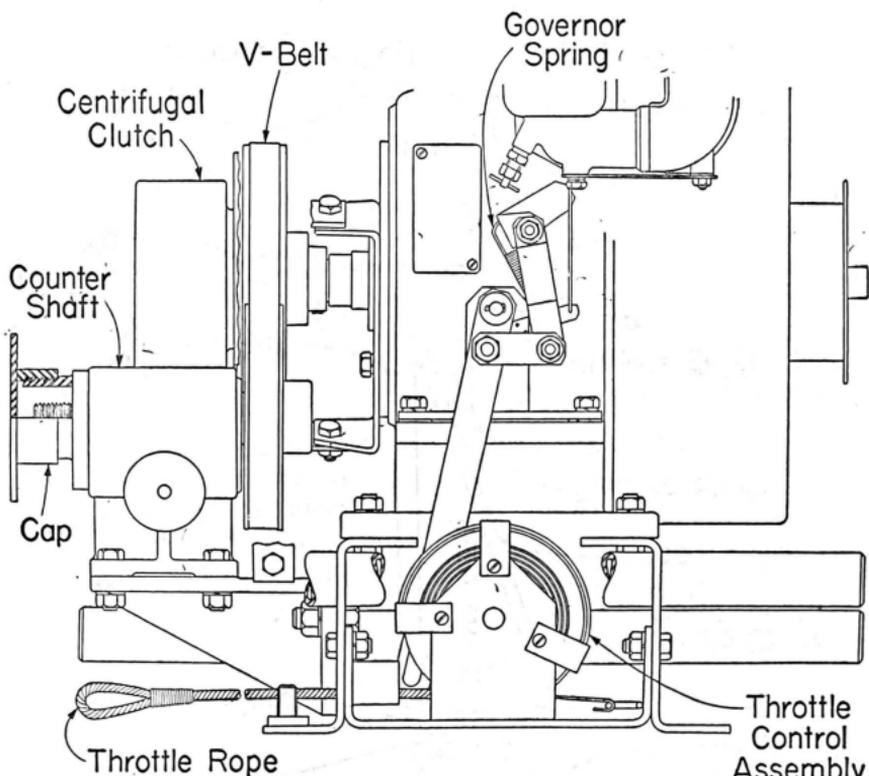
3.07 When operating in a position where the wind will blow the exhaust from the small engine into the cab, the rear window of the cab shall be kept closed.

3.08 If the scraper catches while the auger is being cleaned, release the scraper.

4. NAMES OF PARTS

4.01 The following illustration shows the various parts associated with the PE digger which may be required as replacement parts by the operating crews.





Engine Mounting
Model 23B

5. INSPECTION

5.01 Before assembling the various units of the PE digger they should be given a visual inspection to see that they are in good working condition.

5.02 The engine should be checked for parts which may have loosened due to vibration and for service and lubrication requirements as specified in Part 8.

5.03 Check the flexible shaft to see that it is free from dirt, and inspect it for service requirements as specified in Part 10.

5.04 Check oil level and gasoline level in the engine and lubricant level in transmission.

5.05 Inspect the transmission for indications of excessive oil leakage and for service and lubrication as outlined in Part 11.

5.06 Inspect the torque arm to detect bends in the tube and to determine that the locks at the transmission end of the tube operate properly. Make sure the torque arm

telescopes properly. If it does not operate freely, lubricate it by rubbing the tube with a block of paraffin.

5.07 If any discrepancy is found it should be corrected immediately. If it cannot be repaired in the field, it should be reported in accordance with local practice.

6. ENGINE OPERATION

6.01 The engine is air-cooled and, therefore, during operation, except in extremely cold weather, there should be no obstruction to the passage of air flowing in at the starting pulley and out of the vents around the engine cylinder.

6.02 The engine tank holds about 1-1/4 gallons of gasoline and will require filling at the beginning of each half day of operation. **DO NOT USE OIL IN THE GASOLINE.** Keep plenty of gasoline in the tank as the engine may lose power if the tank is less than 1/3 full of fuel.

6.03 In starting the engine open the gasoline shut-off valve in fuel filter by turning several revolutions counter-clockwise.

6.04 Except when the engine is hot it will be necessary to choke it for easy starting. Close the carburetor choke by moving choke lever in a clockwise direction.

6.05 To start engine wind the starter rope around starter pulley with the knot in the pulley notch. See Paragraph 3.05 for precautions to be observed in starting engine.

6.06 With choke closed to prime the engine, pull quickly and steadily on the rope to spin the flywheel. Then open the choke about one-eighth and repeat operation.

6.07 After starting a cold engine, always permit it to warm up for three to five minutes before running it at full speed or putting it under load.

6.08 After the engine warms up, gradually open the choke until engine runs smoothly with the choke wide open.

6.09 Open throttle slowly to avoid stalling, particularly when the engine is cold or after it has been idling for a considerable period.

6.10 If the engine has been running for a considerable period at idling speeds, open the throttle slowly for a short time to clear the engine cylinder of any excess gasoline and rich vapor mixture which may have accumulated.

6.11 To stop the engine, press the grounded metal lever against the tip of the spark plug and hold it in this position until the engine stops. Do not place hand on spark plug.

6.12 When the engine is to be out of service for several days, service it in accordance with Part 20.

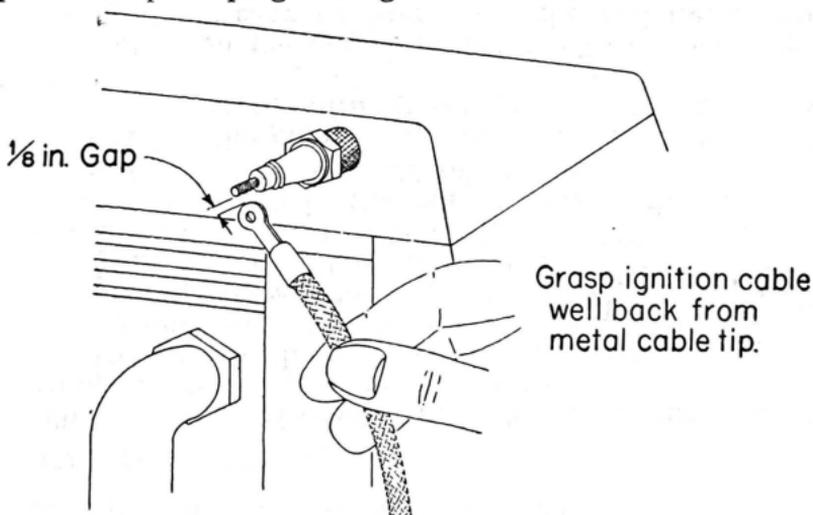
7. ENGINE ADJUSTMENT

7.01 The following paragraphs outline various engine adjustments which may usually be made in the field. The section on the PE digger in the Practices on Motor Vehicles and Construction Apparatus covers the complete maintenance and repair of the engine.

