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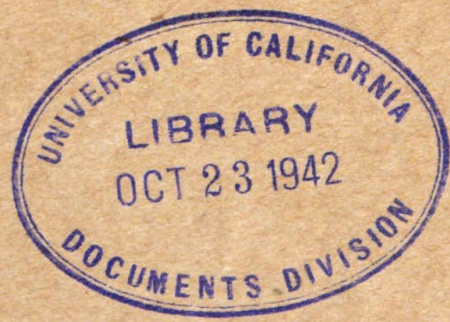
U.S. Dept. of Army

WAR DEPARTMENT

TECHNICAL MANUAL

TRUCK K-44-B AND EARTH BORER
EQUIPMENT HD

September 24, 1942



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WAR DEPARTMENT,
WASHINGTON, September 24, 1942.

TRUCK K-44-B AND EARTH BORER EQUIPMENT HD

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CHAPTER 1

TRUCK K-44-A AND TRUCK K-44-B

General-----	Paragraph
1-----	1
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1. **General.**—*a.* Truck K-44-A and truck K-44-B are 1½-ton trucks equipped with earth borer equipment for digging holes, a power winch and derrick for setting poles, and various accessories to facilitate the work.

b. Responsibility for the proper operation and lubrication (first echelon maintenance) of truck K-44-A or truck K-44-B rests with the truck driver. Second echelon maintenance will be performed by unit maintenance sections. Third and fourth echelon maintenance will be performed by any third or fourth echelon unit or establishment. Winches, power take-offs, and earth borer equipment will be subject to inspections (technical and nontechnical) when the truck is inspected. Technical inspections will be performed only by qualified maintenance personnel.

2. **Components.**—*a.* The main components of truck K-44-A and truck K-44-B are:

1½-ton, 4x4 (2dt), truck chassis (Chevrolet).

Body EBWP, 86 inches wide.

Earth borer equipment (type D for truck K-44-A and type HD for truck K-44-B), with integral pole derrick.

Power take-off P.

Winch EB18RRC-86 or L18RRC-86.

Power reel CR.

Pole derrick supports MC.

Caboscope (derrick rear view mirror).

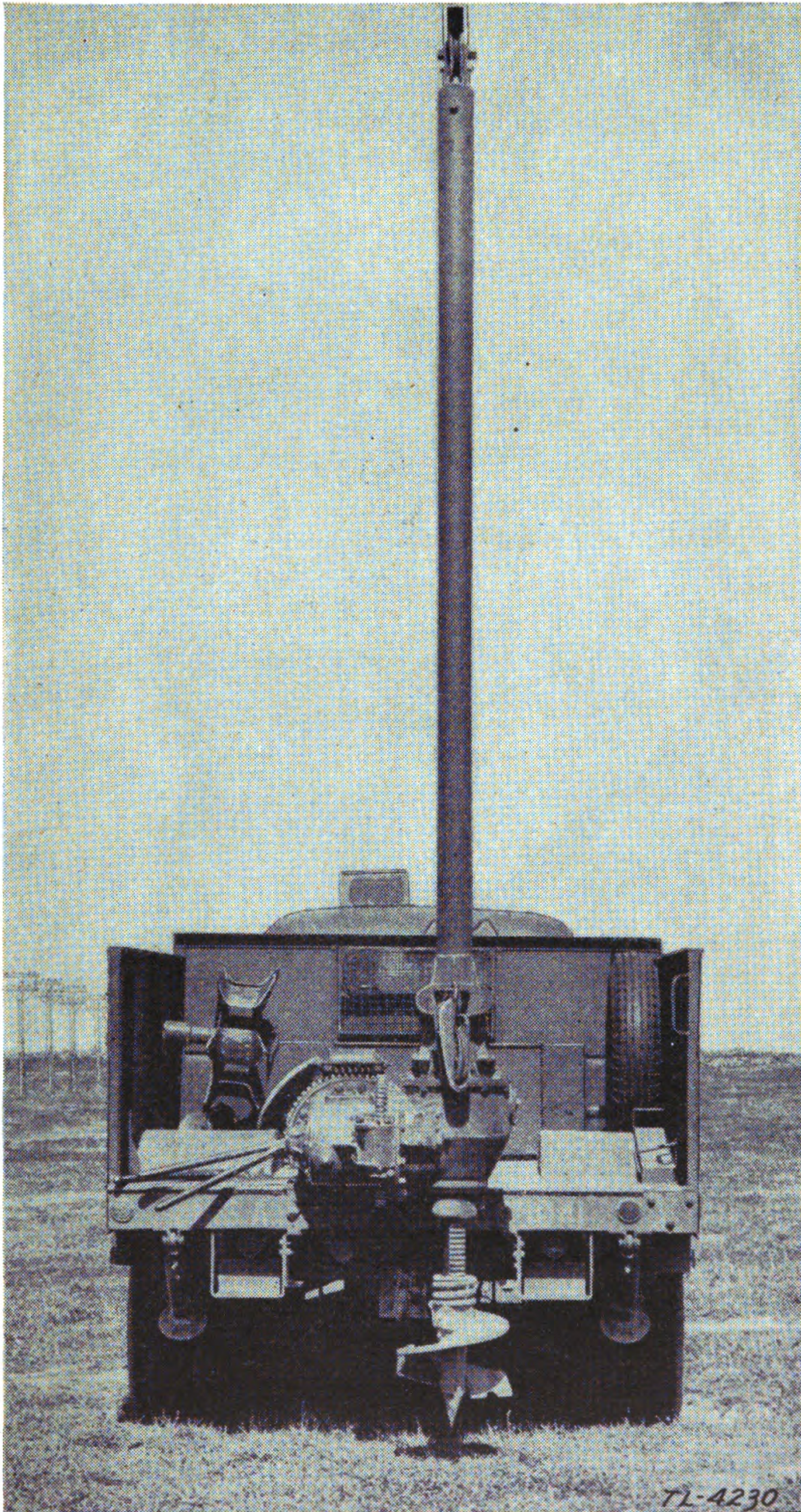


FIGURE 1.—Truck K-44-B with earth borer equipment HD—rear view.



FIGURE 2.—Truck W-44-B with earth borer equipment HD, arranged to bore hole at an angle—side view.

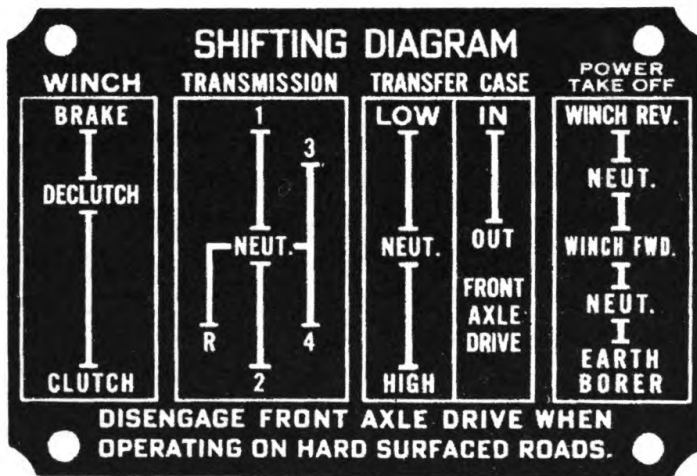
Maintenance equipment ME-14 (one per five earth borers).
 Maintenance equipment ME-16 (one per five winches).
 Tool equipment TE-64 (per earth borer).

b. The above data on truck K-44-A are given for information purposes. This manual describes in detail only the earth borer equipment for truck K-44-B.

3. Detailed description.—*a.* Figures 1 and 2 show rear and side views of truck K-44-B and figure 3 shows the positions of the shift

levers for the various conditions of use. No effort is made in this manual to cover the employment, detailed functioning of parts, servicing and repair, or list of replaceable parts for the truck itself, as this information is covered in TM 10-1202 and TM 10-1203 furnished with each truck. The following list of additional Technical Manuals is given for reference only:

- TM 10-510, The Motor Vehicle
- TM 10-540, Automotive Lubrication
- TM 10-550, Fuels and Carburetion
- TM 10-570, The Internal Combustion Engine
- TM 10-580, Automotive Electricity



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FIGURE 3.—Truck K-44-B—shifting diagram plate.

b. Earth borer equipment HD is covered in chapter 2, and winch EB18RRC or L18RRC-86, power take-off P, and power reel CR are covered in chapter 3. Earth borer equipment D is not in general use and is covered in other publications of limited distribution.

c. The caboscope installed in the roof of the truck cab allows the driver to see above and to the rear of the truck, and is useful when employing the pole derrick. This unit consists of a large plate glass mirror supported on a ball and socket bracket in a weatherproof housing mounted through the roof of the cab. All objects appear in their proper relation to each other and all movements appear in their proper directions.

d. Two pole derrick supports are mounted beneath the rear of the truck and are used to take the load off the springs while boring in heavy soil, such as clay, and when lifting heavy loads with the derrick. A list of replaceable parts for this equipment is given in chapter 3.

CHAPTER 2
EARTH BORER EQUIPMENT HD

SECTION I
GENERAL

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4. Purpose.—*a.* Earth borer equipment HD is a machine designed for digging holes, by power, in various types of soil for setting telephone poles and placing guy anchors.

b. The machine is equipped with an integral derrick for setting telephone poles after the hole has been dug.

5. Characteristics.—*a.* The earth borer equipment HD weighs about 2,000 pounds, without augers or special tools. The integral derrick increases the weight of the machine by approximately 250 pounds, and the augers and special tools about 250 pounds additional.

b. The earth borer will dig holes 9, 12, 16, or 20 inches in diameter and 7 feet 6 inches deep, when the truck is set on level ground and the hole is dug vertically. In dry ground the hole may be up to 2 inches larger in diameter than the size of the auger used.

c. All the truck transmission speed ratios are available through the propeller shaft power take-off.

6. Description.—*a.* The earth borer equipment HD includes the main supporting case tube, which is a steel shell attached to two mounting bases with four 1¼-inch cap screws. This steel shell supports the clutch case, which houses the feed and driving clutches and brakes at one end, and supports the intermediate case and the boring case at the other end. These latter cases project to the rear of and overhang the last body platform cross bearer.

b. The main supporting case tube also houses the main drive and feed shafts. The intermediate case contains the intermediate drive and feed gear trains and has mounted on it the two leveling worms and wheel drives which serve when the main boring case is shifted in position.

c. The boring case contains the final feed and drive gears, and the rack shaft carrier. The rack shaft, on which the earth auger is mounted, is turned by the carrier and is driven up and down through the carrier by the rack pinion.

d. The control levers are mounted on the rear cross bearer of the truck body platform at the left of the earth borer.

e. A large diameter tube is mounted on top of the boring case and is equipped with a guarded sheave at the upper end. The tube is intended for use as a derrick, and is so mounted on the boring case as to form a guard over the rack shaft. Attached to the rear of the truck is an 8-inch strap sheave through which the winch rope passes before it goes to the derrick head sheave.

f. An 8-inch eye snatch block is attached to the derrick tube base casting for use when pulling with the winch rope at various angles from the truck.

g. The maximum size pole that can be handled with the integral pole derrick, limited by the height of the derrick with respect to the balance point of the pole, is normally 35 feet. Longer poles may be handled if the butts are sufficiently heavy.

SECTION II

EMPLOYMENT

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7. Precautions.—*a.* When attempting to reach the pole or anchor hole location, or when leveling the earth borer to bring the auger and derrick to the plumb position, the auger and the top of the derrick must be clear of obstructions. No attempt will be made to move the truck or to plumb the rack shaft during the boring operation while the auger is still in the hole.

b. The lever of the truck transfer case shall be in the neutral position during all boring operations, to avoid movement of the truck.

c. When working on side hills or at any location where the truck has a tendency to move during the boring operation, wheel chocks will be used in addition to the truck brakes. If chocks under the rear wheels are not sufficient to hold the truck, place a cross arm against the front wheels.

d. Place the front axle drive in the engaged or “in” position at all times when it is necessary to reach a pole or anchor hole location.

e. Engage the rack lock (located on the left of the derrick tube support base) at all times when the auger is raised to stop the boring operation for any reason.

f. When raising the auger, take care to stop it before the auger bumper spring is compressed. Under no circumstances clear the auger of soil by allowing the auger to compress the bumper spring fully and bump against the rack shaft carrier lower nut, thereby jarring the soil loose.

g. No person other than the operator should stand close to the borer while it is in operation, as the soil which is spun off the auger sometimes contains objects which can inflict severe injuries.

h. When using the derrick for placing or removing poles, do not stand under or close to the pole or between the pole and the truck body. Men guiding the movement of poles shall be prepared to step aside quickly. Never permit any part of the derrick to come in contact with light, power, or trolley wires.

8. Preparation for boring.—*a.* When spotting the truck in position for boring a hole, drive the truck so that the auger point will be directly over the stake which marks the hole location when the earth borer is raised from the traveling position to the boring position.

b. Set the truck brakes and chock the wheels to prevent movement of the truck during the boring operation.

c. When their use is required, such as when digging in heavy clay, unship the pole derrick supports at the rear of the truck from their fastenings and set them so that they are either directly in contact with the ground or so that any load on the auger will bring the supports into contact with the ground with not more than 1 inch of travel.

d. Plumb the earth borer by turning the leveling worms. A ratchet wrench (EA-21, fig. 10) is provided which fits over the squared ends of the leveling worm shafts. Turning the worms in the desired direction will adjust the position of the machine.

e. Raising the earth borer from its traveling position to the operating position will be easier if a man, standing in the truck body, assists in the leveling operation by pushing up on the derrick while the leveling worm is being turned.

9. Boring operation.—*a.* The earth borer equipment HD is operated by means of two levers mounted at the rear of the truck at the left of the machine. The two levers are mounted in a plane parallel to the rear edge of the truck body platform.

b. Power from the truck engine is furnished through the truck transmission and a power take-off. The speed required will be signaled by the earth borer operator to the truck operator, who will place the power take-off lever (see fig. 3) in the earth borer operating position and select the transmission speed requested. The truck operator will control the engine speed in accordance with the wishes

of the earth borer operator. A high degree of cooperation is necessary between the driver and operator.

c. (1) To bore a hole, spot the truck and level the auger. Signal for the speed desired.

(2) The control levers move in a vertical plane and can be pushed down and pulled up from their normal positions. Push down the left-hand lever and pull up the right-hand lever, causing the auger to rise slightly to release pressure on the rack lock. Then push rack lock cam ring handle to the left, freeing the rack lock.

