WAR DEPARTMENT TECHNICAL MANUAL

TM 5-1172

CRANE, CRAWLER-MOUNTED,

GASOLINE, ¾-CU. YD.,

WITH ATTACHMENTS,

KOEHRING, MODEL 304

WITH CHRYSLER ENGINE MODIFICATION

MAINTENANCE INSTRUCTIONS AND PARTS CATALOG

WAR DEPARTMENT • 25 APRIL 1944

WAR DEPARTMENT
Washington 25, D. C. (17 February 1944)

TM5-1172 Maintenance Manual and Parts Catalog, Crane, Crawler-Mounted, Model 304, is published for the information and guidance of all concerned.

[A. G. 300.7 (1 March 1944)]

By Order of The Secretary of War:

G. C. MARSHALL,
Chief of Staff

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

DISTRIBUTION: X (For explanation of symbol see FM 21-6)

is published for the information and guidance of all concerned.

REFER TO TM 5-5405 AND ENG. 9-5405 FOR INFORMATION ON CHRYSLER C-36-520 ENGINE

OPERATION
AND
MAINTENANCE MANUAL
AND
PARTS CATALOG

MODEL 304
KOEHRING EXCAVATOR

SERIAL NUMBERS	U. S. REGISTRATION NUMBERS
3304 through 3373	966528 through 966747
3517 through 3666	986056 through 986244
3733 through 3992	9,113,628 through 9,113,698

MANUFACTURED FOR CORPS OF ENGINEERS

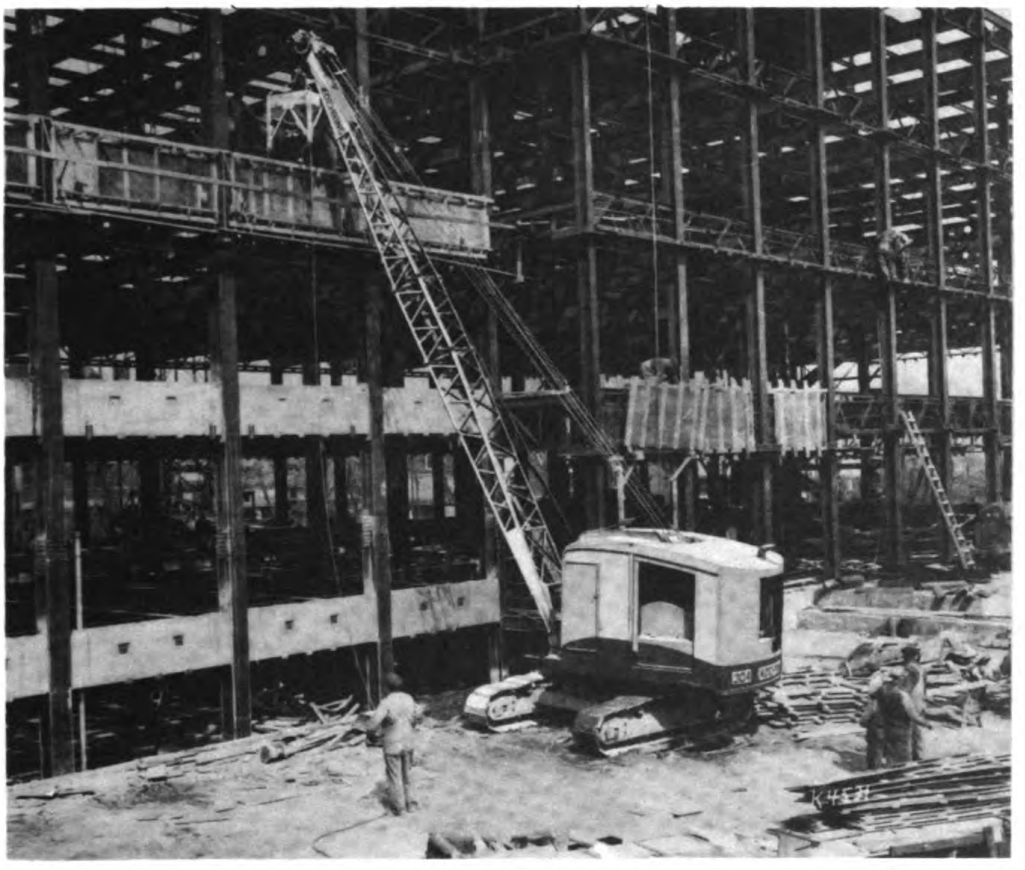
KOEHRING COMPANY
3026 WEST CONCORDIA AVE.
MILWAUKEE 10, — WISCONSIN

INDEX OPERATION SECTION

INDEX - MAINTENANCE SECTION

INDEX PARTS SECTION

KOEHRING MODEL 304 LIFTING CRANE



GENERAL DESCRIPTION

The Koehring Model 304 Lifting Crane may be operated with a single line, two part line or three part line of hoisting cable. (For the reeving of cable to meet these three classifications see pages 81 and 82.) Lifting Crane capacities as shown on page 28 are based on normal line speeds and line pulls for average Lifting Crane work. For loads between 18,000 lbs. and 12,000 lbs., a three part line should be used. For loads between 12,000 lbs. and 6,000 lbs., a two part line should be used. For loads of 6,000 lbs. and under, use a single part line. A three part line reduces hoist speed and line load two-thirds - a two part line, one half. Loads on hoist drum, hoist clutch and hoist brake are reduced proportionately. In computing lifting capacities, the weight of the hook block (250 lbs.) must be added to the load. Koehring Cranes are so designed that loads may be lowered against the gears to assist in careful handling of loads. This is accomplished by disengaging the engine clutch, engaging the hoist clutch and releasing the brake slightly. This rotates the gears backward and retards the movement of the load. (For Lifting Crane lever operation, see Working Operations for Hoisting and Lowering a Load, Page 58).

GENERAL USE

Lifting Cranes are used for unloading steel from carriers; placing steel in the construction of bridges, buildings, ships, etc.; lifting concrete buckets; and material handling at warehouses, supply yards, factories, shipyards, docks, etc.

KOEHRING MODEL 304 CLAMSHELL CRANE

GENERAL DESCRIPTION

The Clamshell Crane is similar in every way to the Lifting crane except that it is used for excavating or material handling with a clamshell bucket and is equipped with a tagline cable to prevent the bucket from rotating or twisting the cables. (See page 83.) A clamshell bucket may be equipped with teeth for new excavation work in pits, trenches, foundations and under water. Buckets also are used without teeth for rehandling material or loading from stock piles. A clamshell bucket is operated by two cables, reeved as described on page 83. Both drum laggings are of the same diameter thus winding both cables at the same speed. The holding line lifts and holds the loaded bucket suspended. The closing line controls the closing and opening of the bucket. For smooth clamshell operation, the closing line drum clutch (right hand) should be adjusted just tight enough to close the bucket with a full load and then start slipping. The holding line drum clutch (left hand) should be adjusted tight enough to lift the bucket and load without slipping. (For working ranges see Pages 28, 29, 30 and 31.

GENERAL USE

Clamshell Cranes are used for excavation work in subways, buildings, sand and gravel pits, drainage and irrigation ditches - for stock piling and material handling.

KOEHRING MODEL 304 DRAGLINE

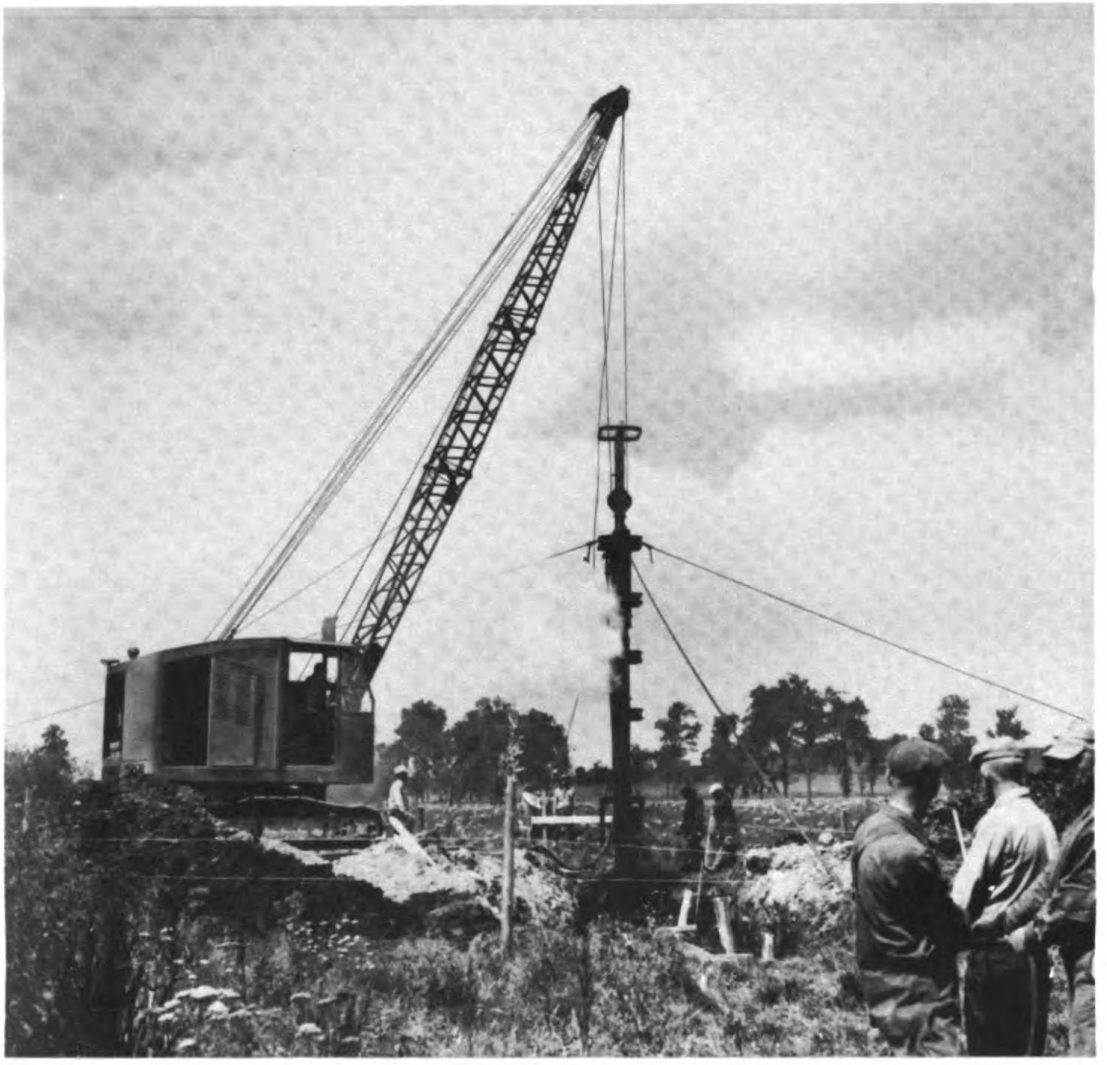
GENERAL DESCRIPTION

The dragline is similar to a Lifting Crane except that it is equipped with a fairlead (Figure 78, Page 99), used as a drag cable guide to the drag drum; with smaller lagging on the right hand or drag drum (Figure 74, Page 95), and a dragline bucket for excavating. The dragline bucket is operated by two cables, which are reeved as described on Page 82. The hoist line lifts and holds the loaded bucket suspended and controls the digging depth. The teeth of the bucket penetrate for digging as the drag cable drags the bucket towards the machine over the material being excavated. It also balances the loaded bucket while being hoisted. The dragline excavates material from a depth below the ground level of the machine. It can dig to varying depths, depending upon the length and angle of the boom, the nature of the material and the skill of the operator. It can deposit excavated material on either side or back of the machine or load into hauling conveyances. (For working ranges, see Page 33.)

GENERAL USE

Draglines are used for digging and cleaning ditches, building dikes and levees, stripping mines and gravel pits, placer mining or excavating.

KOEHRING MODEL 304 PILE DRIVER



GENERAL DESCRIPTION

The Pile Driver is similar in every way to a Lifting Crane except that it is equipped with a structural steel frame of either the stationary or swinging type known as leads which guide the hammer up and down for the pile driving operation. Stationary leads are attached to the boom point and are raised or lowered by raising or lowering the boom. Swinging leads are suspended from the boom point by a cable operated by one of the hoist drums on the machine. Two types of hammers are the drop hammer and the steam hammer. The drop hammer is lifted and dropped on the piling. The steam hammer is placed on top of the piling and operated by steam led to it through a hose from an outside source. Each type of hammer is suspended on a cable leading from one of the hoist drums over the boom point sheave to the hammer.

GENERAL USE

Pile Drivers are used for driving piling for bridges, bridge piers and building foundations. They are also used for driving sheeting or piling around excavations to keep the sides from caving.

KOEHRING MODEL 304 SHOVEL

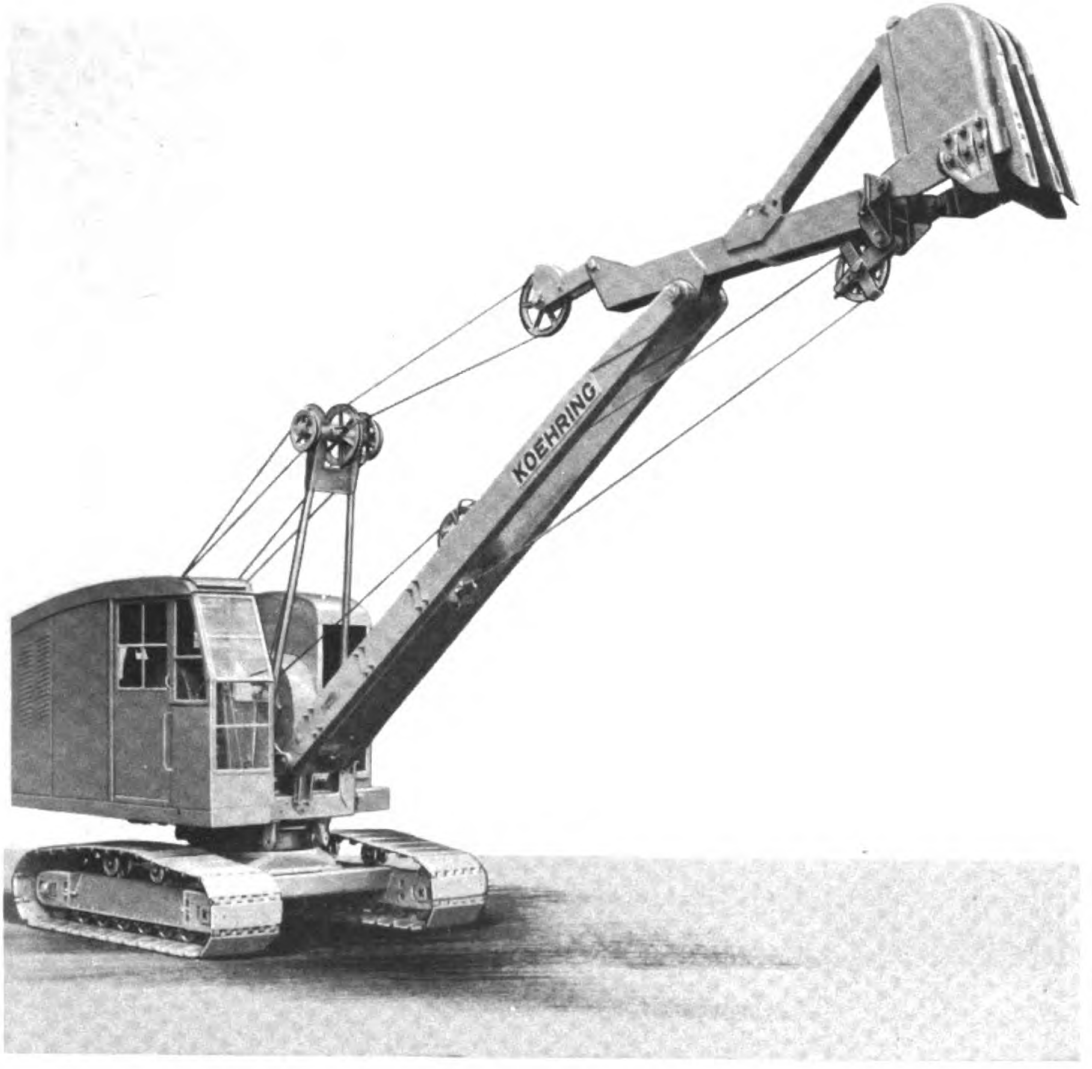
GENERAL DESCRIPTION

The Shovel is designed especially for excavating purposes and is equipped with an attachment consisting of boom, dipper sticks and dipper. A tapered drum lagging for operation of the dipper hoist cable is mounted on the left end of the hoist drum shaft as in Figure 72, Page 95. On the right end of the same shaft a split drive sprocket for the operation of the crowd chain is mounted. Although the particular function of a shovel is to dig from ground level up to the maximum digging height of the dipper, it may be used for digging shallow trenches below ground level and between the crawlers. Because of the accuracy and speed with which the dipper can be controlled, a power shovel is ideal for loading the material it digs into trucks, wagons or other conveyances. (See Page 35 for working ranges.)

GENERAL USE

Shovels are used for digging and loading rock, earth and ore on highway, general construction and mining work.

KOEHRING MODEL 304 PULL SHOVEL



GENERAL DESCRIPTION

The Pull Shovel combines some of the features of a dragline and a Shovel. The pull shovel digs as the dipper is pulled toward the machine like a dragline bucket and can be controlled with the same speed and accuracy as a shovel dipper. The main drum laggings are of the same size as those used in dragline crane service. A pin-connected gib frame at the front of the machine supports the cable sheaves employed in the boom and dipper raising and lowering operations. The boom and dipper handle are rigid members. This design of machine permits deep digging below ground level. (See Page 36 for working ranges).

GENERAL USE

Pull Shovels are used for trench digging for sewer lines and conduit, basements and foundations.

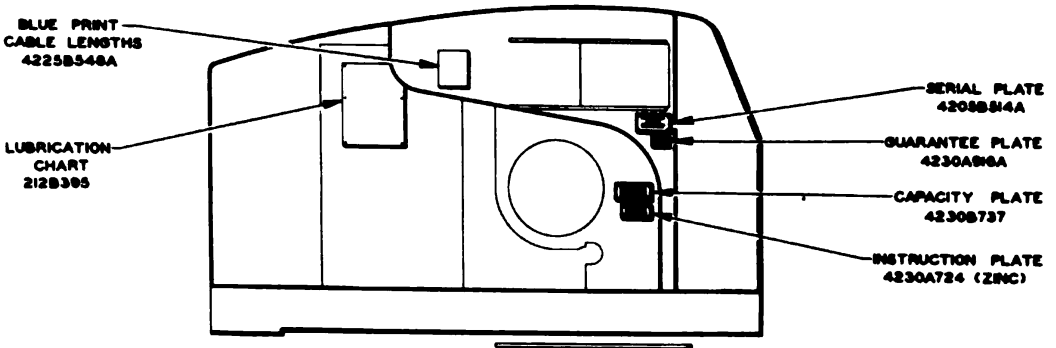
GENERAL DESCRIPTION

The Koehring Model 304 Lifting Crane is commonly known as a "combination" machine. With the exception of a few minor machinery changes in some instances, only the booms need to be changed to meet the requirements of various types of operations. All conversions are powered by the same engine. With the exception of the shovel assembly, which requires one extra lever, no changes are made in the operating levers of the various units. The operator's seat is mounted near the front on the right corner of turntable or deck where levers controlling all movements of the machine are within easy reach of the operator. Large windows at front, top and sides afford the operator a vision range of more than 180 degrees and at the same time protect him from the elements. As illustrated in the preceding pages and as described at various points throughout this manual, travel of the machine is accomplished by two endless crawlers made up of crawler shoes linked together by pins and driven over drive sprockets and idler rollers. NOTE: "Right hand side" or "left hand side" of the machine or any part of either side - as frequently referred to in this manual - means the right hand or left hand side when viewing the machine from the rear.

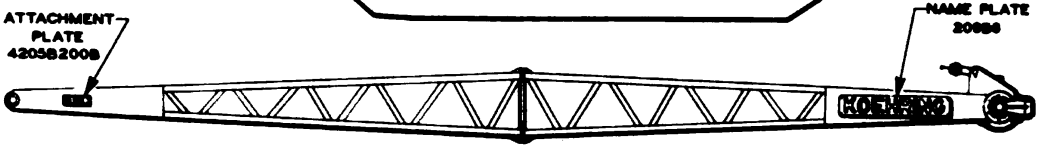
IDENTIFICATION AND ADDRESSES OF MANUFACTURERS OF ACCESSORIES AND EQUIPMENT USED ON KOEHRING MODEL 304 EXCAVATOR

AIR CLEANER, UNITED - MODEL T195-12495	United Specialties Co., Chicago, Ill.
CARBURETOR, CARTER - MODEL 373S	Carter Carburetor Co., St. Louis, Mo.
CLUTCH, TWIN DISC - MODEL B-111-P2	Twin Disc Clutch Co., Racine, Wis.
DISTRIBUTOR, AUTO-LITE - MODEL IGP4201	Electric Auto-Lite Co. Toledo, Ohio.
ENGINE, CHRYSLER - MODEL C36-520	Chrysler Corporation, Industrial Engine Div., Detroit, Mich.
FUEL PUMP, "AC" - MODEL 1523869	AC Division General Motors Corp., Flint, Mich.
GENERATOR, AUTO-LITE - MODEL DGZ4801-A	Electric Auto-Lite Co. Toledo, Ohio.
GOVERNOR, PIERCE - MODEL A1557	Pierce Governor Co., Anderson, Indiana.
OIL FILTER, DELUXE - MODEL JC	Deluxe Products Corp., La Porte, Indiana.
STARTER, AUTO-LITE - MODEL MAX4058	Electric Auto-Lite Co., Toledo, Ohio.
VOLTAGE REGULATOR - MODEL VRP-4001-AX	Electric Auto-Lite Co., Toledo, Ohio.