7.02 The spark plug furnished with the engine is a Champion No. 5 Commercial or equivalent. With intermittent operation of the digger this plug runs too cold in temperatures below freezing. When the temperature is below freezing a Champion No. 7 or 8 Commercial or equivalent, should be used for easy starting and smooth operation. The hotter plug may be used at all temperatures but will require more frequent replacement due to its tendency to burn more quickly than the No. 5 plug.

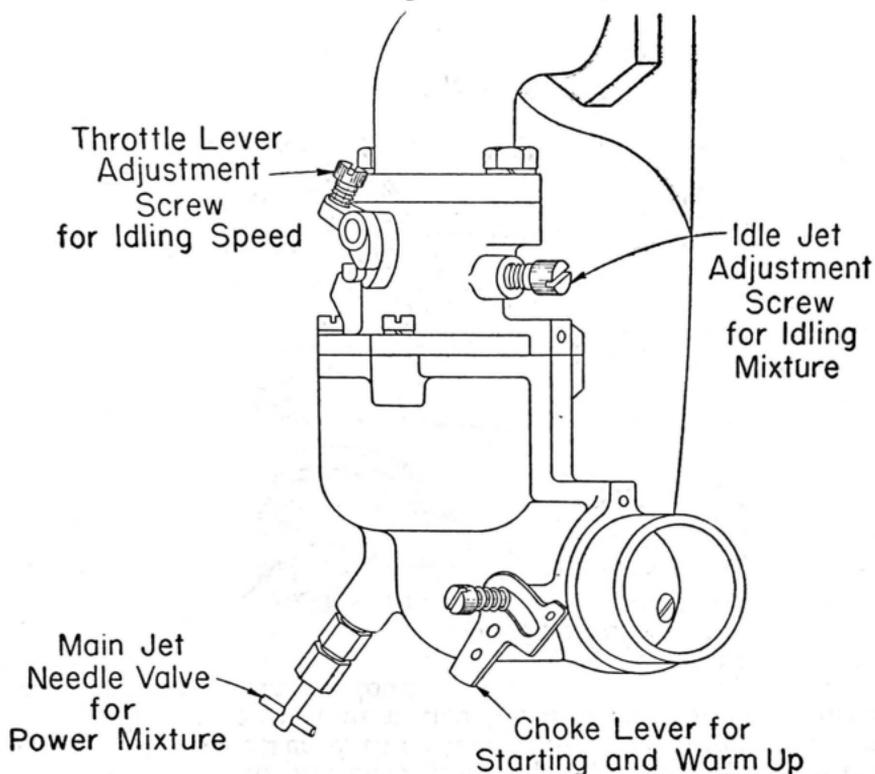
7.03 If it is found difficult to start the engine or to adjust the carburetor so that the engine runs smoothly, check the strength of the electrical spark and the condition of the spark plug as follows:

- (a) Remove the ignition cable from the spark plug.
- (b) Grasp the ignition cable well back from the metal cable tip to avoid shock and hold the tip about 1/8 inch from the end of the spark plug electrode.
- (c) Rotate the engine flywheel by means of the starter rope. If the spark jumps this gap, the ignition system up to the spark plug is in good condition.



- (d) Check the spark plug to see that it is clean and of the heat range specified in Paragraph 7.02. Check the gap between the electrodes of the plug which should be about .025 inch or about half the diameter of the electrodes.

7.04 The engine carburetor has four basic adjustments as shown in the following illustration:



7.05 The main jet needle valve should normally be opened about 1-1/4 turns and the idle adjustment screw about 1/2 to 3/4 turn.

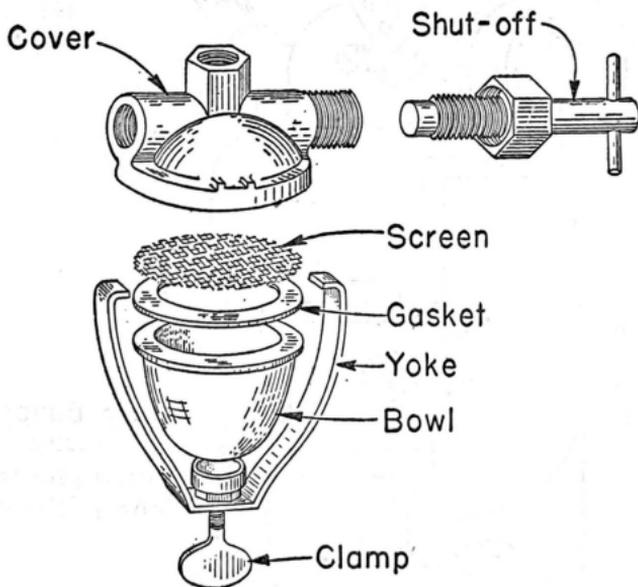
7.06 If the carburetor is out of adjustment reset it as follows:

- (a) Turn the main jet needle valve and the idle jet adjustment screw clockwise until they rest lightly against their valve seats. Do not force the screws too firmly against the seats or the valves may be damaged.
- (b) Open the main jet needle valve 1-1/4 turns by turning it counterclockwise.
- (c) Open the idle jet adjustment screw 1/2 turn by turning it counterclockwise.
- (d) Start the engine using the choke as indicated in Part 6 and permit it to warm up thoroughly.
- (e) Adjust the main jet needle valve so that the engine under no load runs smoothly at full governed speed with the choke fully open. Too rich a mixture causes the

engine to roll, fire unevenly and produces a dull sound in the exhaust. This is corrected by closing the main jet needle valve (clockwise rotation) a small amount at a time (1/8 turn or less). Too lean a mixture is indicated by flame from the muffler and lack of power. Correct by opening the main jet (counterclockwise rotation) a small amount. Later when the engine is under full load it may be necessary to make an additional adjustment of this needle valve in the manner described for the no load adjustment.

(f) Adjust the idle jet adjustment screw to secure smooth idling. If the mixture is too rich, indicated by misfiring, smoke and a dull sound in the exhaust, correct by a small clockwise rotation of the idle jet adjustment screw. Too lean a mixture is indicated by misfiring and stalling, and may be corrected by a small counterclockwise rotation of the idle jet adjustment screw. Changing the adjustment of the main jet needle valve will usually affect the idling mixture, and require adjustment of the idle adjustment screw.

(g) Adjust the throttle lever adjustment screw, turning it clockwise to increase the idling speed and counterclockwise to decrease the speed, until the engine idles as fast as possible without noticeable grabbing of the centrifugal clutch under no load.