(3) Lower auger shaft by pulling up left-hand lever and pushing down right-hand lever until auger is near the ground.

(4) Push down on both levers and bore until the auger is buried to the bottom of the bumper spring. Never bury the spring.

(5) Raise the auger by pulling up right-hand lever and pushing down left-hand lever until auger is about 18 inches above the ground, then push down both levers and spin off the soil from the auger.

(6) Repeat these operations until the hole is bored to the desired depth.

(7) The auger may be held up by elevating both control levers. The truck operator should restore the power take-off lever to neutral.

d. A handy measuring device is a long-handled shovel on which markers of one or two turns of black friction tape have been placed to indicate lengths of 5 and 6 feet (the depths of pole holes most used). It is necessary only to drop the shovel into the hole and refer the tape marker to ground level to determine the hole depth.

10. Boring in various soils.—*a.* When boring holes in sandy, clay, or ordinary soil, the auger will be found to work best around a speed of approximately 125 rpm. In clay, take care to prevent overloading the auger. Load the auger to the bottom of the bumper spring only. In clay there is a tremendous suction and too heavy a load may strain the machine.

b. Care should be taken when boring in soil containing loose rock, niggerheads, etc., to prevent damage to the earth borer. If the rocks are too large to be removed by the auger, loosen and remove them by hand. Rocks up to 10 inches in diameter can be picked up by the auger. To remove rocks of this size, lower the auger slowly into the hole, turning it very slowly until the auger comes into contact with the rock and works underneath it. Raise auger slowly until the rock is at ground level and pick the rock off the auger with a shovel. If the rock is not over 10 inches in diameter it can in all probability be loosened and dislodged by first pushing on both levers to rotate and feed the auger downward, then quickly raising the auger slightly to loosen the rock.

c. Boring in disintegrating shale or similar rock can be accomplished by boring at very slow speed, the auger rotating at about 25 rpm. This type of boring requires sharp blades. If the blade is slightly worn, it is advisable to reverse it; if badly worn, the blade should be replaced. In boring holes in this type of soil it may be possible to bore only from five to seven holes with the same blade. The auger points may last one or two holes longer.

d. Boring in sandstone or frozen ground also requires a slow speed and sharp blades and points.

e. When starting to bore a hole, regardless of the type of soil, keep the speed of rotation of the auger down to about 25 rpm until a depth of about 18 inches is reached. If no serious obstructions have been encountered, higher speeds may then be selected. This procedure will prevent damage to the earth borer, since the nature of the soil may more readily be determined after the first 18 inches have been penetrated. The existence of a rocky layer, about 1 foot thick, just under the surface will often be found. Impact loads on the earth borer will be materially reduced by using care when starting the boring operation.

f. When boring in sand, sandy loam, or any soil which tends to stick in the rack shaft teeth, brush the teeth out as often as necessary with a wire brush. This will prevent dirt from being carried up into the rack carrier sleeve and lodging behind the rack thrust plates, with resulting damage to the plates from excessive pressure.

11. Use of derrick.—*a. Preparation.*—(1) When using the derrick to handle poles, thread the winch rope through both the lower and upper derrick sheave blocks and erect the derrick, tilting the top of the derrick away from the rear of the truck. The overhang of the upper derrick sheave shall not exceed 4 feet.

(2) In addition to the above, when it is necessary to make a pull at any angle from the truck, as when snaking a pole along the ground, insert winch rope through eye snatch block mounted on the side of the boring case, to prevent strain on the derrick. (See fig. 4.) When the pole is pulled up to the machine, ready to lift off the ground, the cable can be quickly removed from the lower eye sheave without disconnecting it from the pole.

b. Placing and removing poles.—After digging the hole, drive truck ahead until auger clears the hole. Attach winch rope to the pole slightly above the balance point so that the pole will be "butt-heavy." Place power take-off lever in the "winch forward" position and truck transmission in second or third speed, and operate the winch as described in chapter 3 to raise the pole. To lower the pole into the hole,

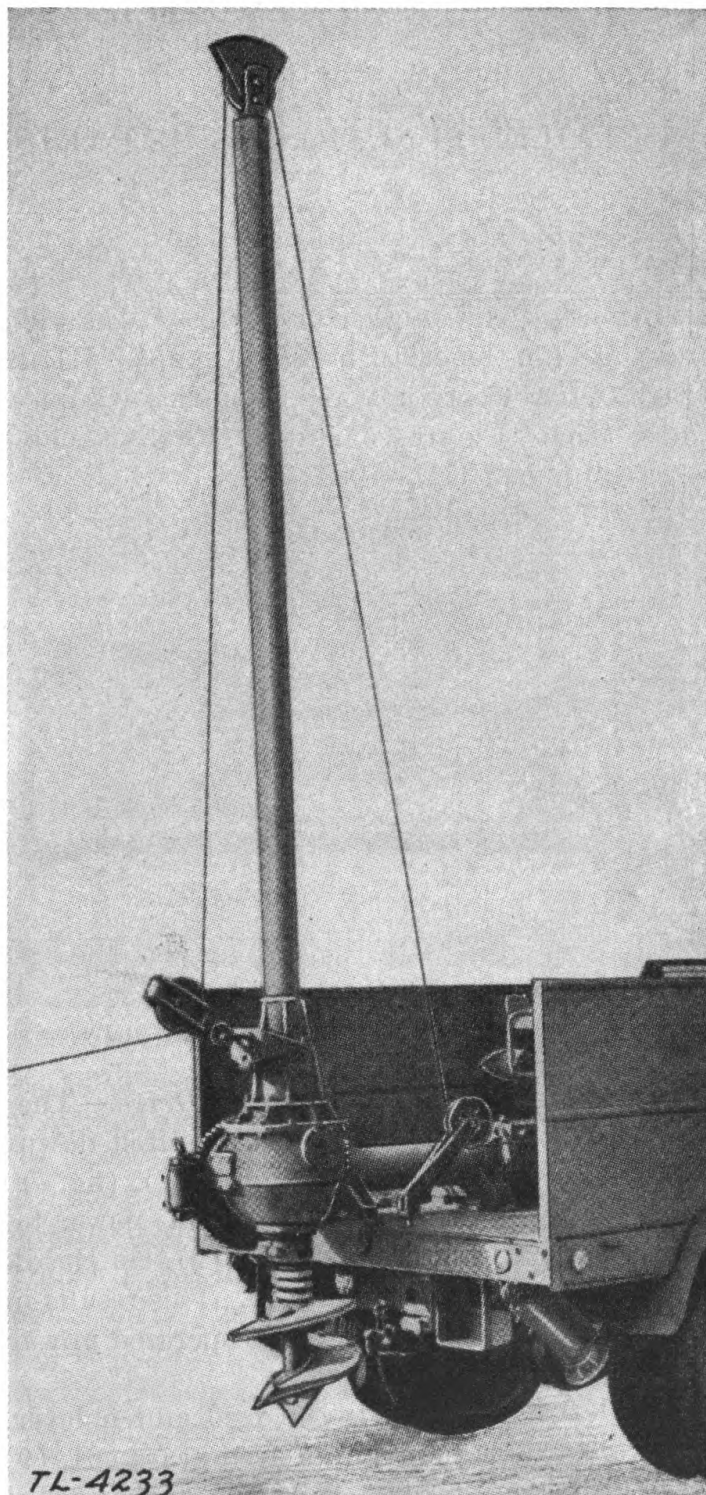


FIGURE 4.—Earth borer equipment HD, hook-up of winch cable to pull pole up to machine.

place power take-off lever in the "winch reverse" position. TM 11-363 covers further details of the use of a derrick in construction work.

SECTION III

DETAILED FUNCTIONING OF PARTS

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Gear trains-----	14

12. Drawings.—*a. Assembly drawings.*—A complete set of the assembly drawings for the earth borer equipment HD has been distributed to each Signal Corps unit receiving that equipment.

b. Unit assemblies.—Figures 5 and 6 are disassembled views of the earth borer equipment HD.

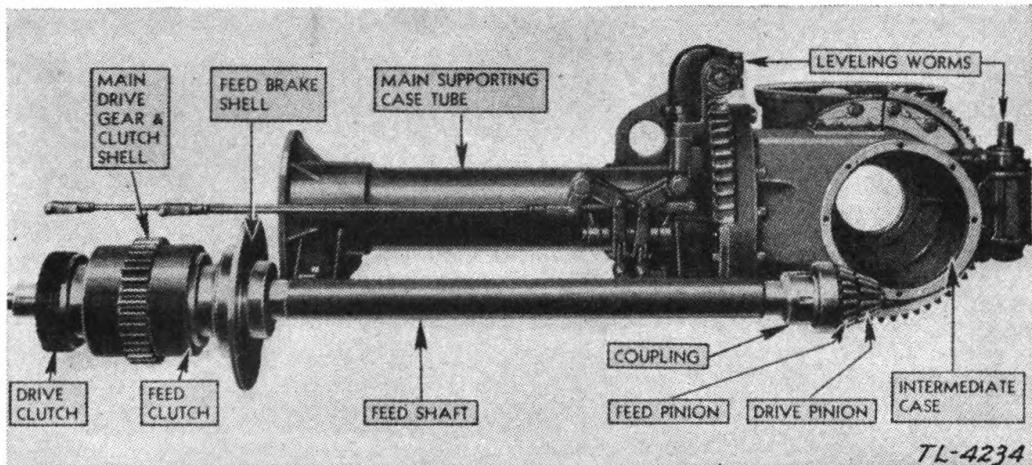


FIGURE 5.—Earth borer equipment HD, unit assemblies, clutch and main supporting cases.

13. Clutch levers and clutches.—*a. Drive.*—The right-hand lever is the drive clutch lever, and when operated downward causes the train of driving gears (7), (8), (10), and (12), (fig. 7) to be driven by the truck motor through the power take-off, power take-off chain drive, drive sprocket (1), clutch drive gear (2), clutch idler gear (3), main drive gear (19), and drive clutch (4). This results in rotation of the auger. When the drive clutch lever is operated upward, the train of drive gears is held firmly in place.

b. Feed.—The left-hand lever is the feed clutch lever, and when operated downward causes the train of feed gears (6), (9), (11), and (13), (fig. 7) to be driven, through operation of the feed clutch (5) in the same manner as the drive gears in *a* above. This results in the auger being driven downward. (See par. 14.) When the feed clutch

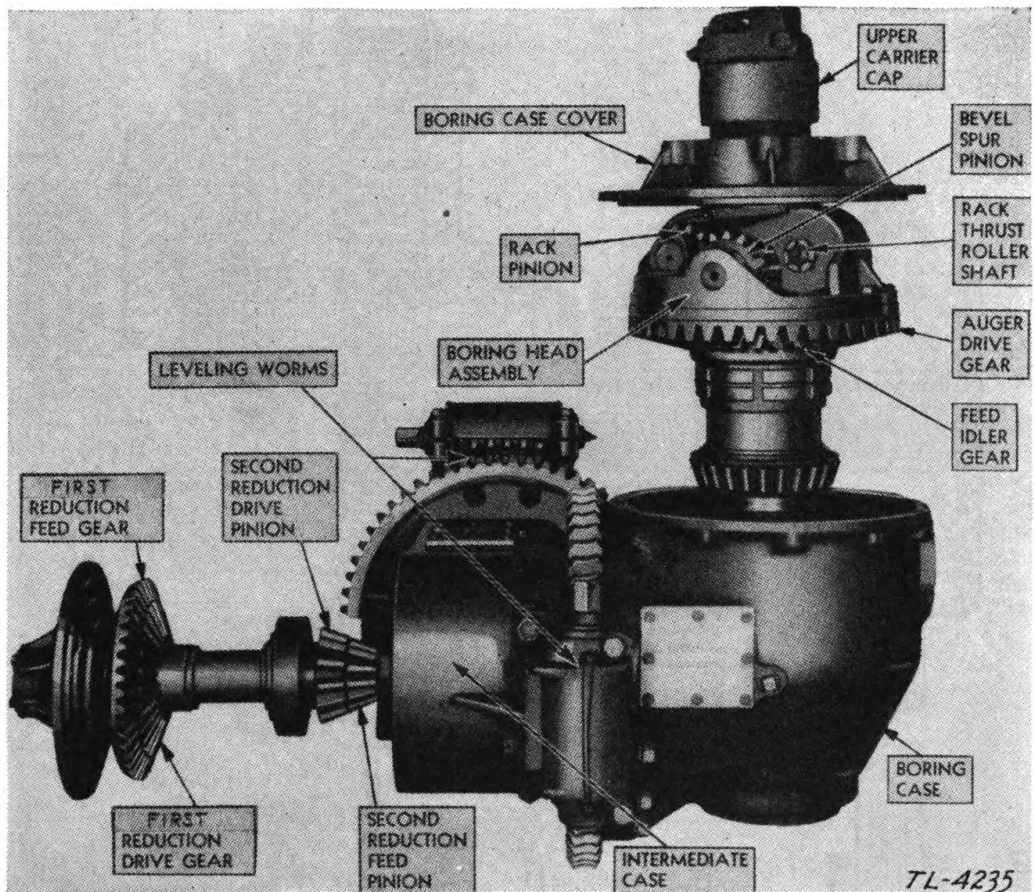
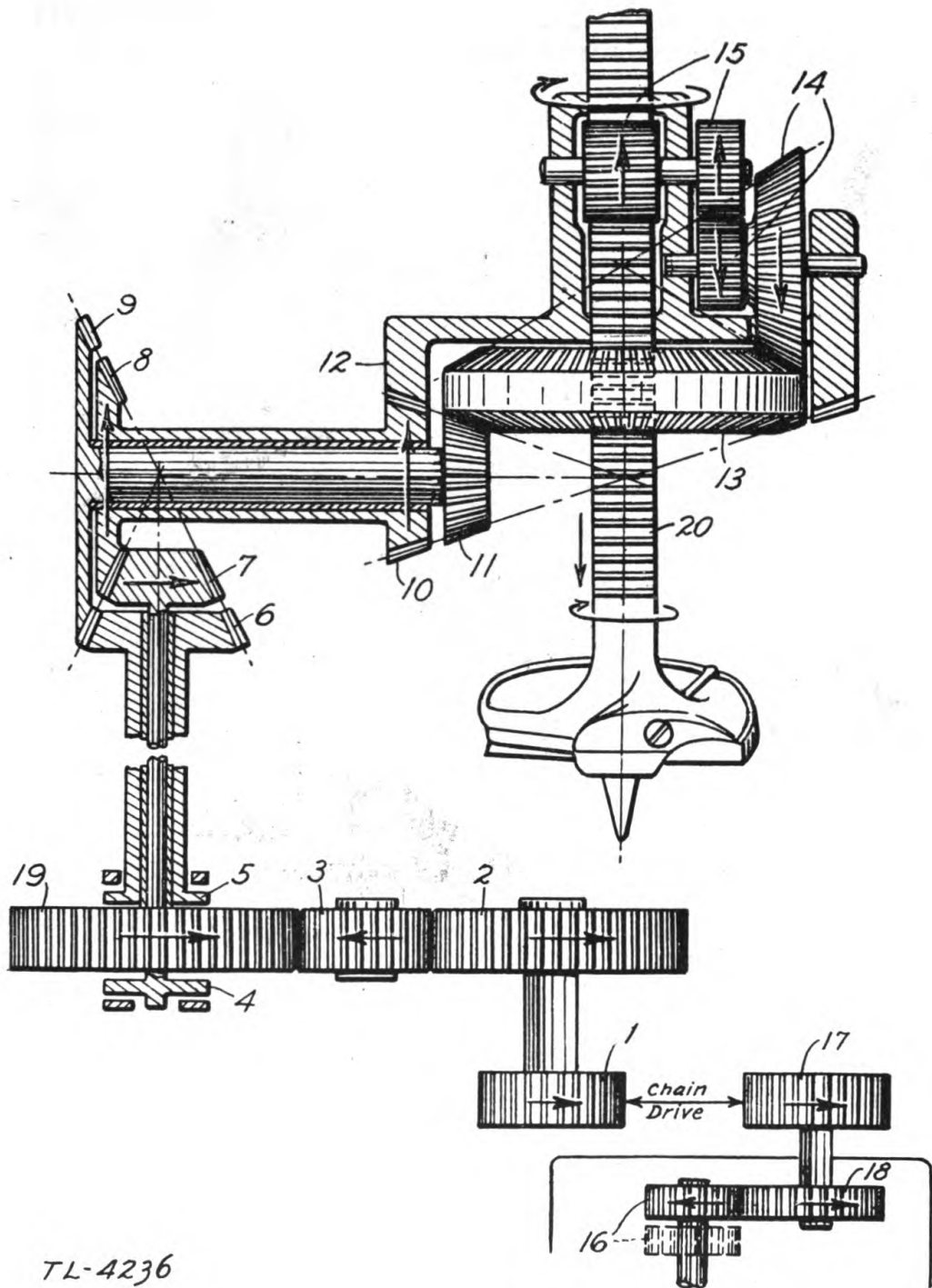