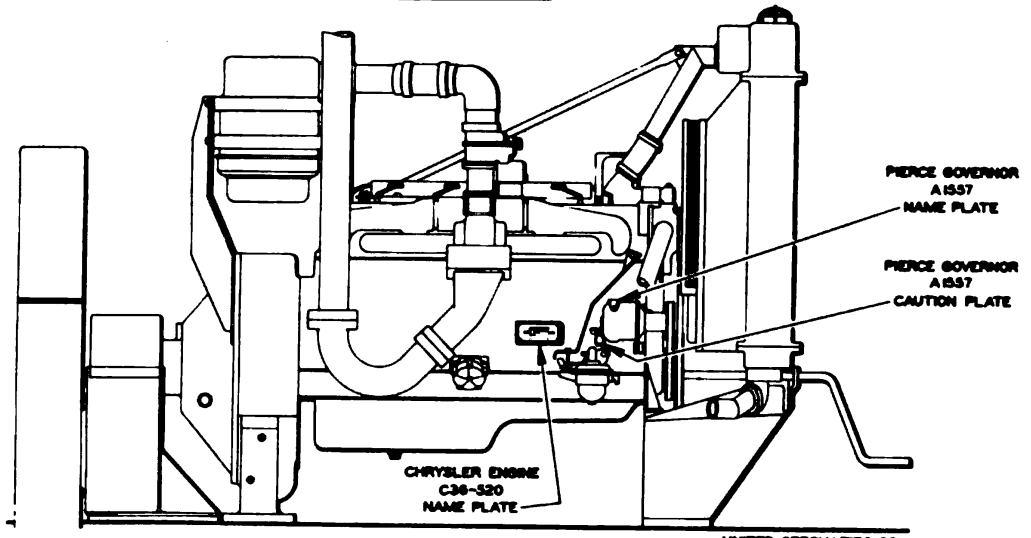
LOCATION OF NAME PLATES

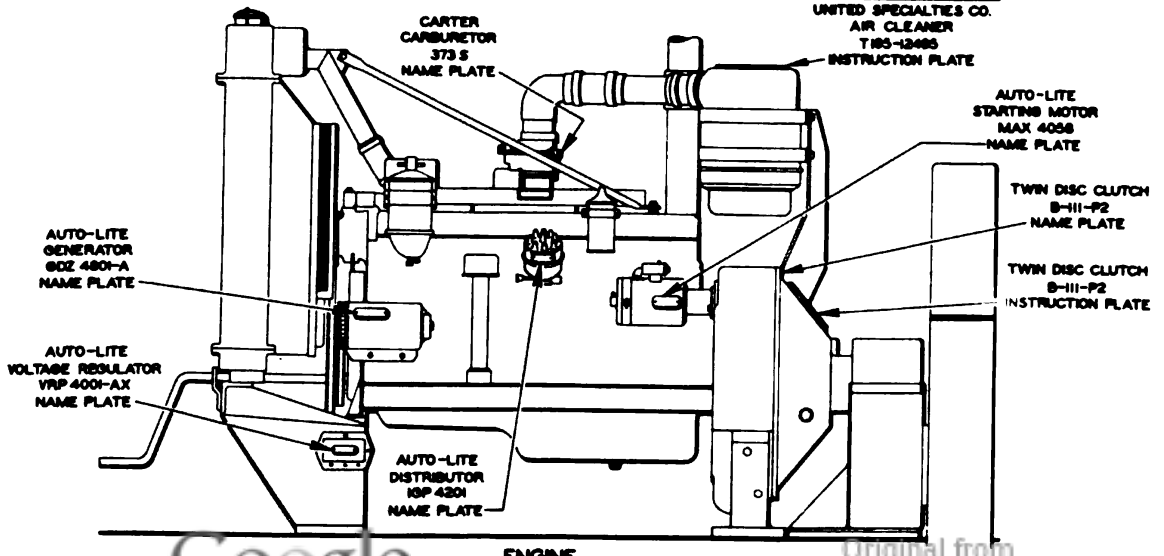


CAB



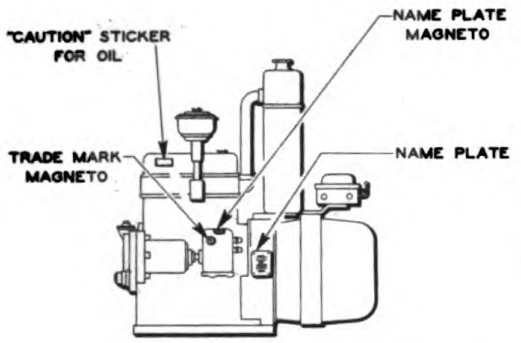
CRANE BOOM



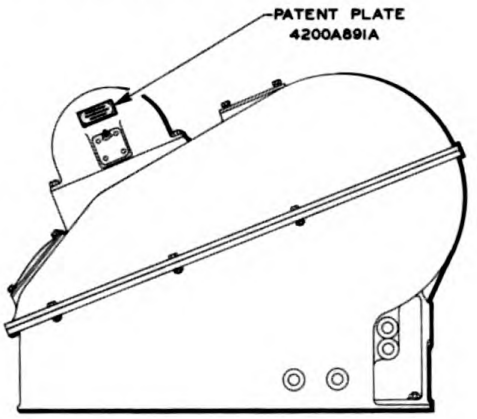


ENGINE

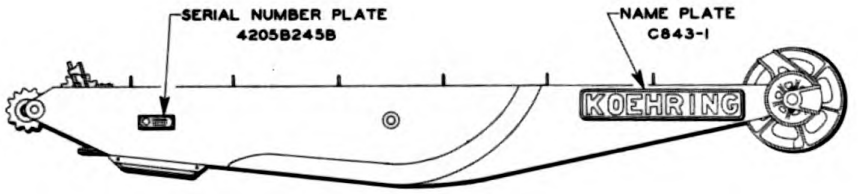
LOCATION OF NAME PLATES



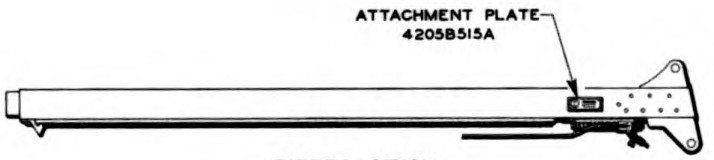
KOHLER LIGHT PLANT



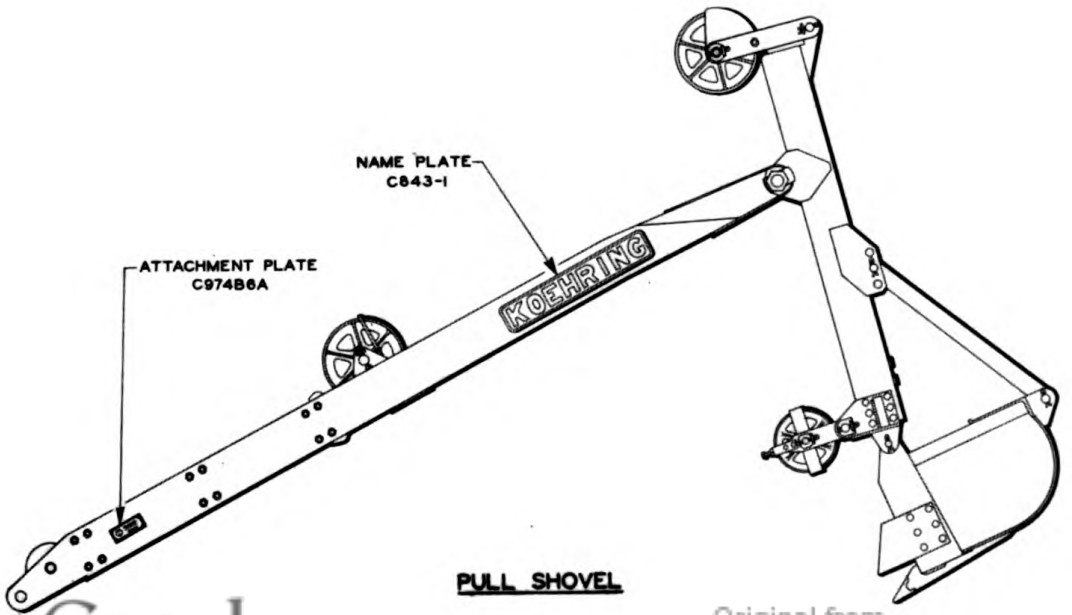
DIPPER TRIP



SHOVEL BOOM



DIPPER STICK



PULL SHOVEL

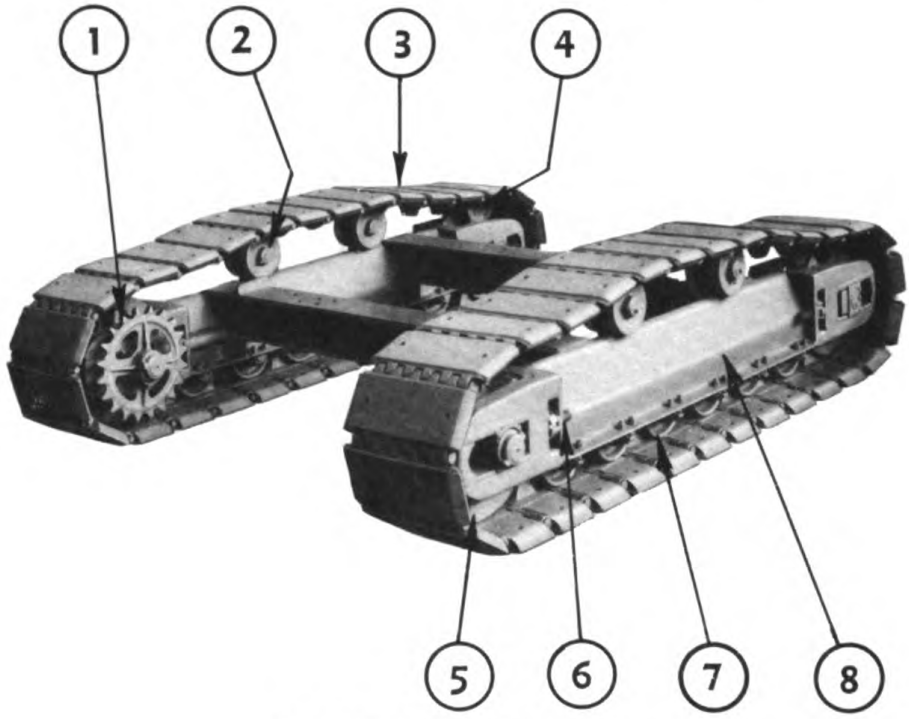
NAME PLATES

OPERATION SECTION

INTRODUCTION

This manual, consisting of three sections (Operation, Maintenance and Parts), was prepared from the cumulative experiences of the Engineers who designed the Koehring Model 304 Excavator and the Field Service Engineers who have installed and serviced the machine in all parts of the world under every conceivable working condition. Every effort was made to present this valuable data simply and briefly without sacrificing completeness so that the inexperienced operator can easily and quickly absorb the information he needs to be efficient in his work. We urge you to study this manual carefully - it will pay you dividends later in the form of fewer troubles and better work. The experienced operator, too, will benefit by a careful study of all the material presented here because, in preparing it expressly for the inexperienced, we have uncovered and presented many important details not ordinarily found in manufacturers' bulletins and other literature on the same subject.

MACHINE COMPONENTS, ASSEMBLIES AND ACCESSORIES



KOEHRING CRAWLER

1—DRIVE SPROCKET
2—TOP CRAWLER ROLLER
3—CRAWLER BELT
4—FRONT TUMBLER
5—REAR TUMBLER
6—ADJUSTING BOLTS
7—BOTTOM CRAWLER ROLLER
8—CRAWLER FRAME

FIG. 1

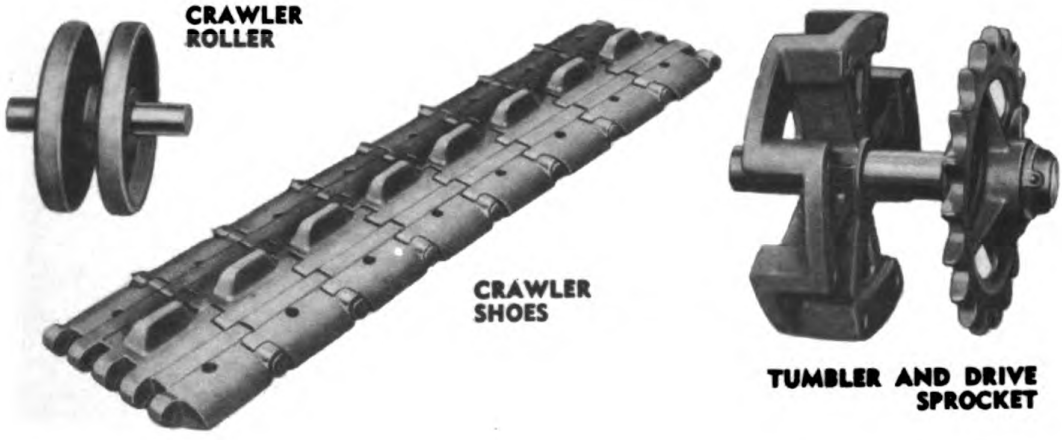
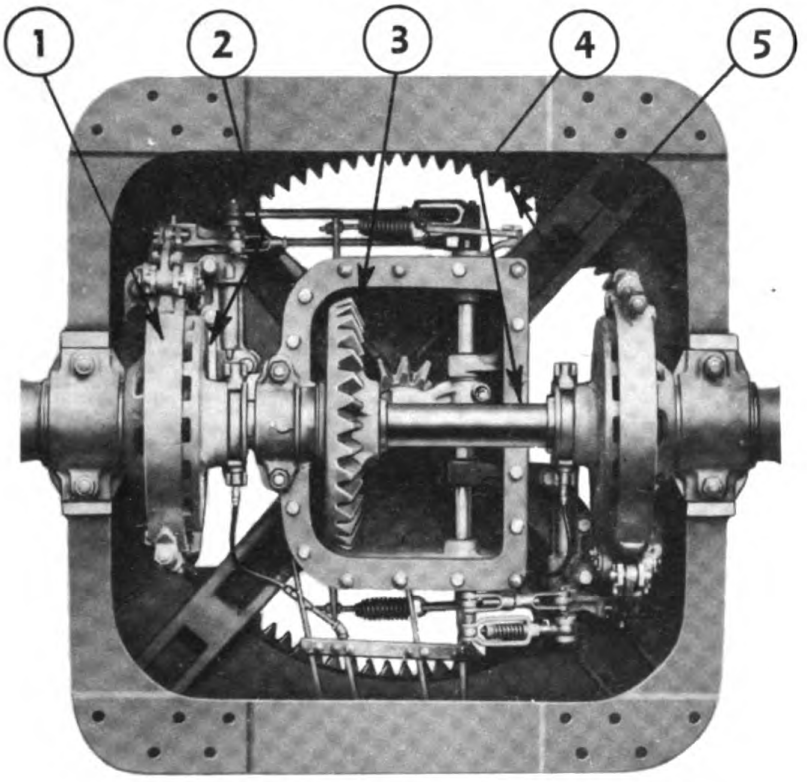


FIG. 2

MACHINE COMPONENTS, ASSEMBLIES AND ACCESSORIES



TRACTION SHAFT ASSEMBLY

1—TRACTION BRAKE
2—TRACTION JAW CLUTCH
3—TRACTION BEVEL GEARS
4—TRACTION SHAFT
5—SWING GEAR

FIG. 3

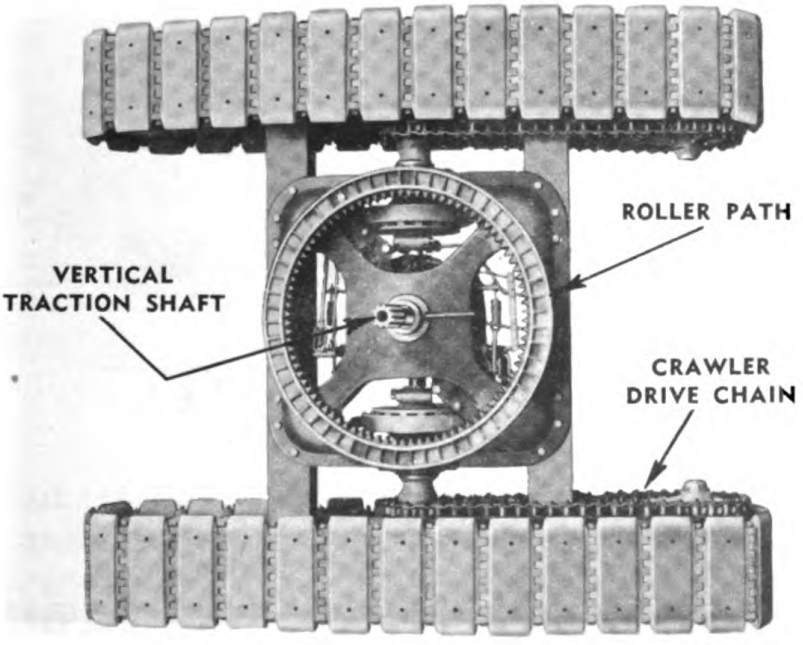


FIG. 4

MACHINE COMPONENTS, ASSEMBLIES AND ACCESSORIES

TURNTABLE ASSEMBLY

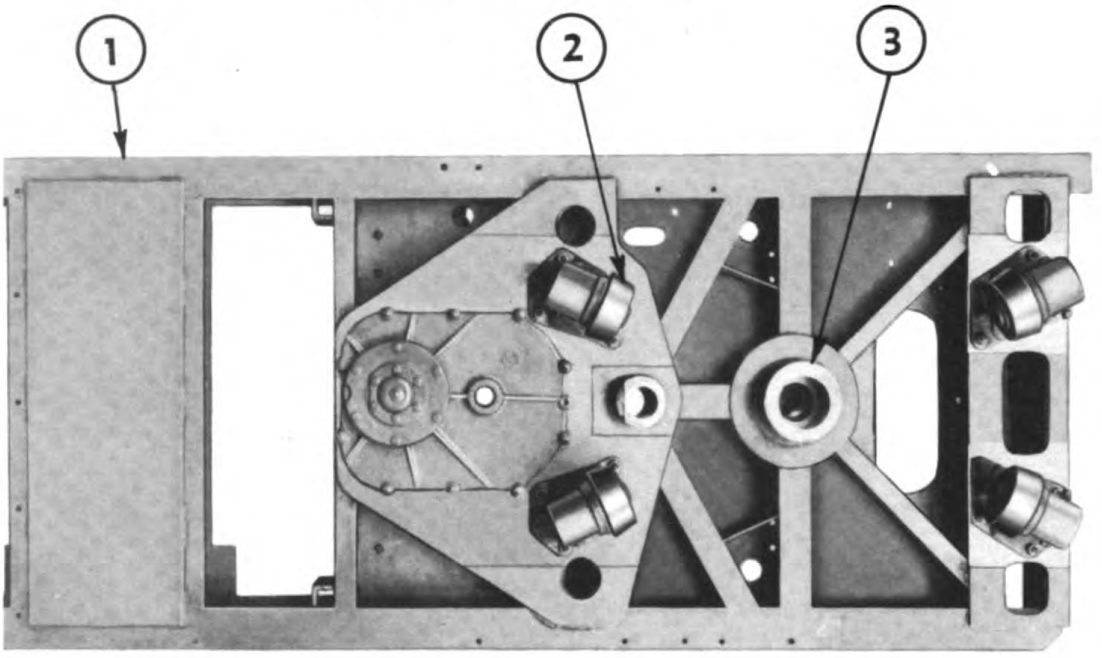


FIG. 5 BOTTOM VIEW

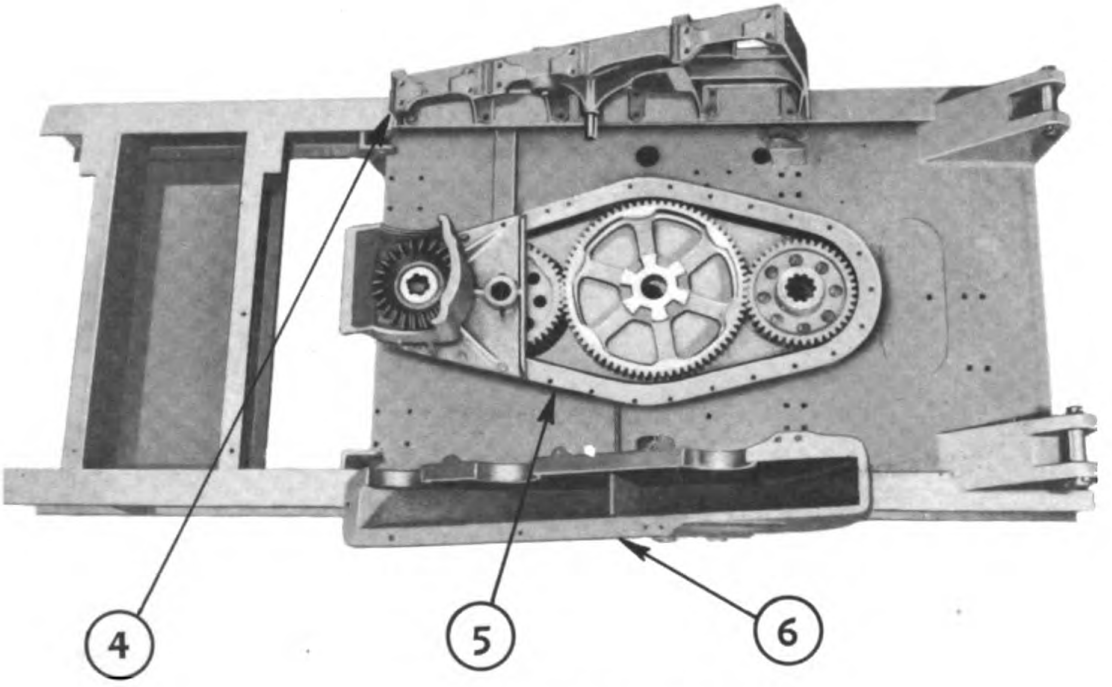


FIG. 6 TOP VIEW

1—TURNTABLE
2—TURNTABLE ROLLER
3—TURNTABLE PIVOT
4—SIDE STAND
5—UPPER TURNTABLE GEAR CASE
6—MAIN GEAR CASE

MACHINE COMPONENTS, ASSEMBLIES AND ACCESSORIES

OPERATING MACHINERY

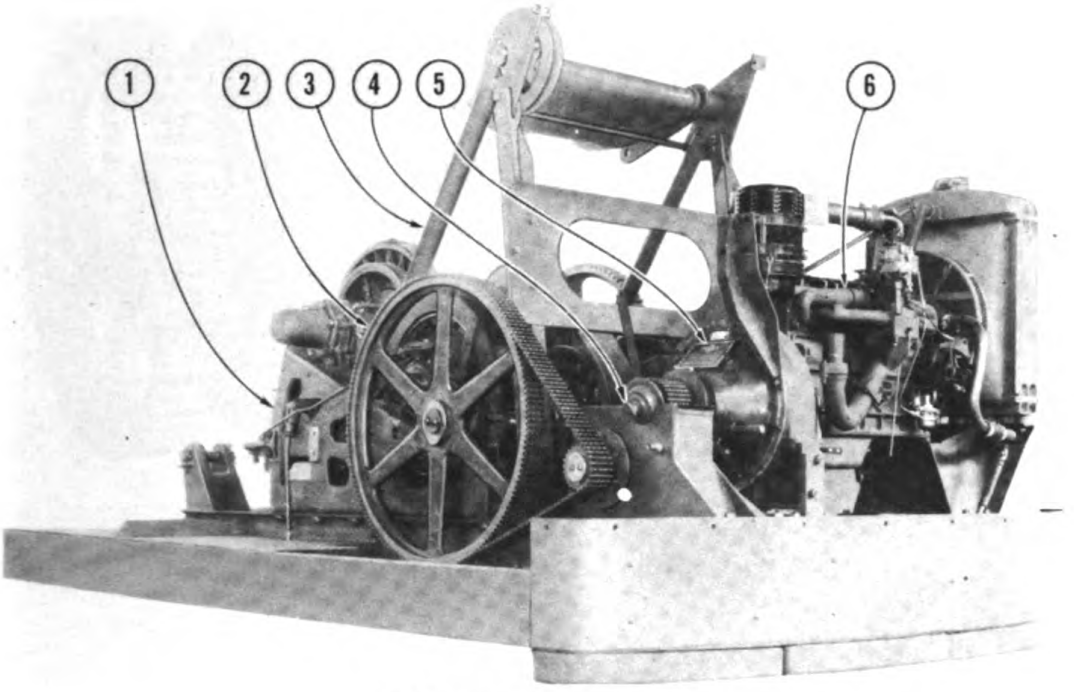


FIG. 7 REAR VIEW

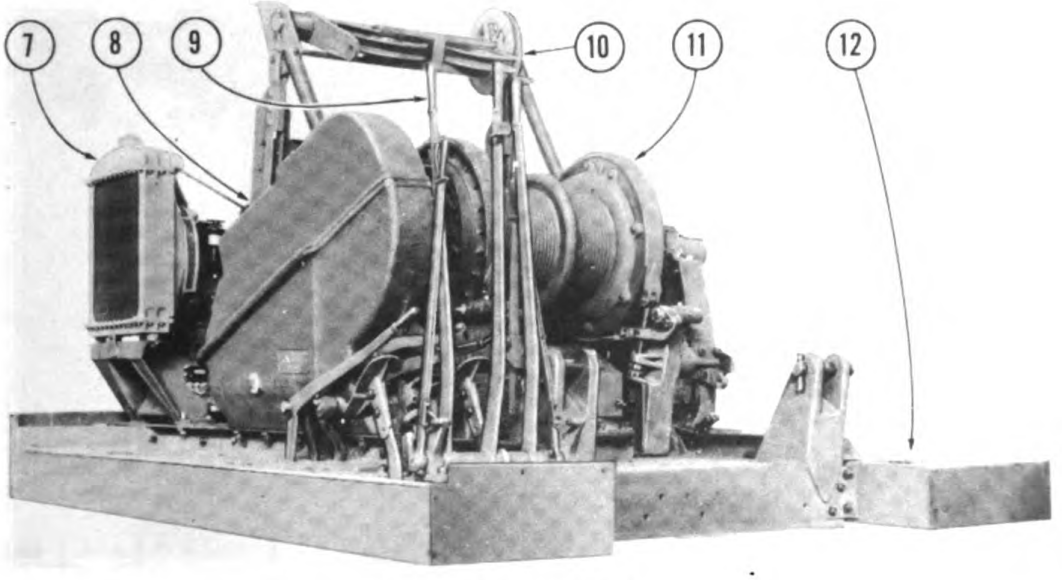


FIG. 8 FRONT VIEW

1—SIDE STAND
2—2ND REDUCTION DRIVE
3—"A" FRAME
4—1ST REDUCTION DRIVE
5—ENGINE CLUTCH
6—ENGINE
7—RADIATOR
8—MAIN GEAR CASE
9—OPERATING LEVERS
10—BOOM HOIST SHEAVES
11—MAIN DRUMS
12—TURNTABLE

MACHINE COMPONENTS, ASSEMBLIES AND ACCESSORIES
SHAFT ASSEMBLIES

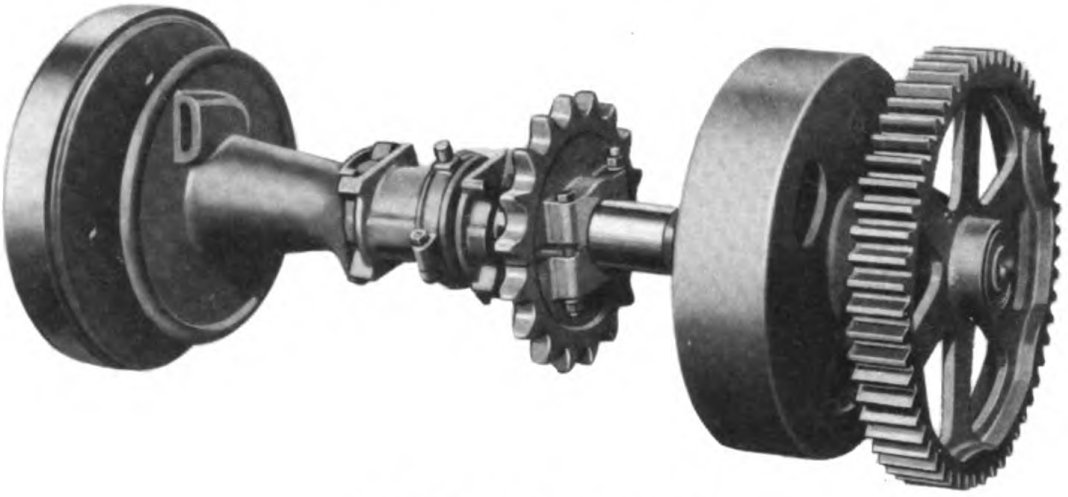


FIG. 9 BOOM HOIST

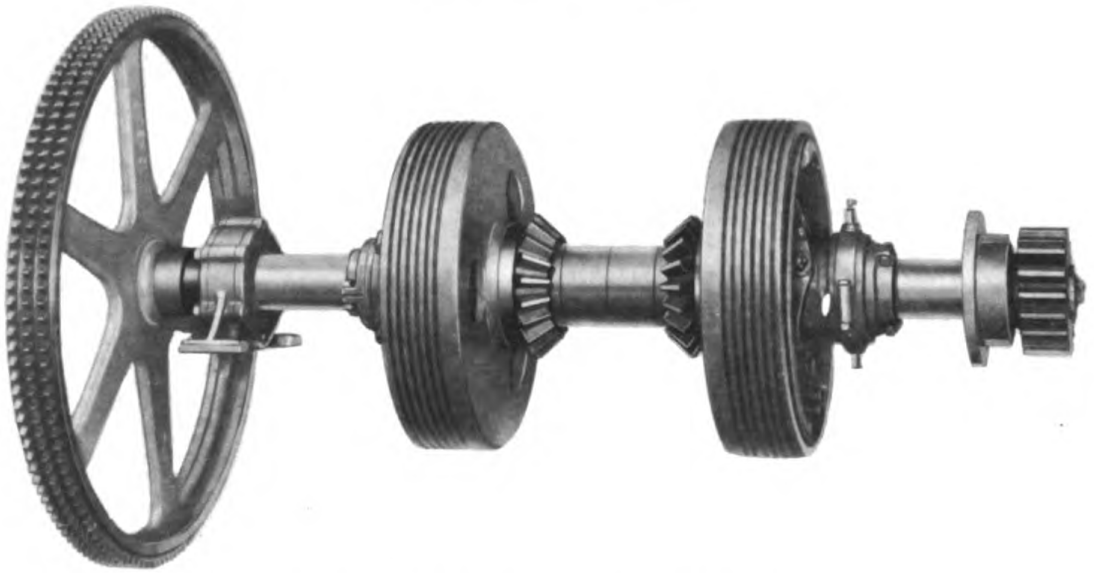


FIG. 10 SWING AND TRACTION

FIG. 11 LOWER TRACTION

MACHINE COMPONENTS, ASSEMBLIES AND ACCESSORIES

DRUM LAGGINGS

Various types and sizes of drum laggings are used for the various operating combinations to which the machine can be adapted. Illustrated below are the types of laggings used for the combinations indicated. Instructions for making all drum lagging changes are given under "Equipment Changes For Various Operations", (Page 96).