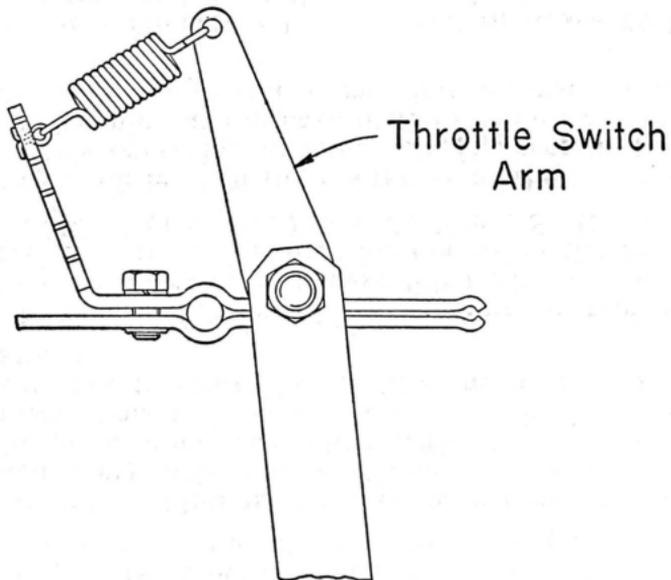
FUEL FILTER

(h) To Clean Fuel Filter :

- (1) Loosen clamp below filter bowl.
- (2) Remove and clean filter bowl and screen.
- (3) Make sure gasket is in good condition and seats properly.
- (4) Open shut-off valve to see if fuel flows freely from the tank. If a gummy or varnishlike substance is found use alcohol to dissolve it. See Part 20.

7.07 The governor is operated by a throttle switch. The throttle switch arm should be set so that when the throttle is in the "OFF" position, there is no tension on the spring and also no back lash. The arm may be adjusted by loosening the nut which holds it and then moving the throttle switch over to its proper location. Then tighten the nut, taking care that the arm does not move.

7.08 Proper adjustment of the throttle switch arm will result in an engine speed of 2800 to 3000 revolutions per minute with the throttle switch in the "ON" position. The auger speed will then be about 50 revolutions per minute. The proper operation of the engine depends upon the governor spring having the correct tension. Therefore, it is important that only the spring supplied by the engine manufacturer be used when replacement is necessary.



8. ENGINE SERVICE AND LUBRICATION

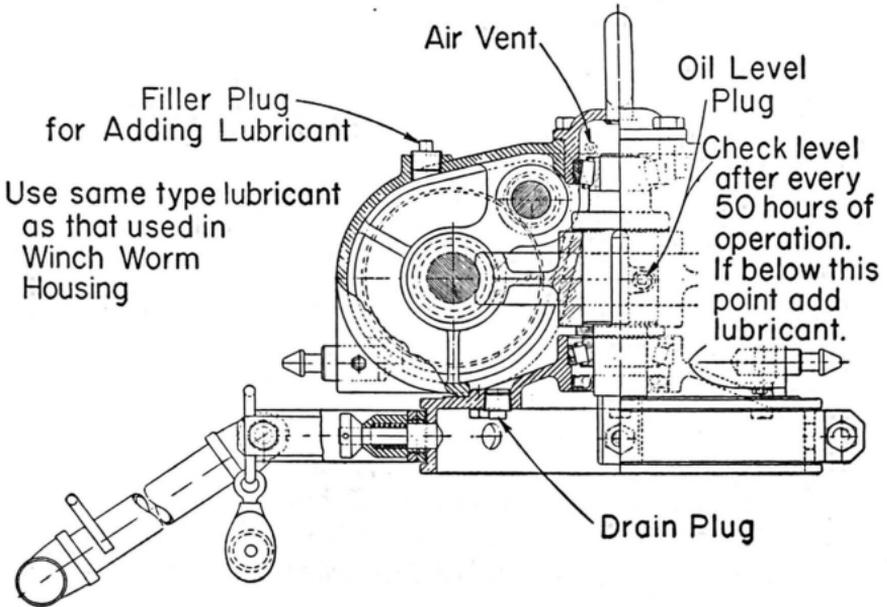
- 8.01 Clean the filter bowl on the under side of the gasoline tank as required and check it for leakage.
- 8.02 The air intake filter is of the oil bath type. It should be cleaned every fifty hours of operation and the lower portion of the air cleaner case filled with clean engine oil to the mark shown. This will require about one-half pint of oil. It may be necessary to clean the air filter more often in dusty or dirty locations.
- 8.03 The engine is lubricated by a pump system in the crankcase. Keep the crankcase filled with a good grade of oil not heavier than SAE No. 20 for operating the engine in temperatures of 32°F. or above. Below 32°F. use SAE No. 10 W.
- 8.04 Check the oil level in the crankcase at the beginning of each day's operation and add oil, if necessary, to the top of the filler opening at the base of the engine. Do not open this filler pipe while the engine is running because oil will be splashed out.
- 8.05 Drain the crankcase oil at the end of **every 50 hours** of operation and refill the case with the grade of oil specified in Paragraph 8.03. The crankcase holds about two quarts of oil and should be filled until the oil is level with the top of the filler pipe.

9. FLEXIBLE SHAFT SERVICE AND LUBRICATION

- 9.01 Special caps are provided to prevent dirt from entering the shaft case when not in use and they should be in place whenever the shaft is disconnected from the transmission or engine.
- 9.02 The newer type of flexible shaft is provided with a grease fitting at each end of the shaft. Lubricate every 50 hours of operation with a lightweight cup grease. As the rotation of the shaft tends to draw the grease through the shaft toward the transmission, the entire length of the shaft is lubricated by the grease injected into the fitting nearest the engine.
- 9.03 Lubricate the older type shaft by pulling the core out of the case and coating it with cup grease.
- 9.04 If dirt should get into the case, remove the core, clean the case with a dry swab, and wipe the dirt off the wire core. Then relubricate the core and place it in the outer case.

10. TRANSMISSION SERVICE AND LUBRICATION

10.01 The PE transmission is illustrated below:



PE TRANSMISSION

11. ASSEMBLY

11.01 Assemble the digger as follows:

- (a) Place the engine on the platform of the truck if it is equipped with a rear mounted derrick, or in the left side compartment of the body if the truck is equipped with a front mounted derrick.
- (b) Remove cap from countershaft of the engine. Then remove the short dust cap from the flexible shaft. Screw the caps together to protect the threads.
- (c) Attach the core of the shaft to the threaded portion of the engine countershaft assembly. This attachment need not be tightened with a wrench since the transmission of power will tighten it.
- (d) Attach the end of the flexible shaft case to the threaded portion of the countershaft housing. Tighten securely.
- (e) Attach the torque arm to the transmission.

(f) Attach the winch line hook to the eye of the transmission and raise the transmission (with the derrick) to about three feet above the ground.

(g) Remove the short cap from the transmission and then the long dust cap from the flexible shaft. Screw the caps together to keep the threads clean. Insert the square shaft into the transmission and connect the shaft case by turning the ferrule nut securely on to the threaded projection of the transmission case. When tightened the ferrule permits the case of the flexible shaft to rotate at this end.