FIGURE 6.—Earth borer equipment HD, unit assemblies, intermediate and boring cases.

lever is held upward, the feed gears, around to and including the feed idler gear, are held firmly in place.

14. Gear trains.—Figures 7, 8, and 9 show action of gear trains of the earth borer equipment. Direction of rotation of the various gears and the auger are shown for the various conditions of use.

a. Lowering auger (fig. 7).—To lower the auger at its maximum rate (but not for actually boring), as when bringing the auger to the ground preparatory to boring, pull up on the left (feed) lever and down on the right (drive) lever. This will hold in position the train of feed gears consisting of the first reduction feed pinion and gear (6) and (9), second reduction feed pinion (11), and feed idler gear (13), and will rotate the drive gear train through the action of drive clutch (4). This drive gear train transmits power through the first reduction drive pinion and gear (7) and (8), second reduction drive pinion (10), and auger drive gear (12). As the auger drive gear and rack shaft carrier holding bevel spur pinion (14) and rack pinion (15) rotate around stationary feed idler gear (13), these pinions are driven in the direction shown by the arrows, resulting in auger rack (20) being



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| 1. Drive sprocket. | 11. 2d reduction feed pinion. |
| 2. Clutch drive gear. | 12. Auger drive gear and rack shaft carrier. |
| 3. Clutch idler gear. | 13. Feed idler gear. |
| 4. Drive clutch. | 14. Bevel spur pinion. |
| 5. Feed clutch. | 15. Rack pinion. |
| 6. 1st reduction feed pinion. | 16. Power take-off sliding gear. |
| 7. 1st reduction drive pinion. | 17. Power take-off drive sprocket. |
| 8. 1st reduction drive gear. | 18. Power take-off gear. |
| 9. 1st reduction feed gear. | 20. Rack and auger. |
| 10. 2d reduction drive pinion. | |

FIGURE 7.—Earth borer equipment HD, gear trains, lowering auger.

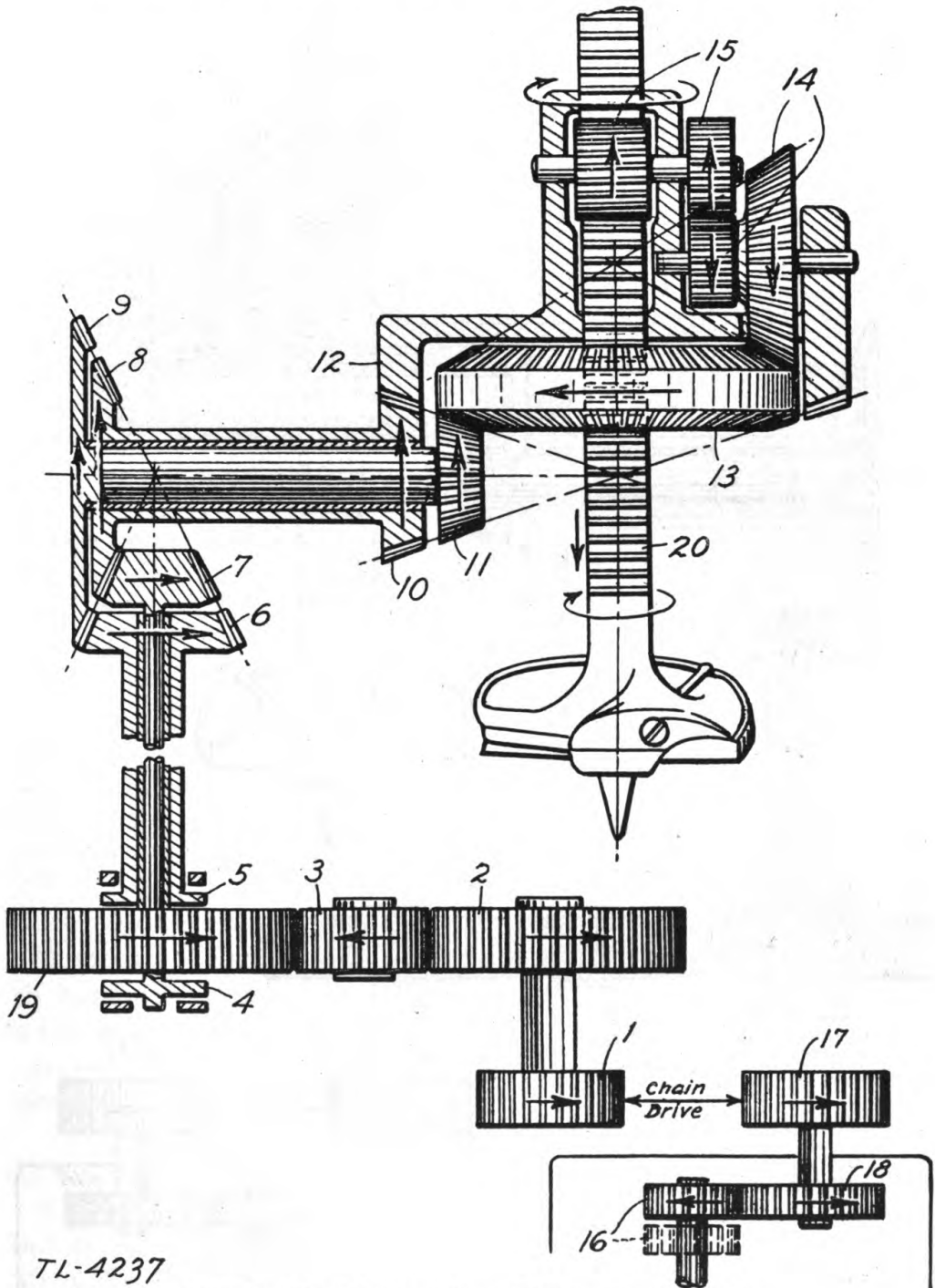
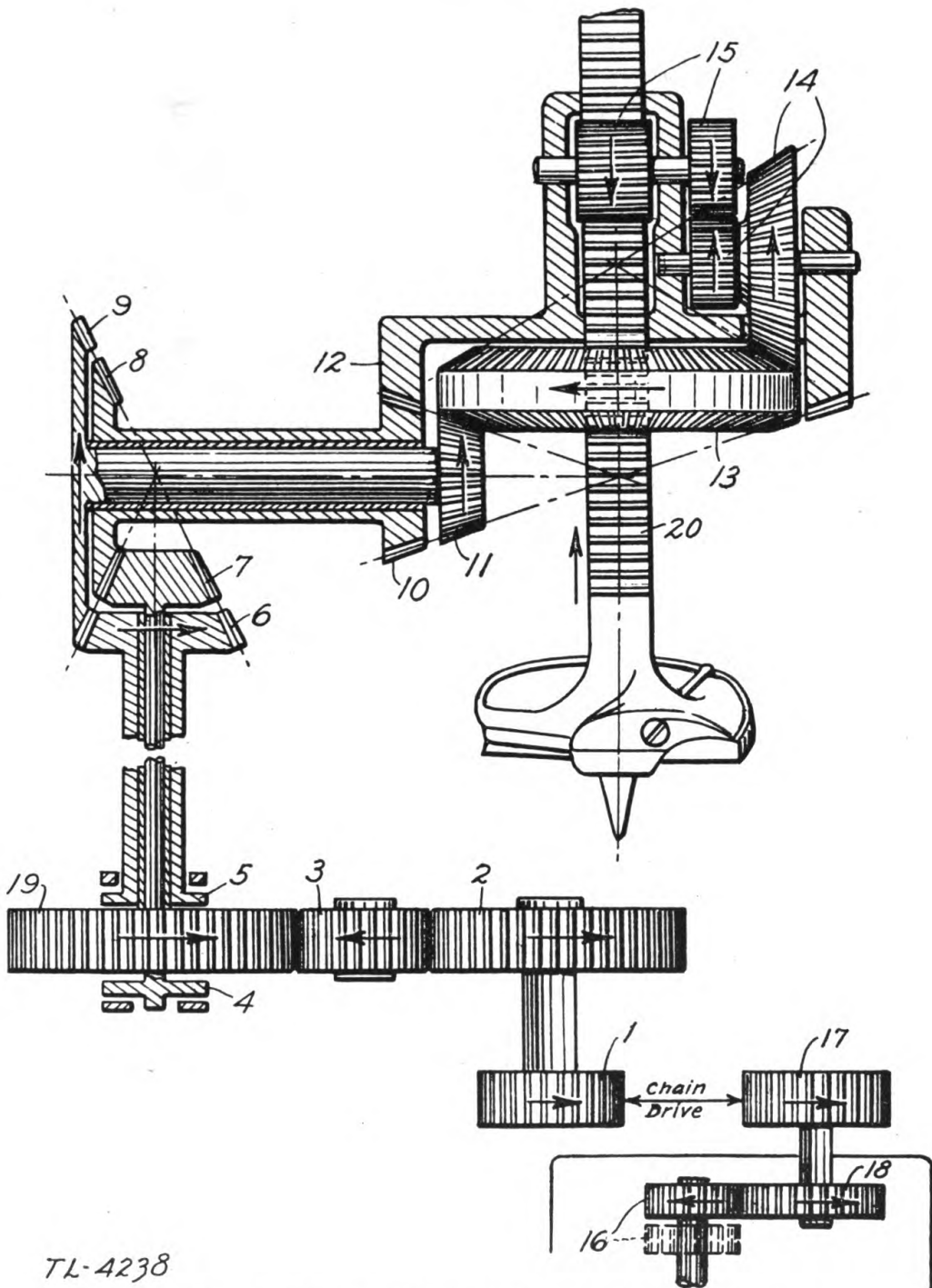


FIGURE 8.—Earth borer equipment HD, gear trains, boring.

driven downward at the maximum rate. The auger is also revolving, due to the revolution of the auger drive gear, but this feature is not utilized at this time.

b. Boring (fig. 8).—With both levers pushed down, both the feed and drive gear trains are revolving, but the combination of gears is



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FIGURE 9.—Earth borer equipment HD, gear trains, raising auger.

so designed that auger drive gear (12) is driven at a slightly faster rate than feed idler gear (13). Due to the differential action between these gears, rack pinion (15) revolves at a much slower rate than given in *a* above, but in the same direction, resulting in a slow feed of the auger downward for boring.

c. Raising the auger (fig. 9).—With left (feed, lever pushed down and right (drive) lever up, the drive gear train is held fast and the feed gear train is driven through feed clutch (5). Auger drive gear (12) and the carrier holding bevel spur and rack pinions (14) and (15) do not rotate, but the revolving feed idler gear (13) drives those two pinions in the direction shown by the arrows, resulting in the rack and auger (20) being moved upward without revolving.

d. Operation with truck transmission in reverse.—In *a*, *b*, and *c* above, it was assumed that the truck transmission was being operated in one of the forward speeds. If the truck transmission is placed in reverse, the rotation of the train of gears will be just the opposite of that shown in figures 7 and 9. Thus the auger rack can be lowered without rotating by operating the left (feed) lever down and the right (drive) lever up, or can be rotated and raised at the same time by operating the left lever up and the right lever down. The principal use of this reverse action is in assembling and disassembling the earth borer as covered in section IV.

SECTION IV

SERVICING AND REPAIR

	Paragraph
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Adjustments.....	19

15. Lubrication.—*a.* Fill the clutch housing to the oil plug level with SAE 10W engine oil and maintain the oil level to the plug at all times. If clutches tend to slip, add a small amount of kerosene to the oil (not more than 30 percent).

b. Oil all pins and lever bearings, not equipped with Alemite-Zerk lubricating fittings, daily.

c. Grease all bearing points equipped with lubricating fittings with light grease weekly.

d. Use universal joint lubricant, No. 1 grade, in the intermediate and boring cases. If this cannot be retained without leaking, use either No. 2 or No. 3 grade, depending upon conditions. For temperatures below freezing, use universal joint lubricant No. 1 grade mixed with kerosene. The maximum admixture of kerosene will be 30 percent.

e. Lightly lubricate leveling worm segments with light grease. As soon as the grease becomes contaminated with dirt and dust, wash it off and apply a new coat.

f. The rack shaft will not be lubricated when boring in dry, dusty soil. At other times apply light engine oil sparingly to the rack shaft.