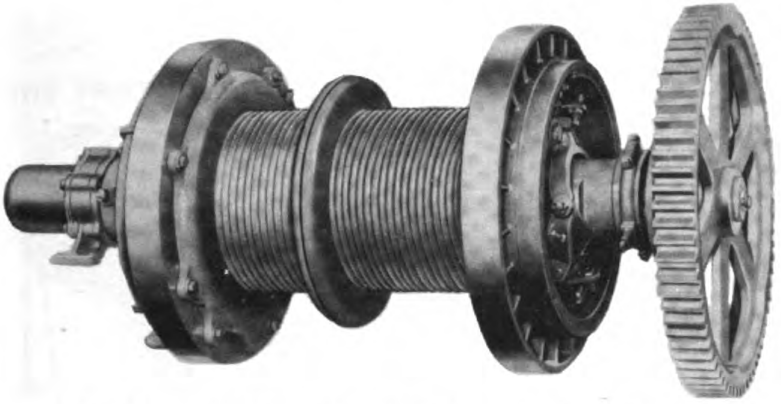


FIG. 12 CRANE, CLAMSHELL AND PILE DRIVER

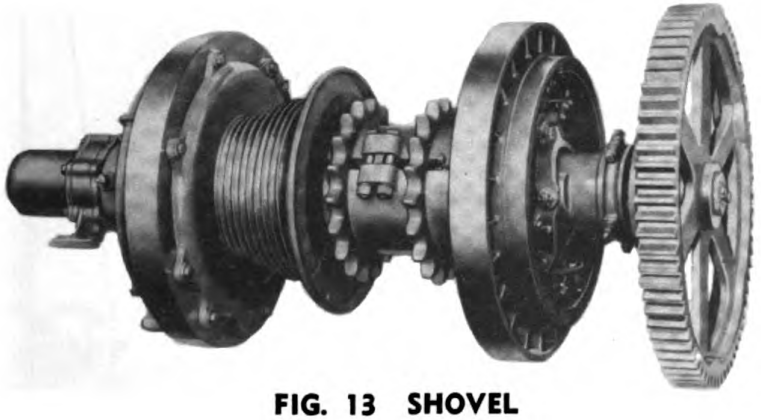


FIG. 13 SHOVEL

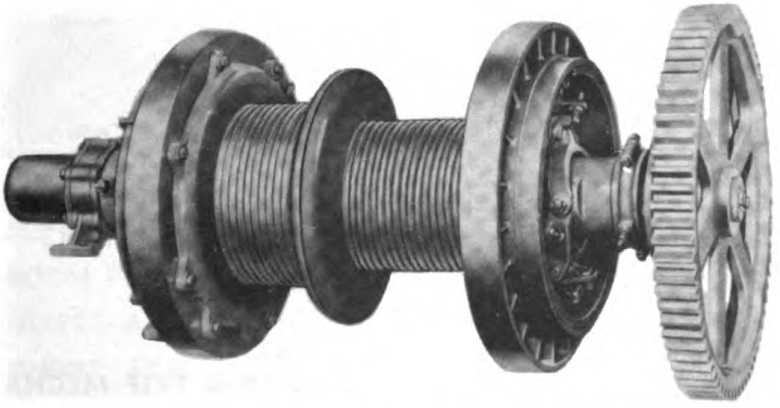
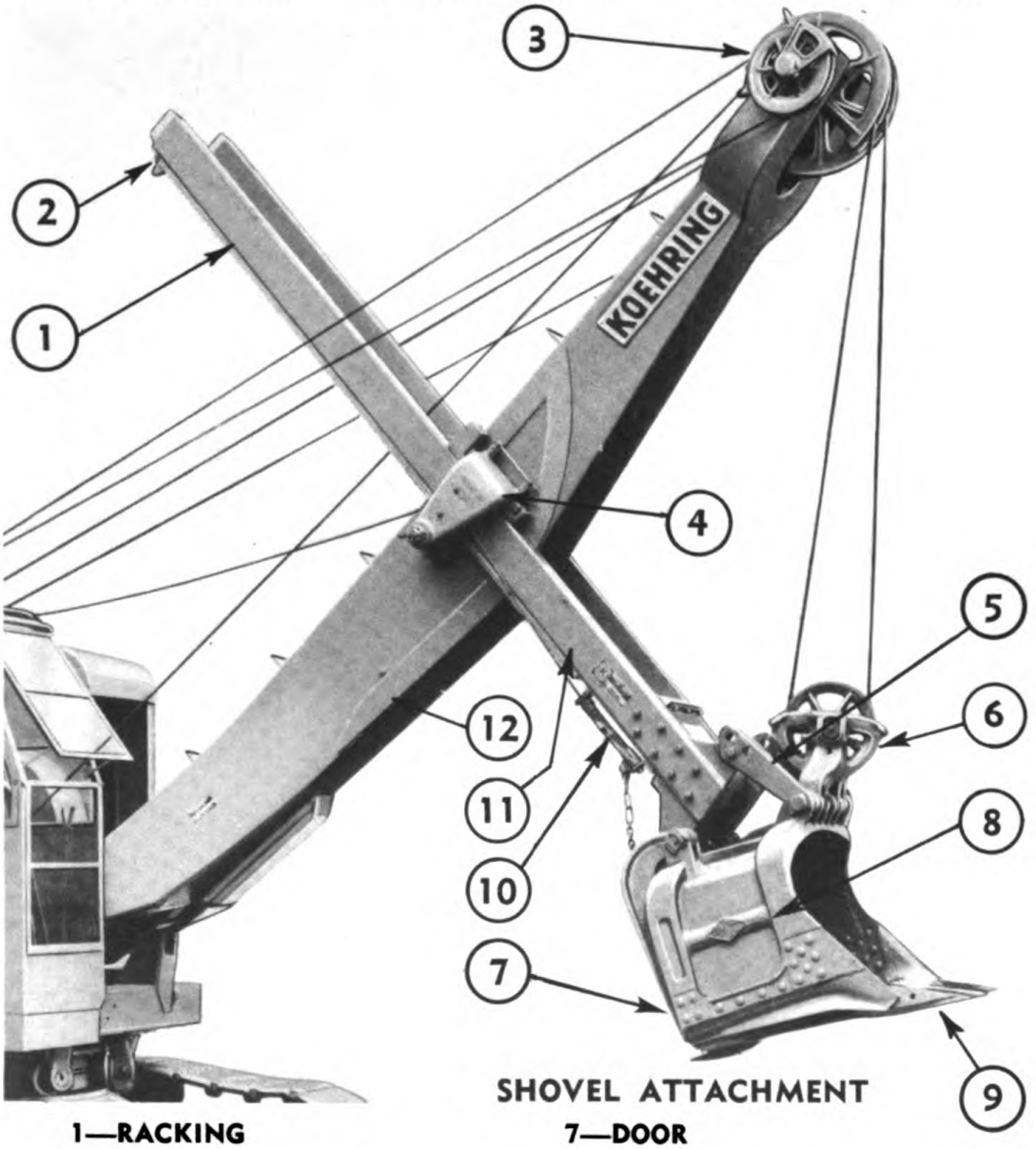


FIG. 14 DRAGLINE AND PULL SHOVEL

MACHINE COMPONENTS, ASSEMBLIES AND ACCESSORIES

FIG. 15 CRANE BOOM

1—BOOM FOOT 2—CABLE GUARD 3—POINT SHEAVES

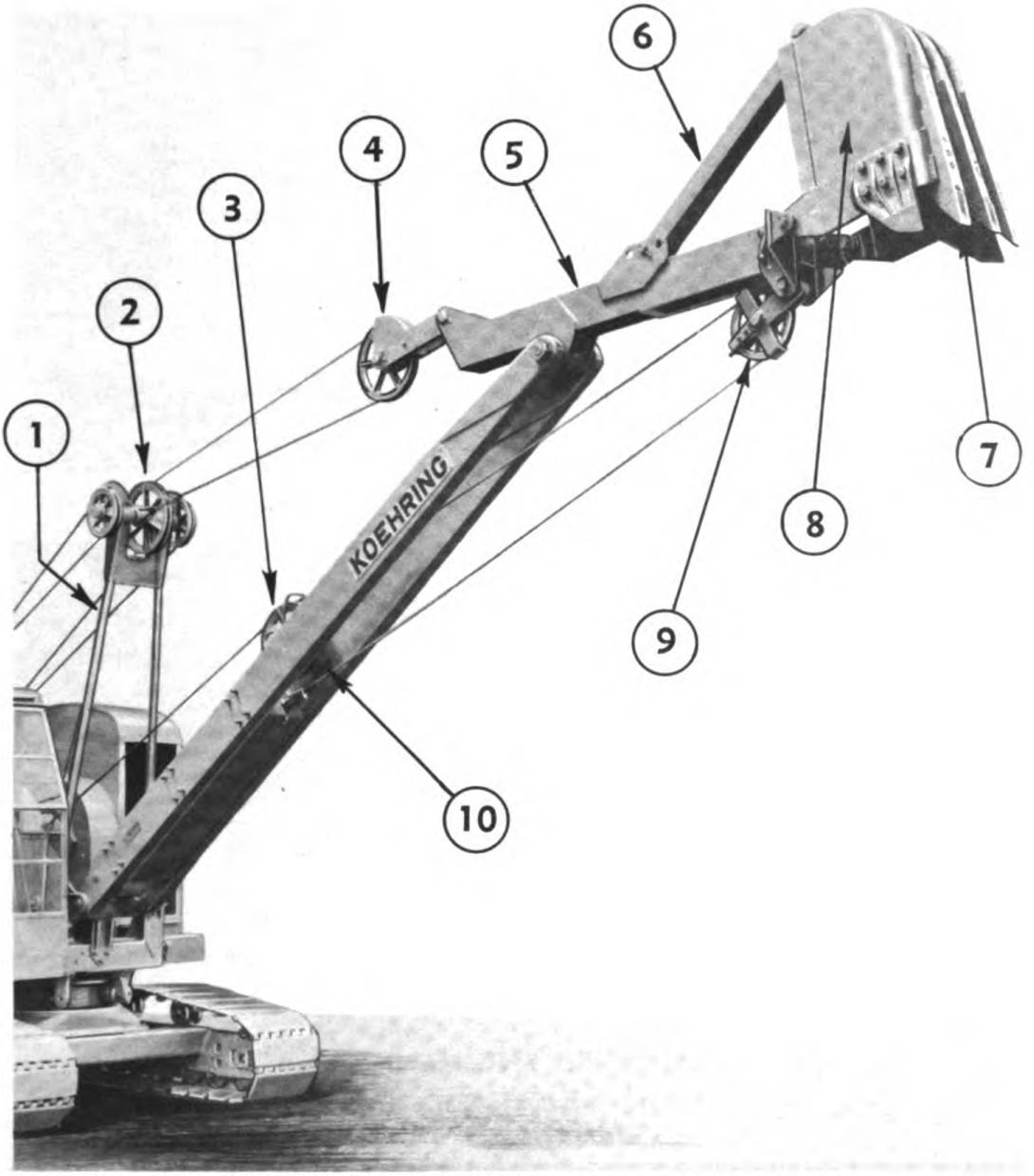


SHOVEL ATTACHMENT

1—RACKING
2—STOPS
3—POINT SHEAVES
4—SADDLE BLOCKS
5—DIPPER ANGLE BRACES
6—SHEAVE BLOCK
7—DOOR
8—DIPPER
9—TEETH
10—DIPPER TRIP MECHANISM
11—DIPPER STICKS
12—BOOM

FIG. 16

MACHINE COMPONENTS, ASSEMBLIES AND ACCESSORIES



PULL SHOVEL ATTACHMENT

1—JIB FRAME
2—JIB FRAME SHEAVES
3—BOOM FLEETING SHEAVE
4—DIPPER ARM SHEAVE
5—DIPPER ARM
6—DIPPER ANGLE BRACE
7—TEETH
8—DIPPER
9—DIPPER SHEAVE BLOCK
10—BOOM

FIG. 17

MACHINE COMPONENTS, ASSEMBLIES AND ACCESSORIES

AUXILIARY FRONT DRUM FOR PILE DRIVER

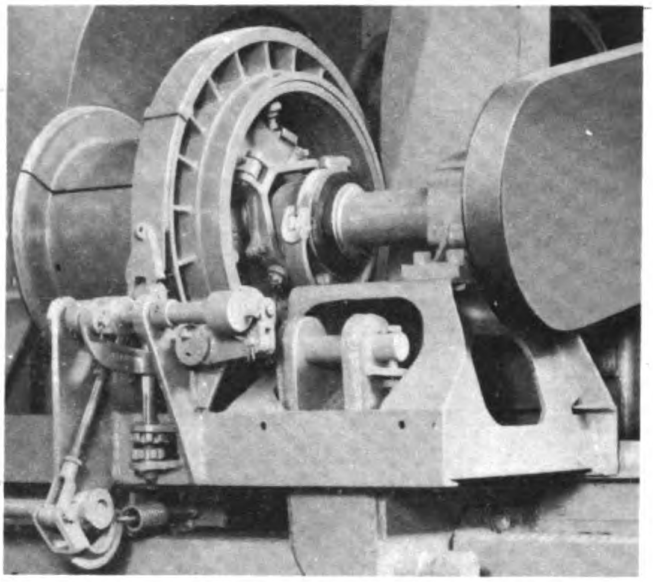


FIG. 18

DRAGLINE FAIRLEAD

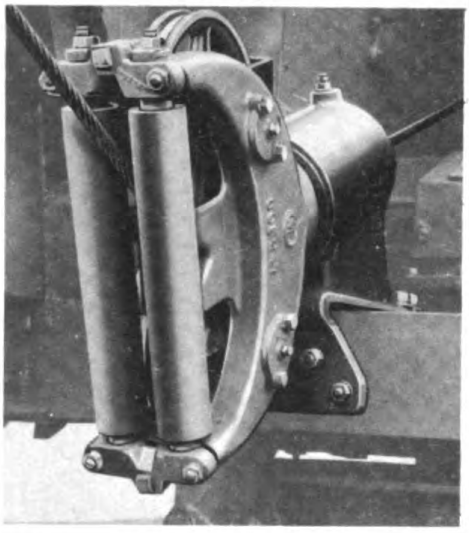


FIG. 19

TAGLINE FOR CLAMSHELL

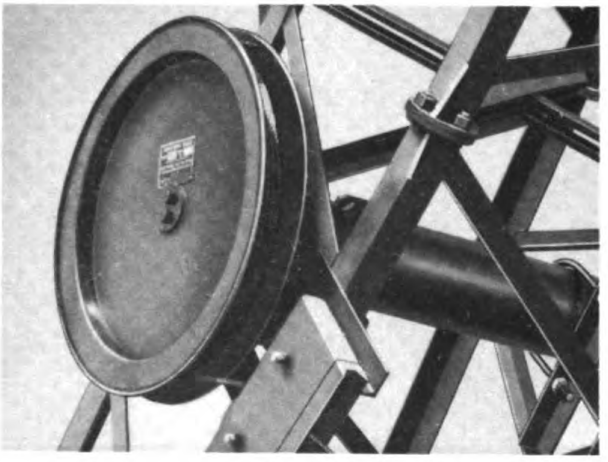


FIG. 20

CHRYSLER GASOLINE ENGINE AND REDUCTION DRIVE

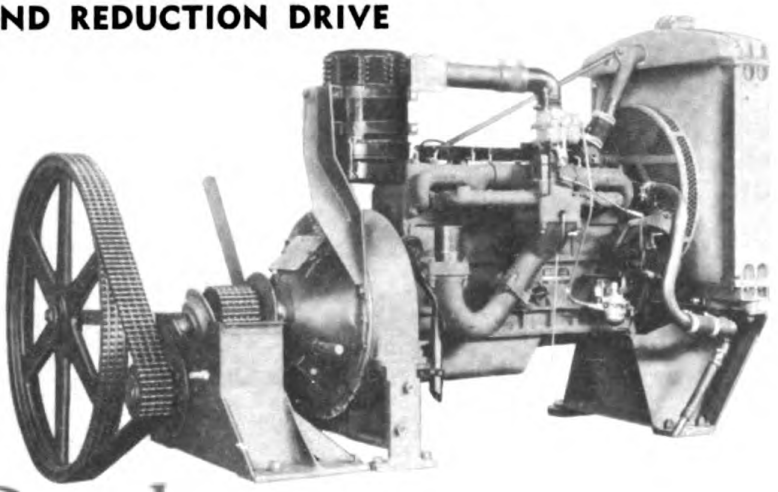


FIG. 21

MACHINE SPECIFICATIONS

Boom, Crane - length 35', two piece with two sheaves at point. Welded construction with four chord angles braced by diagonal struts.

Boom, Pull Shovel - length 19'-3", all welded box type construction.

Boom, Shovel - length 18', all welded box type construction. Shipper shaft mounted through center of boom. One piece continuous crowd chain operating inside the boom.

Capacity, Lifting - with 40' boom at 12' radius, 75% of overturning load is 18,000 lbs. with machine on firm level floor.

Dipper, Pull Shovel - capacity 3/4 cubic yard. Welded construction.

Dipper, Shovel - capacity 3/4 cubic yard. Welded construction.

Dipper Arm, Pull Shovel - length 6'-3", all welded box type.

Dipper Sticks, Shovel - length 15', double, outside type, welded box construction.

Hook Block, Crane - 10 ton capacity, single sheave type with swivel hook.

Length (from front of crawlers to rear of tail swing) 14'-10".

Length, Crawler - 11'-8".

Light Plant - Kohler (1500 watt) Model E.

Over All Dimensions - height (from ground to top of cab) 10'-10½".

Rear End Radius - 9'-0".

Speed, Drum Shaft - 38.1 R.P.M. idle.

Speed, Line (idle) - hoist (Crane, Clamshell, Dragline) 159' per minute. Drag (Dragline, Pull Shovel) 136' per minute.

Speed, Swing - 3.5 R.P.M.

Speed, Traction - 0.9 M.P.H.

Steering Brakes(Traction Brakes) - positive action controlled from operator's position. Crawlers can be steered in any direction with cab in any position over carbody. As special safety feature both traction brakes can be applied at any time.

Weight, Crane - approximately 40,445 lbs.

Weight, Shovel - approximately 43,400 lbs.

Width, Crawler - 9' -7".

Width, Crawler Shoe - 21".

ENGINE SPECIFICATIONS

Chrysler, Model C36-520 gasoline engine, 8 cyl. "L" head, 3¼" bore, 4-7/8" stroke, 79 H.P. fully equipped with engine speed governed full load at 1700 R.P.M.

Air Cleaner, United - Model T195-12495.

Automatic Choke, Pierce.

Battery, Globe - Model V89.

Carburetor, Carter - Model 373S.

Clutch, Twin Disc - Model B-111-P2.

Coil, Auto-lite - Model CE4028.

Crankcase Capacity - 6 quarts.

Distributor, Auto-lite - Model IGP4201.

Firing Order - 1,6,2,5,8,3,7,4.

Fuel Pump, "AC" - Model 1523869.

Fuel Tank Capacity - 55 gal.

Generator, Auto-lite - Model GOZ4801-A.

Governor, Pierce - Model A1557.

Oil Filter, Deluxe - Model JC.

Radiator Capacity - 8 gal.

Spark Plugs, Auto-lite - Model #A5.

Spark Plug Gap - .025".

Starter, Auto-lite - Model MAX4058.

Valve Clearance (Hot engine) - Intake .010", Exhaust .012".

Voltage Regulator, Auto-lite - Model URP-4001-AX.

HOW TO DETERMINE LIFTING CRANE WORKING RANGES. (SEE TEXT, PAGE 27.)

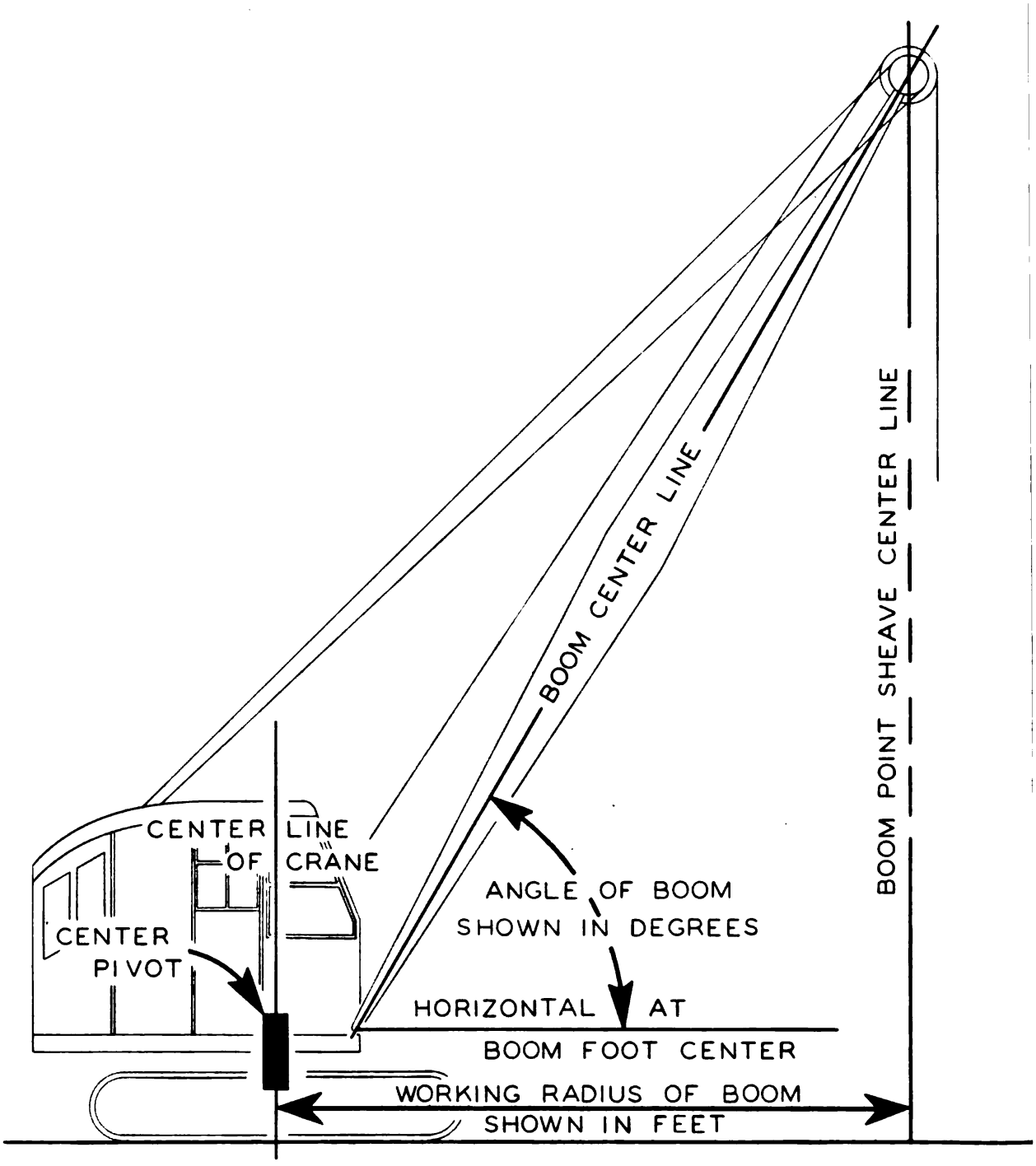


FIGURE 22

PRINCIPAL OPERATING MOTIONS OF SHOVEL

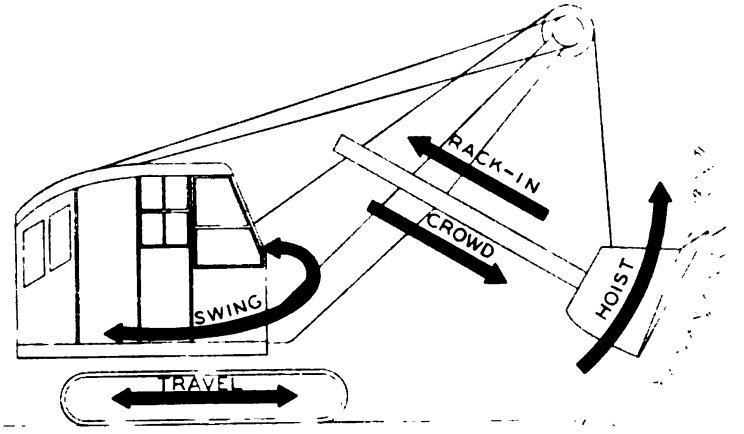


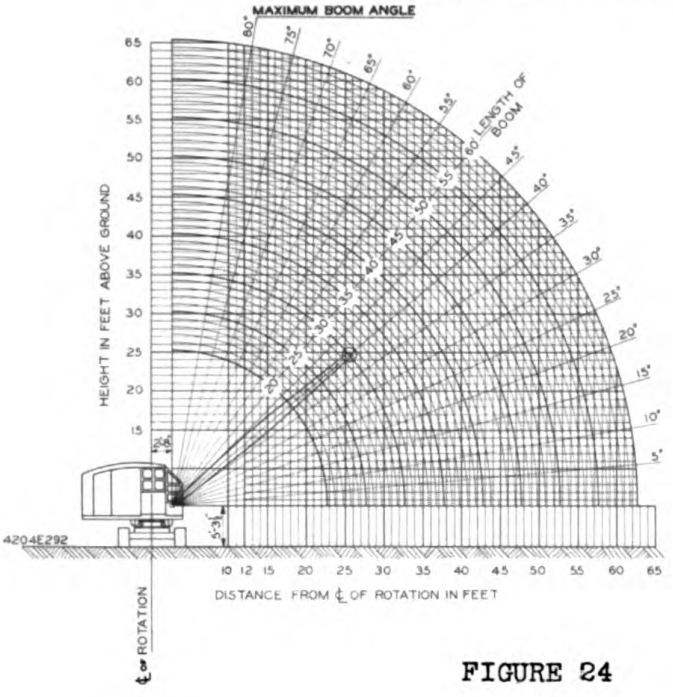
FIGURE 23

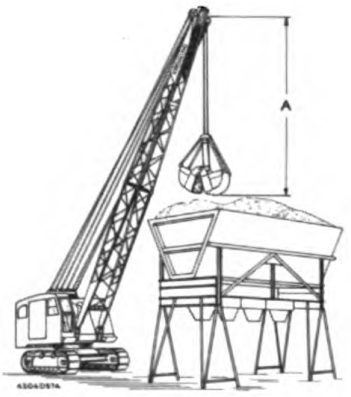
Traveling, swinging, and raising or lowering the boom are motions common to all combinations of the Koehring Model 304 Excavator (Crane, Clamshell, Dragline, Pile Driver, Shovel and Pull Shovel.) Your manipulation of the crowd, rack-in and hoist motions of the shovel determines the ease and speed at which you operate as well as the productive capacity of the shovel. With practice you will be able to crowd and hoist simultaneously while digging racking-in when necessary as your dipper travels up through the cut. As you swing to dump the loaded dipper it can be hoisted to any desired height within the range of the machine, and by racking-in or crowding (out) you can accurately spot the dipper at any point for dumping.

HOW TO DETERMINE LIFTING CRANE WORKING RANGES

The lifting capacity of a crane, as generally specified by manufacturers, is based upon boom length, boom radius in feet and boom angle in degrees. These capacities usually are presented in tabular form and the ratings, as shown on these forms, are standard. To allow for a safety factor in continuous normal operation, lifting crane ratings are given at 75% of the tipping-over load while clamshell and dragline ratings are given at 66-2/3% of the tipping-over load. Other variations in capacity ratings are explained on page 29. Figure 24, page 28 illustrates the various working ranges by which capacities are determined. To determine the capacity of a crane, for which the standard capacity ratings have been established as shown on page 29, you must first consider the length of boom. After fixing the boom at the proper angle for the type of work, measure the distance, on the ground, from the center line of the machine to the center line of the boom point sheave. Thus with boom length and working radius established determine the crane lifting capacity under the "Lifting Crane Service" column on page 29. The use of one part, two part or three part hoist cable reeving depends upon the nature of the work and the weight of the load. For continuous operation, one part reeving should be used on loads of 1/3 and under the maximum rating. Two part reeving should be used on loads between 2/3 and 1/3 of maximum rating. Three part reeving should be used on loads between 2/3 of maximum and minimum. When handling loads with three part cable reeving, the hoist line speed and the loads on hoist drum, hoist clutch and hoist brake are reduced 2/3.

RADIUS DIAGRAM
LIFTING CRANE, CLAMSHELL AND DRAGLINE





Clamshell Bucket	
Size Cu. Yds.	Dimension "A"
1	10'-6"
¾	10'-6"
⅝	10'-0"
½	9'-6"

FIGURE 24

LOAD DIAGRAM
LIFTING CRANE, CLAMSHELL AND DRAGLINE.

SAFE LOAD WITH 40 FT. BOOM AND ON FIRM LEVEL FOUNDATION.

LIFTING CRANE CAPACITIES ARE BASED ON 75% OF OVERTURNING LOAD.

CLAMSHELL AND DRAGLINE CAPACITIES ARE BASED ON 66 2/3% OF OVERTURNING LOAD.