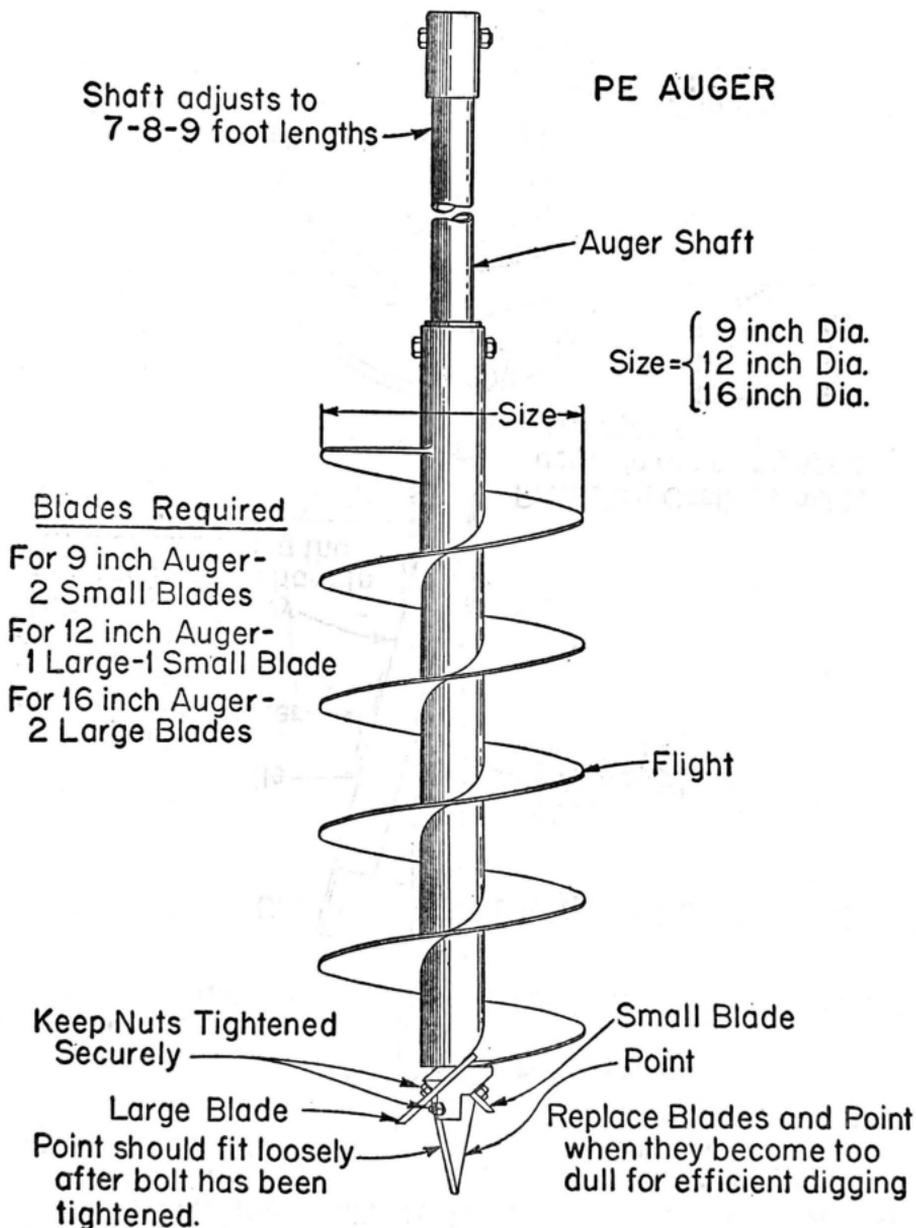
(h) Attach the throttle rope to the switch at the engine base.

(i) Raise the transmission with the winch line until it is at a convenient height to attach the auger shaft to the square shaft at the bottom of the transmission. Secure it in place by the auger shaft bolt or SL pin.

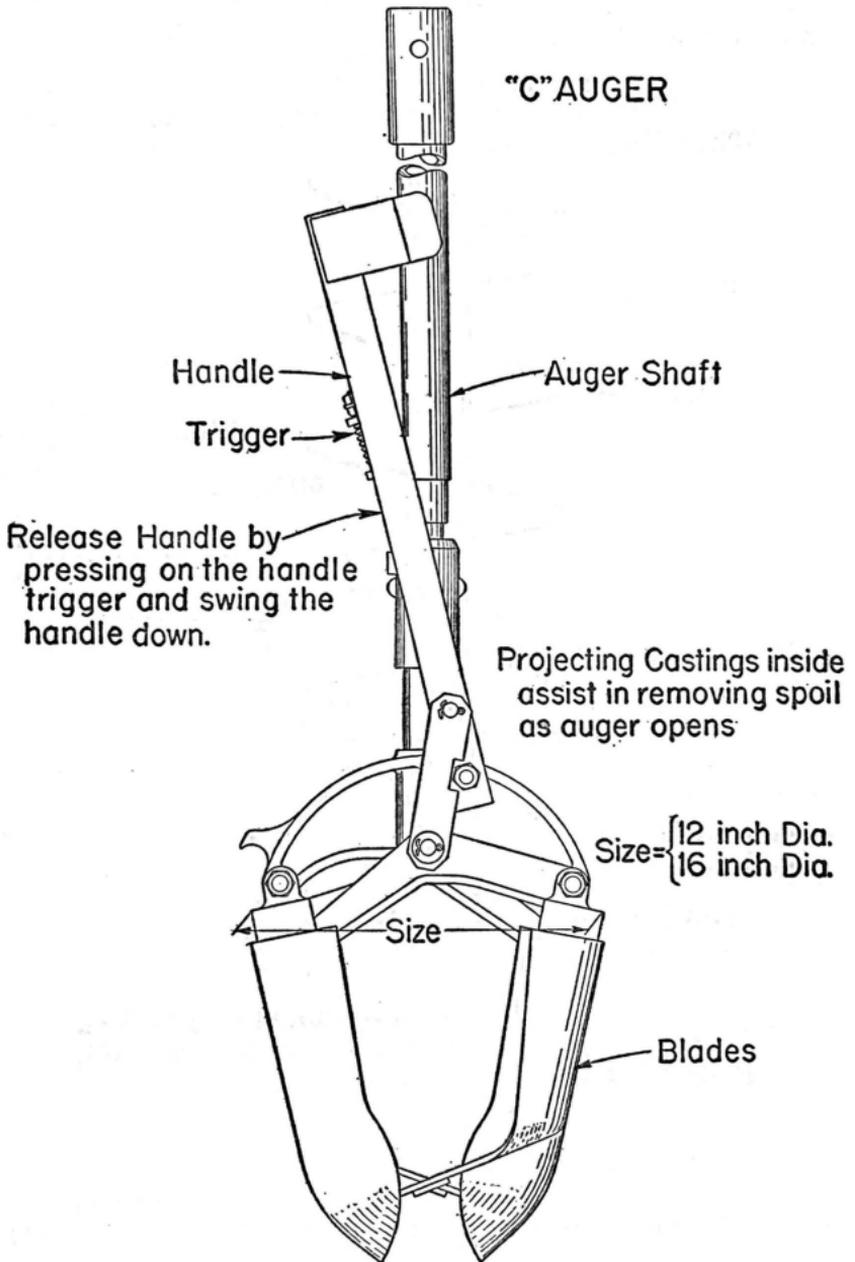
11.02 In case the machine has not been completely disassembled, proceed with the assembly at the appropriate step.

12. AUGERS

12.01 The PE auger is furnished in three sizes as illustrated below.



12.02 The C type auger is a bucket type auger which opens to dump the spoil. It is furnished in two sizes as illustrated below.