16. Locating trouble.—*a.* If trouble appears in the boring machine, the pipe plugs, inspection plates, and handhole covers in the various unit cases can be removed and the functioning of the parts observed.

b. Excessive motion between the leveling worm and leveling worm wheel segment will be readily detected and indicates the need for adjustment of the leveling worms.

c. Wear of the rack thrust plates is indicated by chattering of the rack shaft. If the rack shaft chatters when driven up, the lower thrust plates are worn. Worn upper thrust plates will make the shaft chatter when driven down.

d. If the rack shaft seems to bind when driven up or down, or there is a periodic hammer blow inside the derrick tube, the shaft is probably bent and must be straightened. Inspect the thrust roller and rack pinion bearings and shafts. If damaged they must be replaced. The shaft can be straightened cold, as described in paragraph 19*a*.

17. Disassembly.—The earth borer equipment HD can be disassembled in units. This feature renders possible the making of repairs to one unit without disassembling the entire machine.

Caution: Before removing a bolted or a riveted part, such as a gear, cover plate, or a flange, the derrick or derrick mounting base, mark the part to be removed and the portion of the machine from which the part is to be removed at adjacent points so that the disassembled parts can be replaced in their original relative positions. Where shims are used, replace the same number of shims in their original locations.

a. Threads.—All threaded parts have right-hand threads with the exception of the feed clutch shaft and nut and the drive clutch shaft and nut.

b. To remove auger.—Have power on the machine and truck transmission in low gear. Raise rack shaft slightly, release rack lock and lower auger until it rests on the ground. Remove wire from the end of the auger pin and drive out the pin. Then raise auger rack shaft slowly until the bumper spring is against the rack shaft carrier lower nut. Continue raising auger rack shaft until the auger is pressed off the shaft. Two men are required to grasp the auger, one on either side, to prevent auger from dropping to the ground. If the auger is less than 16 inches in diameter, only one man is required to ease the auger to the ground.

c. To remove lower rack thrust plates.—Turn boring case over with horizontal leveling worm, so that it lies below the intermediate case with the pole derrick parallel to the ground. Loosen rack shaft carrier lower nut clamping bolt and unscrew the nut. Apply power to the earth borer with truck transmission in reverse and slowly feed the shaft out of the boring case. This will push out the rack thrust plates. Remove wire around rack thrust plate cage, take out the four thrust plate studs (three long and one short) and remove thrust plates. If necessary, the cage can be slid along the rack shaft and removed over the end of the shaft.

d. To remove upper rack shaft thrust plates.—Turn boring case to the position described in *c* above. Apply power to the machine and run rack shaft out of the case until the shaft projects about one-half its length. Remove bolts holding the derrick base casting to the boring case cap. Three men can then remove the pole derrick by walking it off to the right of the truck. The derrick will be laid on previously prepared rests, such as two wooden horses. Remove rack shaft carrier upper nut from the carrier. Feed rack shaft out of the case to the right, pushing out rack thrust plates and cage. Remove wire, thrust plate studs, thrust plates, and cage.

e. To remove rack shaft.—Remove auger, pole derrick, and thrust plates as described in *b*, *c*, and *d* above. The rack shaft can then be fed to the right out of the boring case. Take care to feed out the shaft *without turning*, and to support the end of the shaft. It will require about four men to remove the rack shaft from the case after the rack pinion ceases to feed out the shaft.

f. To remove rack pinion.—(1) Remove auger, pole derrick, rack thrust plates, and rack shaft as described in *b*, *c*, *d* and *e* above, and circular handhole cover in the boring case. Revolve rack carrier so that parts to be removed can be reached through handhole. Screw off rack pinion shaft nut. Turn rack carrier sufficiently to expose the head of the rack pinion felt retainer setscrew, and remove the set-screw. Turn rack carrier again and, using a brass drift pin about $\frac{1}{2}$ inch by 6 inches, drive rack pinion out of the carrier about 2 inches. Turn rack carrier again, take off rack pinion shaft bearing, and pull out rack pinion and its two bearings. Tap threaded end of rack pinion shaft lightly and turn rack carrier so that the head of the shaft can be reached and the shaft removed.

(2) The rack pinion can also be removed from the rack carrier after the rack carrier has been removed from the boring case.

g. To remove rack thrust roller.—Take off handhole cover on the boring case and turn rack carrier so that parts to be removed

can be reached. Remove thrust roller shaft nut, drive roller shaft in about 2 inches with a brass drift, $\frac{1}{2}$ inch by 6 inches. Turn rack carrier and pull out shaft. Drive out shaft bearing with a brass drift inserted through the roller bearing bore, turn rack carrier, and take out shaft bearing. Remove rack thrust roller and roller bearing.

h. To remove bevel spur pinion.—Take off handhole cover in boring case and turn rack carrier until the rack thrust roller shaft nut can be reached. Take off shaft nut and drive roller shaft in until the end is flush with the bearing. Turn rock shaft carrier to reach the bevel spur pinion shaft setscrew. Remove the setscrew. Screw a handhole cover cap screw into the tapped hole in the end of the bevel spur pinion shaft and pull out the shaft. Turn rack carrier and take out bevel spur pinion, its two bearings, and the thrust plate.

i. To remove rack carrier unit.—Remove auger, pole derrick, thrust plates, and rack shaft as described in *b*, *c*, *d*, and *e* above. Then turn boring case back to the normal vertical, or boring position, and remove boring case cap. Cut a piece of 2 by 4 lumber to a length just enough to span the diameter of the rack carrier sleeve. Trim the corners of the 2 by 4 block so that it will pass through the bottom oil seal. Pass a $\frac{3}{4}$ -inch rope (doubled) through rack carrier sleeve from top to bottom, place block in the loop and draw up rope so that the block lies against the bottom end of rack carrier sleeve and does not project at any point beyond the outside diameter of the sleeve. Tie a square knot in the rope at the top of the sleeve. Place upper loop of rope over the hook of a chain hoist, or the winch rope hook on a wire rope hanging from a pole derrick on another truck, and carefully raise rack carrier out of boring case. The rack carrier unit can readily be cleaned and disassembled while hanging from the chain hoist.

j. To disassemble rack carrier.—Remove the rack pinion, rack thrust roller, and bevel spur pinion as described in *f*, *g*, and *h* above. Remove second reduction drive gear and shims by taking out cap screws. Remove lower Timken bearing and shims, straighten lock key, and with special tool EA-2395 (fig. 10), remove feed idler gear bearing adjusting nuts. Remove feed idler gear and Timken bearings.

k. To remove intermediate drive unit.—If it is desired to remove only the intermediate drive unit from its case, and the rack carrier has not been removed from the boring case, level the auger and then unbolt boring case cap. Place a $1\frac{1}{2}$ -ton capacity automotive-type jack under the auger point. Apply pressure with the jack until rack carrier and boring case cap rise about $\frac{1}{2}$ inch. Remove intermediate

case cap and pull out intermediate drive unit. A short pry bar may be inserted through the inspection plate opening in the main boring case to start the unit out.

l. To disassemble intermediate unit.—Take off second reduction feed pinion shaft nut and drive out the pinion. Take off second reduction drive pinion shaft nut and drive first reduction drive gear off second reduction drive pinion shaft.

m. To remove clutch drive unit.—Take off clutch case cover, remove feed and drive clutch levers and shift shaft collars. Drive shift shafts to clutch lever side of the case sufficiently far to permit removal of the Woodruff key. Then drive shaft back until the second Woodruff key can be removed. Remove shift shaft. Remove clutch shift forks and throw shoes. Remove cap screws from clutch case cap and take off the cap. Pull clutch unit out of clutch unit housing.

n. To disassemble clutch unit.—Remove drive shaft nut, release drive sleeve lock washer, and remove drive sleeve lock nut. Slip off rear ball bearing and remove brake spacer and brake shell. Remove drive clutch and brake hub with the drive clutch and brake plates. Remove clutch spacer. Slip off main drive gear and remove front ball bearing from inside the gear. Take off drive sleeve. Release feed tube nut lock washer and remove feed tube lock nut. Remove ball bearing, then slip off feed clutch and brake hub with the feed clutch and brake plates. Remove drive chain from drive sprocket. Take out cap screws holding the clutch case to the main supporting case tube and take off clutch case. Remove feed brake shell and spacer. Pull drive and feed clutch shafts out of the main supporting case tube.

o. To disassemble feed and drive clutch shafts.—Remove drive clutch shaft nut and take off first reduction drive pinion. This pinion can also be removed from the shaft, without disassembling the clutch unit, through the intermediate case after the intermediate drive unit has been removed from the case.

p. To remove first reduction feed pinion.—Disassemble clutch unit and remove drive clutch shaft after taking off first reduction drive pinion. Straighten first reduction feed pinion coupling lock key and unscrew the coupling, using special tool EA-2397 (fig. 10). Take off first reduction feed pinion. Take off ball bearing and shims.

q. To remove clutch drive gear and idler gear.—Take off nuts on both shafts. Remove drive sprocket and take out drive gear shaft bearing cages. Remove idler gear shaft. Take out idler gear

through the clutch case. Remove drive gear shaft and take drive gear out through the clutch case.

r. To remove leveling worm.—Take out mounting cap screws and remove housing and worm gear. Line up key slot in the bushings with the shaft key and press worm shaft out of the worm gear.

18. Assembly.—Clean and inspect all parts before assembling, in order to detect defective parts. Assemble all parts as marked before they were disassembled. Read instructions in paragraph 19. All external, bolted flange surfaces should be smooth and clean. Use orange shellac to seal the joints between flanged cases and cover plates or other attachments.

a. Clutch unit.— (1) *Feed clutch and brake.*—Mount the double row ball bearing on feed pinion hub. Assemble first reduction feed and drive pinions to their tube and shaft respectively. Insert drive clutch shaft into feed clutch shaft tube. Place front ball bearing and shims on feed clutch shaft tube. Insert assembled shaft and tube in main supporting case tube, carefully entering the ball bearings in their respective seats. Assemble main drive gear and idler gear in the clutch case. Insert feed brake spacer in feed brake shell and place brake shell in position on the flanged end of the main supporting case tube. Mount clutch case in its proper position on the main supporting case tube and fasten the bolts. Place feed clutch and brake hub key in the key seat in feed clutch drive shaft tube and slide on the hub, the pilot end of the hub against the ball bearing on the shaft tube. Replace brake plates, starting with an outer plate and alternating outer and inner plates—a total of ten plates. Next put on the throw collar. Follow with the clutch plates, starting with an inner plate and alternating inner and outer plates—a total of eleven plates. Put on clutch spacer and then slip a ball bearing on the end of the feed clutch shaft tube. Replace lock washer and lock nut. Lock the lock nut in place by bending over the lock washer lug.

(2) *Drive clutch and brake.*—Mount a ball bearing on the clutch and brake hub, pushing it against the hub shoulder. Place clutch spacer against the bearing. Place drive clutch plates against the spacer, starting with an inner plate and alternating inner with outer plates—a total of eleven plates. Next, put on the throw collar and follow with the brake plates, starting with an inner plate, alternating inner and outer plates—a total of ten plates. Place main drive gear and clutch shell in position on the near bearing on the feed clutch and brake. Slip clutch and brake assembly over the end of the drive clutch shaft. Place drive brake spacer and drive brake shell in position against the end of the clutch case. Place last ball bearing in position and fasten

with lock washer and lock nut. Replace clutch case cap and fasten with cap screws.

(3) *Sealing*.—When assembling the clutch unit, all flanged surfaces will be treated with a coat of orange shellac which has been allowed to thicken.

b. Intermediate drive unit.— (1) Mount shielded ball bearing and shims on the second reduction drive pinion, and fasten with lock nut and spring. Place drive gear spacer, shims, key and first reduction drive gear. Place large double-row ball bearing on the end of the second reduction drive pinion shaft and fasten in place with adjusting nut. Lock adjusting nut with adjusting nut lock spring.

(2) Slip second reduction drive pinion roller bearing over second reduction feed pinion shaft, and insert second reduction feed pinion shaft into second reduction drive pinion shaft tube. Mount first reduction feed gear on the splined end of feed pinion shaft. Place ball bearing in intermediate case bearing retainer flange, mount the bearing on the hub of first reduction feed gear, and fasten assembly with first reduction feed gear adjusting nut and lock spring. Place small double row ball bearing on the end of second reduction drive pinion shaft and fasten with pinion shaft nut. Then place intermediate drive unit assembly in the intermediate case. Fasten bearing retainer flange with the cap screws. Replace intermediate case cap and fasten with cap screws.

c. Bevel-spur pinion.—Place roller bearings inside the bore of the pinion. Hold pinion and thrust washer in their proper location in the rack carrier and insert pinion shaft. Fasten in place with the setscrew.

d. Rack thrust roller.—Place roller shaft in position with the head against the rack carrier. Place roller bearing (well oiled) over the shaft and mount roller in position. Place roller shaft bearing in position and fasten with rack thrust roller shaft nut.

e. Rack pinion.—Place felt retainer, with new felts, between the two sets of tooth faces on the rack pinion. Wire the two parts of the felt retainer together with two turns of 16-gage soft iron wire. Insert rack pinion shaft in rack carrier. Place rack pinion bearings, well oiled, inside the bore of the pinion and slide into place on the shaft. Replace pinion shaft bearing and pinion shaft nut. Screw up felt retainer setscrew. Lock setscrew with 16-gage soft iron wire.

f. Feed idler gear.—Replace shims. Replace upper Timken bearing cup, feed idler gear, and lower Timken bearing cup. Put on upper feed idler gear bearing adjusting nut, lock washer, and lower feed idler gear bearing adjusting nut, using special tool EA-2395 (fig. 10). Turn over locking lug to hold lower lock nut in place. Replace rack carrier

lower bearing spacer, shims, and lower rack carrier bearing. Replace upper rack carrier bearing.

g. Second reduction drive gear.—Replace original shims, mount gear, and fasten with drive gear bolts. Lock bolts and bevel-spur pinion shaft setscrew by wiring together in pairs with 16-gage soft iron wire.

h. Rack carrier.—Lower rack carrier into boring case, making certain that second reduction pinion and gear teeth are in proper mesh. Replace boring case cap and fasten with nuts and bolts.

i. Leveling worm.—Insert worm gear into worm housing, place thrust washer with setscrew slot in line with the setscrew, press in worm shaft with the key on the opposite side from the setscrew, then insert bearings and tighten clamp bolts. Mount leveling worm housing, adjust position with shims, and fasten with cap screws.

j. Rack shaft.—Place main boring head in a horizontal position. Place end of rack shaft in upper end of rack carrier (which now projects toward the right of the truck) and put power on the machine. Slowly feed the rack shaft into the machine until the shaft projects equally from both ends of the rack carrier. Insert rack thrust plates for part of their length between rack shaft and inside of rack carrier sleeve. Place thrust plate cage over rack shaft and the ends of the thrust plates. Insert thrust plate studs in the cage and the plates and fasten studs in place by taking two turns of 16-gage soft iron wire around the cage. The thrust plate cages may be pushed into their final position by hand. If not, then feed the rack shaft slowly so that the plates and collars are drawn into their proper place.

k. Auger.—Raise main boring case into normal vertical position, and place auger on the ground directly under end of rack shaft. Slip bumper spring over end of rack shaft. Put power on the earth borer with truck transmission in *reverse gear*. Lower shaft slowly, entering the end of the shaft into the socket in the auger. Continue to feed the shaft downward, pressing auger into position. Replace auger pin and fasten with a loop of .109 iron wire.