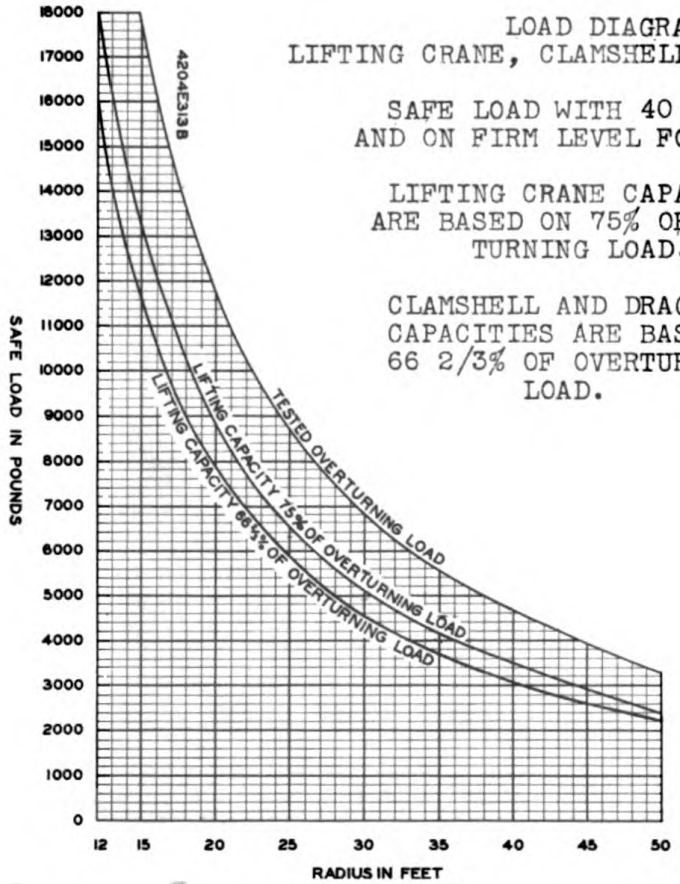


FIGURE 25

304 LIFTING CAPACITIES
MACHINE ON FIRM LEVEL FLOOR

Boom	Radius in Feet	Boom Angle in Degrees	Height Sheave Pin Above Grade	Lifting Crane Service 75% Rating Type A	Clamshell & Dragline Service 66⅔% Rating Type A
				110" x 94" Subframe	110" x 94" Subframe
35	12	75	39'- 2"	18000	16000
	15	69	38'- 2"	13200	11750
	20	61	35'- 9"	8850	7860
	25	50	32'- 0"	6500	5800
	30	38	27'- 0"	5100	4550
40	12	77	44'- 3"	18000	16000
	15	72	43'- 5"	13200	11750
	20	64	41'- 6"	8850	7860
	25	56	38'- 7"	6500	5800
	30	47	34'- 7"	5100	4550
	35	36	29'- 0"	4150	3700
45	12	78	49'- 4"	17850	15850
	15	74	48'- 6"	13050	11600
	20	67	47'- 0"	8700	7710
	25	60	44'- 4"	6350	5650
	30	53	41'- 0"	4950	4400
	35	44	36'- 9"	4000	3550
	40	34	30'- 6"	3350	2950
50	12	79	54'- 6"	17700	15700
	15	76	53'-10"	12900	11450
	20	70	52'- 2"	8550	7560
	25	63	50'- 0"	6200	5500
	30	57	47'- 3"	4800	4250
	35	50	43'- 9"	3850	3400
	40	42	38'- 9"	3200	2850
	45	32	32'- 0"	2600	2310
55	12	80	59'- 6"	17550	15550
	15	77	59'- 0"	12750	11300
	20	72	57'- 6"	8400	7410
	25	66	55'- 6"	6050	5350
	30	60	53'- 0"	4650	4100
	35	54	49'-10"	3700	3250
	40	48	45'- 8"	3050	2700
	45	39	40'- 4"	2450	2160
	50	31	33'- 6"	1950	1735

For average dragline and clamshell service, the 66-2/3% rating is recommended. For more favorable conditions the 75% rating is satisfactory.

For continuous dragline service we do not recommend a bucket and load exceeding 4700 and for continuous clamshell service a bucket and load exceeding 6500.

Clamshell and dragline buckets of different makes vary in weight and capacity which must be checked carefully in arriving at the proper working radii. In wet material allowance must be made for suction which at times is as much as 20% increase in weight. The weight of the hook block, slings, eveners, grapple or any device for handling the load must be considered a part of the load in determining the lifting capacity of the lifting crane.

For lifting loads for longer booms than listed, deduct 150 lbs. from above figures for each 5 ft. of boom added.

HOW TO USE THE CHART ON PAGE 31 FOR DETERMINING MAXIMUM SIZE STOCK PILE WITH DIFFERENT BOOM LENGTHS AND CLAMSHELL BUCKET CRANE

From the table "Bucket Data" take the height of bucket, dimension "A" for the size bucket to be used. Lay this dimension on the diagram with the upper end on the curve marked with the length boom used. Move this measured dimension around the curve until its lower end coincides with the diagonal line drawn through the center of the 4 foot flat top of stock pile. In other words, to a position where the vertical distance between boom point shaft and top of pile is equal to "A". If the radius as shown at the top of the diagram does not exceed the maximum allowable radius for the weight of loaded bucket, this is the maximum size stock pile that can be built. If this radius is greater than the allowable radius for the load, move the line "A" to the left until it coincides with the maximum radius as shown by the load diagram and given at the top of this diagram. The stock pile immediately below this point is the maximum that can be built.

Example 1: What is the maximum stock pile to which sand and gravel can be delivered with a 604 Crane with a 55 ft. boom and 1 yard clamshell bucket:

"A"-10' 6". The vertical distance between the curve for the boom point of a 55 ft. boom and the top of stock pile is 10' 6" at a radius of 45' 6". A 604 Crane will handle a load of 6585 pounds on a 55 ft. boom at a radius of 47' 0". Therefore the stock pile will have a radius at its center of 45' 6", a height of 30 feet and width at bottom of 79 feet.

Example 2: What is the maximum stock pile to which sand and gravel can be delivered with a 301 Crane and 3/4 yard clamshell bucket on a 50 ft. boom:

The vertical distance "A" between the curve for the boom point of a 50 foot boom and top of stock pile is 10' 6" at a radius of 42' 0". But the maximum radius at which a 301 Crane will handle a load of 4620 pounds on a 50 ft. boom is 34' 3". Therefore, the maximum radius of stock pile is 34' 3". The height is 21 feet and the width of bottom of pile is 56' 6".

WEIGHT OF MATERIALS IN POUNDS

Material	Lbs. Per Foot	Lbs. Per Yard	Material	Lbs. Per Foot	Lbs. Per Yard
Ashes	30	810	Limestone, Block	180	....
Cement, Portland	94	2538	Limestone, Broken	100	2700
Cinders	40	1080	Magnesite, Broken	105	2835
Clay, Dry Excavated	70	1890	Marl, Wet Excavated	140	3780
Clay, Wet Excavated	110	2970	Masonry, Debris	90	2430
Coal, Broken Penn., Anthracite	57	1539	Mica, Block	180	....
Coal, Broken Bituminous	52	1404	Mica, Broken	100	2700
Coke, Blast Furnace	30	810	Mud, Fluid	110	2970
Concrete, Wet Mixed	135	3645	Peat, Moist	50	1350
Copper Ingots	550	....	Peat, Wet	70	1890
Dolomite, Fine or Lumps	100	2700	Phosphate Rock, Broken.	110	2970
Earth, Excavated Common Loam, Dry	80	2160	Plaster, Ground	60	1620
Earth, Excavated Common Loam, Moist	90	2430	Salt	76.5	2080
Earth, Excavated Common Loam, Wet	110	2970	Sand, Slightly Damp	105	2835
Granite, Block	170	....	Sand, Wet	120	3240
Granite, Broken	96	2592	Slag, Broken Furnace	110	2970
Gravel, Screen 1/4" to 2"	105	2835	Slate	96	2592
Gravel and Sand, Pit Run	120	3240	Snow	15 to 50	....
Gypsum Rock, Crushed	100	2700	Steel	490	....
Ice	57.4	....	Sugar Beets	35 to 40	....
Iron Punchings	225	....	Sulphur	125	3375
Iron, Cast	450	....	Tar	62	....
Iron, Wrought	480	....	Tin	459	....
Lead	710	....	Trap Rock, Broken	105	2835
Lignite, Broken	52	1404	Water	62.4	....
Lime	64	1728	Zinc or Spelter, Cast	430	....

PRECAUTIONS

LIFTING CRANE SERVICE:

Crane must be on firm level ground when determining lifting capacity and 75% rating must be used. The weight of the hook block must be added to the weight of the load. Handle loads of 6000 lbs. or less with single line, loads between 6000 lbs. and 12000 lbs. with two part line and loads between 12000 lbs. and 18000 lbs. with three part line. Be careful in the handling of loads with the crane boom at an angle of 65 degrees or more above horizontal.

CLAMSHELL SERVICE:

Clamshell must be on firm level ground when determining lifting capacity and 66-2/3% rating must be used. The weight of the clamshell bucket must be added to the weight of the load. For special conditions, loads greater or less than those shown may be advisable. Allowance must be made for suction when working in wet or sticky material. To prevent striking the boom with the clamshell bucket, boom angle should not be above 60 degrees. For continuous clamshell service we recommend that combined weight of bucket and load does not exceed 6500 lbs.

DRAGLINE SERVICE:

Dragline must be on firm level ground when determining lifting capacity and 66-2/3% rating must be used. The weight of the dragline bucket must be added to the weight of the load. For special conditions, loads greater or less than those shown may be advisable. Allowance must be made for suction when working in wet or sticky material. For continuous dragline service we recommend that the combined weight of drag bucket and load does not exceed 4700 lbs.

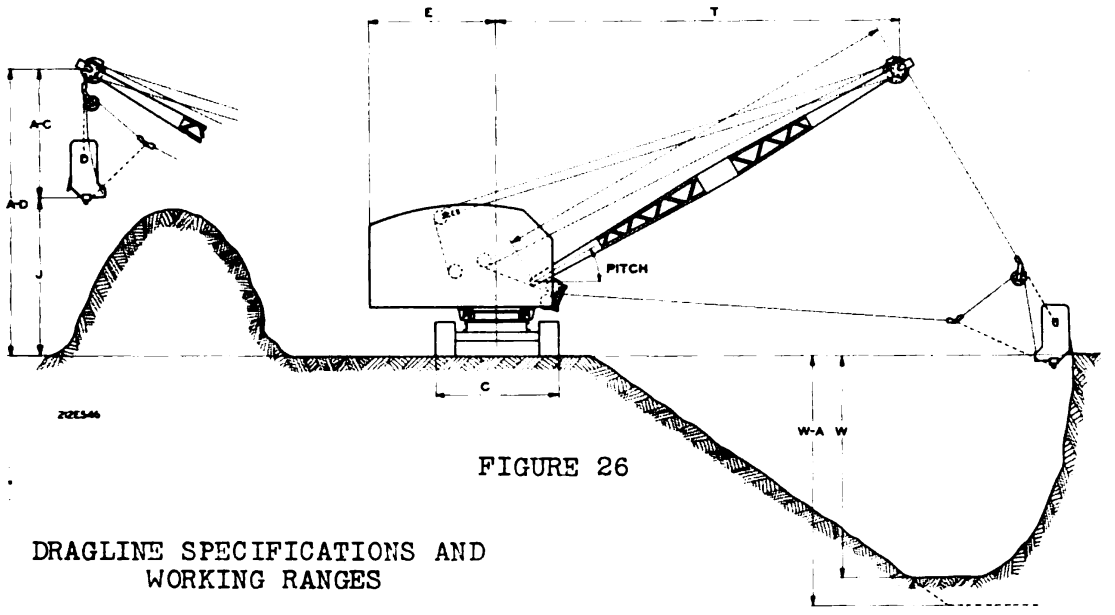


FIGURE 26

DRAGLINE SPECIFICATIONS AND WORKING RANGES

C-Overall width crawlers..... 9' 7"
E-Rear End Radius..... 9' 0"
J-Dumping Height (Height of boom minus "A-C")..... See table Page 29
T-Maximum radius..... See table Page 29

Digging depth with boom at 35° and hoist line 20° from vertical, the std. ropes furnished with a dragline are of sufficient length to allow an approximate digging depth below grade equal to 1/3 boom length.

WEIGHTS OF DRAGLINE BUCKETS

Size	Empty	Loaded with wet earth	With Loaded Gravel
3/4-26 cu. ft.	2200#	4700 See Note Page 29	4700 See Note P.29
1/2-17 cu. ft.	1600	3470	3385
3/8-11 cu. ft.	900	2110	2055

Note 1-No fixed rule can be given for governing depth to which the material can be excavated as it varies greatly with the nature of the material being excavated and the skill of the operator. It increases directly as the length of the boom increases.

Note 2-A skilled operator can easily throw the bucket ten feet or more beyond the end of the boom, the distance depending upon the length and pitch of boom.

Note 3-The cut above indicates in a general way how making a cut from the side affects the digging depth. The cut indicates in a general way how making the cut from the end of the excavation affects the digging depth.

Note 4-Weights given are average and are not applicable to any certain make of bucket. Any variation in weight or cubic contents of buckdt must be taken into consideration. The working radius for any given load must not exceed the rating shown by the load diagram, Page 29.

NOTES

SHOVEL SPECIFICATIONS AND WORKING RANGES.

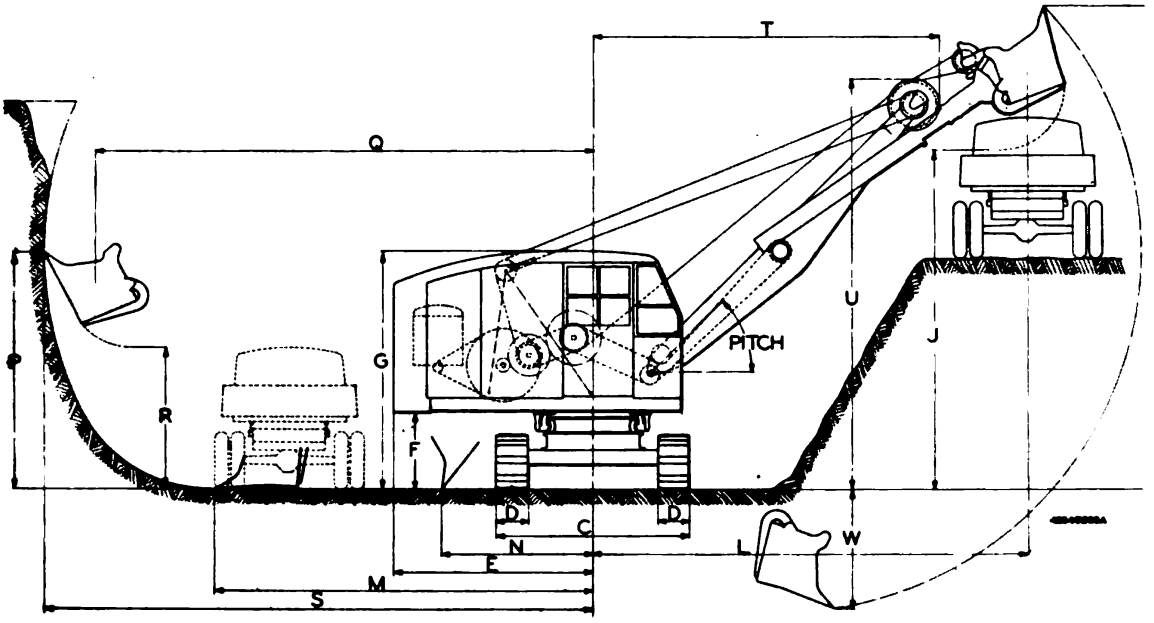


FIGURE 27

	Boom Length 18′- 0 ″ Pitch of Boom.....	35°	40°	45°	50°	55°	60°	65°
C	Overall Width Crawlers..	9′- 7 ″	9′- 7 ″	9′- 7 ″	9′- 7 ″	9′- 7 ″	9′- 7 ″	9′- 7 ″
D	Width of Shoe.....	21″	21″	21″	21″	21″	21″	21″
E	Rear End Radius.....	9′- 0 ″	9′- 0 ″	9′- 0 ″	9′- 0 ″	9′- 0 ″	9′- 0 ″	9′- 0 ″
F	Clearance under Counterweight.....	3′- 7½″	3′- 7½″	3′- 7½″	3′- 7½″	3′- 7½″	3′- 7½″	3′- 7½″
G	Height, Boom Lowered..	10′-10½″	10′-10½″	10′-10½″	10′-10½″	10′-10½″	10′-10½″	10′-10½″
P	Digging Height (at S)...	10′- 6 ″	11′- 2 ″	11′- 9½″	12′- 4 ″	12′-10½″	13′- 3½″	13′-8½″
T	Boom Clearance Radius.	18′- 6 ″	17′- 6 ″	16′- 5½″	15′- 3 ″	14′- 0½″	12′- 8½″	11′- 3½″
U	Boom Clearance Height..	17′- 0 ″	18′- 3½″	19′- 5 ″	20′- 6 ″	21′- 5½″	22′- 3 ″	23′- 0 ″

15 Ft. Sticks — ¾ cu. yd. Dipper

J	Dumping Height, Max..	13′- 1 ″	14′-10½″	16′- 7 ″	18′- 2 ″	19′- 9 ″	21′- 1 ″	22′- 4″
K	Cutting Height, Max....	18′-10 ″	20′-11 ″	22′-11 ″	24′- 9 ″	26′- 5 ″	27′-11 ″	29′- 4 ″
L	Dumping Radius, Maximum Height.....	25′- 5 ″	24′- 4 ″	23′- 1 ″	21′-9 ″	20′- 3 ″	18′- 7 ″	16′-10 ″
M	Level Floor, Max. Rad..	18′- 1 ″	18′- 0 ″	17′-10 ″	17′- 7 ″	17′- 3 ″	16′-11 ″	16′- 4 ″
N	Level Floor, Min. Rad...	6′- 4 ″	6′- 7 ″	6′-11 ″	7′- 3 ″	7′- 9 ″	8′- 5 ″	8′- 7 ″
Q	Dumping Radius, Maximum Reach.....	25′- 6 ″	25′- 1 ″	24′--6 ″	23′-11 ″	23′- 4 ″	22′- 8 ″	21′-11 ″
R	Dumping Height, Maximum Reach.....	6′- 7 ″	7′- 3 ″	7′-11 ″	8′- 6 ″	9′- 0 ″	9′- 5 ″	9′-10 ″
S	Digging Radius, Maximum Reach.....	28′- 3 ″	27′- 9 ″	27′- 3 ″	26′- 7 ″	26′- 0 ″	25′- 4 ″	24′- 7 ″
W	Cut Below Floor Level..	8′- 2 ″	7′- 6 ″	6′-11 ″	6′- 4 ″	5′-10 ″	5′-5 ″	5′- 0 ″

PULL SHOVEL SPECIFICATIONS AND WORKING RANGES.

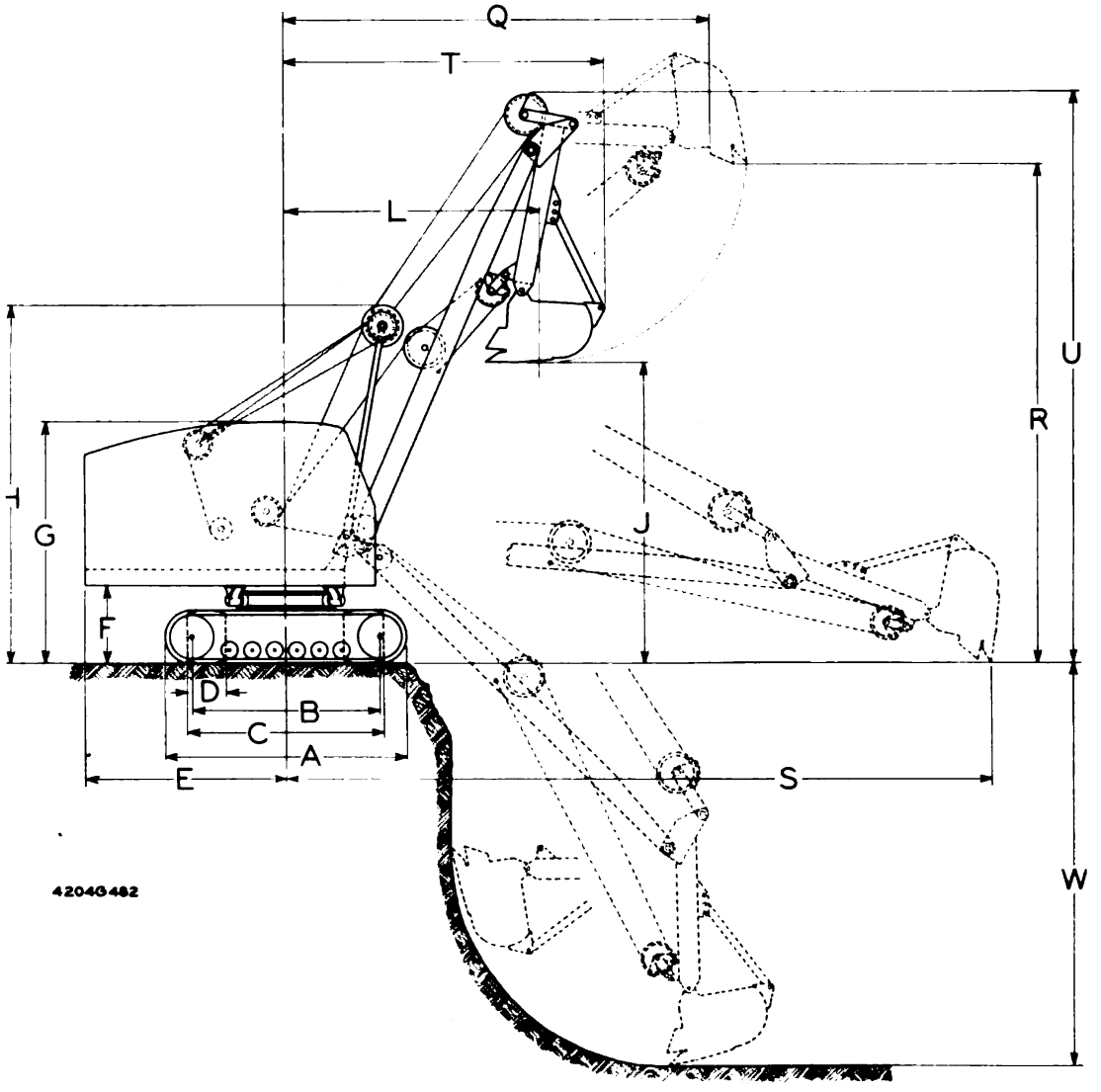


FIGURE 28

	Boom	19′-3″			
	Dipper Arm	6′-3″			
	Dipper	¾-yd.			
A.	Overall Length of Standard Crawlers	11′ 8″	J.	Clearance Height at Beginning of Dump	12′ 0″
	Extra long Crawlers	13′ 4″	Q.	Radius at End of Dump, Highest Position	19′ 3″
C.	Overall Width of Crawlers with				
	21″ Wide Shoes	9′ 7″	R.	Clearance Height at End of Dump	22′ 3″
	24″ Wide Shoes	9′ 10″	S.	Maximum Digging Reach	32′ 0″
	30″ Wide Shoes	10′ 11″			
	Overall Width of Cab	8′ 9″	T.	Clearance Radius of Boom and Bucket at Maximum Dumping Height	14′ 5″
E.	Tail Swing Clearance	9′ 0″			
	Clearance Heights		U.	Height of Boom at Maximum Dumping Height	25′ 6″
G.	Over Cab	10′ 10½″			
H.	Over Jib Frame	16′ 0″	W.	Digging Depth	18′ 0″

POWER FLOW DESCRIPTION
(SCHEMATIC DRAWING OF POWER FLOW, PAGES 38 AND 39)

IMPORTANT - The following description and illustrations are intended to supply both the operator and mechanic with information which will help him to be more efficient in the operation, maintenance or repair of his machine. A close study of this information will enable him to understand and be able to trace the flow of power from the engine throughout the upper and lower machinery and therefore quickly locate and diagnose any trouble in machine operation.

When studying the following material keep in mind that with the engagement of engine clutch all engine power is transmitted to the main shafts from which it is distributed for the various machine operations by five main clutches.

Each clutch performs an individual operation and can take all or any part of the engine power output.

The illustrations on pages 38 and 39 show assemblies of the upper deck or turntable machinery and the carbody or lower machinery. The flow of power from the engine throughout the machinery is indicated by a solid line and arrows.

With motor running and engine clutch (9) engaged, power is transmitted by a six strand roller chain from the engine sprocket (10) to the large sprocket (13) in the first reduction case. From sprocket (13) power flows through the take-off shaft to the small sprocket (12), and then through a four strand roller chain (14) to the large sprocket (16) which is keyed to the left hand end of the swing and traction jackshaft (15). The clutch spiders which are keyed to the jackshaft rotate inside the swing and traction clutch drums (17) and (7) and are engaged by a lever system that is designed so that both clutches cannot be engaged at the same time. Both clutch drums (17) and (7) are equipped with bevel pinions which are in constant mesh with the bevel gear (8) at the top of the vertical swing and traction jackshaft. As either one of the clutches is engaged, its clutch drum and bevel pinion rotates to drive the bevel gear which transmits power to the upper deck gears for swinging or traveling while the other bevel pinion and clutch drum idles in the opposite direction.

The small spur tooth pinion (6), keyed to the right hand end of the swing and traction jackshaft meshes with the spur gear (4) keyed to the boom hoist clutch drum assembly (5) mounted on ball bearings on the right hand end of the boom hoist shaft. The boom hoist clutch spider inside boom hoist clutch drum (5) and the shifter sleeve (19) are keyed to the boom hoist shaft. When the boom hoist clutch is engaged, power is transmitted from the spider through the shaft to the shifter sleeve (19) which in turn transmits it to the boom hoist drum (18) or to the racking-in sprocket (20) for the raising of the boom or racking-in of the shovel dipper. The shifter sleeve is controlled by an operating lever and either of the two operations can be selected by movement of that lever.