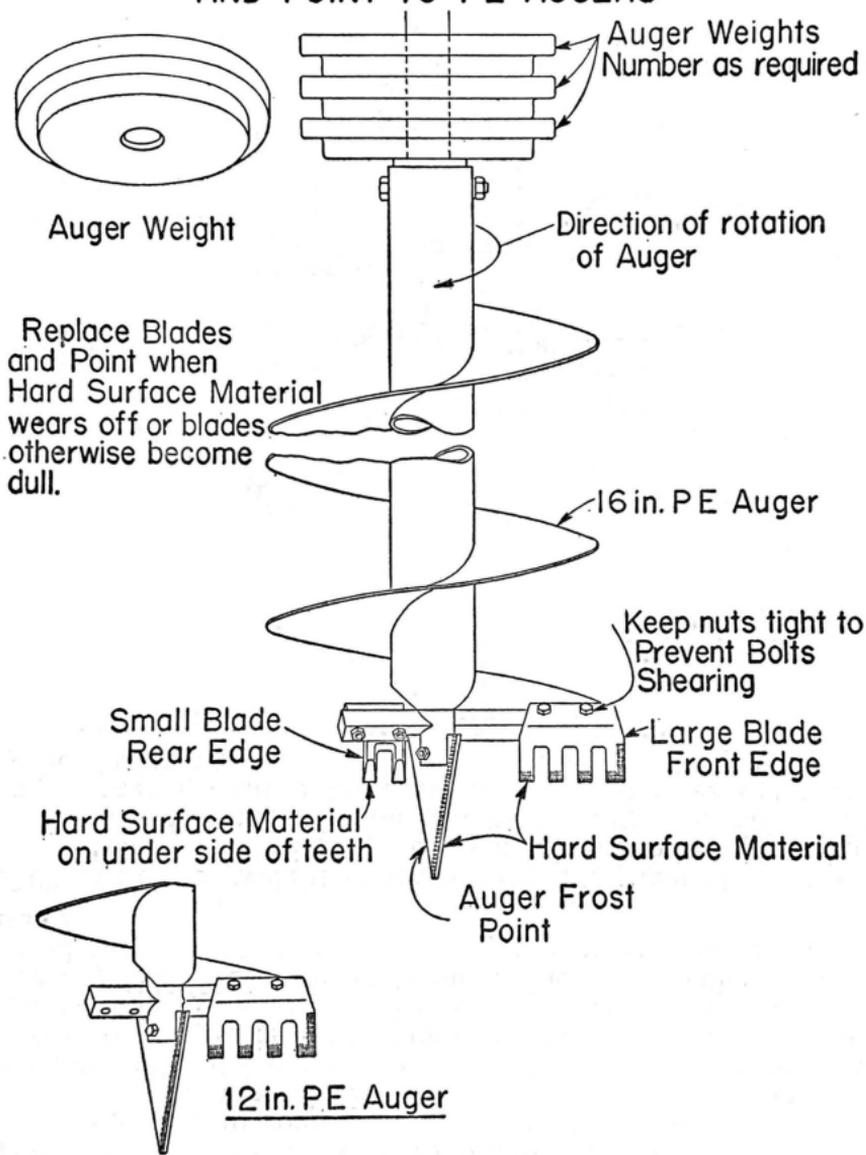
13. FROST BLADES

13.01 Frost blades and a frost point are available for the PE-12 and PE-16 augers and should be used when frozen ground is encountered or if conditions are such that the standard blade will not cut into the earth. The frost blade has teeth and the frost point is longer than the regular type. The 16 inch auger requires one large and one small blade, but the 12 inch auger requires one large blade only. The frost blades may also be used for digging in extremely hard clay or other compacted material.

13.02 An auger weight which fits the PE auger shaft may be used to aid digging in frost. The number of weights required will depend upon the type of digging encountered. For deeply frozen ground a total weight of as much as 200 pounds may be desirable.

13.03 The method of attaching the frost blades, frost point and auger weight is shown below.

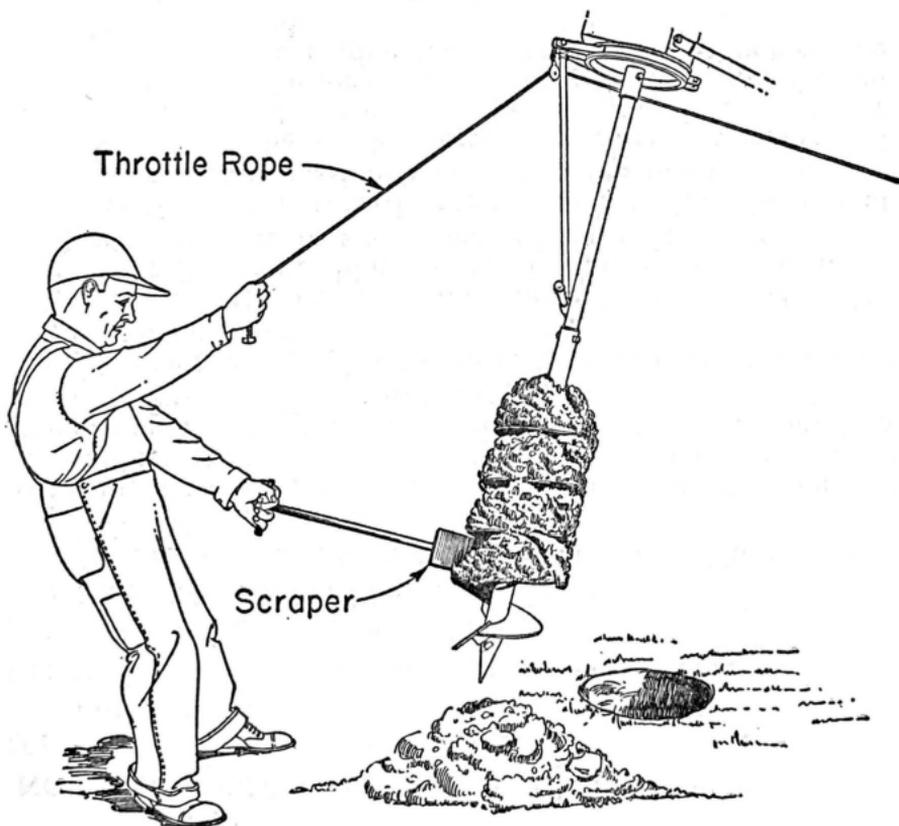
ATTACHMENT OF FROST BLADES AND POINT TO PE AUGERS