19. Adjustments.—*a. Rack shaft.*—The rack shaft may become bent in service, and should be removed and straightened cold to prevent splitting in the rack shaft carrier or other damage. *Under no conditions will heat be applied to the shaft.* The shaft, if bent, will usually be found to be bent in two planes; that is, the tooth side will be concave, or hollow, and one of the adjacent sides will also be concave. This combination of bends will also result usually in the shaft showing a slight twist. An axle straightening machine or a hydraulic press, capable of no less than 70 tons pressure, should be

used to straighten the shaft. Remove shaft, lay it on a flat surface and determine direction and amount of the bend. Lay shaft on the press bed so that the beginning of the bend is about at one end of the bed. Block shaft up at either end of the press bed with 1-inch thick steel blocks. Run press ram down until it touches a 1-inch thick block laid on the shaft. Apply pressure to spring the shaft about $\frac{3}{4}$ -inch out of line. Hold the pressure. A large flat block about 1 inch by 4 inches by 4 inches should be held on the top surface of the shaft close to the ram, with a long pair of tongs. Strike this block about twice with a 12- or 16-pound sledge. Repeat on other side of ram. Release pressure and measure the amount of bend. Move rack shaft 1 foot along the bent portion, and repeat above procedure until the shaft is straight. Straightening the shaft on both bent faces will remove the twist. Care must be taken in setting up the job so that the shaft cannot be bent too far or accidentally slip off the blocks. Attempts to do the job too quickly may result in injury to personnel and damage to the rack shaft.

b. Clutches.—When the movement in the clutch throw collars becomes excessive, add one stationary (outer) plate to the drive side. This addition will decrease the lever movement $2\frac{1}{2}$ inches.

c. First reduction drive pinion.—Shims placed behind the bearing and between the lock washer and nut, and between the nut and shaft end, at the clutch case cap end of shaft, will adjust the pinion.

d. Feed idler gear.—Shims between the feed idler gear upper bearing and the rack carrier seat adjust backlash of the bevel spur pinion. If too tight, add shims. A slight amount of backlash is necessary.

e. Second reduction feed and drive gears.—If the backlash of both the second reduction drive and feed pinions is insufficient, add more shims between the lower bearing spacer and the lower Timken bearing.

f. Rack carrier in boring case.—Shims placed between the top end of the rack carrier seat and the upper Timken bearing will adjust the play of the rack carrier in the case. Removal of the handhole cover will permit the shim thickness to be measured.

g. Leveling worm.—Take up play in worm by adjusting threaded bushing, using special tool EA-2398 (fig. 10). Line up setscrew hole in bushing flange and replace setscrew to hold bearing in proper location. Shims between the worm housing and the boring head case adjust the mesh of the worm and worm-wheel segment.

h. Chain drive.—There should be no looseness in the chain. To adjust, loosen pillow block mounting screws and turn adjusting

screw until all looseness in the chain is removed, then tighten mounting screws securely.

SECTION V

LIST OF REPLACEABLE PARTS

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20. List of replaceable parts.—a. *Earth borer equipment HD and maintenance equipment ME-14.*—The last column in the following list shows the number of spare parts which form maintenance equipment ME-14. There are no Signal Corps stock numbers for the items in this parts list.

(1) Auger assembly, 9-inch.

Reference number (Mfr's part number)	Name	Function	Description	Mfr's drawing number	Mfr.	Spares (ME-14)
99-E-2	Pin	Auger		99-E-2	H. T.	20.
99-E-4	Bolt	Auger point		99-E-4	"	20.
155-A-26	Frame	Auger	9 inches	155-A-26	"	
240-B-81	Point and blade.	Auger		240-B-81	"	30.

(2) Auger assembly, 12-inch.

99-E-2	Pin	Auger		99-E-2	H. T.	20.
99-E-4	Bolt	Auger point		99-E-4	"	20.
128-E-14	Bolt	Auger blade		128-E-14	"	60.
175-A-4	Frame	Auger	12 inches	175-A-4	"	
182-A-38	Plate	Auger thrust		182-A-38	"	20.
210-B-82	Point	Auger		210-B-82	"	30.
128-E-7	Blade	Auger		128-E-7	"	60.

(3) Auger assembly, 16-inch.

99-E-2	Pin	Auger		99-E-2	H. T.	20.
99-E-4	Bolt	Auger point		99-E-4	"	20.
128-E-14	Bolt	Auger blade		128-E-14	"	60.
155-A-14	Frame	Auger	16 inches	155-A-14	"	
158-A-38	Plate	Auger thrust		158-A-38	"	20.
210-B-82	Point	Auger		210-B-82	"	30.
216-B-55	Blade	Auger		216-B-55	"	60.

(4) Auger assembly, 20-inch.

Reference number (Mfr's part number)	Name	Function	Description	Mfr's drawing number	Mfr.	Spares (ME-14)
99-E-2	Pin	Auger		99-E-2	H. T.	20.
99-E-4	Bolt	Auger point		99-E-4	"	20.
121-E-59	Bolt	Auger blade		121-E-59	"	60.
149-A-70	Frame	Auger	20 inches	149-A-70	"	
150-A-48	Plate	Auger thrust		150-A-48	"	20.
210-B-82	Point	Auger		210-B-82	"	30.
210-B-67	Blade	Auger		210-B-67	"	60.

(5) Boring head assembly.

EA-659	Lock	Rack		EA-2575	H. T.	2.
EA-666	Shaft	Rack lock		"	"	2.
EA-1001	Carrier	Rack		"	"	
EA-1002	Case	Boring		"	"	
EA-1006	Cap	Boring case		"	"	
EA-1008	Nut	Rack shaft carrier upper		"	"	
EA-1068	Cage	Rack thrust plate		"	"	2.
EA-1069	Spacer	Rack carrier lower bearing		"	"	2.
EA-1070	Plate	Rack thrust	Large	"	"	90.
EA-1071	"	"	Small	"	"	30.
EA-1072	Shaft	Rack thrust roller		"	"	2.
EA-1073	Roller	Rack thrust		"	"	2.
EA-1074	Shaft	Rack pinion		"	"	2.
EA-1075	Bearing	Rack thrust roller shaft		"	"	
EA-1077	Stud	Rack thrust plate	Long	"	"	15.
EA-1078	"	"	Short	"	"	5.
EA-1087	Plate	Inspection		"	"	
EA-1093	Shaft	Auger rack	13 feet	"	"	
EA-2348	Screw, set	Cone point		"	"	
EA-2362	Shim	Rack carrier lower bearing		"	"	3 sets.
EA-2394	Wheel	Leveling worm		"	"	2.
EA-2417	Gear	Feed idler	34 teeth	"	"	

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EA-2419	Segment	Case retaining ring		"		
EA-2423	Gear	Auger drive	42 teeth	"		
EA-2425	Pinion	Rack	12 teeth	"		
EA-2426	"	Feed bevel spur	13 to 16 teeth	"		10.
EA-2427	Spacer	Upper cap		"		1.
EA-2428	Shaft	Bevel spur pinion		"		3 sets.
EA-2429	Washer	Bevel spur pinion thrust		"		2.
EA-2430	Bolt	Drive gear		"		6.
EA-2431	"	"		"		18.
EA-2432	"	"		"		3.
EA-2433	Retainer	Rack pinion felt		"		4.
EA-2434	Felt	Rack pinion		"		8.
EA-2435	Shim	Auger drive gear		"		1 set.
EA-2436	Cover	Hand hole		"		6.
EA-2437	Pin	Thrust washer stay		"		
EA-2438	Screw, cap	Boring case segment		"		
EA-2439	Nut	Rack shaft carrier lower		"		
EA-2440	"	Feed idler gear bearing adjusting		"		3 sets.
EA-2441	Shim	Rack carrier upper bearing		"		2.
EA-2442	Washer, lock	Feed idler gear bearing adj. nut		"		1 set.
EA-2443	Shim	Rack lock shaft		"		
EA-2444	Screw	Rack lock spring		"		
EA-2445	Stud	Rack lock		"		4.
EA-2446	Spring	Rack shaft		"		
EA-2447	"	Rack pinion shaft		"		2.
EA-2448	Nut	Feed idler gear		"		2.
38556	Bearing			Timkin or equiv.		
74537	"	Rack carrier	Cone	"		
74850	"	Rack carrier bearing	Cup	"		
663512	Seal, oil	Boring case cap		C. R. Co		4.
Acid shed	Bearing	Feed bevel spur pinion	Short	Gwiliam		2.
Acid shell	"	"	Long	"		2.
Acid sherry	"	Rack pinion bearing		"		6.

(6) Clutch and brake assembly.

Reference number (Mir's part number)	Name	Function	Description	Mir's drawing number	Mfr.	Spares (ME-14)
EA-311	Washer	Sprocket retainer	Long	EA-2576	H. T.	
EA-1011	Case	Clutch		"	"	
EA-1016	Shell	Main drive gear and clutch		"	"	
EA-1017	Hub	Clutch and brake		"	"	
EA-1018	Collar	Throw		"	"	
EA-1042	Shell	Brake		"	"	
EA-1044	Cap	Clutch case		"	"	
EA-1045	Sleeve	Drive		"	"	
EA-1047	Collar	Shift shaft		"	"	
EA-1048	Spacer	Brake		"	"	
EA-1049	Spacer	Clutch		"	"	
EA-1051	Shaft	Clutch shift		"	"	
EA-1055	Shaft	Idler gear		"	"	
EA-1057	Pin	Bell lever		"	"	
EA-1058	Rod	Drive control	Long	"	"	1.
EA-1059	"	Feed control	Short	"	"	2.
EA-1060	Lever	Drive clutch		"	"	
EA-1061	"	Feed clutch		"	"	
EA-1062	"	Drive control		"	"	
EA-1063	"	Feed control		"	"	
EA-1064	"	Drive bell		"	"	
EA-1065	Link	Link		"	"	
EA-1066	Pin	Control lever		"	"	
EA-1067	Bracket	Control		"	"	
EA-1081	Plate	Clutch	Outer	EA-2576	"	3 sets.
EA-1082	"	"	Inner	"	"	3 sets.
EA-1083	Fork	Clutch shift		"	"	2.
EA-1085	Lever	Feed bell		"	"	
EA-1114	Bushing	Idler gear		"	"	
EA-1259	Shaft	Drive gear		EA-2576	"	
EA-1654	Washer, lock	Feed tube lock nut		"	"	
EA-2034	Sprocket	Drive	18 teeth	"	"	6.

EA-2342	Gasket	Oil seal retainer.	"	"	
EA-2343	Lever	Control	EA-2576	"	
EA-2344	Spacer	Drive gear	"	"	
EA-2351	Key	Sprocket	"	"	
EA-2352	"	Clutch drive gear	"	"	
EA-2357	Gear	Clutch drive	"	"	2.
EA-2361	"	Idler	"	"	1 set.
EA-2364	Cover	Clutch case	"	"	5.
EA-2365	Shim	Clutch drive shaft	"	"	
EA-2402	Shoe	Clutch throw	"	"	
EA-2403	Pin	Clutch throw shoe	"	"	
EA-2406	Gasket	Clutch case cover	EA-2576	H. T.	2.
EA-2454	Shim	Drive shaft and feed tube bearing	"	"	1 set.
EA-2489	Nut	Idler shaft and drive shaft	"	"	
EA-2490	Nut, lock	Drive shaft and drive shaft	"	"	1.
EA-2491	Washer, lock	Drive sleeve	"	"	1.
EA-2492	Key	Feed tube	"	"	2.
EA-2493		Drive sleeve, drive shaft and feed tube.	"	"	
EA-2494	Retainer	Bearing and oil seal	"	"	1.
EA-2495	"	Bearing	"	"	
EA-2496	Plug	Clutch case cover	"	"	
313-M	Bearing	Clutch shell	"	S. R. B. or equiv.	
313-MF	"	Feed tube	"	"	
407-M	"	Drive gear shaft	"	"	
A-1-208	Seal, oil	Bearing retainer	"	Universal	2.
XA-10219	Bushing	Shift shaft	"	H. T.	2.

(7) Intermediate and main supporting case assembly.