The spur gear (4) on the boom hoist shaft meshes with the large spur gear (1) keyed to the main drum shaft (2). Also keyed to the main drum shaft are the two spiders which rotate inside of the clutch drums (21) and (3) which are mounted on the shaft with anti-

(Continued on page 40)

POWER FLOW CHART
(FOR DESCRIPTION SEE PAGES 37 AND 40)

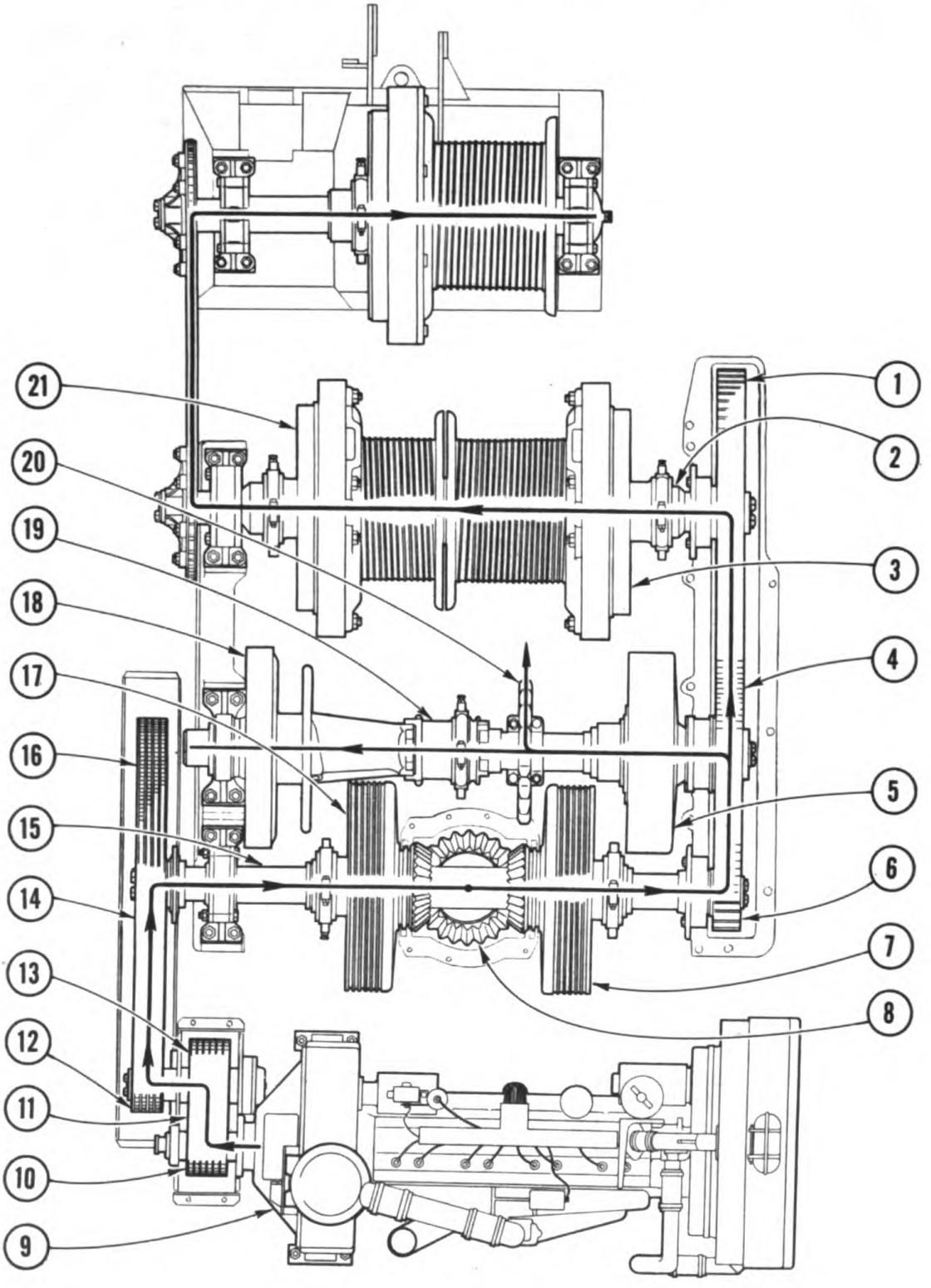


FIGURE 29

POWER FLOW CHART

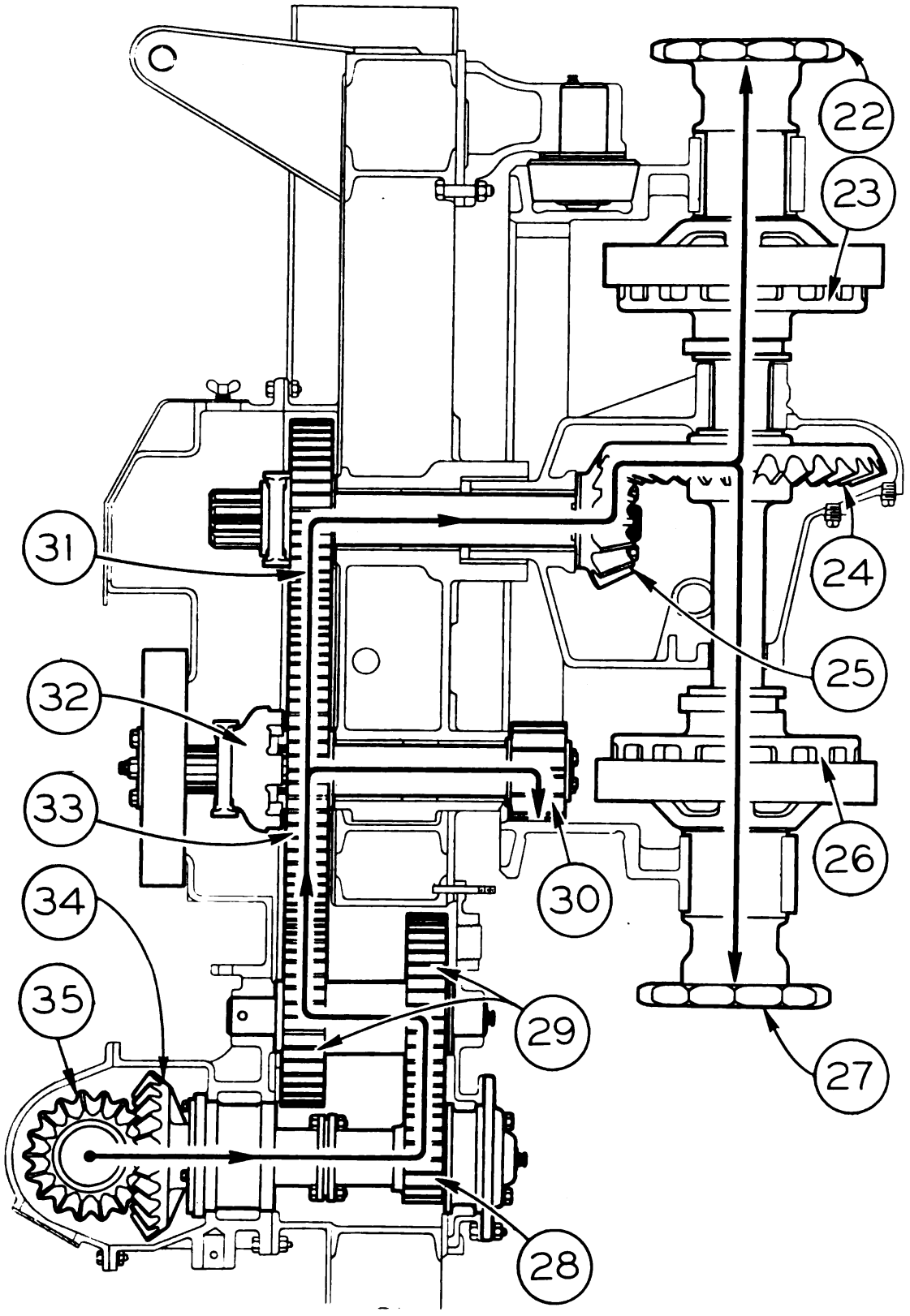


FIGURE 30

friction bearings. When either or both clutches are engaged the drums will rotate with the shaft to furnish power for the digging or hoisting operations. When the clutches are disengaged the drums remain stationary while the shaft rotates freely on anti-friction bearings located at each of its ends. The gear train (1), (4) and (6) is enclosed and runs in transmission grease. The roller chains (11) and (14) are enclosed and run in oil.

Power to the lower machinery is transmitted through a series of gears, bevel pinions and vertical shafts. From the bevel pinion (35) power flows to the bevel gear (34) which is mounted on a spline at the upper end of the vertical swing and traction shaft. From the spur tooth pinion (28) mounted on a spline at the lower end of the vertical swing and traction shaft power flows to the lower gear of gear assembly (29). The upper gear of this assembly meshes with spur gear (33) on the swing shaft. Spur gear (33) meshes with the splined spur gear (31) on the vertical traction shaft when the splined gear (31) is down as shown in drawing.

The jaw clutch (32) slides on the splines at the upper end of the vertical swing shaft, and engages with the jaws at the top of spur gear (33) on the vertical swing shaft. Jaw clutch (32) and splined gear (31) are operated by a shifter yoke and both cannot be engaged at the same time. The shifter yoke is operated by lever No. 2, Page 42. With splined gear down and jaw clutch up, the vertical swing shaft remains stationary; the swing shaft gear idles on the shaft and power flows to the vertical traction shaft, then down to the lower bevel pinion (25) to drive the machine in traction. When the splined gear (31) is raised up out of mesh with gear (33) and the jaw clutch on the vertical swing shaft is shifted down to engage the clutch jaws with the swing shaft spur gear (33), power is transmitted to the swing pinion (30) on the lower end of the vertical swing shaft to swing the turntable as desired.

The traction bevel pinion (25) meshes with the traction bevel gear (24) which is keyed to the lower traction shaft. The lower traction shaft transmits power to the jaw clutches (23) and (26) which, when engaged, transmit the power to the drive sprockets (22) and (27) and then by drive chains to the drive tumblers and crawlers.

With both traction jaw clutches disengaged, the shaft can be rotated without moving the machine. The linkage controlling the movement of both traction jaw clutches is so arranged that the disengagement of either jaw clutch will set a brake on the drum of that clutch and lock the drive tumbler and crawler for steering; or both jaw clutches may be disengaged and both brakes set, thus locking both crawlers from moving.

ENGINE CONTROLS

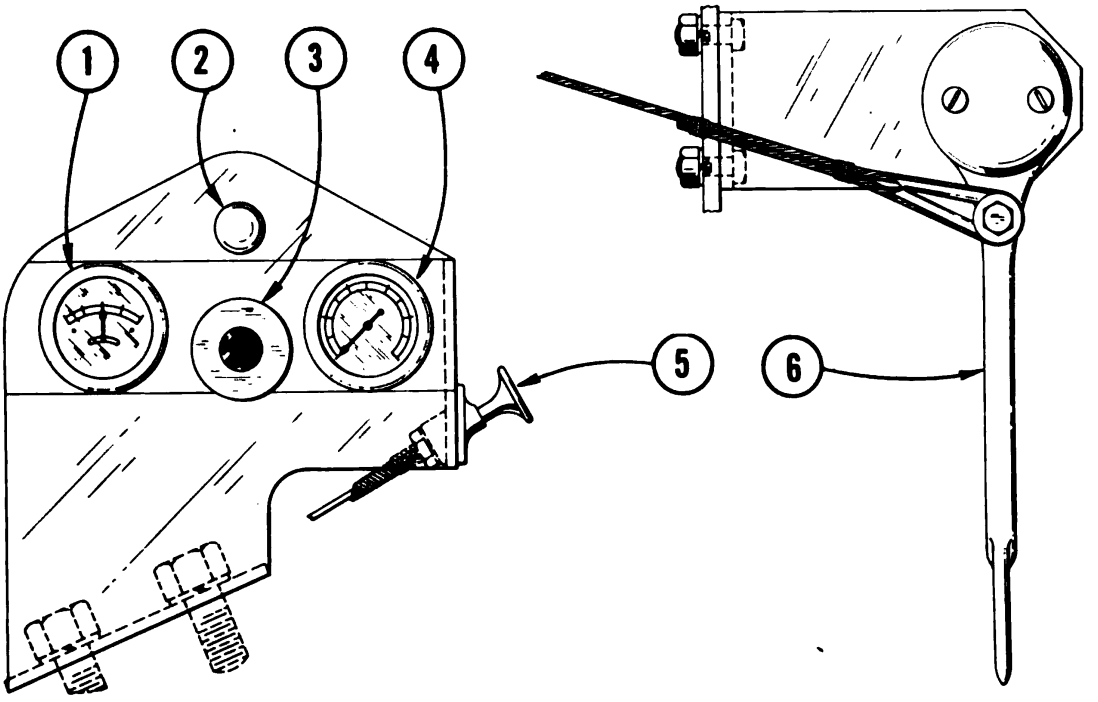


FIGURE 31

The engine controls consist of the ignition switch (2), starter button (3), throttle control (5) and governor control (6). In addition, the engine control panel contains an oil pressure gauge (4) which indicates the pressure in the oil circulating system of the engine and an ammeter (1) which indicates the rate of charge or discharge of electric current flowing into or out of the battery.

The governor control (6) is in front of the operator at his left and is connected with the governor to control engine speeds within the governor's range; the throttle control (5) controls engine speeds from this point to low idling.

The ignition switch (2) is of the "push pull" type. In "on" (out) position it closes the circuit between the battery and the ignition system therefore supplying the necessary electric current for engine operation. In "off" (in) position the circuit between battery and ignition system is broken, stopping the flow of electricity necessary to run the engine.

The starter button (3) actuates a solenoid which closes the circuit between the battery and the electric starting motor thus supplying the necessary current for its operation.

The engine is equipped with an automatic choke which controls the mixture of gasoline and air at the carburetor according to the temperature of the engine, and operates when starting and during the time the engine is reaching operating temperature. As the engine warms (due to the heat of the exhaust manifold affecting the choke) the choke valve opens automatically and stays in open or "off" position until the manifold cools.

OPERATING LEVERS

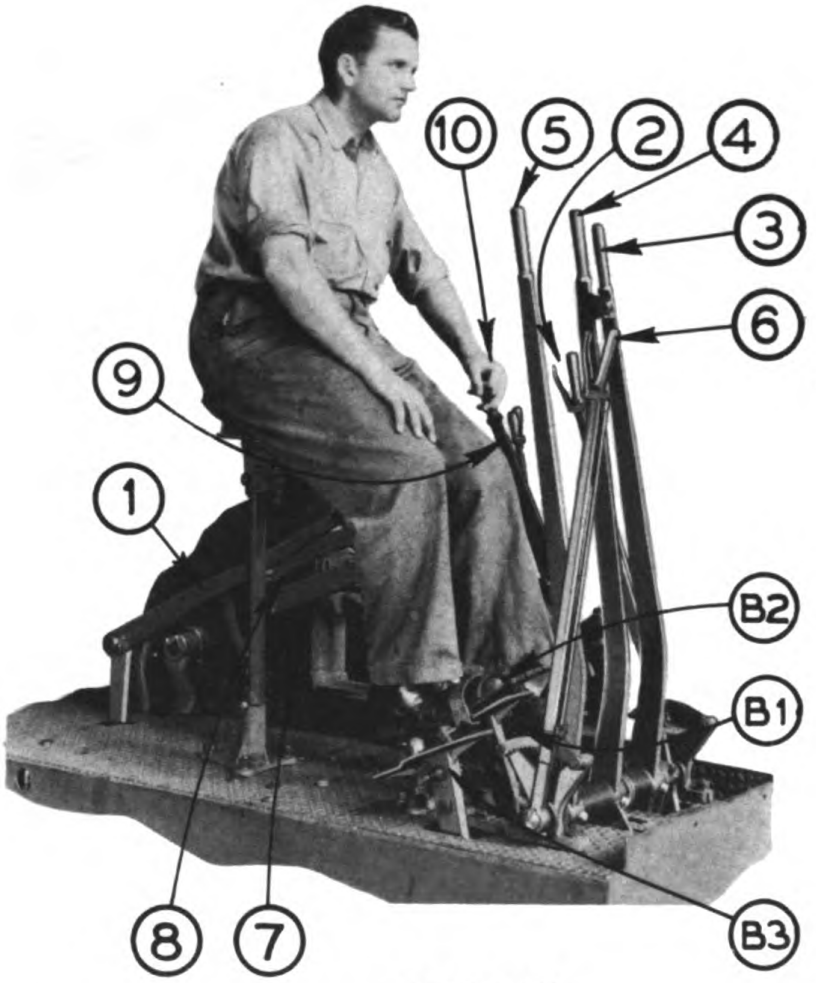


FIGURE 32

The operator's seat is mounted near the front on the right turntable platform or deck. As shown in the above illustration, all engine and machine controls are within easy reach of the operator, and all motions of the machine are controlled by the operator without leaving his position. The seat is adjustable to any desired height and may be moved forward or backward as required.

OPERATING LEVERS NAMED

#1 - Engine Clutch Lever.
#2 - Swing and Traction Jaw Clutch Lever.
#3 - Swing and Traction Clutch Lever.
#4 - Right Drum Clutch and Boom Hoist Lever-For Crane Type Operation.
#5 - Left Drum Clutch Lever.
#6 - Swing Brake Lever.
#7&#8-Steering Levers.
#9 -Used in Shovel Operation Only.
#10 -Boom Safety Ratchet Pawl Lever.
Pedal #B1 - Right Drum Brake Pedal.
Pedal #B2 - Boom Drum Brake Pedal.
Pedal #B3 - Left Drum Brake Pedal.

SUMMARY OF OPERATING LEVERS

(Levers common to all operating combinations)

OPERATION	POSITION OF LEVERS	
	PUSH	PULL
Swing right		#3 Lever
Swing left	#3 Lever	
Travel - Push #2 lever forward to shift from swing to travel	#3 Lever (For forward)	#3 Lever (For reverse)
Steer Right	#7 Lever	#8 Lever
Steer Left	#8 Lever	#7 Lever
Raise Boom	#4 Lever	
Lower Boom		#10 Lever #B2 Pedal
Lock for Digging		#7 Lever #8 Lever
Hoist Brake (Left Drum)	#B3 Pedal	
Swing Brake		#6 Lever
Boom Safety Pawl	#10 Lever (To engage)	#10 Lever (To disengage)
Right Drum Brake	#B1 Pedal	

LEVER APPLICATIONS WHEN USING VARIOUS ATTACHMENTS

NOTE--During the digging cycle in Shovel Operation, the left hand is used continuously for swinging. The right hand throws in the hoist lever and moves over to the crowd lever for control of crowding and racking-in. The right hand also bumps dipper trip for dumping.

	OPERATION	PUSH	PULL
CRANE	Hoist Load (Right Drum)		#4 Lever
	Lower Load (Right Drum)	#B1 Pedal	#B2 Spring released
SHOVEL	Hoist Dipper		#5 Lever
	Crowd		#4 Lever
	Rack-In	#4 Lever	
	Dipper Trip	Bump trip on handle of #4 Lever	
DRAG-LINE	Hoist Bucket		#5 Lever
	Drag Bucket		#4 Lever
CLAM-SHELL	Close Bucket		#4 Lever
	Hold Bucket		#5 Lever
	Dump Bucket		#B1 Pedal
PULL SHOVEL	Hoist Dipper		#5 Lever
	Dump		Release #B1 Pedal
	Lower Dipper		Release #B2 Pedal
	To Dig		#4 Lever

FIGURE 33

LEVER NO. 1 DESCRIBED—ENGINE CLUTCH LEVER

This lever operates the main engine clutch and should be down - engine clutch disengaged - while starting the engine. To engage engine clutch pull up on lever (1) until you feel it snap past a tight spot or, as ordinarily termed, "Snap into back-lock." It is best to engage engine clutch slowly with engine running at slow speed. BE SURE levers (3), (4) and (5) are in neutral position when engaging engine clutch. CAUTION: Engine clutch should never slip. See "Engine Clutch Adjustment", Page (87).

FIGURE 34

LEVER NO. 2 DESCRIBED - SWING AND TRACTION JAW CLUTCH LEVER

This lever has two positions. When latched in the forward notch, the travel gears are engaged and the machine will travel forward or backward by operating lever (3). When latched in the rear notch, the swing gears are engaged and the turntable and boom will swing right or left by operating lever (3). To shift lever (2), have lever (3) in neutral - engine clutch engaged, lever (1) up - pull back lever (2) to shift to swing or push forward to shift to traction. If lever (2) does not latch in selected position, keep pressure on it while moving lever (3) forward and backward SLOWLY, thus rotating the gears until they can be engaged and lever latched in proper notch. CAUTION: Be sure lever (2) is latched before operating machine.

FIGURE 35

LEVER NO. 3 DESCRIBED—SWING AND TRACTION CLUTCH LEVER

This lever operates the two friction clutches that swing the turntable right or left when swing gears are engaged or travel the machine forward or backward when traction gears are engaged. See lever (2) for changing swing and traction operations. A forward movement of lever (3) swings turntable and boom to the left; a backward movement of same lever swings to the right. A forward movement of lever (3) travels machine forward; a backward movement travels machine backward. The drive chain end of crawlers, is the rear end of traction assembly. Traction clutch may be back-locked while traveling. Lever (3) should be in neutral when not in use.

FIGURE 36

LEVER NO. 4 DESCRIBED-RIGHT DRUM CLUTCH AND BOOM HOIST LEVER
(As used in crane type operation)

This lever operates two friction clutches. When lever (4) is pulled back, the right hand drum clutch is engaged. In operation, this clutch is backlocked when the right hand drum is used as a dragline drum, closing line drum on a clamshell or as a hoist line drum on crane or clamshell. When lever (4) is pushed forward, the boom hoist clutch is engaged to raise the boom. Boom hoist clutch should not backlock. Lever (4) should be in neutral when engaging engine clutch. For the use of lever (4) in shovel operation, see "Operating A Shovel" under "Working Operations", page 60.

FIGURE 37

LEVER NO. 5 DESCRIBED-LEFT HAND DRUM CLUTCH LEVER

This lever operates the clutch on the hoist drum which winds the load lifting cable. In operation, this clutch is backlocked when lifting a load unless the load is to be raised only a few inches. To engage clutch pull back on lever (5) until the clutch snaps into backlock. To release clutch push lever (5) forward to end of travel. This clutch should be released when engaging engine clutch.

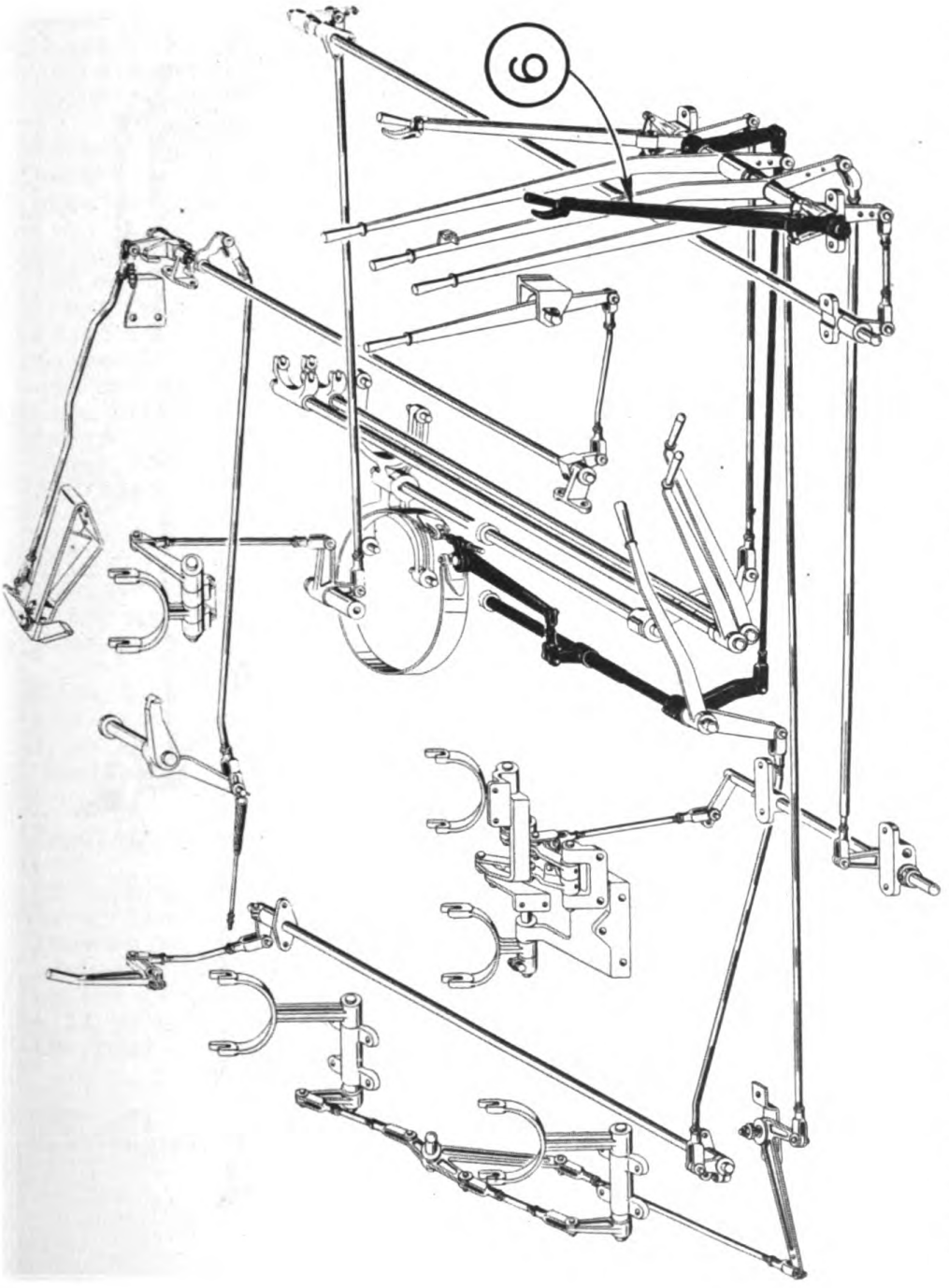


FIGURE 38

LEVER NO. 6 DESCRIBED-SWING BRAKE LEVER

This lever operates a brake which prevents the turntable or upper deck from swinging. This lever must be in forward position - brake released - while operating in swing gear. CAUTION: Brake MUST be set when traveling. Operator should not get off machine without first setting swing and traction brakes and engaging boom pawl.

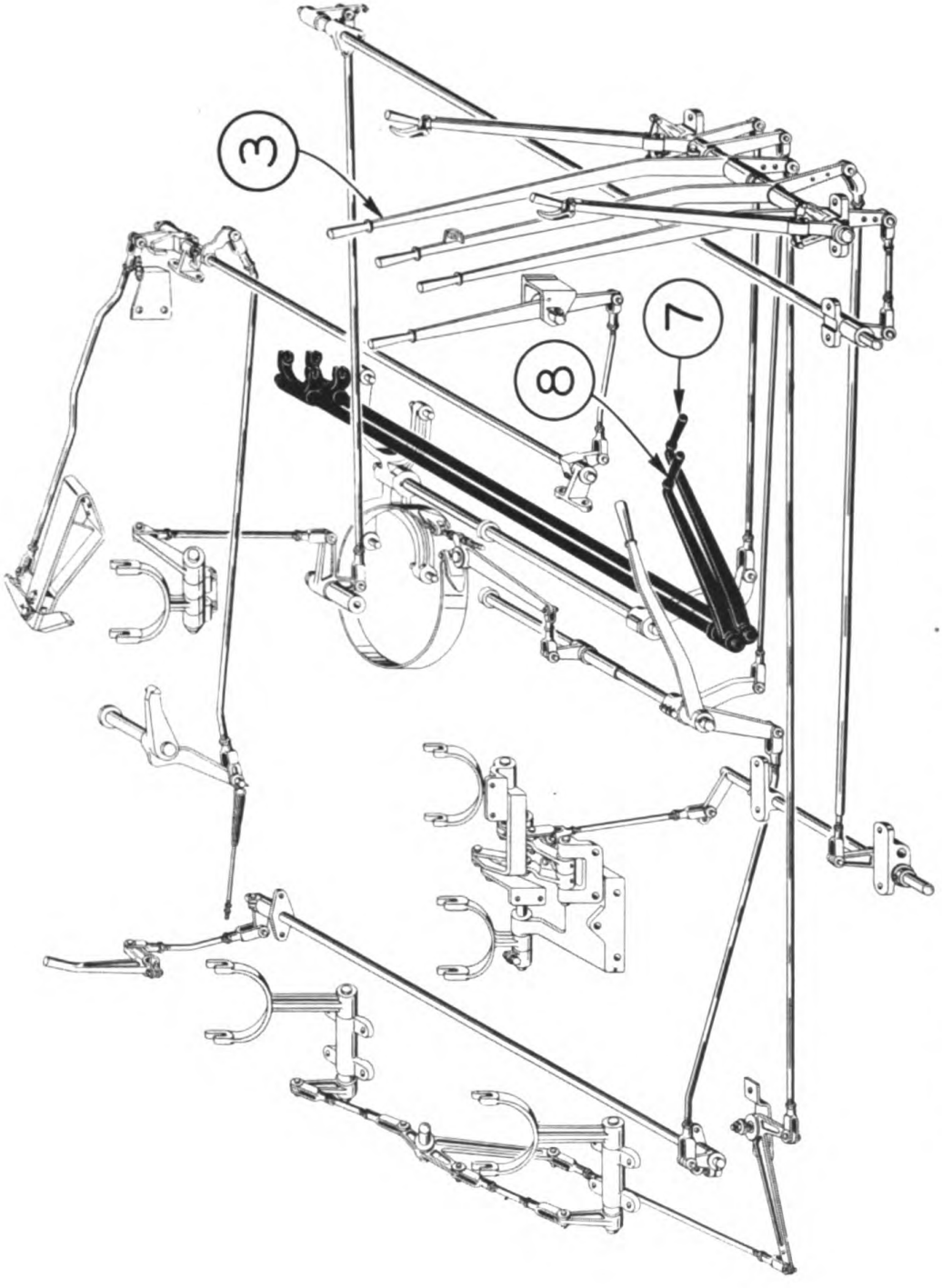


FIGURE 39-STEERING LEVERS 7 AND 8 (SEE DESCRIPTION NEXT PAGE)

LEVERS NO. 7 AND NO. 8 DESCRIBED

STEERING LEVERS:

These levers operate the steering jaw clutches and traction brakes on the lower traction shaft under the carbody.