14. NORMAL OPERATION (Front or Rear Mounted Derrick)

- 14.01 Assemble the derrick in accordance with the standard practice.
- 14.02 Assemble the digger in accordance with Part 12.
- 14.03 Operate the digger as follows:
- (a) Start the engine as outlined in Part 6.
 - (b) Locate the truck so that the auger is over the proposed hole location.
 - (c) Pull slowly on the throttle switch rope allowing the engine to clear itself of rich vapors and come up to speed. Then shut the engine down to an idling speed by again pulling on the throttle switch rope.
 - (d) Before the auger is allowed to feed into the ground, the workman should:
 - (1) Lock the transmission handle in a position which will enable him to watch and signal the truck operator, and to stand clear of the pole derrick.
 - (2) Grasp the throttle rope with his right hand and the transmission handle with the other hand.
 - (3) Signal the truck operator to lower the auger and start to dig. Speed up the engine before the auger starts to dig because the clutch will not transmit the full torque of the engine unless fully engaged before the load is applied.
 - (4) As the auger enters the ground, grasp the transmission handle with both hands.
 - (5) Keep the throttle rope in the right hand at all times during the digging operation.
 - (e) Signal the truck driver, to lower the auger by means of the winch line and permit the auger to feed into the ground. A slow idling speed of the truck engine should be maintained to secure sufficiently slow digging speed. It may be necessary for the driver to engage the truck clutch intermittently.
 - (f) Where the ground is hard, apply full weight of the auger and transmission to the cutting head. In other cases, it may be necessary to hold tension in the winch line. The truck driver should govern the speed of feeding the auger into the ground by the sound of the engine thus attempting to get rapid digging speed, but to avoid overloading the engine which will cause it to slow down and the centrifugal clutch to release.

- (g) Do not let the auger feed too fast when operating in soft, wet earth. This type of earth will slow down the engine if the auger is fed too fast or the auger may screw into the soil instead of digging it loose. The loaded auger would then be difficult to pull out of the hole.
- (h) When the auger has filled with spoil to a point about level with the top of the flight, signal truck operator to raise the auger by taking up on the winch line.
- (i) As the rotating auger starts to rise, drop the transmission handle and pick up scraper with left hand while still holding the throttle rope in the right hand.
- (j) Just as the lower end of the auger is about to clear the hole, stop the rotation of the auger (in dry sand digging, it may be advisable to stop the auger just after it starts to rise) by pulling on the throttle rope with the right hand and then releasing it. (The throttle must be in the released position before exerting the next pull on the throttle rope.)
- (k) Hook scraper above the digger blade.
- (l) By means of the scraper, pull the loaded auger away from the hole to the spoil bank as shown below.



(m) With the right hand, pull slowly on the throttle rope to start the auger to rotate. Do not fully open the throttle during this operation. The rotation of the auger will carry the scraper up the flight of the auger. Do not hold down on the scraper because this will cause it to bind as it travels up the auger.

(n) If the scraper catches as it travels up the flight of the auger, do not attempt to hold it.

(o) When the spoil is removed, move the auger back over the hole location and unhook the scraper. Place the scraper at the side of the spoil and again dig as outlined above.

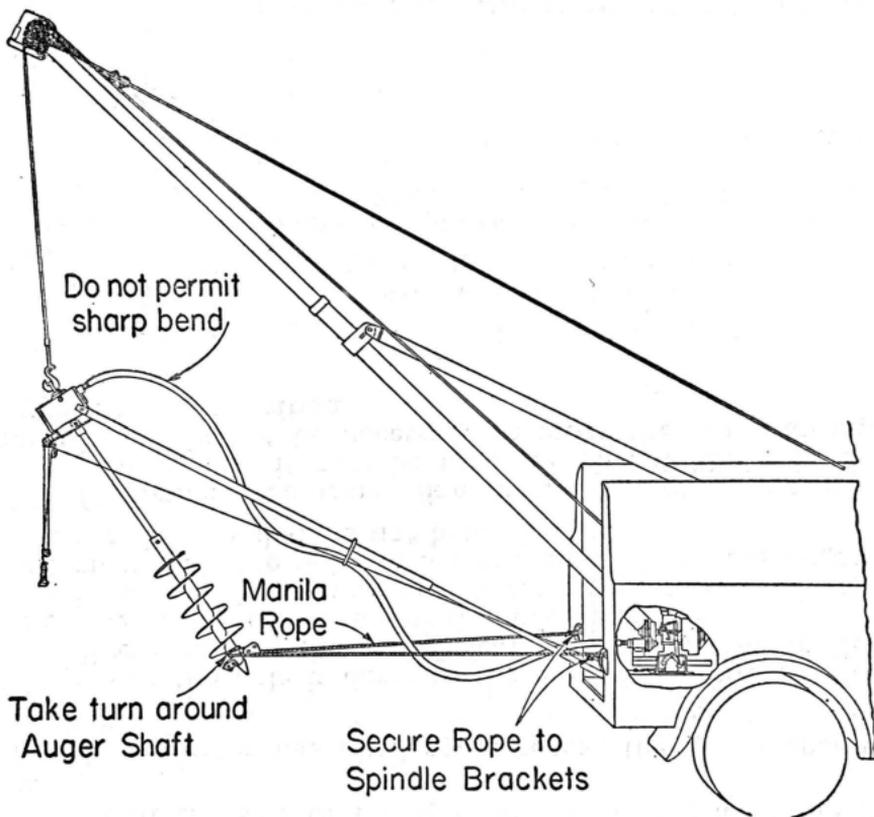
(p) When auger has filled again repeat the above operations.

14.04 When the hole is down to the desired depth, raise the digger so that the auger clears the ground. Move the point of the auger to one side of the hole and lower the digger so that it lies on the ground in a horizontal position and will not interfere with the pole setting operation. Place the digger so that the flexible shaft is not bent sharply.

14.05 Disconnect the winch line from the digger transmission so that it may be used for placing the pole. In general it should not be necessary to move the truck during the pole setting operation.

14.06 If the next pole location is only a short distance away, the digger may be left suspended from the derrick. For moves of more than a few spans or where the ground is rough, control the swinging of the auger as shown below.

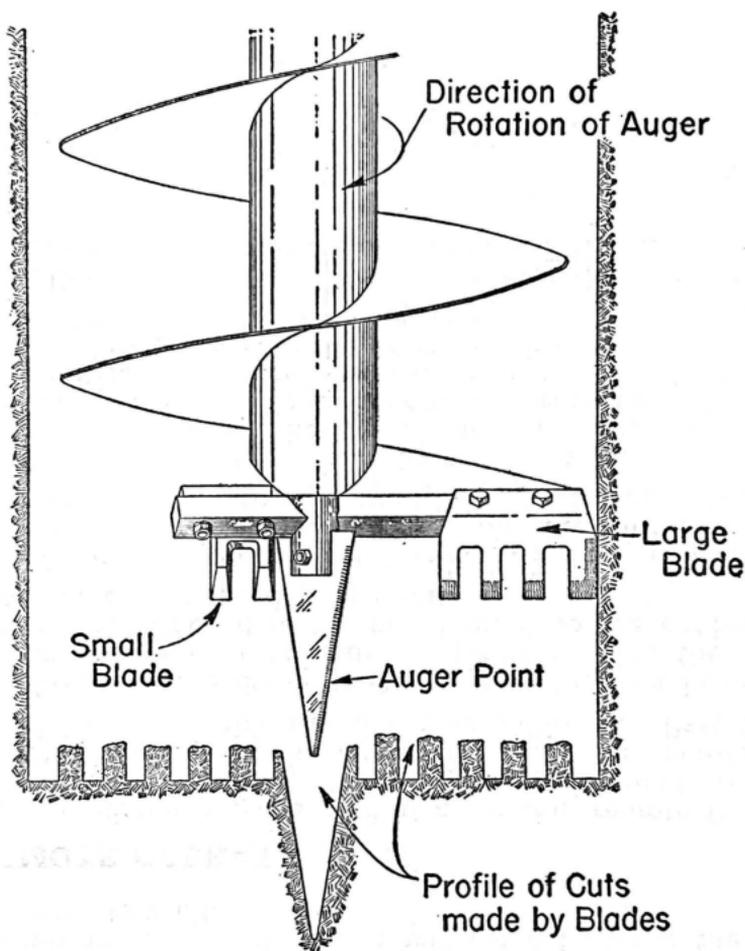
METHOD OF TRANSPORTING DIGGER FOR SHORT DISTANCES