EA-1003	Case	Intermediate	EA-2575	H. T.	1.
EA-1004	Pinion	Second reduction drive	"	"	5.
EA-1007	"	Second reduction feed	EA-2574	"	
EA-1019	Case	Main supporting, intermediate case end (front).	"	"	
EA-1020	"	Main supporting, clutch case end (rear).	EA-2576	"	

(7) Intermediate and main supporting case assembly—Continued

Reference number (Mfr's part number)	Name	Function	Description	Mfr's drawing number	Mfr.	Spares (ME-14)
EA-1053	Shaft	Feed clutch		EA-2576	H. T.	2.
EA-1054	"	Drive clutch		"	"	
EA-1076	Tube	Main supporting case		"	"	
EA-1079	Hub	First reduction feed gear		EA-2575	"	
EA-1084	Cover	Intermediate case cap		"	"	
EA-1086	Cap	Intermediate case		"	"	
EA-2341	Gasket	Intermediate case cap cover		"	"	
EA-2349	Plate	Inspection		EA-2574	"	2 sets.
EA-2350	Shim	Second reduction feed pinion		EA-2575	"	1.
EA-2363	Coupling	Clutch feed pinion shaft		EA-2575	H. T.	(24) 1 set.
EA-2383	Bearing	Second reduction feed pinion roller		EA-2574	"	2.
EA-2408	Gasket	Inspection plate		EA-2574	"	1.
EA-2420	Gear	First reduction feed	42 teeth	EA-2575	"	2.
EA-2421	Pinion	First reduction feed	18 teeth	EA-2574	"	1.
EA-2422	Pinion	First reduction drive	12 teeth	"	"	2.
EA-2424	Gear	First reduction drive	28 teeth	EA-2575	"	1.
EA-2448	Nut	Second reduction feed pinion		"	"	2.
EA-2449	Spring	Second reduction drive pinion bearing lock nut.		"	"	
EA-2450	Nut	First reduction feed gear adjusting		"	"	
EA-2451	Spring	First reduction drive gear adjusting nut lock.		"	"	2.
EA-2452	Key	First reduction drive gear		"	"	
EA-2453	Spacer	Drive gear		"	"	
EA-2454	Shim	First reduction drive gear and feed gear.		"	"	2 sets.
EA-2455	Shim	First reduction drive gear double row bearing.		"	"	2 sets.
EA-2456	Shim	Second reduction drive pinion bearing.		"	"	2 sets.
EA-2457	Nut, lock	Second reduction drive pinion bearing.		"	"	

EA-2458	Flange	Intermediate case bearing retainer			
EA-2459	Key	First reduction drive pinion	EA-2574	"	2.
EA-2460	Nut	Drive clutch shaft	"	"	
EA-2461	Collar	Clutch feed pinion shaft coupling	"	"	
EA-2462	Ring	Clutch feed pinion shaft coupling lock.	"	"	
EA-2463	Shim	Clutch feed pinion bearing	"	"	1 set.
EA-2464	Key	Clutch feed pinion	"	"	2.
EA-2466	Bushing	Drive shaft	"	"	2.
EA-2467	Screw, cap	Main supporting case	"	"	
EA-2468	Bushing	Foot	"	"	
EA-2469	Base	Rear mounting	EA-2575	H. T.	
EA-2470	Base	Front mounting	EA-2576	"	
313-M	Bearing	First reduction feed gear hub	"	S. R. B. or equiv.	
315-MF	Bearing	Second reduction drive pinion	EA-2575	"	
5213-K	Bearing	First reduction drive gear double row	"	"	
5215-F	Bearing	First reduction feed pinion	EA-2574	"	
5306	Bearing	First reduction feed gear	EA-2575	"	

(8) Derrick and sheave assembly.

EA-525	Ring	Rack lock cam	EA-2386	H. T.	2.
EA-526	Stud	Rack lock cam ring	"	"	
EA-527	Handle	Rack lock cam ring	"	"	
EA-1094	Cap	Derrick tube	"	"	
EA-1095	Screw, cap	Derrick tube and sheave	"	"	
EA-1099	Base	Derrick tube support	"	"	
EA-1107	U-bolt	Sheave	"	"	
EA-2366	Tube	Derrick	"	"	
EA-2367	Bracket	Sheave anchor	"	"	
EA-2481	Spacer	Rack sheave	"	"	2.
EA-2482	Bushing	Rack sheave	"	"	2.
EA-2483	Screw	Rack shaft guide	"	"	2.
EA-2484	Pin	Rack shaft guide	"	"	2.
EA-2485	Cover	Rack sheave	"	"	

(8) *Derrick and sheave assembly—Continued.*

Reference number (Mir's part number)	Name	Function	Description	Mfr's drawing number	Mfr.	Spares (ME-14)
EA-2486	Block	Rack sheave support		EA-2386	H. T.	
EA-2487	Sheave	Rack		"	"	
EA-2488	Guide	Rack shaft		"	"	

(9) *Strap sheave assembly.*

EA-2498	Sheave	Sheave		190-A-7	H. T.	2.
EA-2499	Spacer	Sheave		"	"	2.
EA-2500	Bushing	Sheave		"	"	
EA-2501	Pin	Dowel		"	"	
EA-2502	Strap	Sheave		"	"	
EA-2503	Pin	Sheave		"	"	
EA-2504	Bolt, eye	Sheave		"	"	
EA-2505	Bolt	Sheave		"	"	

(10) *Snatch sheave assembly.*

109-E-63	Pin	Sheave		176-A-88	H. T.	
119-E-58	Spacer	Sheave		"	"	
119-E-60	Bolt	Sheave		"	"	
176-A-78	Housing	Sheave		"	"	
EA-2498	Sheave	Sheave		"	"	
EA-2500	Bushing	Sheave		"	"	

(11) *Leveling worm assembly.*

EA-1080	Shaft	Leveling worm		EA-2574	H. T.	1.
EA-2393	Worm	Leveling		"	"	1.

EA-2416	Bearing	Worm shaft locking	"	"	4.
EA-2471	Shim	Worm housing	"	"	2 sets.
EA-2472	Bearing	Worm adjusting	"	"	4.
EA-2473	Washer	Worm thrust	"	"	4.
EA-2474	Stud	Worm housing mounting	"	"	
EA-2475	Washer	Worm housing cap screw	"	"	4.
EA-2476	Screw, cap	Worm housing mounting	"	"	12.
EA-2477	Key	Worm shaft	"	"	2 sets.
EA-2478	Screw, set	Worm thrust washer	"	"	1.
EA-2479	Shim	Worm housing	"	"	
EA-2480	Housing	Worm	"	"	

b. Tool equipment TE-64 (see fig. 10).

EA-21	Wrench	Ratchet for level adjusting	155-A-24, Plate 11.	H. T.-----
EA-2395	Wrench	Spanner, for EA-2440 nut	"	"
EA-2397	Wrench	Spanner, for EA-2363 coupling	"	"
EA-2398	Wrench	Leveling worm adjustable bearing	"	"

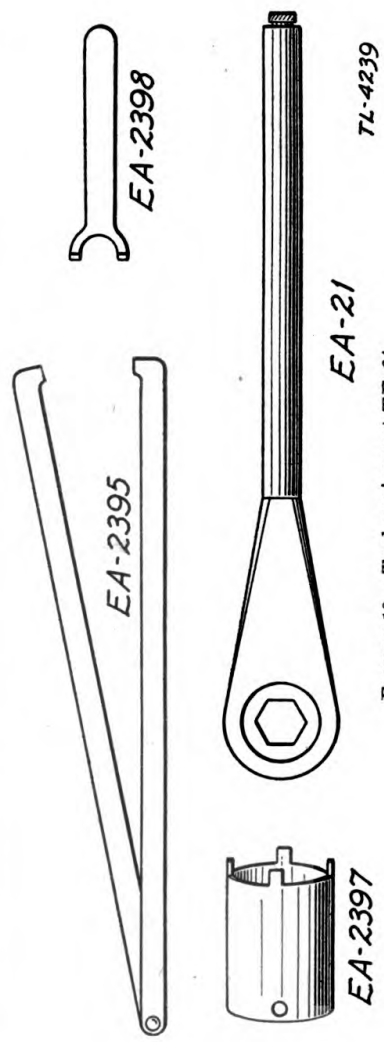


FIGURE 10.—Tool equipment TE-64.

21. List of manufacturers.

Abbreviation	Name	Address
C. R. Co.	Chicago Rawhide Company	Chicago, Ill.
Gwilliam	Gwilliam Bearing Company	360 Furman St., Brooklyn, N. Y.
H. T.	Highway Trailer Company	Edgerton, Wisconsin
S. R. B.	Standard Steel & Bearing Company	Plainville, Conn.
Timken	Timken Roller Bearing Company	Canton, Ohio
Universal	Universal Oil Seal Company	Pontiac, Michigan.

CHAPTER 3
WINCH EB18RRC-86 OR L18RRC-86

SECTION I
GENERAL

Description ----- Paragraph 22

22. Description.—*a.* The winch (fig. 11) has an 18-inch drum with 19-inch flanges mounted on a shaft supported on a hanger and a housing containing the winch worm and wheel. Two 5-inch

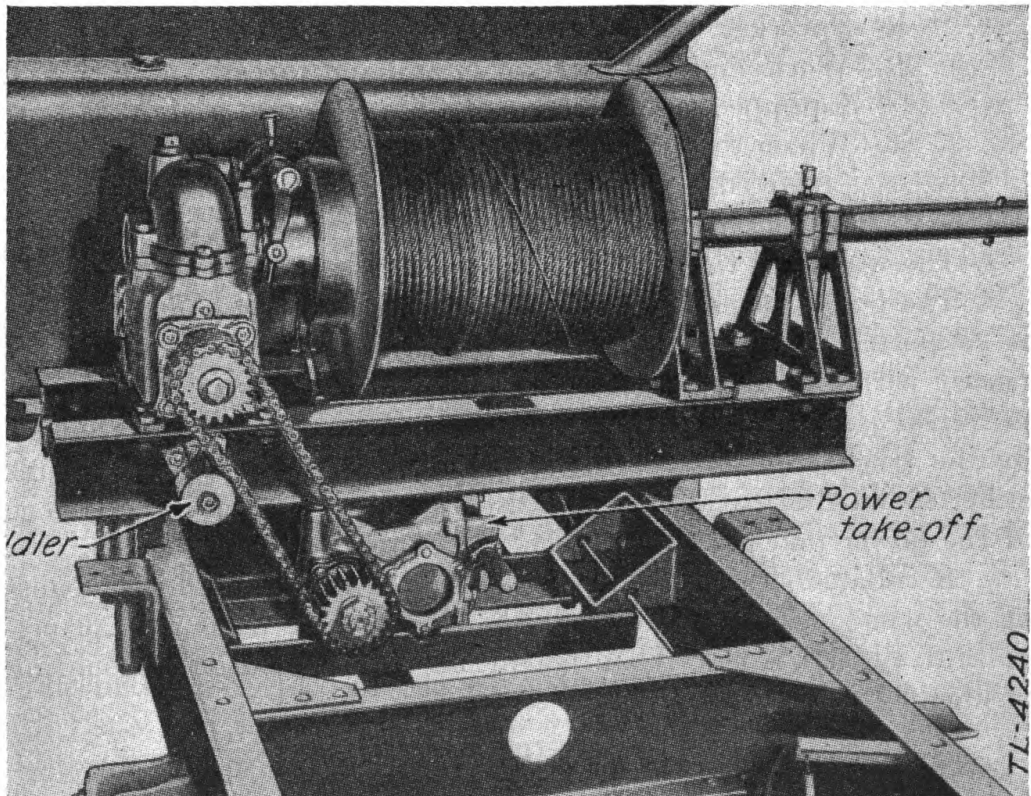


FIGURE 11.—Winch EB18RRC-86 or L18RRC-86.

I-beams form the winch base, which is fastened with long studs to mounting brackets attached to the truck frame. Winches EB18RRC-86 and L18RRC-86 are identical except that winch EB18RRC-86 is mounted in an offset position in relation to the centerline of the truck, and that portion of the winch base that overhangs the truck frame is reinforced.

b. The winch has a combination clutch and brake operated by means of a single control lever mounted inside the truck cab. An

automatic brake operates to hold a load suspended when the load is brought to a stop.

c. A pull of 10,000 pounds for limited periods at slow speeds is possible with this winch.

d. The model designation EB18RRC-86 or L18RRC-86 is described as follows:

L—Worm and worm wheel housing assembled to left of winch drum on base.

EB—Indicates winch is for use with earth borer equipment, is mounted to right of centerline of truck, and requires reinforcement of the portion of winch base that overhangs right frame member of truck.

18—Drum is 18 inches long between flanges.

R—Sprocket (on worm shaft) is toward rear of truck.

R—Worm and wheel are of right-hand thread.

C—Equipped with clutch.

86—Winch drum shaft is extended to be flush with the outside edge of 86-inch wide body, for mounting of power reel CR.

e. The weight of the winch is approximately 500 pounds.

f. The power take-off P is mounted directly under the winch and is supported on brackets fastened to the truck frame. It is connected with the main shaft of the transfer case through a double universal joint. This permits the use of all the gear ratios afforded by the truck transmission when driving the winch or earth borer either forward or backward. Figure 3 shows the operating positions of the power take-off lever, which is mounted in the truck cab.

g. A collapsible power take-up reel CR is provided which mounts on the winch drum shaft outside the truck body. It is used principally to pull in wire. When not in use it is carried on a mounting inside the truck body.

SECTION II

EMPLOYMENT

	Paragraph
Power take-off P-----	23
To raise a load-----	24
To lower a load-----	25
Winch rope-----	26
Power reel CR-----	27

23. Power take-off P.—a. The farthest rear position of the take-off lever (see fig. 3) is the earth borer position. In that position, power is furnished to the earth borer. The next forward posi-

tion is a neutral position. The middle position engages the winch drum and all forward speeds of the truck transmission are available to drive the drum forward, or "winding up." The direction of rotation of the drum can be reversed by leaving the lever as it is and placing the transmission in reverse gear, but this is not desirable because the truck engine must be raced to unwind rope from the drum at any appreciable speed.

b. The next forward position is another neutral position. The farthest forward position of the take-off lever is the winch reverse gear. In this position all speeds of the transmission are available and the winch drum will revolve backward. This gear should be used for short periods only, as its continued use may result in overheating in the worm housing.

c. When the power take-off gears are properly meshed, or in neutral, a small detent drops into a notch in the shifter shaft. The operator will become familiar with the "feel" in a short time and will readily find the proper positions of the power take-off lever.

d. The power take-off P and the truck transmission are arranged so that, when conditions require, the truck and winch may be operated at the same time. This should be done only in an emergency when the help of the winch is required to move the truck. Place the power take-off lever in the "winch forward" position and the truck transfer case lever in the "low" position. With the truck transmission in a forward gear, the truck can be driven forward at the same time that the winch is revolving.