Lever (7) operates the right hand steering jaw clutch and traction brake and steers the machine to the right when traveling forward - drive chains to the rear. It steers to the left when traveling backward - drive chains to the front.

Lever (8) operates the left hand steering jaw clutch and traction brake - steering to the left when traveling forward or to the right when traveling backward.

To operate, pull up into a backlock either lever (7) or lever (8) - depending upon the direction of steering - and the proper traction brake will be set. A momentary reverse on traction clutch lever (3) will release the load on the traction jaw clutch so that it can be disengaged. Continue travel operation with lever (3) and machine can be steered in desired direction. To release traction brake and engage steering jaw clutch, push down on steering lever (7) or (8), holding it down with left hand while reversing lever (3) until you are sure steering jaw clutch is fully engaged and that steering lever is at bottom of travel.

NOTE - Moving lever (3) forward or backward as directed above changes the direction of rotation of the lower traction shaft and lines up the traction jaws so they can be engaged or releases the load on the faces of the jaws so they can be disengaged.

Both levers (7) and (8) can be pulled up at the same time to set the traction brakes and disengage the traction jaw clutches, thus holding the machine stationary while working or when parked on an incline.

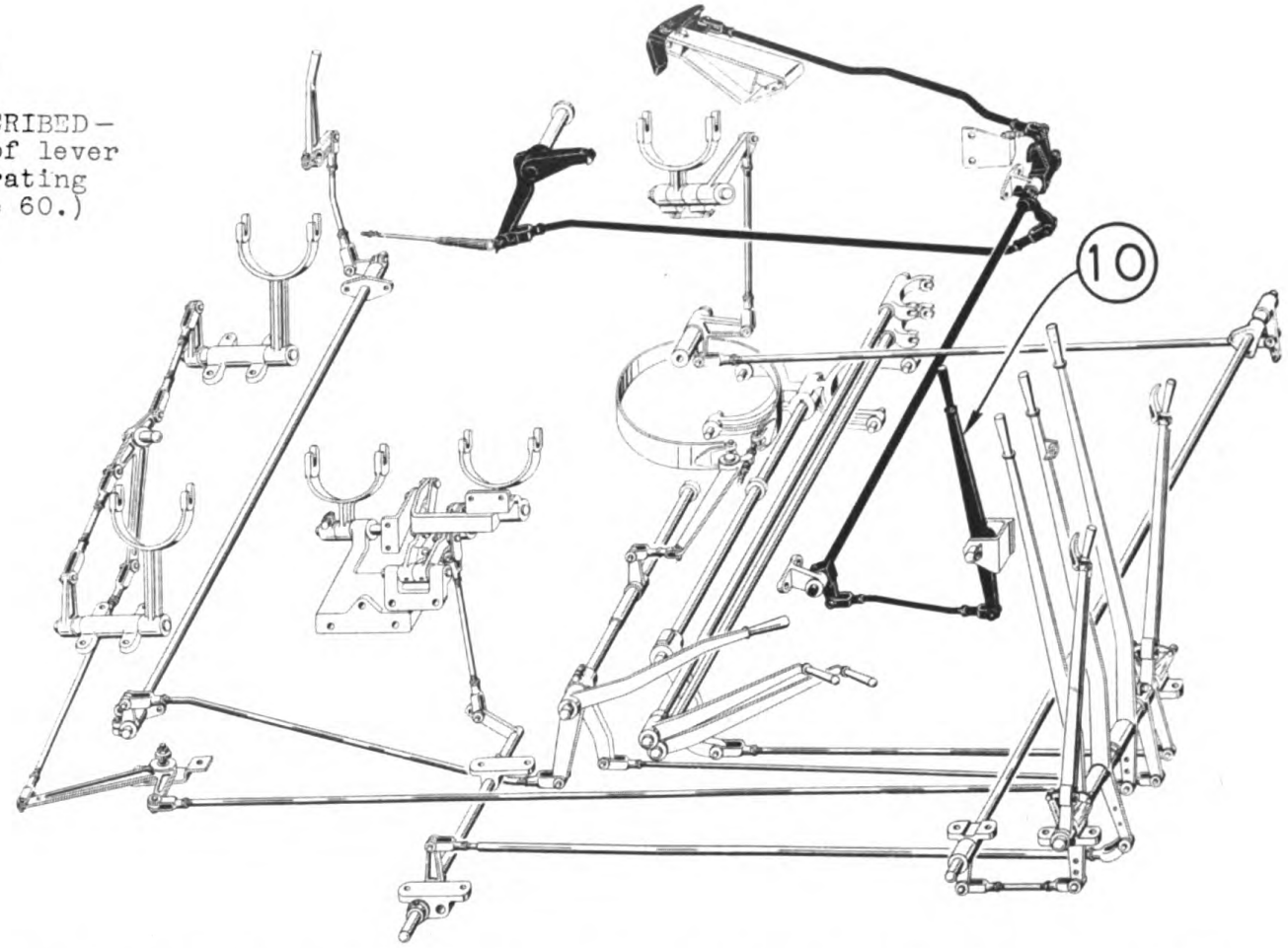
SPECIAL SAFETY FEATURE:

If machine starts coasting down grade, both traction brakes can be applied to stop machine by pulling up on levers (7) and (8). In such an emergency disregard all other levers. Setting the brakes may not disengage the traction jaw clutches until the load on the faces of the jaws has been released at which time the jaws will be automatically disengaged by a spring interconnected with the brake operating linkage.

CAUTION: Traction brakes and swing brake should be set and boom pawl engaged before operator gets off the machine.

FIGURE 40

LEVER NO. 10 DESCRIBED—
(For description of lever No. 9, see "Operating A Shovel", Page 60.)



BOOM SAFETY RATCHET PAWL LEVER: The boom safety ratchet pawl is in an engaged position when lever (10) is forward, disengaged when lever is back. Thus, to engage boom pawl, push lever (10) forward; to disengage, raise boom slightly and pull lever (10) backward. There is an interconnecting lever linkage that automatically prevents the boom pawl from becoming disengaged while boom is being raised. CAUTION: Never engage boom pawl while boom is being lowered. Always bring boom drum to complete stop before engaging ratchet pawl. Always be sure boom pawl is engaged before leaving machine.

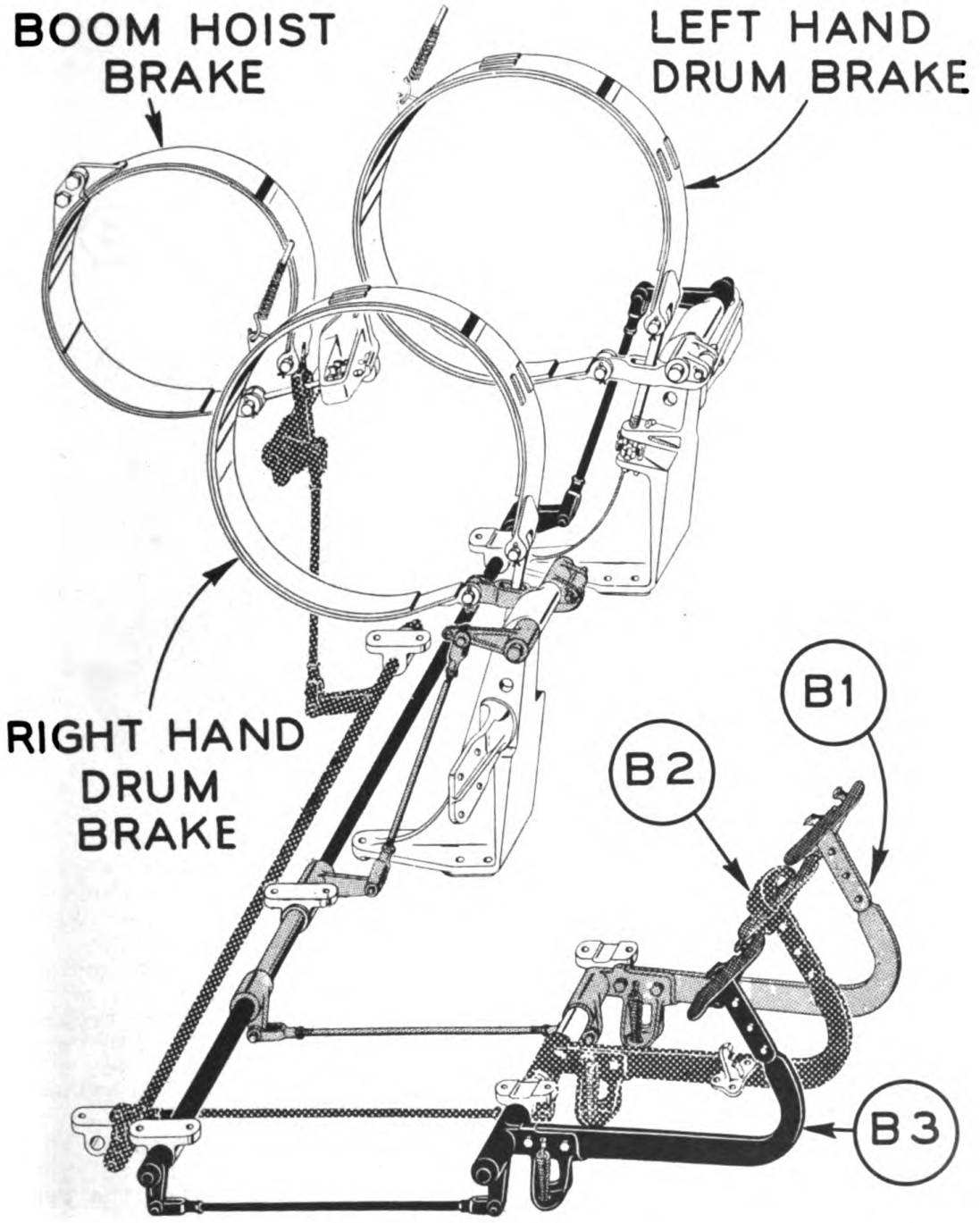


FIGURE 41

PEDALS B1, B2 AND B3 DESCRIBED-

PEDAL B1: This pedal operates the brake on the right hand drum. To set brake it is pushed down and can be latched in that position.
PEDAL B2: This pedal operates the brake on the boom hoist drum and is held under spring tension at all times.
PEDAL B3: This pedal operates the brake on the left hand drum. To set brake it is pushed down and can be latched in that position.

LEVER OPERATING PROCEDURE

(For levers named, see Page 42.)

TO START MACHINERY:

1. Be sure clutch levers No. 3, No. 4 and No. 5 are in neutral position.
2. Lift up on engine clutch lever No. 1 slowly until upper machinery is rolling freely then continue lifting the lever until you feel the engine clutch snap into a backlock.

NOTE--To avoid a jarring or jerking operation, the engine should be running only at idling speed when engaging engine clutch.

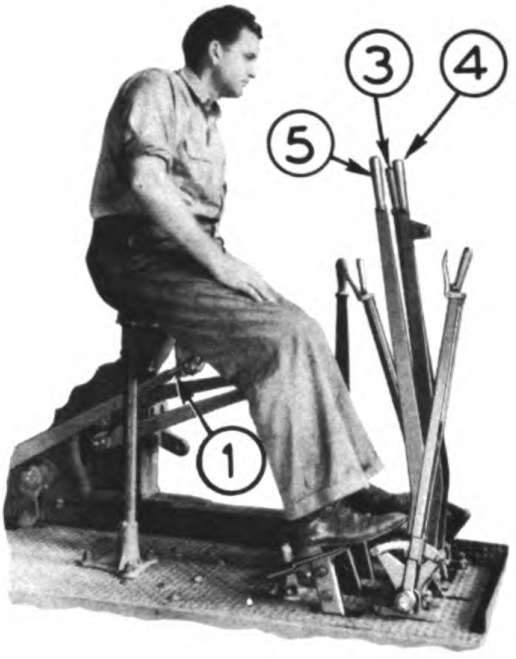


FIGURE 42

TO TRAVEL:

1. Lever No. 1 must be up (engine clutch engaged.)
2. Lever No. 2 must be in forward position (traction gears engaged.)
3. Lever No. 6 must be in backward position (swing brake set.)
4. Levers No. 7 and No. 8 must be down (traction brakes released and traction jaw clutches engaged.)Lever No. 3 will now travel machine forward or backward. (To steer, see Levers No. 7 and No. 8.) NOTE---When traveling long distances, machine should travel forward (drive chains in the rear.) Boom should be raised just high enough to balance machine so that weight is evenly distributed over all crawler rollers. If boom is too high the rear rollers will carry most of weight; if boom is too low the front rollers will carry most of weight.

FIGURE 43

LEVER OPERATING PROCEDURE (CONT'D.)

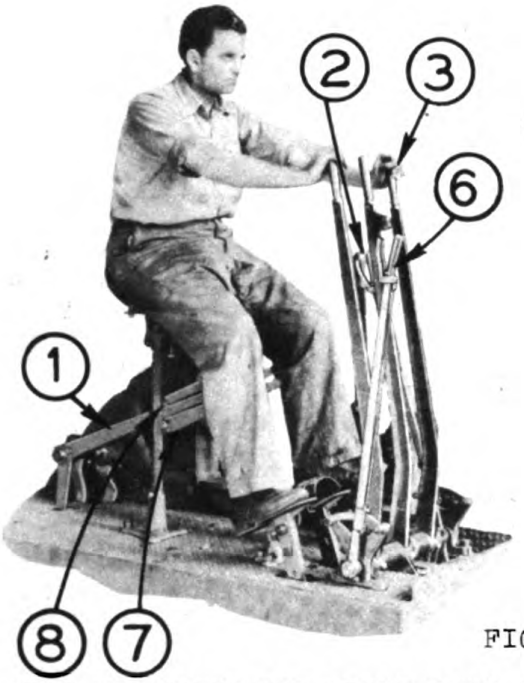


FIGURE 44

TO SWING:

1. Lever No. 1 must be up (engine clutch engaged).
2. Lever No. 2 must be in backward position (swing gears engaged.)
3. Lever No. 6 must be in forward position (swing brake released.)
4. Levers No.7 and No. 8 must be up (traction brakes set.) In some types of work on level ground, traction brakes do not need to be set. Lever No. 3 will now swing the turntable and boom right or left. To stop a swing motion, reverse on Lever No.3.

TO RAISE AND LOWER THE CRANE BOOM AND PULL SHOVEL GIB FRAME

1. Lever No. 1 must be up (engine clutch engaged.)
2. If Lever No.9 is on the machine, it must be in forward position (boom hoist engaged.) Lever No. 4 is now pushed forward to raise boom during which operation there will be a clicking noise made by the safety boom pawl dropping from one ratchet to the next. When boom is at desired working angle, return Lever No. 4 to neutral. With boom pawl Lever No.10 forward, place foot in stirrup of Pedal B2 and lift up slowly to make sure that safety boom pawl is firmly seated in the ratchet. To lower the boom, raise it slightly then disengage the safety boom pawl by pulling back on Lever No. 10; place foot in stirrup of Pedal B2 and lift up slowly. When boom is at desired angle, press down on Pedal B2; engage safety boom pawl (Lever No. 10 forward) then lift Pedal B2 slowly until you are sure safety boom pawl is firmly seated. CAUTION: Do not engage safety boom pawl while the boom is being lowered. To raise and lower shovel boom, see Page 105.

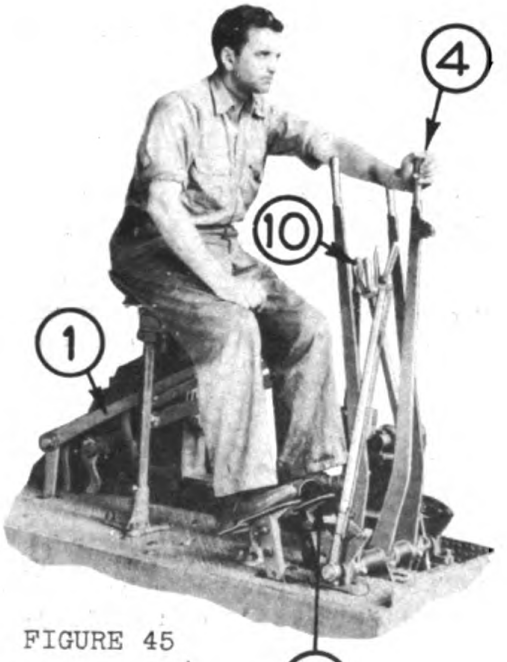


FIGURE 45

SAFETY PRECAUTIONS

For the safety of the operator and others working near the machine, and to prevent damage to the machine, the following rules should be observed:

1- Be sure all operating levers are in neutral before engaging engine clutch.
2- Always engage engine clutch slowly with the engine idling.
3- Always set swing brake when traveling.
4- Always set traction brake when parked or when operating on inclines.
5- Never lift loads greater than the rated capacity at given radii - the engine is powerful enough to tip the machine over.
6- Never swing fast when load is near or at rated capacity because fast swinging causes load to extend beyond boom point thus increasing the radius beyond the capacity of the machine. This carelessness might tip the machine over.
7- Keep the machine in good operating condition.
8- Keep the machine clean. The process of cleaning is one good way to discover trouble in the making such as loose bolts, water leaks, oil connections, etc.
9- When hand cranking the engine always use left hand and pull crank handle upward and across the engine. This reduces the hazard of the arm being struck by the crank handle should there be a reversal of direction of crankshaft rotation.
10-Read the operation section of this manual carefully.

CAREFUL OPERATION IS THE BEST INSURANCE AGAINST AN ACCIDENT.

RECEIVING A NEW MACHINE:

Before Koehring machines are shipped from the factory, they are given a final inspection. Each item is carefully checked with specifications after which each machine is put through an actual operating test. Despite these precautions, oversights sometimes occur or the machine might have been damaged in transit. To further safeguard the purchaser's interest, the machine should be carefully inspected before unloading, noting on the bill of lading any damaged or missing parts and reporting the same to the freight agent. Thus all parties concerned are properly protected until responsibility for such damages or shortages is determined.

STARTING A NEW MACHINE:

(These rules apply also to starting used machines.) Before starting machine, it should be thoroughly inspected by the operator. Remove metal shields from windows and store the shields in the rack provided for them on the left deck. Inspect all gear cases to be sure they are filled to the proper oil level. Check the greasing of machine and open gears. Inspect all cables to be sure there are no broken strands and that the cables are properly and securely fastened at both ends.

BEFORE STARTING THE ENGINE

LUBRICATION:

Check the amounts of oil in the engine and the air cleaner to be sure they are up to the proper oil levels. Refer to "Engine Lubrication", Page (67) for correct grades of oil to be used for the prevailing temperature. Remove the spark plugs and pour approximately 1/2 an ounce of engine oil into each cylinder to insure lu-

brication of the pistons and the cylinders at the first starting of the engine. Replace spark plugs. Note--This practice is also advisable when starting engines that have been idle for thirty days or more.

FUEL:

Fill the fuel tank. Add one pint of light engine oil to each five gallons of gasoline during the first fifty hours of operation. CAUTION: Never fill the fuel tank near an open flame or when the engine is running. Keep metal funnel in contact with metal filler when filling fuel tank to avoid the possibility of a static spark igniting the vapors.

COOLING:

Fill the cooling system with clean, soft water or anti-freeze solution, depending upon climatic condition. The capacity is 8 U. S. gallons. Never pour cold water into an empty or partially empty cooling system if the engine is hot as it might cause the engine block or cylinder head to crack or warp. Never pour hot water into the cooling system when the engine is very cold as this, too, might cause the engine block or cylinder head to crack or warp.

STARTING THE ENGINE:

When you are sure all preliminary steps as outlined in the foregoing paragraphs have been completed, the engine is ready to start. Be sure engine clutch is disengaged (Lever No. 1, Page 42 down) and the ignition switch is ON. Push throttle control to about one-third open position. (No choking operation is necessary on the part of the operator since the engine is equipped with an automatic choke. This device controls the mixture of gasoline and air at the carburetor according to the temperature of the engine, and operates when starting and during the time the engine is reaching operating temperature.) Engage the starter until the engine starts but for no longer than fifteen second periods at a time. If the engine fails to start at the first attempt, repeat the procedure after allowing ten to fifteen seconds to elapse. If the engine becomes over choked or flooded, open the throttle fully while operating the starter. After the engine starts, watch the oil pressure gauge. If oil pressure is not built up immediately, shut off the engine and investigate the cause.

WARM-UP PERIOD:

After starting a cold engine, operate it at a speed slightly faster than idling (approximately 700 revolutions per minute) for a few minutes to allow it to warm up before placing it in service. Allow the engine to reach normal operating temperature before placing it under full load. This will permit the oil to warm up and reach the bearing surfaces, reducing the possibility os scoring and premature wear of internal engine parts.

STOPPING THE ENGINE:

Before stopping the engine, disengage the engine clutch. Allow the engine to idle a few minutes then turn ignition switch off. CAUTION: Turning ignition switch off while engine is running fast does not give the cooling system a chance to carry off the excessive heat developed in the engine by high speed or heavy load operation.

WORKING OPERATIONS (Page 42)

HOISTING AND LOWERING A LOAD:

NOTE - Either or both right and left hand drums may be used. With the engine clutch engaged (lever No. 1 up) pull back on lever No. 5 slowly if the left hand hoist drum is used. As you feel the hoist clutch begin to engage, release the right hand brake pedal B-3 and continue pulling lever No. 5 back until the clutch is fully engaged or back-locked. When the load has been raised to the desired height, push down on the brake pedal B-3, setting the brake, and push forward on lever No. 5, releasing the hoist clutch. Setting the brake and releasing the hoist clutch must be an almost simultaneous operation - setting the brake a fraction of a second before releasing the hoist clutch. If the hoist clutch is released before the brake is set, the load will drop several feet before the brake catches it, thus putting an unnecessary strain on cables, boom, drum shaft and gears. The brake can be latched to hold a load suspended while traveling but in picking up a load and swinging it to another location, it is not necessary to latch the brake. To lower the load, ease the foot pressure on the brake pedal. If the right hand hoist drum is used for hoisting and lowering a load, operation follows the same procedure as above outlined except that lever No. 4 and brake pedal B-1 are used.

OPERATING A CLAMSHELL:

With the holding cable (left hand drum) and the closing cable (right hand drum) wound evenly on the drums with no slack in either cable, pull back on levers No. 4 and No. 5, engaging both drum clutches at the same time, and release brake pedals B-1 and B-3. When the bucket is high enough to swing over the material to be handled, push down on both brake pedals and release both clutches. If the bucket is not completely open, release left foot brake pedal B-1 slightly allowing the closing cable to unwind and the bucket to open, being careful to avoid too much slack in the cable. Swing the bucket over the material to be handled. Release both brake pedals B-1 and B-3 slightly, allowing the same amount of cable to unwind from both drums and the bucket will lower wide open to the material. With the closing cable drum clutch fully engaged or back-locked by pulling back on lever No. 4, release the left brake pedal B-1 and the bucket will begin closing. When the bucket is fully closed, fully engage the hoist clutch by pulling back on lever No. 5, release brake pedal B-3 and bucket and load will be raised. While the bucket is raising, swing the machine so the bucket will be over the desired location for depositing the material it contains. When the bucket has reached the desired height, press down on both brake pedals B-1 and B-3 and, with the right hand, release clutch levers No. 4 and No. 5. Releasing slightly on left brake pedal B-1 will open the bucket and release the load. NOTE: For clamshell operation, bend levers No. 4 and No. 5 close enough together so that they may be operated simultaneously with the right hand for disengaging both clutches. The left hand is then free for operation of the swing lever.

Precautions: Do not allow too much slack cable to unwind from

WORKING OPERATIONS (CONT'D.)

the drum when dropping the bucket on the material. Never drop a closed bucket on the material - it is destructive carelessness. Keep the cables winding evenly on the drums; crossing cables on drums will damage the cable. By keeping clutches and brakes properly adjusted and by following the operating procedure as outlined, there will be even wear on both clutch bands, both cables and both brakes. Better clamshell work can be done if machine is on level ground.

Tagline: If the tagline does not prevent the bucket from twisting around, more tension can be added by pulling several feet of cable off the drum, then hold the drum and rewrap around the drum the slack cable that has been pulled off.

OPERATING A DRAGLINE:

When dragline has been moved to its digging location, set the traction brakes (levers No. 7 and 8 up) to hold the machine stationary while dragging the bucket. For average dragline work the boom angle is usually between 30 and 40 degrees. However, certain types of work and height of spoil bank (excavated material) will determine boom angle. For example, a shallow cut will not produce a high spoil bank, therefore boom can be worked at a lower angle, whereas a deeper cut produces a higher spoil bank and consequently requires a higher boom angle for sufficient clearance to dump dragline bucket. After checking the hoist cable (left hand larger drum) and the drag cable (right hand smaller drum) to be sure the cables are wound evenly on the drums and that there is no slack, pull back on hoist clutch lever No. 5 and release brake pedal B-3 to lift the bucket to a height that is just a little more than the length of the bucket when lever No. 5 is pushed forward to disengage clutch and brake pedal B-3 is pressed down to hold bucket suspended. Swing bucket over material to be excavated. Lower the bucket to the material by releasing brake pedal B-3 gradually. Engage the drag clutch (lever No. 4) and release brake pedal B-1. As the bucket is pulled toward the machine, it will dig and load the bucket with the material being excavated. The depth of digging is controlled by tension on the hoist cable. The bucket will be filled at some point between the fairlead and the boom point when it should be raised by the hoist cable while tension on the drag cable is controlled to prevent spillage. CAUTION: The drag cable anchor on the drag chains of the bucket must never be pulled against the dragline fairlead. When the bucket is filled, push down on brake pedal B-1 and release drag clutch lever No. 4. Engage hoist clutch lever No. 5 and release hoist brake pedal B-3 Release brake pedal B-1 just enough to balance the bucket and load while it is being hoisted. CAUTION: Holding the drag brake too tight will increase the hoist load and hold the bucket too close to the under side of the boom. When the drag brake is too loose it allows the bucket to tip down and spill the load while hoisting. Never hoist the bucket against the boom point. Swing the machine to dumping position while hoisting and when the bucket has reached the desired height, set the hoist brake pedal B-3 and release the hoist clutch lever No. 5. To dump the bucket, release the drag brake pedal B-1 gradually. Always keep slack out of the cables and be sure cables wind evenly on the drums while operating.