14.07 When using frost blades the operation is the same with the exception of the following:

- (a) Make a pilot hole for the auger point with a digging bar before starting the auger into the ground. This will prove helpful particularly when the proposed hole is on the side of a hill or other sloping ground.
- (b) Remove any debris at the hole location which might tangle on the auger.

- (c) After the auger has entered into the ground, it is sometimes necessary to rock it from side to side to facilitate breaking the frost.
- (d) The cutting action of the frost blades is illustrated below.



14.08 When using the C auger the operation is the same except that it is emptied in a different manner. The auger is filled by rotation, then stopped and pulled out of the hole and away from it. The handle is then released by pressing on the trigger on the handle and swinging the handle down.

14.09 As the auger opens two projecting castings inside the auger tend to force the spoil along the blade and assist in clearing it. After the auger has been cleared, it is then closed to a locked position and is ready for the next operation.

14.10 The C type auger fills very quickly. It will generally be found, when digging extremely dry earth, that the auger may best be completely filled and the soil packed slightly to prevent spilling when the auger is raised. If the soil is particularly damp and sticky, the auger will clean better if the auger is not completely filled.

15. REMOTE OPERATION

15.01 The digger may be used at a location remote from the truck by removing all the digging equipment from the truck. When moving the digger and engine to the remote location partially disassemble the digger as outlined in Part 19.

15.02 Assemble the digger at the remote location in accordance with Part 12 with the exception that the torque arm should be attached to the metal spool on the engine base by means of the standard B eye bolt.

15.03 If possible, run a winch line from a snatch block on a pole or other support to the hole location so that the winch line can be used to raise the loaded auger out of the hole.

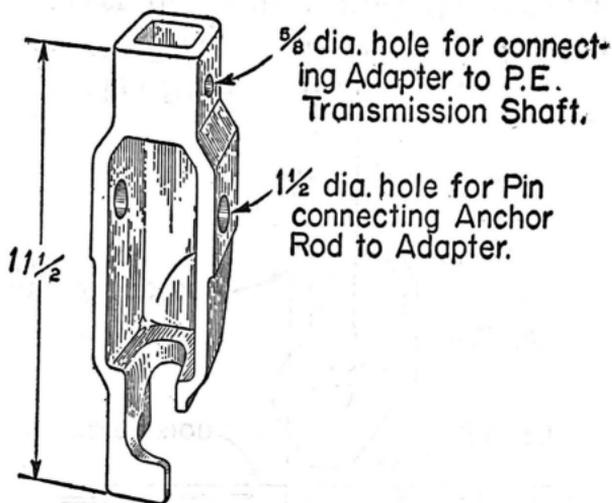
15.04 If the winch line can not be run to the remote location the bolt holding the top of the auger shaft should be removed and left out while digging so that each time the auger is to be emptied the transmission can be removed and placed on the ground thus decreasing the effort required by the workmen to pull the loaded auger out of the hole.

15.05 Other procedures in the remote operation are the same as outlined for normal operation in Part 14.

16. PE ANCHOR ADAPTER

16.01 The PE anchor adapter is used to attach integral rod type screw anchors to the PE digger so that they can be turned into the ground with power furnished by the digger.

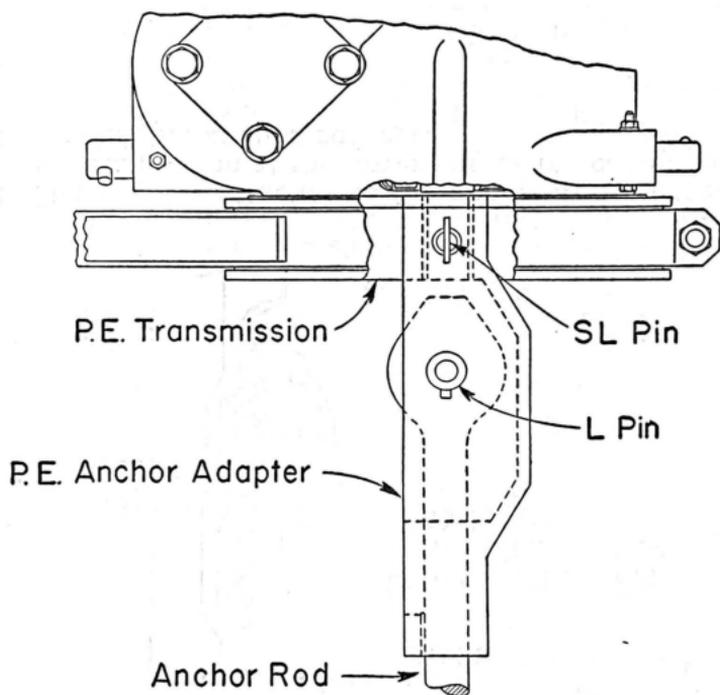
P.E. ANCHOR ADAPTER



16.02 The adapter attaches to the anchor rod by means of a hooked portion at the lower end of the casting and a pin or bolt through the anchor rod eye.

16.03 Place the rod in the opening above the hook holding the rod, at right angles to the adapter, swing the rod on the adapter until the rod and the adapter are in line and place the pin or bolt through the eye.

ATTACHMENT OF ANCHOR ROD TO P.E. ANCHOR ADAPTER

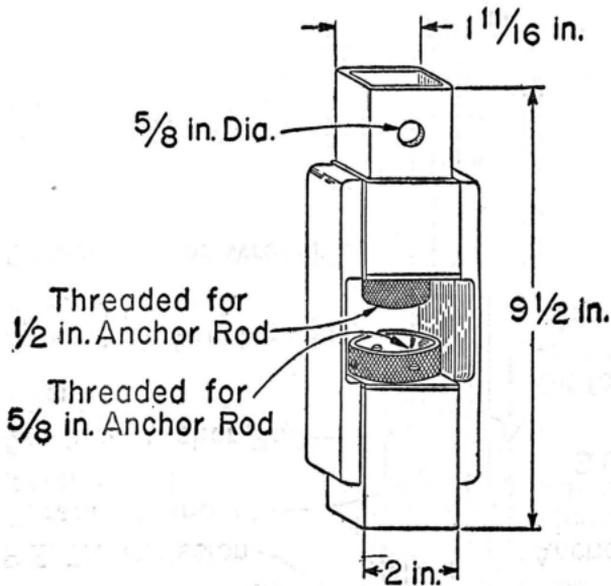


16.04 To disconnect the adapter from the rod, remove the adapter from the PE digger, remove the pin which is through the rod eye, tip the adapter 90 degrees and unhook it from the rod.