24. To raise a load.—Start the engine, depress truck clutch pedal, and shift transmission to the desired forward speed in the usual manner. Allow pedal to return momentarily to normal and depress it again, "slipping" the clutch. Place power take-off lever in the "winch forward" position. Allow pedal to return to normal slowly, as the engine takes the load. At the same time, depress accelerator pedal until the winch is revolving at the desired speed. When the load is at the desired height, depress clutch pedal to stop the winch. Place power take-off lever in a neutral position. Set pole derrick supports when required as covered in paragraph 8*c*.

25. To lower a load.—Depress clutch pedal, shift transmission lever to the desired speed, and move power take-off lever to the winch reverse position. Allow clutch pedal to return slowly to normal, and depress accelerator pedal until the desired speed is reached.

Caution: In operating the winch, the left foot shall be kept on the clutch pedal in readiness for a quick stop. The drum should cease

revolving when the clutch pedal is fully depressed. If it does not stop instantly, the condition should be reported immediately.

26. Winch rope.—*a. Rope capacity.*—The rope capacity of the winch is as follows:

5/16-inch diameter wire rope.....	2,500 feet
3/8-inch diameter wire rope.....	2,000 feet
7/16-inch diameter wire rope.....	1,200 feet

b. Sizes and use of wire rope.

Size (inch)	Kind of steel	Type of lay	Maximum load capacity (pounds)	General use
5/16	Cast.....	Fixed	13,000	General telephone construction work, such as cable placing and pole line construction. Do. For use on power reel CR in placing lengths of aerial cable where long lengths of winch rope are necessary.
3/8	Improved plow.....	do	12,200	
5/16	do.....	do	8,000	

c. Winch rope speeds.—The following table shows the approximate winch rope speeds in feet per minute which can be obtained. These speeds will vary slightly with different engine speeds and different gear ratios.

Rpm.....	Rope speed in ft/min with power take-off lever in "winch forward" drive and transmission in—					Rope speed in ft/min with power take-off lever in "winch reverse" drive and transmission in—				
	1st	2d	3d	High	Rev	1st	2d	3d	High	Rev
Low speed 700 rpm.....	30	45	75	150	25	35	60	95	190	30
Med. speed 1,200 rpm.....	50	95	150	255	35	65	100	180	320	45

d. Winch rope sheaves.—See paragraph 11 for use of the winch rope sheaves.

27. Power reel CR.—*a.* To mount the power reel CR on the winch shaft, place reel spindle on shaft and engage pin in winch shaft in reel spindle grooves. Push reel toward the truck body as far as possible and turn reel to the left as far as possible. The reel is held in position by pressure of the reel spindle spring against the end of the winch

shaft. Reverse this procedure when it is desired to remove the reel from the winch shaft.

b. The winch shall be driven with the power take-off lever in the "winch forward" drive position at all times when using the power reel, so that the reel turns clockwise as viewed from a position facing the mounted reel. Place the truck so that the reel will be in line with the load to be pulled.

c. To remove a coil of wire or rope from the power reel, collapse the reel by turning the handle counterclockwise, after which the coil may be readily removed. The reel is extended to its full diameter by pulling the small spider toward the handle end of the reel spindle until the lugs on the handle pick up the grooves in the spider hub and turning the handle clockwise to the limit of its travel.

d. The reel CR will hold either 200 pounds of wire or 1,500 feet of 5/16-inch improved plow steel wire rope.

SECTION III

DETAILED FUNCTIONING OF PARTS

Combination clutch and brake.....	Paragraph 28
Worm brake.....	29

28. Combination clutch and brake.—a. The combination clutch and brake is mounted on the winch shaft between the worm housing and the drum flange. It consists of a flanged collar, the edge of the flange having teeth cut in it to match teeth cut in a projection on the drum flange. The flanged collar is faced with brake lining. The clutch and brake mechanism is moved on the winch shaft by means of a handle mounted in the truck cab. The normal position in use is with the clutch teeth engaged. Operating the handle forward to the "de-clutch" position disengages the clutch and puts the device in the de-clutch or neutral position. A further forward movement of handle applies the brake and tends to stop rotation of the drum. This brake is not designed to stop the drum instantly but is only to slow it down sufficiently to prevent the winch rope from becoming entangled when paid off the drum by hand.

b. When the brake has been applied and the lever released, spring pressure causes the lever and the clutch assembly to return to the "de-clutch" position. The clutch, when in the engaged position, locks in place and cannot be disengaged as long as there is a load on the winch.

29. Worm brake.—In addition to the clutch brake, the winch is equipped with a worm brake that is automatic in operation. The worm brake operates immediately when the load on the winch line is brought

to a stop. The load tends to make the drum revolve backward and, as the worm wheel tries to turn, it pushes the worm gear forward in its case. This action draws a disk on the end of the worm shaft against a lined plate mounted on the worm housing, preventing rotation of the worm gear.

SECTION IV

SERVICING AND REPAIR

	Paragraph
Lubrication-----	30
Repairs-----	31

30. Lubrication.—*a. Power take-off.*—The oil capacity of the case is 7 pints. Fill through the hole in the top of the case with SAE 90 gear oil. The level of oil is checked by removing check plug on the side of the case. The oil should reach this level. Lubricate the pillow block housing fitting with SAE 90 gear oil. Lubricate the universal joints and slip joint fittings with light grease weekly.

b. Winch.—(1) The lubricant to be used for the winch worm gear is Jesco No. 22 lead soap lubricant. This lubricant consists of a lead soap suspended in a high grade mineral oil. If this is not available, use SAE 90 gear oil or universal joint lubricant, No. 1 grade. The Jesco lubricant is especially useful for lubricating the winch worm gear because it conducts the generated heat away from the gears more rapidly than a plain oil, and maintains its lubricating qualities at high temperatures. It will, therefore, permit operation of the winch at its maximum allowable capacity for a longer period than would be possible with a plain oil.

(2) Maintain the level of the lubricant in the worm gear case at the height of the oil level plug when the worm gear is not rotating. If the level of the lubricant is too high in the worm gear case, the lubricant will flow out at the bearings. If the level is too low, the gears, thrust washers, and bearings will not receive sufficient lubrication and will wear excessively. The vent in the oil filler plug must be kept clear of obstructions at all times. If the vent becomes clogged, pressure will build up in the worm gear case and force the lubricant out at the bearings.

(3) Drain lubricant from each winch worm gear case and replace with fresh lubricant when major repairs are made to the truck engine or to the winch. *Do not flush the winch worm gear case.* Flushing the gear case will result in dilution of the worm gear lubricant and insufficient lubrication of the worm gear.

(4) Every day, before the winch is operated, remove oil level plug from each worm gear case, and inspect each case as to the level of the

lubricant. If the level of the lubricant is below the oil level plug, remove oil filler plug and add enough lubricant to bring the level of the lubricant up to the height of the oil level plug. Replace both plugs.

(5) Lubricate chain adjustment idler fitting with light grease weekly. Wick oil cups are provided at all other wearing points. Fill these cups with the same grade of oil as is used in the truck engine once every week of service.

(6) Lubricate the chain with a light transmission oil. It should be applied to the inside of the chain. Remove the chain occasionally, wash in kerosene, and then soak in heavy oil for 30 minutes.

31. Repairs.—Requisitions for repair parts should contain the serial number of the winch, the manufacturer's name, and the drawing number of the required part. The serial number of the winch and the power take-off will be found on plates mounted on the winch base and on the power take-off case. The manufacturer's name is also stamped on these plates. Drawing numbers may be found in paragraph 32.

a. Chain.—The chain is adjusted so that it is tight when the winch is installed. If properly lubricated, long service life may be expected. The chain can be used until slack causes a noticeably uneven drive. The adjustable idler should then be loosened and moved firmly against the chain and the lock bolt tightened. When the limit of adjustment has been reached, the chain must be replaced when next it needs tightening. The connecting link consists of two pins and two outside plates connecting them. To remove the chain, pull the two cotter pins, lift off loose outer plate, withdraw the other plate with its two pins, and remove the D-shaped bushing.

b. Sprocket.—(1) The winch sprocket is a light press fit on the worm shaft. To remove it, drive the sprocket about $\frac{1}{8}$ inch toward the worm housing and remove tapered sprocket key. The sprocket can then be removed. It may sometimes be necessary to use a gear puller.

(2) When remounting the sprocket, care should be taken to locate it on the worm shaft in proper relation to the driving sprocket on the power take-off by testing with a straightedge across the faces of both sprockets. Make the check with the worm turned until it takes a position as far toward the front of the truck as it will go. Drive the winch sprocket on the worm shaft with a brass punch or soft hammer, and set $\frac{1}{8}$ inch farther toward the rear of the truck than the driving sprocket.

c. Worm wheel.—(1) To remove the worm wheel, disconnect vertical clutch control rod, remove worm housing cover and drum shaft hanger caps. Drum shaft assembly can then be lifted out. Remove tie wire and anchor screws which extend through the hub of the worm wheel into the drum shaft. The worm wheel can then be pulled off the worm shaft. If necessary to use a press to remove the worm wheel from the shaft, it is advisable first to remove the winch drum. This can be done by taking out the $\frac{3}{4}$ -inch pin near the end of the shaft, allowing the drum to slide off.

(2) When installing a new worm wheel, press it on the drum shaft over the keys until the anchor holes in the worm wheel line up with those in the shaft. Replace anchor screws and lock with tie wire.

d. Drum shaft.—(1) To replace the drum shaft, remove the shaft and worm wheel assembly, as described in *c* above, then remove clutch as follows: Take out hex head retaining screw and flush type pipe plug. Revolve detent sleeve on the hub until the ball bearings, detents, and detent spring can be removed through the hole formerly occupied by the pipe plug. The clutch assembly can then be removed from the shaft.

(2) When installing a worm wheel on a new drum shaft, set assembly in the winch with clutch in the neutral position. Locate worm wheel so there will be a 1-inch space between the end of the clutch hub and the face of the worm wheel housing. Then, using the anchor screw holes in the worm wheel as a guide, drill into the shaft about $\frac{5}{16}$ inch deep, a $\frac{5}{16}$ -inch drill, and install the anchor screws.

e. Worm.—(1) To replace the worm, it is generally necessary to remove the complete winch from the truck, due to lack of working space. If the construction of the body does not readily permit lifting the winch out of the winch compartment, the drum and drum shaft assembly should be removed as described in *c* above; the work housing with the worm in it can then be removed from the I-beam base.

(2) After the sprocket has been removed from the worm shaft, take out the four cap screws holding the worm brake assembly at the opposite end of the housing and pull worm with assembly out of housing.

f. Automatic worm brake.—(1) To remove and replace the worm brake assembly, proceed as follows: Remove the 1-inch cap screws from from the small cover plate. Turn a $\frac{5}{16}$ -24 cap screw about $1\frac{1}{4}$ inches long into the hole in stop pin which will be found in one of the four holes in the brake nut. Stop pin can then be pulled out and worm threaded free from worm brake assembly. Remove stop sleeve from the old worm and, after riveting it on the new worm, thread worm back into brake assembly. Turn brake nut onto worm as far as it

will go, then back it off until the face of the brake toward the lining is $1\frac{5}{16}$ inches from the back face of the bearing cage, or $2\frac{1}{2}$ inches from the face of the worm housing. Now replace stop pin, putting it in the hole closest to the stop sleeve on the side away from the stop in a clockwise direction with the endplay in the worm (which is $\frac{3}{16}$ to $\frac{1}{4}$ inch) toward the worm brake. Rotate brake nut by hand so its direction of travel is toward the center of winch and continue until it strikes the stop and will rotate no farther. With brake nut in this position, adjust backing plate with the six cap screws, leaving about $\frac{1}{16}$ -inch clearance between backing plate and brake plate with brake lining attached. Lock the six cap screws with the jam nuts and replace brake nut cover plate.

(2) When the worm brake lining becomes oily or glazed or worn out and the winch fails to hold load, the lining can be replaced without removing the worm, as follows: Loosen the six jam nuts and remove the six $\frac{3}{8}$ -inch spring tension screws from their seat in the bearing cap. The backing plate and the brake plate to which the brake lining is riveted can now be removed. Rivet new lining onto the brake plate and replace parts in their original positions. Do not lock jam nuts until the brake has been adjusted in the following manner: Force worm in worm housing toward worm brake end of housing; that is, take up end play of the worm in the direction toward truck cab when assembly is mounted. Screw brake flange toward center of winch until it strikes the stop and then, by means of the six spring tension screws, leave about $\frac{1}{16}$ -inch clearance between backing plate and brake plate to which the lining is attached. Lock jam nuts in position.

g. Oil seal.—The oil seal, located at each end of the worm housing, cannot be adjusted and if oil leaks at either end of the housing, the oil seal should be replaced. Care should be exercised to avoid injury to oil seals when replacing a worm in the worm housing.

SECTION V

LIST OF REPLACEABLE PARTS

	Paragraph
List of replaceable parts.....	32
List of manufacturers.....	33

32. List of replaceable parts.—The last column shows the spare parts which form maintenance equipment ME-16. There are no Signal Corps stock numbers for the items in this parts list.

a. Winch clutch and brake assembly.

Reference number (Mfr's part number)	Name	Function	Description	Mfr's drawing number	Mfr.	Spares (ME-14)
196-A-41	Bracket	Clutch lever		169-A-45	A. C. B	6.
123-E-42	Detent	Clutch		"	"	
239-B-67	Fork	Clutch operating		"	"	
123-E-62	Key	Clutch shaft		"	"	
104-E-54	Key	Sliding clutch member	.65-.75 carbon steel	"	"	4.
137-E-6	Lever	Hand		"	"	
239-B-60	Lining	Brake		"	"	6.
123-E-44	Pin	Clutch operating fork		"	"	
239-B-66	Plate	Clutch and brake	Cast bronze	"	"	
123-E-41	Ring	Detent sleeve stop		"	"	1.
123-E-60	Screw, cap	Detent sleeve	Std. 3/4" SAE	"	"	2.
133-E-39	Shaft	Clutch		"	"	
239-B-65	Sleeve	Detent		"	"	2.
250-B-28	Socket	Hand lever		"	"	
123-E-61	Spring	Detent		"	"	3.
123-E-43	Spring	Drum shaft		"	"	
	Ball	Detent	Hardened steel, 1 1/32" dia	"	"	6.
	Ball	Detent	Hardened steel, 1 1/16" dia	"	"	
	Bolt	Hand lever	3/8"-16 NC, with nut and lock washer	"	"	
	Cup, oil		1/8" wick	"	"	
	Pin	Hand lever	Steel 1/4" x 1 1/2", drive fit	"	"	
	Pin	Hand lever	No. 6 taper, 1 1/2" long	"	"	
	Plug, pipe		1/2", flush type	"	"	
	Rivet	Stop ring	Round head, 3/4" x 5/8"	"	"	
	Rivet	Brake lining	Tubular brass, 3/16" x 3/4"	"	"	
	Rivet	Clutch shaft	Oval head, 1/4" x 1 3/4"	"	"	
	Screw, cap		3/8"-24 x 1", NF with lock washer	"	"	
	Screw, cap		1/2"-20 x 4 1/2", NF with lock washer	"	"	
	Screw, cap		File head, 1/2"-20 x 5/8", NF with shake-proof lock washer.	"	"	
	Washer, lock		1/2" SAE	"	"	
	Washer, plain		3/8", for shims	"	"	

b. Winch drive housing assembly.