Dragline operation requires a good sense of timing and much practice. As you become more proficient, you will be able to cast the

WORKING OPERATIONS (CONT'D.)

bucket several feet beyond the boom point either by accurately timing the drag brake release as you swing toward the digging position or by stopping the machine at the end of the swing, pulling the bucket up near the boom foot then releasing the drag brake, allowing the bucket to swing out beyond the boom point then letting the bucket down. The short cable from the arch of the bucket around a sheave on the hoist chains and down to the ends of the drag chains is called a "dump cable" and is furnished with the bucket. This cable may be lengthened or shortened to improve the balancing of the bucket. To avoid damaging the bucket, the dump sheave, the spreader bar and chains, never drop the bucket from any great height. Dropping the bucket flat on the ground will bend the bottom and thus impair the digging angle of the lip and teeth - the teeth and the front of the bucket arch should rest on the ground to be in proper digging position.

OPERATING A SHOVEL:

As illustrated on page 27, the principal operation motions of a shovel are hoisting the dipper, crowding out and racking-in the dipper, and swinging from digging position to dumping position and back. When machine is at the digging location, set the traction brakes (levers No. 7 and No. 8 up) to hold the machine stationary while working. In average work the boom should be at an angle of approximately 45 degrees. When working against a high bank which requires a high digging reach, the boom should be higher but never beyond a 65 degree angle. In a low or shallow cut the boom should be lower but never beyond a 35 degree angle. After the boom has been set at the proper working angle, with dipper on the ground, be sure the boom safety ratchet pawl is firmly seated. Shift lever No. 9 toward the operator to racking-in position. Shift lever No. 2 back to position for engagement of swing gears. Engage the racking-in clutch (lever No. 4 forward) to raise the dipper slightly for clearance then engage the hoist clutch (lever No. 5 back) with the right hand; release the hoist brake B-3; engage the crowd clutch (lever No. 4 back) with the right hand and release crowd brake pedal B-1. After the dipper has been crowded into the bank - just far enough to slice off a cut deep enough to fill the dipper as it is being hoisted - release the crowd clutch (lever No. 4 forward to neutral) and set the crowd brake (pedal B-1 down), thus holding the dipper at the desired digging depth while hoisting. When the dipper is full, release the crowd brake and rack-in the dipper away from the bank for clearance while swinging. Release the hoist clutch when the dipper has reached the desired height and set the hoist brake. Swing the dipper to dumping position then press down on the dipper trip lever to open the dipper door for discharge of the material. The dipper door will slam shut and lock as it is being lowered on the return swing to digging position. Never crowd the dipper with such force that it stalls the engine. Do not hold the dipper crowded into the bank by slipping the crowd clutch as this practice puts unnecessary wear on the crowd clutch band and takes power away from the hoist effort. The dipper can be held in any position - crowded out beyond the boom point or racked-in under the boom - with the crowd brake. The dipper can be held at any height with the hoist brake. Never swing while the dipper is resting on the ground or while digging to avoid bending the dipper sticks or twisting the boom. Never crowd out the dipper so far that the stops (sometimes called greenhorns) on the under side of the dipper sticks strike the shipper shaft pinions. Never rack in so far that dipper stick spacer block strikes boom. During operation, the

WORKING OPERATIONS (CONT'D.)

left hand is used to engage the swing clutch. The right hand is used to engage the hoist clutch then shift to engage the crowd clutch and back to the hoist lever when crowding is completed. The only exception to this procedure is when making shallow cuts where it is necessary to engage the crowd clutch slightly ahead of the hoist clutch. In this latter case the left hand is used on the crowd lever and the right hand on the hoist lever. The crowd clutch should be adjusted so that it does not back-lock during operation. Never drop the dipper too fast. Avoid striking the crawlers and thus eliminate damage to the machine and dipper.

When loading hauling equipment, never hold the dipper too high for dumping as the falling material might damage the truck or wagon. If the dipper becomes loaded at the bottom of a cut rack in enough to clear the rest of the bank while hoisting - hoisting a loaded dipper through the bank consumes extra power and time. Much practise and keen observation is required to become an efficient shovel operator.

OPERATING A PULL SHOVEL:

The operating cycle of a pull shovel consists of extending the dipper arm with dipper to its maximum reach; lowering the boom, arm and dipper to the digging point; pulling the dipper to the machine to fill it; hoisting and swinging to dumping position; dumping then swinging back to digging position. When machine is at digging location, set the traction brakes (levers No. 7 and 8 up) to hold the machine stationary while pulling on the dipper. Engage the hoist clutch (lever No. 5 back) and release hoist brake pedal B-3. Release drag drum brake pedal B-1 just enough to allow cable to pay out until the dipper arm is fully extended. Release hoist clutch (lever No. 5 forward) and set hoist brake pedal B-3. Lower the dipper to the ground by slightly releasing the hoist brake. Engage the drag clutch (lever No. 4 back) to pull the dipper toward the machine thus filling the dipper. The depth of the cut can be controlled by the tension held on the hoist cable with the hoist brake. When the dipper is filled, or pulled up close to the boom, release the drag clutch and set the drag brake. Engage the hoist clutch and release the hoist brake to raise the boom and dipper. Swing to dumping position. Releasing slightly on the drag brake will allow the dipper to swing out for dumping the excavated material. As the drag cable is paying out in the dumping operation, it is necessary to wind some hoist cable on the hoist drum to prevent the boom from lowering. Swing back to digging position. Do not swing the machine while the dipper is on the ground or being filled to avoid damaging the dipper arm and boom. Keep the cables winding evenly on the drums. Do not drop the dipper more than a few inches to force the teeth into exceptionally hard material.

WORKING OPERATIONS (CONT'D.)

MAIN DRUM SHAFT

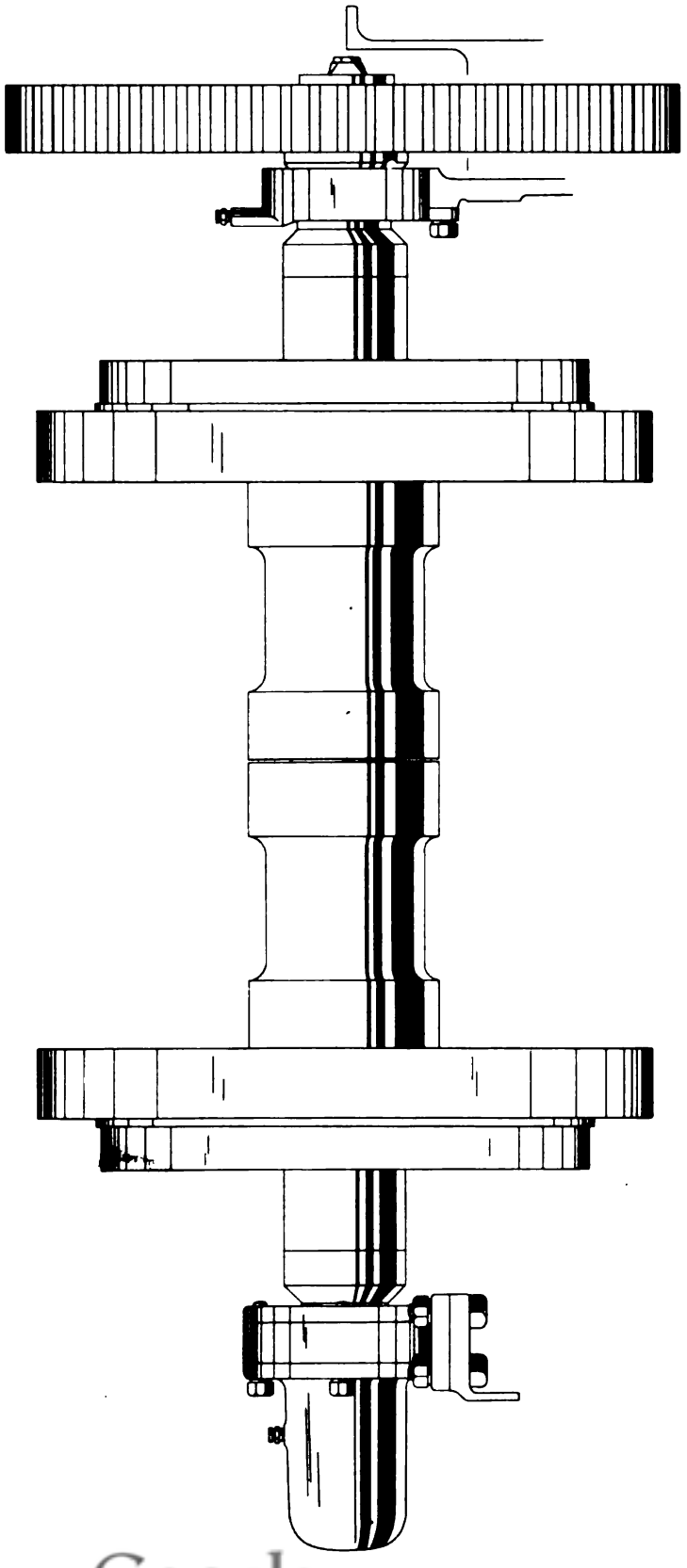


FIGURE 46

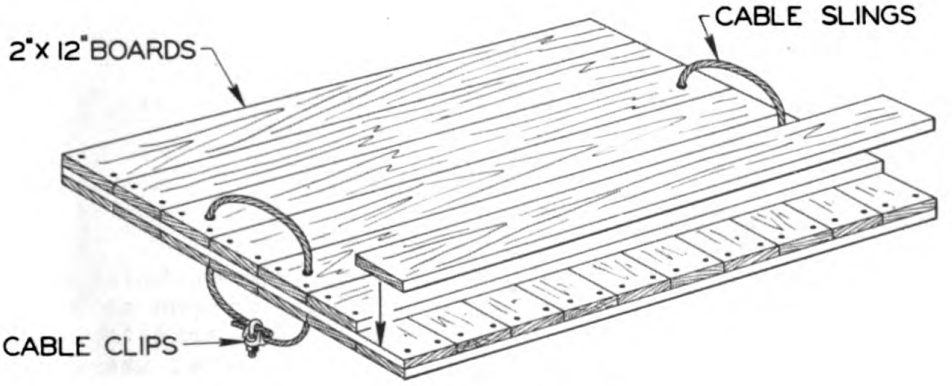
The main drum skeleton shaft is designed as illustrated in Figure 46 above. Application of the drum and sprocket laggings for use in operating the various combinations is described under "Equipment Changes For Various Operations" beginning on Page 95.

OPERATION UNDER ABNORMAL CONDITIONS

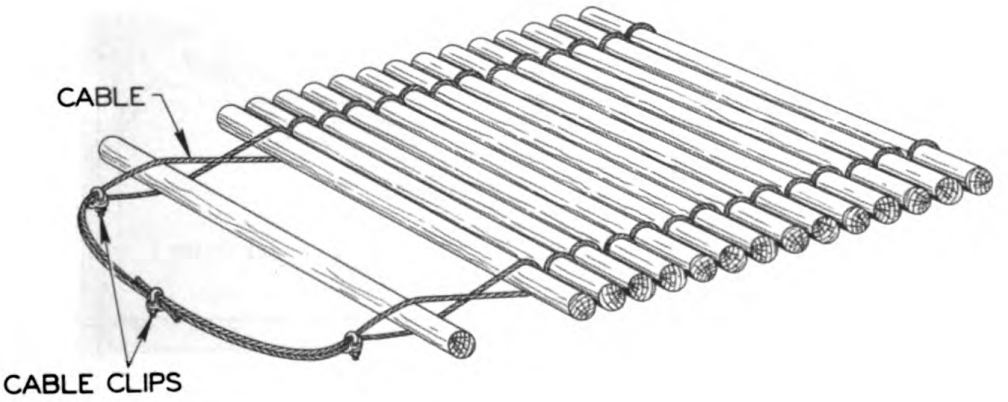
EXTREME SOFT GROUND:

A firm footing for the machine is essential. If the ground is soft enough to bog down the crawlers, mats should be used. Mats are usually made in sets of three or four so that when finished with one cut, the second and third mats can be swung into position ahead of those on which the machine is working and thus provide a continuous firm path for the machine. Mats may be built of 2" x 12" timbers or logs as illustrated in Figure 47 below.

The timber mat should be of laminated construction as shown with each board securely nailed. Holes should be bored through each end for insertion of cable slings as shown. Pieces of old cable can be used for this purpose. Mats can also be built of logs or poles laced together with old cable as shown in Figure 47, allowing enough overlap at one end for slings.



BOARD MAT



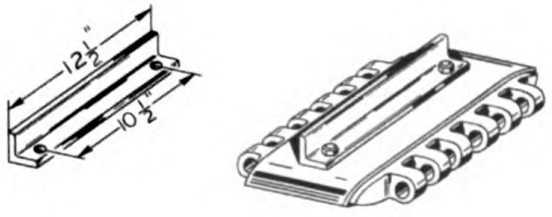
LOG MAT

FIGURE 47

OPERATION UNDER ABNORMAL CONDITIONS (CONT'D)

EXTREME SLIPPERY GROUND:

To prevent slipping in hard wet clay, ice or snow, grousers should be attached to crawler pads as shown in Figure 48 below. Holes are provided in each crawler pad for the attachment of grousers with ordinary 3/4" machine bolts. Grousers may be cut in 12½" lengths and drilled with two 13/16" holes on one side as shown.



CLEAT-METHOD OF ATTACHMENT

FIGURE 48

WHEN MIRED IN SOFT GROUND:

If machine becomes mired in soft ground, remove hoist cable from boom and attach free end securely with clips to tree as illustrated in Figure 49 below. Apply power to hoist and traction until machine is on firm ground. If machine is dragline, use drag cable. Illustration shows front end down. If rear end is down swing cab around and fasten cable to tree in rear.

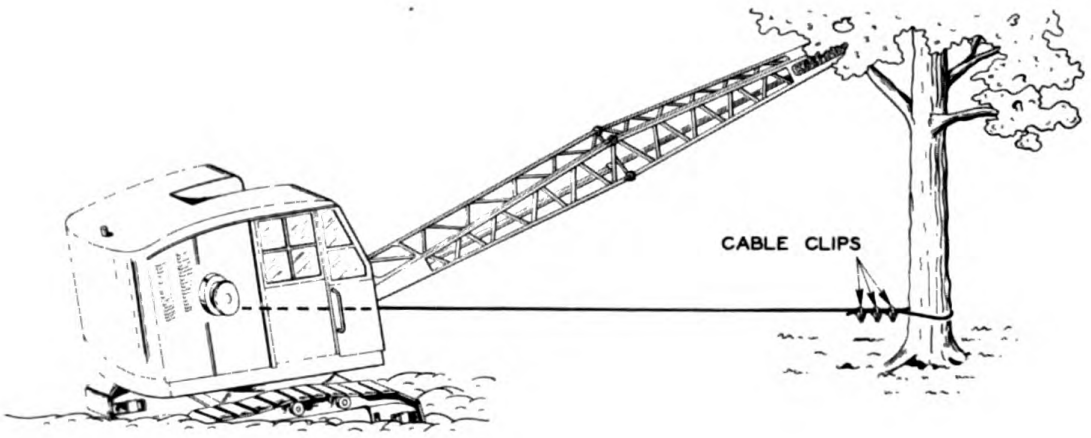


FIGURE 49

NOTE - For engine operation under abnormal conditions see Engine Section.

NOTES

CRANE, CRAWLER-MOUNTED, GASOLINE, ¾-CU YD, WITH ATTACHMENTS

(KOEHRING, MODEL 304)

MFR'S. SERIAL No. located on name plate at left of operator's position in cab.

Reference TM 5-1168.

TABLE OF CAPACITIES AND LUBRICANTS TO BE USED

UNIT	CAPACITY (Approx.)	LOWEST EXPECTED AIR TEMPERATURE		
		Above +32°F.	+32°F. to 0°F.	Below 0°F.
Power Unit Crankcase	8 qt.	OE SAE 30	OE SAE 10	Refer to TM 5-1168
Chain Drive Case	5 qt.	OE SAE 50	OE SAE 30	
Main Gear Case	10 qt.	GO SAE 90	GO SAE 90	GO Grade 75
Turntable Gear Case-Lower	18 qt.			

KEY

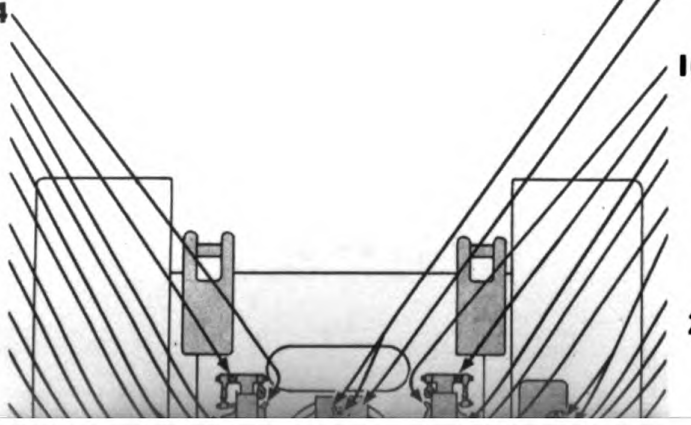
Lubricants

- **OE**—OIL, engine Crankcase grade (unless otherwise specified)
- **GO**—LUBRICANT, gear, universal
- **CG**—GREASE, general purpose No. 1 (above +32°F.) No. 0 (below +32°F.)
- **WB**—GREASE, general purpose No. 2
- **WP**—GREASE, water pump

NOTE—See Reverse Side for lubrication of CRAWLER

Lubricant • Hours

- Drum Bearing (Note 8) WB 1024
- Brake Control Shaft CG 64
- Clutch Crank (Sparingly) WB 64
- Shifter Ring CG 8
- Clutch Control Shaft CG 64
- Swing Shaft Gear (Note 7) CG 4
- Drum Shaft Bearing WB 256
- Racking In Sprocket (Shovel only) CG 256
- Brake Control Crank CG 64
- Shifter Ring (Shovel only) CG 8
- Boom Pawl CG 64

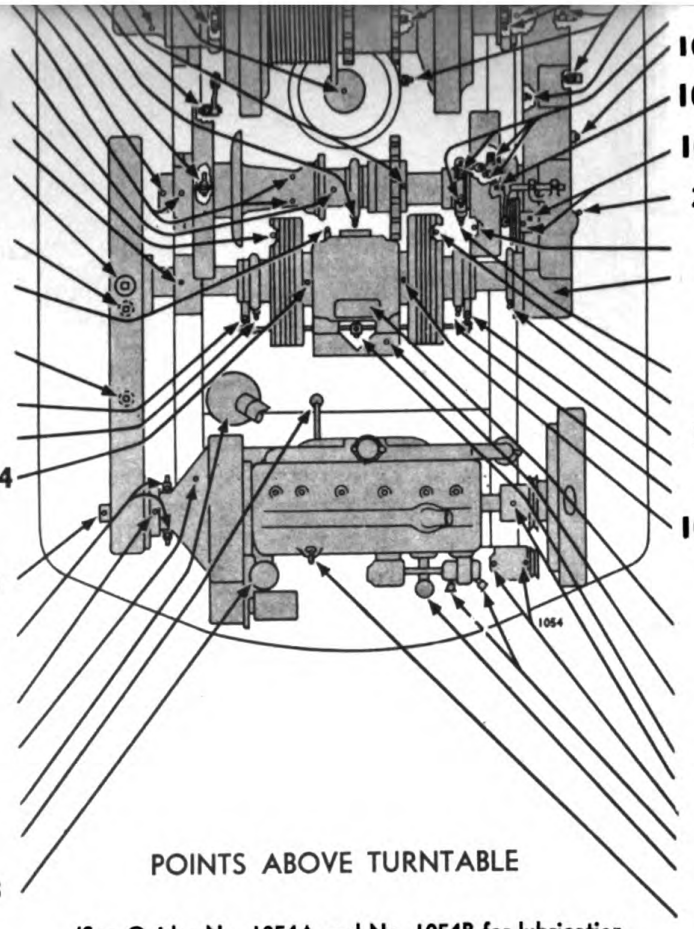


Hours • Lubricant

- 64 OE Shifter Fork and Collar (Remove turntable-gear case cover)
- 64 GO Turntable Gear Case-Lower Fill (See Table) (Fill with 18 qt. exactly)
- 1024 WB Drum Bearing (Note 8)
- 64 CG Brake Control Shaft
- 64 WB Clutch Crank (Sparingly)
- 64 CG Control Shaft Bearings (Reached through hand hole)
- 8 CG Shifter Ring
- 64 CG Lever and Control Shaft Bearings
- 64 CG Clutch Control Shaft
- 256 WB Drum Shaft Bearing
- 64 CG Clutch Control Shaft
- 64 CG Lever and Control Shaft Bearings

WAR DEPARTMENT LUBRICATION GUIDE
CORPS OF ENGINEERS CHART NO. 1054
POINTS ABOVE TURNTABLE

Boom Hoist Drum Bushings (Shovel work, lubricate every 4 hours)
Shifter Sleeve (Shovel only) CG 64
Clutch Crank (Sparingly) WB 64
Jack Shaft Bearing WB 256
Chain Drive Case Fill (See Table) OE 64
Chain Drive Case Drain Plug Drain and refill (Note 6) 128
Intermediate Gear-Upper Bearing (Note 7) CG 8
Chain Drive Case Level Plug Check level 64
Clutch Control Shaft CG 64
Shifter Ring CG 8
Swing and Traction Shaft Bevel Pinion Bearing (Remove bevel gear case cover) (Note 8) WB 1024
Clutch Pilot Bearing (Remove pipe plug) WB 256
Engine Clutch Control Shaft (oil holes) OE 32
Take-Off Shaft Bearing (Sparingly) WB 8
Engine Clutch Collar (Sparingly) CG 8
Air Cleaner (Note 4) OE 8
Crankcase Drain Plug Drain and refill (Note 5) 64
Oil Filter (Clean case and replace element) 128



POINTS ABOVE TURNTABLE

64 CG Clutch Control Shafts
1024 *Main Gear Case Drain Plug* Drain and refill (Note 6)
1024 WB Boom Hoist Clutch Brg. (Note 8)
1024 WB Dipper Trip Bearings (Shovel only) (Note 8)
256 WB Dipper Trip Bearing (Shovel only)
64 WB Clutch Crank (Sparingly)
64 GO Main Gear Case Fill (See Table) (Note 6) (Remove inspection plate and fill to lower edge)
8 CG Shifter Ring
64 WB Clutch Crank (Sparingly)
256 WB Jack Shaft Bearing
64 CG Clutch Control Shaft
8 CG Shifter Ring
1024 WB Swing and Traction Shaft Bevel Pinion Bearing (Remove bevel gear case cover) (Note 8)
4 WB Bevel Gear Case (Open inspection plate, spread grease in case on gear teeth)
8 CG Bevel Gear Shaft-Upper Bearing (Sparingly)
32 CG Clutch Control Lever
64 CG Fan Hub
64 OE Generator (3 to 4 drops)
32 WP Water Pump
8 OE Crankcase Fill (See Table) Drain and refill (Note 5)
8 *Crankcase Level* Check level

(See Guides No. 1054A and No. 1054B for lubrication of points BELOW TURNTABLE and ATTACHMENTS)

SEE REVERSE SIDE

For Additional Lubrication and Service Instructions on Individual Units and Parts

Requisition replacement guide from The Engineer Field Maintenance Office, P.O. Box 1679, Columbus, Ohio.

24 Nov. 43

Above guide supersedes all previous instructions.

NOTE: For lubrication of the Chrysler Engine and its related parts see Engine Section.

WAR DEPARTMENT LUBRICATION GUIDE
CORPS OF ENGINEERS CHART NO. 1054
POINTS ON CRAWLER

CRANE, CRAWLER-MOUNTED, GASOLINE, ¾-CU YD, WITH ATTACHMENTS

(KOEHRING, MODEL 304)

MFR'S. SERIAL No. located on name plate at left of operator's position in cab.

Reference TM 5-1168.

TABLE OF CAPACITIES AND LUBRICANTS TO BE USED

UNIT	CAPACITY (Approx.)	LOWEST EXPECTED AIR TEMPERATURE		
		Above +32°F.	+32°F. to 0°F.	Below 0°F.
Lower Traction Bevel Gear Case	2 qt.	GO SAE 90	GO SAE 90	GO Grade 75

KEY

Lubricants

- **OE**—OIL, engine Crankcase grade (unless otherwise specified)
- **GO**—LUBRICANT, gear, universal
- **CG**—GREASE, general purpose No. 1 (above +32°F.) No. 0 (below +32°F.)
- **WB**—GREASE, general purpose No. 2
- **CW**—OIL, lub., chain and wire rope, grade 2

NOTE—See Reverse Side for lubrication of points ABOVE TURNTABLE

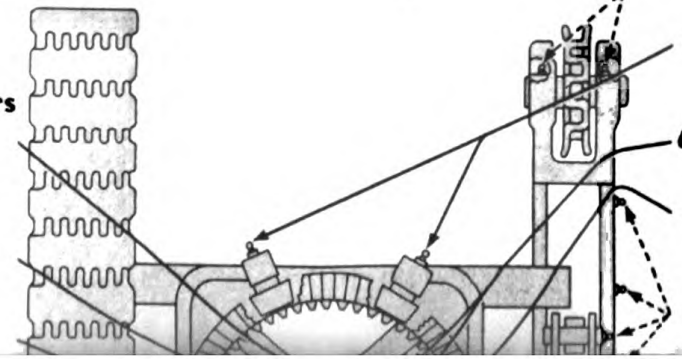
CAUTION Lubricate Dotted Arrow Points on BOTH SIDES

Lubricant • Hours

Lower Traction Bevel Gear Case Fill and Level (See Table) (Note 6) **GO 64**

Lower Traction Bevel Gear Case Drain Plug Drain and refill (Note 6) **1024**

Jaw Clutch **CG 64**



Hours • Lubricant

- **8 CG** Front Tumbler Bearings (Note 7)
- **4 CG** Turntable Rollers (Note 10)
- **64 CG** Shifter Shaft
- **8 CG** Traction Shaft Bearing (Note 7)
- **8 CG** Guide Rollers (Note 7)

Traction Shaft Bearing (Note 7) **CG 8**

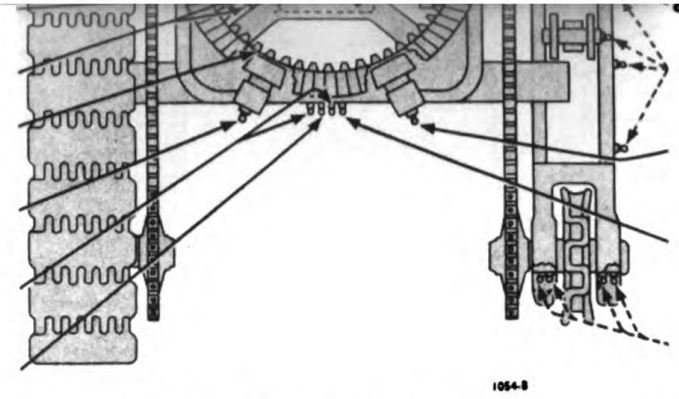
Shifter Shaft **CG 64**

Turntable Gear and Swing Pinion **CW 8**

Turntable Roller (Note 10) **CG 4**

Lower Traction Shifter Collar **CG 32**

Vertical Traction Shaft Bearing (Note 7) **CG 8**



64 CG Jaw Clutch

8 CG Guide Rollers (Note 7)

4 CG Turntable Roller (Note 10)

8 CG Lower Traction Shaft Bearing (Note 7)

8 CG Rear Tumbler Bearings (Note 7)

POINTS ON CRAWLER

(See Guides No. 1054A and No. 1054B for lubrication of points BELOW TURNTABLE and ATTACHMENTS)

NOTES Additional Lubrication and Service Instructions on Individual Units and Parts NOTES

1. **FITTINGS—Clean before applying the lubricant gun.**
2. **CLEANING—SOLVENT,** dry-cleaning, or **OIL,** fuel, Diesel, will be used to clean or wash all parts. Use of gasoline for this purpose is prohibited. **All parts will be thoroughly dry before relubrication.**
3. **HOURS—The hours indicated are for normal service. For extreme conditions of heat, water, mud and dust, change crankcase oil and lubricate more frequently.**
4. **AIR CLEANER—Every 8 hours, check level, clean and refill oil cup to circular level mark with OE Remove air intake cap and clean screen. Every 64 to 256 hours, depending on dust conditions, remove filter section and wash. Clean air intake pipes and see that connections are tight after reassembling.**
5. **CRANKCASE** *(Power Unit)*—**Drain only when engine is thoroughly warm. Refill to FULL mark on gage. See Table. CAUTION: When running engine, be sure pressure gage indicates oil is circulating.**
6. **GEAR CASES AND CHAIN DRIVE CASE—Check level with machine on level ground and add lubricant if necessary. When draining, drain immediately after operation.**
7. VERTICAL TRACTION SHAFT BEARING, SWING SHAFT GEAR, INTERMEDIATE GEAR-UPPER BEARING, DRIVE SPROCKET AND TRACTION SHAFT BEARINGS, LOWER TRACTION SHAFT BEARINGS, FRONT AND REAR TUMBLER BEARINGS, **GUIDE ROLLERS—Lubricate every 2 hours, when traveling under own power.**
8. DRUM BEARINGS, BOOM **HOIST CLUTCH BEARING,** SWING AND TRACTION **SHAFT BEVEL** PINION BEARINGS, DIPPER TRIP **BEARINGS—To lubricate,** remove plug and install **fitting. Apply WB** sparingly to drum bearings, boom hoist clutch bearing, dipper trip bearings and swing and traction shaft bevel pinion bearings. CAUTION: After lubricating, remove fitting and replace plug. Upon disassembly and before reassembly repack bearings with WB not more than ⅔ full.
9. **TURNTABLE GEAR CASE-UPPER—While traveling apply CG on rotating gears (with gear shift in, traction and both steering clutches out).**
10. **TURNTABLE ROLLERS—Lubricate vertical wall of** roller track with CG sparingly. **CAUTION: Do not** permit lubricant to run on roller path as **this causes** rollers to slide and will develop flat spots. **Turntable rollers must rotate.**
11. **OIL CAN POINTS—**Every 8 hours, lubricate brake and clutch pins, toggle pins, operating lever control linkage, swing shaft spline, with OE. CAUTION: Do not get oil on clutch and brake bands. Every 32 hours, lubricate throttle control linkage and swivel pulleys with OE.
12. **POINTS REQUIRING NO LUBRICATION—Magneto, Starter, Traction Drive Chains, Drive Shoe Pins.**

24 Nov. 43

Above guide supersedes all previous instructions.