17. B ANCHOR WRENCH ADAPTER

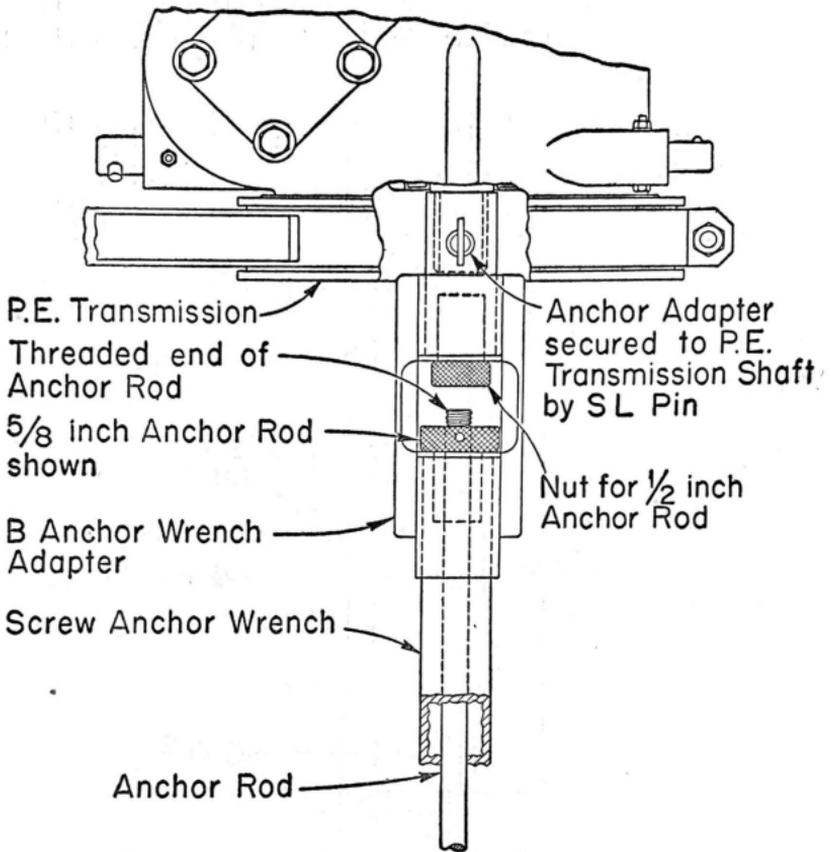
17.01 The B anchor wrench adapter used with the standard anchor wrench for turning wrench type screw guy anchors into the ground is shown below.

B ANCHOR WRENCH ADAPTER



17.02 Make the attachment to the anchor rod as illustrated below.

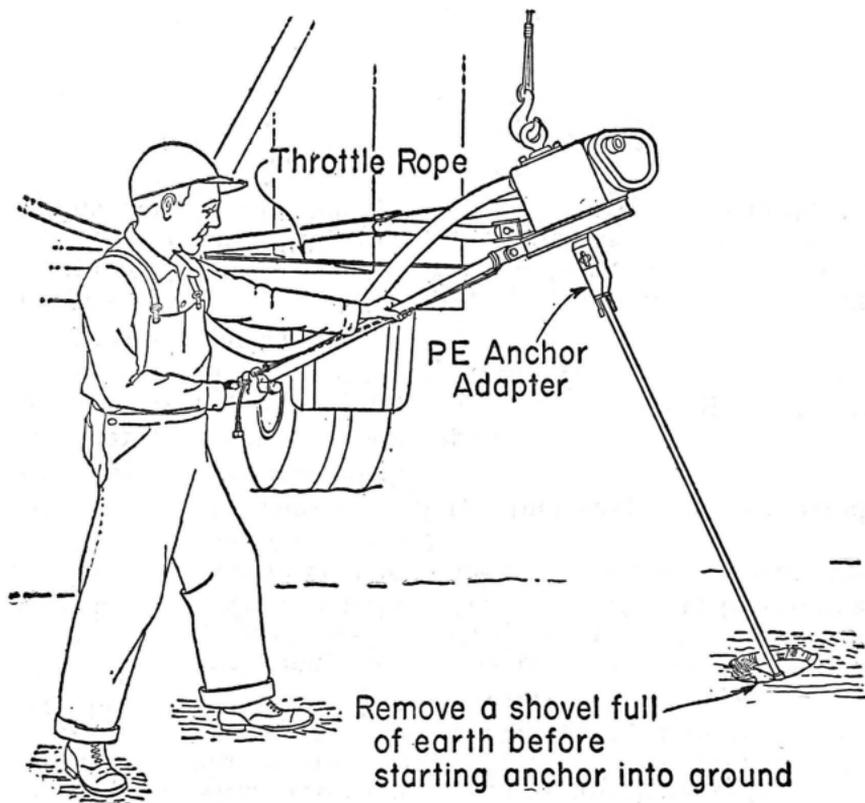
B ANCHOR WRENCH ADAPTER



B ANCHOR WRENCH ADAPTER

18. PLACING ANCHOR

18.01 The method of placing the anchor is shown below and applies to both types of anchor adapters.



PLACING ANCHOR USING PE ANCHOR ADAPTER

18.02 Allow ample slack in the winch line because the anchor screws in rapidly.

19. DISASSEMBLY OF THE DIGGER

- 19.01 To disassemble the digger the procedure is the reverse of that outlined in Part 12.
- 19.02 If the digger is to be used on the following day the flexible shaft may be left connected to the countershaft at the engine end and the dust cap placed on the transmission end. The shaft can then be laid out along the ladder rack of the truck and tied down to hold it in place.
- 19.03 The various parts of the digger should be transported on the truck platform or on a P3 trailer as found convenient.

20. STORAGE OF ENGINE WHEN NOT IN USE

20.01 Engines which are to be stored an appreciable length of time should be completely drained of gasoline to prevent gum deposits forming on the carburetor, fuel filter, fuel lines and tank.

20.02 Gum deposits may affect the operation of the engine when it is used again. Therefore, it is important that the following procedure be adhered to before storing the engine.

- (a) Remove the filter bowl, open the shut-off valve and drain the tank completely.
- (b) Operate the engine until the fuel supply is exhausted.
- (c) Replace the filter bowl.
- (d) Leave the shut-off valve open.
- (e) Remove the spark plug, pour one ounce of SAE No. 20 oil into the cylinder and crank slowly to spread oil.

Replace the spark plug.

20.03 For short storage periods keep the gasoline tank full. Evaporation of gasoline will usually cause gum deposits and keeping the tank full while the engine is idle will tend to reduce this trouble and help prevent corrosion of the tank.