104-E-76	Bushing	Bronze	196-A-30	A. C. B.	
176-A-34	Worm wheel cover		"	"	
157-A-89	Bearing		"	"	
119-E-57	Worm wheel housing		"	"	
109-E-59	Stop pin retaining washer		"	"	
109-E-60	Bearing cage	Paper	"	"	
157-A-88	Worm wheel housing	Paper	"	"	
106-E-94	Worm		"	"	
106-E-74	Winch sprocket	.65 to .75 carbon steel	"	"	6.
114-E-8	Worm wheel	.65 to .75 carbon steel	"	"	2.
119-E-41	Brake		"	"	
125-E-16	Worm brake		"	"	
109-E-58	Stop sleeve		"	"	
	Dowel, for worm wheel housing cover.		"	"	
115-E-53	Spring		"	"	
119-E-35	Stop	$\frac{3}{8}$ "-24x3 $\frac{1}{2}$ " SAE cap screw	"	"	6.
238-B-77	Brake lining		"	"	3.
125-E-45	Worm wheel cover		"	"	
238-B-78	Brake pressure		"	"	
119-E-61	For Hyatt bearing		"	"	2.
239-B-29	For Timken bearing		"	"	
119-E-62	Bearing retainer		"	"	
133-E-17	Bearing retainer		"	"	
250-B-79	Sprocket retaining		"	"	
109-E-12	Worm wheel		"	"	
110-E-65	Bearing cage	A2, No. 200	"	Universal	4.
119-E-70	Bearing retainer	A2, No. 208	"	"	4.
119-E-69	Winch sprocket spacing		"	A. C. B.	2 sets.
110-E-66	Worm thrust bearing		"	"	
125-E-23	Worm thrust bearing		"	"	4.
125-E-24	Worm thrust bearing		"	"	8.
239-B-18	Outer bearing		"	"	8.
125-E-15	Stop		"	"	2.
119-E-65	Sprocket		"	"	
114-E-10	Spring	No. 10 wire	196-A-30	"	
114-E-11	Light spring	$\frac{1}{16}$ " dia. wire	"	"	

b. Winch drive housing assembly—Continued.

Reference number (Mfr's part number)	Name	Function	Description	Mfr's drawing number	Mfr.	Spares (ME-14)
224-B-81	Sprocket	Winch driving	19 teeth	196-A-30	A. C. B.	6.
110-E-11	Stud	Brake anchor		"	"	
119-E-38	Thimble	Spring	Small	"	"	
114-E-9	Thimble	Spring		"	"	
119-E-40	Washer	Stop pin retaining		"	"	
119-E-66	Washer	Sprocket retaining		"	"	
104-E-75	Washer	Worm wheel thrust		"	"	
220-B-69	Wheel, worm	Winch	Bronze	"	"	4.
239-B-92	Worm	Winch	Right hand	"	"	
16476	Bearing		Roller	"	"	
53176	Bearing		Roller (cone)	"	Hyatt	1.
53387	Bearing		Roller (cup)	"	Timken	2.
	Nut	Spring pin	$\frac{3}{8}$ "-24 SAE hex.	"	"	
	Nut	Brake anchor stud	$\frac{1}{2}$ "-20 SAE hex.	"	"	
	Pin, cotter	Spring pin	$\frac{3}{32}$ " x $\frac{3}{4}$ "	"	"	
	Plug, pipe	Oil level	$\frac{1}{4}$ "	"	"	
	Plug, pipe	Oil drain	$\frac{1}{2}$ "	"	"	
	Rivet	Brake lining	Flat head tubular, copper or aluminum, $\frac{3}{16}$ " x $\frac{3}{8}$ "	"	"	
	Screw, cap		$\frac{1}{4}$ "-20 x $\frac{1}{2}$ " USS hex. with lock washers.	"	"	
	Screw, cap		$\frac{1}{2}$ "-20 x 1" SAE hex. with lock washers.	"	"	
	Screw, cap		$\frac{1}{2}$ "-20 x $1\frac{1}{2}$ " SAE hex. lock washers.	"	"	
	Screw, cap		$\frac{1}{2}$ "-20 x 2" SAE hex. with lock washers.	"	"	
	Washer	Spring pin	$\frac{3}{8}$ " std. SAE plain	"	"	
	Wire	Locking	No. 17 B&S steel, 6" long	"	"	
	Wire	Locking	No. 17 B&S steel, 14" long	"	"	
	Wire	Locking	No. 17 B&S steel, 22" long	"	"	
	Wire	Locking	No. 14 ga. soft steel, 12" long	"	"	

c. Winch assembly with clutch.

106-E-5	Block	I-beam reinforcing	Bronze	101-W-20	A. C. B	2.
104-E-51	Bushing	Drum	"	"	"	2.
106-E-79	Bushing	Drum shaft hanger	"	"	"	4.
106-E-76	Cap	Drum shaft hanger	"	"	"	
106-E-77	Clamp	Rope	"	"	"	
104-E-52	Collar	Drum thrust	Bronze	"	"	
101-W-17	Drum	Winch	18"	"	"	
165-A-47	Hanger	Drum shaft	"	"	"	
258-B-80	Member	Winch frame	5", 10-lb steel I-beam	"	"	
109-E-58	Pin	Dowel	"	"	"	
110-E-27	Pin	Spindle	"	"	"	6.
152-E-68	Plate	Name	Aluminum	"	"	1.
106-S-34	Shaft	Drum	"	"	"	4.
151-E-89	Spacer	Winch I-beam	"	"	"	
104-E-85	Washer	Drum thrust	Bronze	"	"	
	Bolt, machine	Mounting	$\frac{1}{2}$ "-20 x $1\frac{3}{4}$ " NF with nut, lock and bevel washer.	"	"	
	Cup, oil		$\frac{1}{8}$ " wick	"	"	
	Pin	Drum	No. 7 taper, 4" long	"	"	2.
	Rivets	Hanger	$\frac{1}{2}$ " x $2\frac{1}{2}$ " steel	"	"	
	Screw, cap	Drum	$\frac{1}{2}$ "-20 x 2" NF	"	"	
	Screw, machine		Flat head, $\frac{5}{8}$ "-11 x $1\frac{1}{4}$ " NC	"	"	4.

d. Propeller shaft power take-off P (type A-328, PLU).

125-E-99	Bushing	Shifter fork	Bronze	165-A-64	A. C. B	
109-E-66	Button	Input shaft thrust	"	"	"	
166-A-69	Cage	Output shaft bearing	Open	"	"	
109-E-96	Cap	Bearing	"	"	"	
109-E-77	Cap	Shifter shaft	"	"	"	
165-A-66	Case	Power take-off	"	"	"	
5061-81	Chain	Drive	"	"	"	
165-A-65	Cover	Power take-off	"	"	"	
132-E-2	Felt	Packing gland	Soft felt	"	"	

d. Propeller shaft power take-off P (type A-328, PLU)—Continued.

Reference number (Mfr's part number)	Name	Function	Description	Mfr's drawing number	Mfr.	Spares (ME-14)
238-B-21	Fork	Shifter	Paper	165-A-64	A. C. B.	
235-B-41	Gasket	Cover	Paper	"	"	
110-E-91	Gasket	Output shaft bearing cage.	Paper	"	"	
110-E-92	Gasket	Shifter shaft cap	Paper	"	"	
109-E-69	Gear	Reverse idler		"	"	
235-B-44	Gear	Sliding		"	"	
104-E-7	Key	Driving sprocket	.65-.75 carbon steel	"	"	
106-E-32	Key	Companion flange and coupling.	.65-.75 carbon steel	"	"	
115-E-91	Nut	Shaft		"	"	
132-E-65	Nut	Detent spring retainer jam.		"	"	
5034-24	Pillow block	Assembly		"	"	
110-E-88	Plate	Shaft lock	Aluminum	"	"	
152-E-68	Plate	Name	3/4" std.	"	"	
104-E-15	Plug	Oil		"	"	
115-E-5	Plunger	Detent		"	"	
109-E-95	Retainer	Bearing	Closed	"	"	
106-E-96	Retainer	Detent spring		"	"	
106-S-50	Retainer	Oil seal		"	"	
132-E-1	Retainer	Shifter shaft packing		"	"	
113-E-3	Ring	Snap lock	3/16" spring steel	"	"	
109-E-98	Screws	Bearing cage cap		"	"	
113-E-4	Seal, oil	Power	A2 No. 212	"	Universal	
235-B-45	Shaft and gears.			"	A. C. B.	
235-B-42	Shaft	Input		"	"	
235-B-43	Shaft	Output		"	"	
105-E-40	Shaft	Reverse idler gear		"	"	
145-B-32	Shaft	Shifter		"	"	
109-E-75	Shims	Bearing cap	Sheet steel	"	"	

115-E-6	Spring	Detent	No. 16 spring steel wire	"	"
125-E-100	Spring	Shifter shaft	No. 8 spring steel wire	"	"
109-E-73	Studs	Mounting		"	"
109-E-94	Sprocket	Driving		"	"
101-S-45	Washer		Copper	"	"
113-E-2	Washer	Bearing retainer		"	"
113-E-1	Washer	Pilot bearing spacing		"	"
109-E-74	Washer	Reverse idler gear thrust		"	"
110-E-57	Yoke end	Shifter shaft		"	"
1309	Bearing	Input shaft, output shaft, and power shaft.	Ball	"	N. D. or equiv.
E-306	Bearing	Input shaft pilot	Roller	"	Hyatt
NC-307	Bearing	Output shaft outer	Roller	"	"
RA-403	Bearing	Reverse idler gear	Roller	"	"
	Nut	Mounting	3/4" SAE with lock washer	"	"
	Nut	Shifter yoke end	1/2"-20 SAE	"	"
	Nut	Shifter fork	7/8"-14 SAE with lock washer	"	"
	Pin	Stud	Taper, No. 2 std	"	"
	Plug, pipe		3/4" std	"	"
	Pin, cotter	Shaft nut	1/8" x 2 1/4" long	"	"
	Screw, cap		3/8"-24 x 3/4" SAE with lock washer	"	"
	Screw, cap	Cover and retainer	3/8"-24 x 1" SAE with lock washer	"	"
	Screw, cap	Cover	3/8"-24 x 2 1/2" SAE with lock washer	"	"
	Screw, machine	Shifter shaft	No. 14-24 x 5/8" ASME oval, fl. head, and lock washer.	"	"
	Wire	Locking	Steel, No. 18 B&S, 18" long	"	"

e. Power reel CR, collapsible.

166-A-78	Handle	Power reel		176-A-78	A. C. B.
119-E-42	Link	Connecting		"	"
110-E-23	Pin	Power reel		"	"
119-E-43	Pin	Pivot		"	"
123-E-66	Pin	Reel arm		"	"
110-E-21	Pin	Sliding		"	"
110-E-18	Plug	Spindle		"	"

e. Power reel CR, collapsible—Continued.

Reference number (Mfr's part number)	Name	Function	Description	Mfr's drawing number	Mfr.	Spares (ME-14)
176-A-77	Segment	Rim		176-A-78	A. C. B.	
123-E-65	Shim	Spindle		"	"	
110-E-20	Spacer	Power reel		"	"	
184-A-34	Spider	Fixed		"	"	
184-A-35	Spider	Sliding		"	"	
239-B-19	Spindle	Short		"	"	
110-E-19	Spring	Power reel		"	"	
110-E-24	Spring	Spindle		"	"	
	Nut, castle		$\frac{5}{8}$ "-18 NF	"	"	
	Pin, cotter		$\frac{1}{8}$ " x 1"	"	"	
	Pin, cotter		$\frac{1}{8}$ " x $\frac{3}{4}$ "	"	"	
	Pin, cotter		$\frac{1}{8}$ " x $\frac{7}{8}$ "	"	"	
	Rivet		$\frac{3}{8}$ " x $3\frac{1}{8}$ " RH	"	"	
	Screw, cap		$\frac{5}{8}$ "-18 NF x $3\frac{1}{4}$ "	"	"	
	Washer		Plain, $\frac{5}{8}$ "	"	"	

f. Pole derrick support MC.

137-E-74	Collar	Lower section		196-A-8	A. C. B.	
137-E-75	Collar	Outer, middle section		"	"	
137-E-76	Collar	Inner, middle section		"	"	
137-E-77	Collar	Main section		"	"	
132-E-79	Eye	Support		"	"	
132-E-83	Flange	Support		"	"	
132-E-80	Section	Upper		"	"	
132-E-81	Section	Middle		"	"	
132-E-82	Section	Lower		"	"	
113-E-53	Pin	Connecting	EX75-A	"	"	

113-E-54	Section	Main	Used on 113-E-53 Pin	"
113-E-55	Lock	Pin	Used on 113-E-53 Pin	"
111-E-63	Detent	Pin	Used on 113-E-53 Pin	"
111-E-62	Spring	Pin	Used on 113-E-53 Pin	"

33. List of manufacturers.

Abbreviation	Name	Address
A. C. B.	American Coach and Body Company	Cleveland, Ohio
Hyatt	Hyatt Bearing Company	Harrison, N. J.
N. D.	New Departure	Bristol, Conn.
Timken	Timken Roller Bearing Company	Canton, Ohio
Universal	Universal Oil Seal Company	Pontiac, Michigan

[A. G. 062.11 (7-14-42).]

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G. C. MARSHALL,
Chief of Staff.

OFFICIAL :

J. A. ULIO,
Major General,
The Adjutant General.

DISTRIBUTION :

IBn 11 (2) ; IC 11 (10).
(For explanation of symbols see FM 21-6.)