CRANE, CRAWLER-MOUNTED, GASOLINE, ¾-CU YD, WITH ATTACHMENTS
(KOEHRING, MODEL 304)

MFR'S. SERIAL No. located on name plate at left of operator's position in cab.

Reference TM 5-1168.

TABLE OF CAPACITIES AND LUBRICANTS TO BE USED

UNIT	CAPACITY (Approx.)	LOWEST EXPECTED AIR TEMPERATURE		
		Above +32°F.	+32°F. to 0°F.	Below 0°F.
Engine Crankcase (Lighting Plant)	7 qt.	OE SAE 30	OE SAE 10	Refer to TM 5-1168

NOTE— See Reverse Side for lubrication of CRANE and ATTACHMENTS

Lubricant • Hours

Air Cleaner (Note 4) OE 8

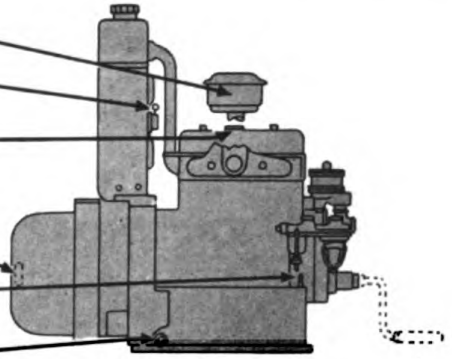
Fan Bearing OE 64
(Late models, packed at assembly)

Crankcase Fill (See Table) OE 8
(Note 5)

Electric Generator Brg. WB 512
(Remove cover, apply with paddle)

Crankcase Oil Level Gage 8
Check level (Keep level between H and L)

Crankcase Drain Plug 64
Drain and refill (Note 5)



LIGHTING PLANT

KEY

Lubricants

OE—OIL, engine Crankcase grade (unless otherwise specified)

CG—GREASE, general purpose No. 1 (above +32°F.) No. 0 (below +32°F.)

WB—GREASE, general purpose No. 2

Hours • Lubricant

32 CG Lever and Control Shaft Bearings
(Located in cab above platform)

32 CG Control Shaft

Control Shaft CG 32

Vertical Traction Shaft CG 8

WAR DEPARTMENT LUBRICATION GUIDE
CORPS OF ENGINEERS CHART NO. 1054A
POINTS BELOW TURNTABLE

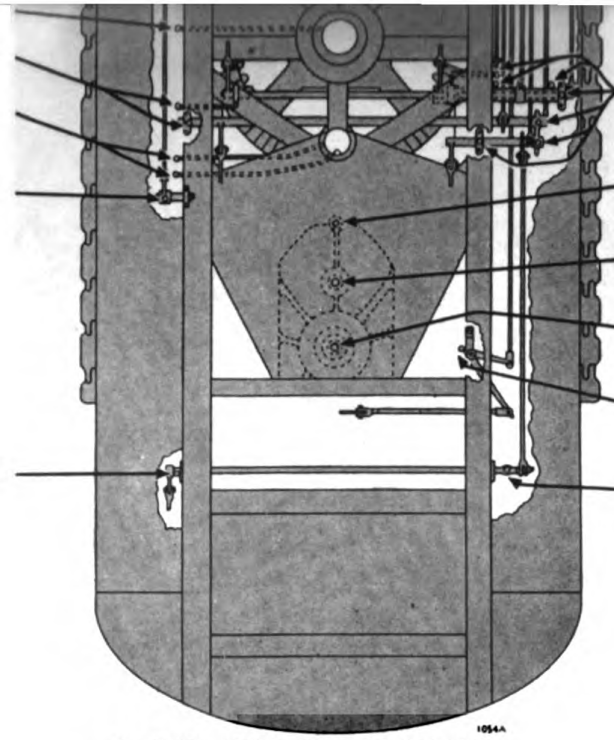
Turntable Hub Bearing **CG** 4

Control Shafts **CG** 32

Vertical Swing Shaft Bearings **CG** 4

Control Crank **CG** 32

Engine Clutch Control Shaft (oil hole) **OE** 32



32 CG Control Shafts

1024 *Turntable Gear Case Lower-Drain Plug* Drain and refill (Drain immediately after operation)

8 CG Intermediate Gear-Lower Bearing (Note 6)

256 WB Bevel Gear Shaft-Lower Bearing

32 CG Swing Clutch Control Crank

32 OE Engine Clutch Control Shaft (oil hole)

POINTS BELOW TURNTABLE

(See Guide No. 1054 and No. 1054B for lubrication of points ABOVE TURNTABLE, CRAWLER and ATTACHMENTS)

NOTES Additional Lubrication and Service Instructions on Individual Units and Parts NOTES

1. FITTINGS—Clean before applying the lubricant gun.
2. CLEANING—SOLVENT, dry-cleaning, or OIL, fuel, Diesel, will be used to clean or wash all parts. Use of gasoline for this purpose is prohibited. All parts will be thoroughly dry before relubrication.
3. HOURS—The hours indicated are for normal service. For extreme conditions of heat, water, mud, and dust, change crankcase oil and lubricate more frequently.
4. AIR CLEANER *(Lighting Plant)*—Every 8 hours, check level, clean and refill oil cup to circular level mark with **OE**. Remove air intake cap and clean screen. Every 64 to 256 hours, depending on dust conditions, remove filter section and wash. Clean air intake pipes and see that connections are tight after reassembling.
5. CRANKCASE *(Lighting Plant)*—Drain only when engine is thoroughly warm. Refill to FULL mark on gage. See Table. CAUTION: When running engine, be sure oil is visible at OIL SIGHT HOLE. Run engine very slowly until it indicates oil is circulating.
6. VERTICAL TRACTION SHAFT BEARING, INTERMEDIATE GEAR-LOWER BEARING—Lubricate every 2 hours, when traveling under own power.
7. PILE DRIVER—Every 8 hours, coat hammer ways and hammer grooves with **CG**.

(Notes continued on reverse side)

Requisition replacement guide from The Engineer Field Maintenance Office, P.O. Box 1679, Columbus, Ohio.

24 Nov. 43
Above guide supersedes all previous instructions.

WAR DEPARTMENT LUBRICATION GUIDE
CORPS OF ENGINEERS CHART NO. 1054A
POINTS ON CRANE AND ATTACHMENTS

CRANE, CRAWLER-MOUNTED, GASOLINE, ¾-CU YD, WITH ATTACHMENTS
(KOEHRING, MODEL 304)

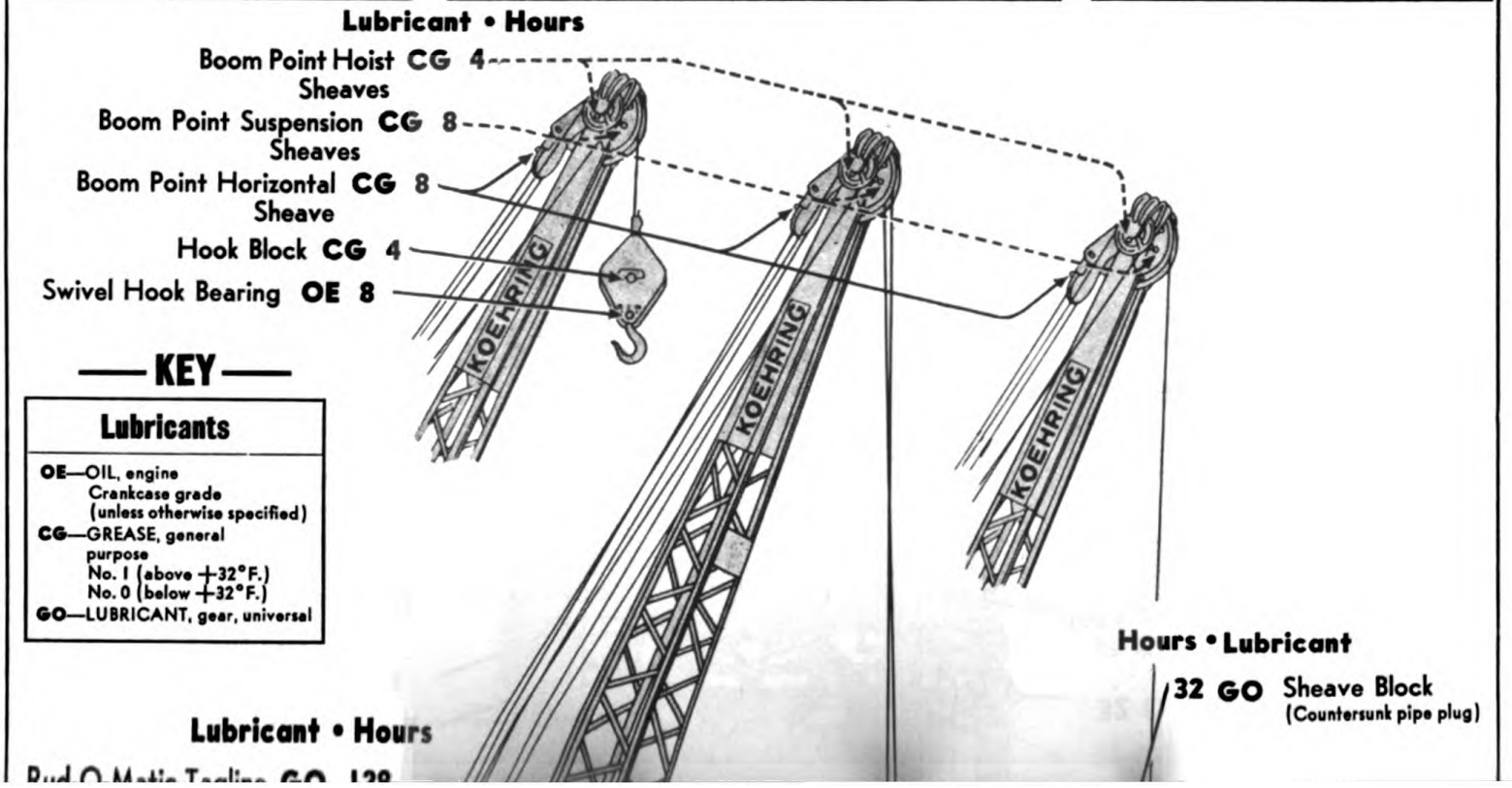
MFR'S. SERIAL No. located on name plate at left of operator's position in cab.

Reference TM 5-1168.

CAUTION Lubricate Dotted Arrow Points on BOTH SIDES

NOTE— See Reverse Side for lubrication of points BELOW TURNTABLE and LIGHTING PLANT ENGINE

CAUTION Lubricate Dotted Arrow Points on BOTH SIDES



WAR DEPARTMENT LUBRICATION GUIDE
CORPS OF ENGINEERS CHART NO. 1054A
POINTS ON CRANE AND ATTACHMENTS

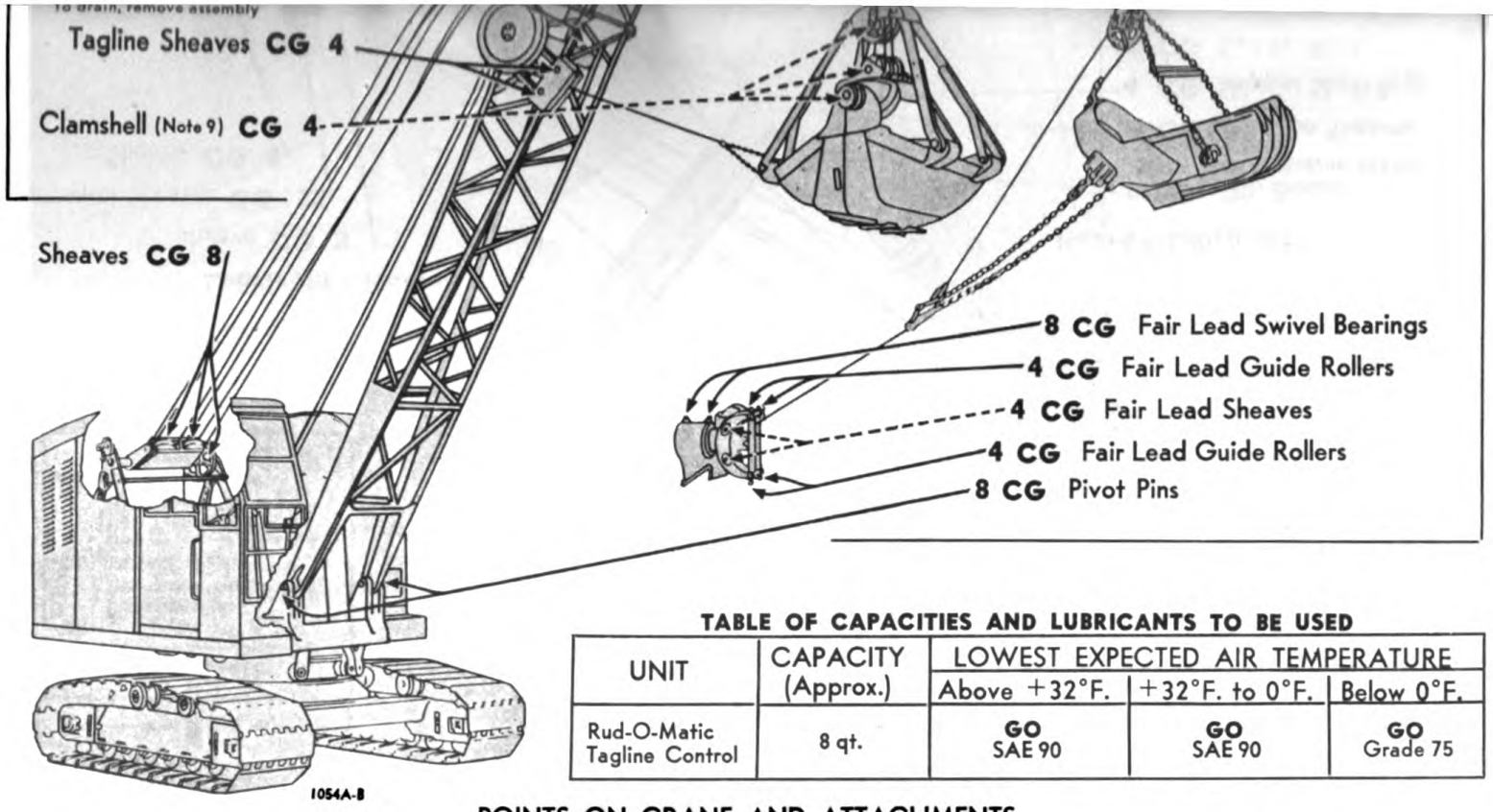


TABLE OF CAPACITIES AND LUBRICANTS TO BE USED

UNIT	CAPACITY (Approx.)	LOWEST EXPECTED AIR TEMPERATURE		
		Above +32°F.	+32°F. to 0°F.	Below 0°F.
Rud-O-Matic Tagline Control	8 qt.	GO SAE 90	GO SAE 90	GO Grade 75

POINTS ON CRANE AND ATTACHMENTS

(See Guides No. 1054 and No. 1054B for lubrication of points ABOVE TURNTABLE, CRAWLER AND ATTACHMENTS)

NOTES Additional Lubrication and Service Instructions on Individual Units and Parts NOTES

(Notes continued from Reverse Side)

8. CABLES—Keep all cables and wire rope well lubricated with OE, except those coming in constant contact with dirt.
9. CLAMSHELL *(Various makes)*—Every 4 to 8 hours, lubricate through fittings with CG.
10. OIL CAN POINTS—Every 8 hours, lubricate operating lever control linkage and shaft oil holes, clamshell guide rollers, clamshell head shaft and clamshell socket pins with OE.

24 Nov. 43
Above guide supersedes all previous instructions.

WAR DEPARTMENT LUBRICATION GUIDE
CORPS OF ENGINEERS CHART NO. 1054B
POINTS ON SHOVEL ATTACHMENT

CRANE, CRAWLER-MOUNTED, GASOLINE, ¾-CU YD, WITH ATTACHMENTS

(KOEHRING, MODEL 304)

MFR'S. SERIAL No. located on name plate at left of operator's position in cab.

Reference TM 5-1168.

NOTE—See Reverse Side for lubrication of PULL SHOVEL ATTACHMENT

CAUTION Lubricate Dotted Arrow Points on BOTH SIDES

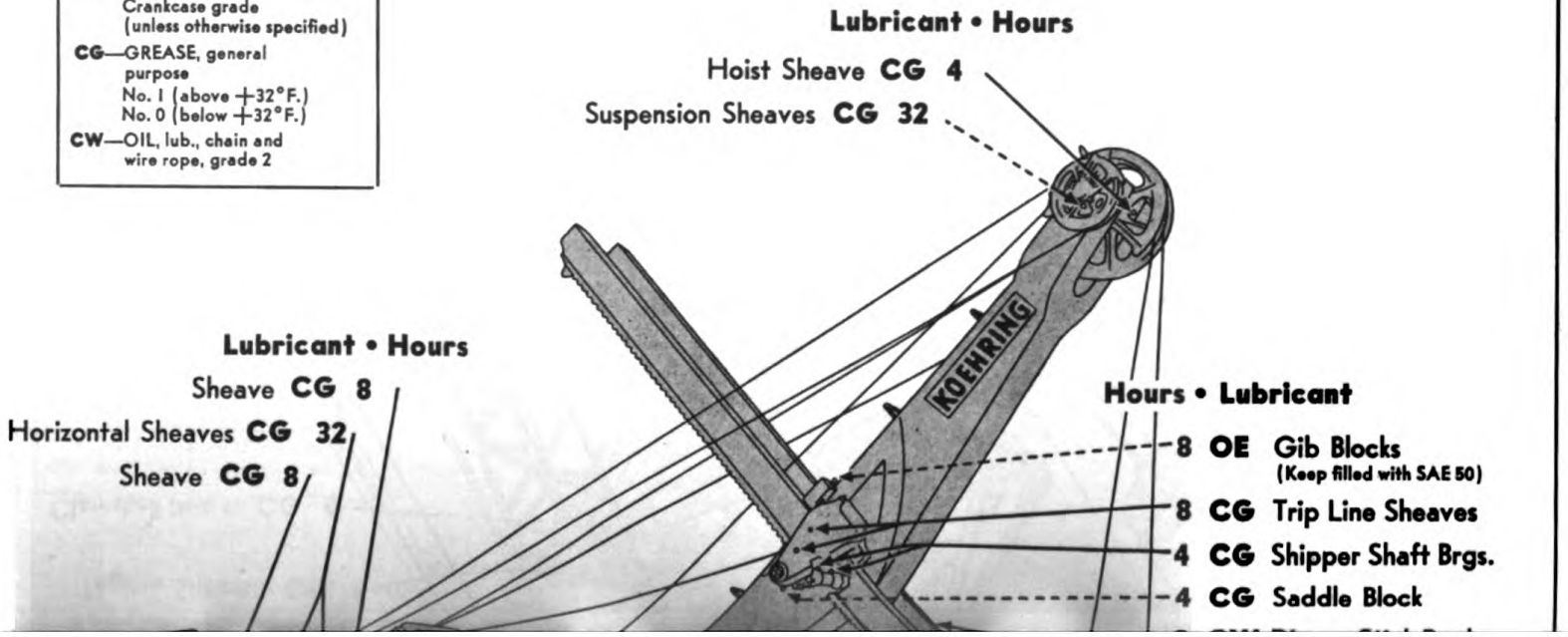
KEY

Lubricants

OE—OIL, engine
Crankcase grade
(unless otherwise specified)

CG—GREASE, general purpose
No. 1 (above +32°F.)
No. 0 (below +32°F.)

CW—OIL, lub., chain and wire rope, grade 2



WAR DEPARTMENT LUBRICATION GUIDE
CORPS OF ENGINEERS CHART NO. 1054B
POINTS OF SHOVEL ATTACHMENT

POINTS ON SHOVEL ATTACHMENT

(See Guides No. 1054 and No. 1054A for lubrication of points on CRAWLER, TURNTABLE and ATTACHMENTS)

NOTES Additional Lubrication and Service Instructions on Individual Units and Parts NOTES

1. FITTINGS—Clean before applying the lubricant gun.
2. CLEANING—SOLVENT, dry-cleaning, or OIL, fuel, Diesel, will be used to clean or wash all parts. Use of gasoline for this purpose is prohibited. All parts will be thoroughly dry before relubrication.
3. HOURS—The hours indicated are for normal service. For extreme conditions of heat, water, mud and dust, lubricate more frequently.
4. CABLES—Keep all cables and wire rope well lubricated with OE, except those coming into constant contact with dirt.
5. OIL CAN POINTS—Every 8 hours, lubricate shovel bucket latch and lever, dipper trip control linkage, crowd drive chain with OE.

CHEK-CHART No.1054B [NOT TO BE REPRODUCED in whole or in part without permission of the Office of the Chief of Engineers.]

24 Nov. 43

Above guide supersedes all previous instructions.

WAR DEPARTMENT LUBRICATION GUIDE
CORPS OF ENGINEERS CHART NO. 1054B
POINTS ON PULL SHOVEL ATTACHMENT

CRANE, CRAWLER-MOUNTED, GASOLINE, ¾-CU YD, WITH ATTACHMENTS

(KOEHRING, MODEL 304)

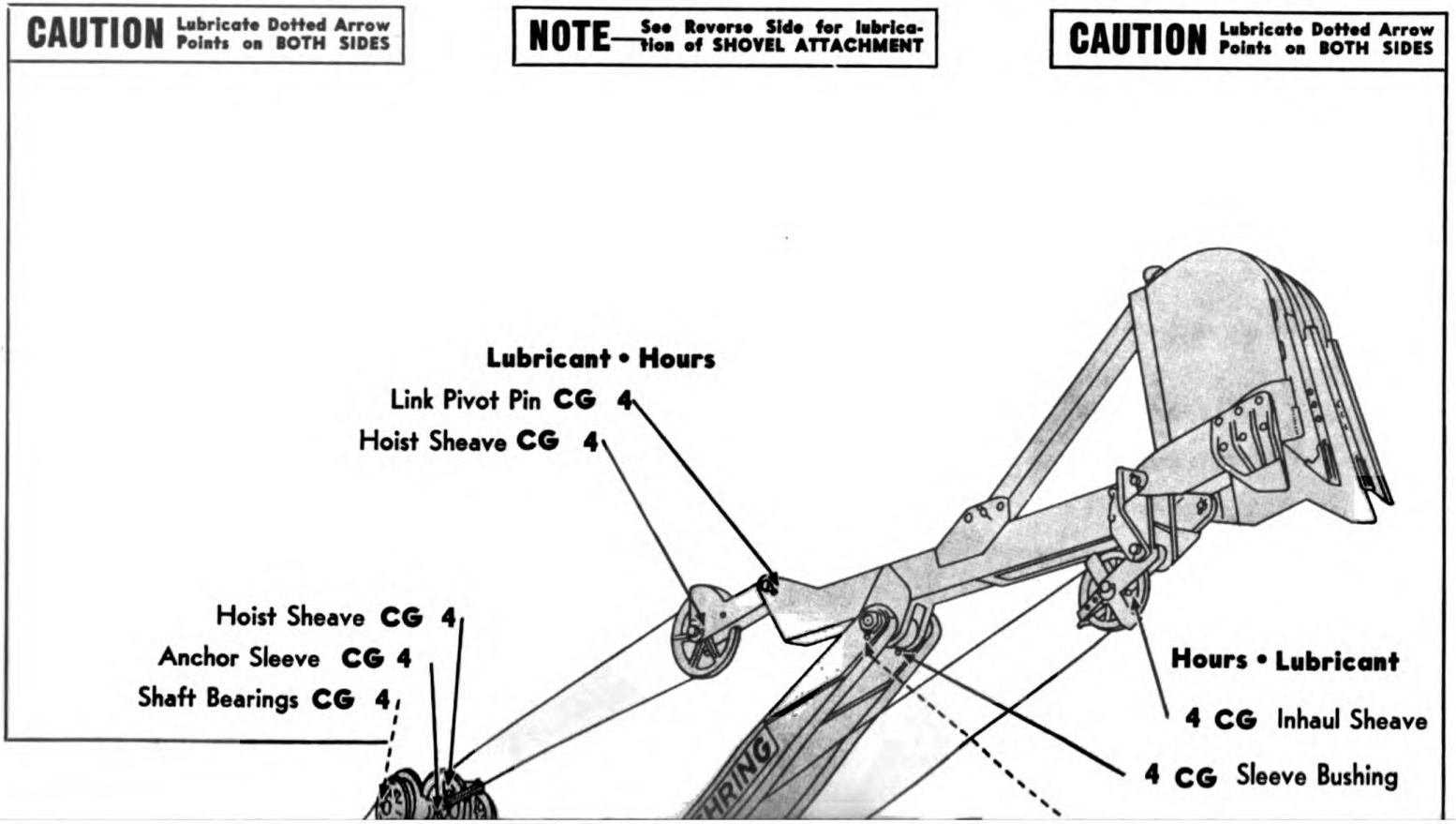
MFR'S. SERIAL No. located on name plate at left of operator's position in cab.

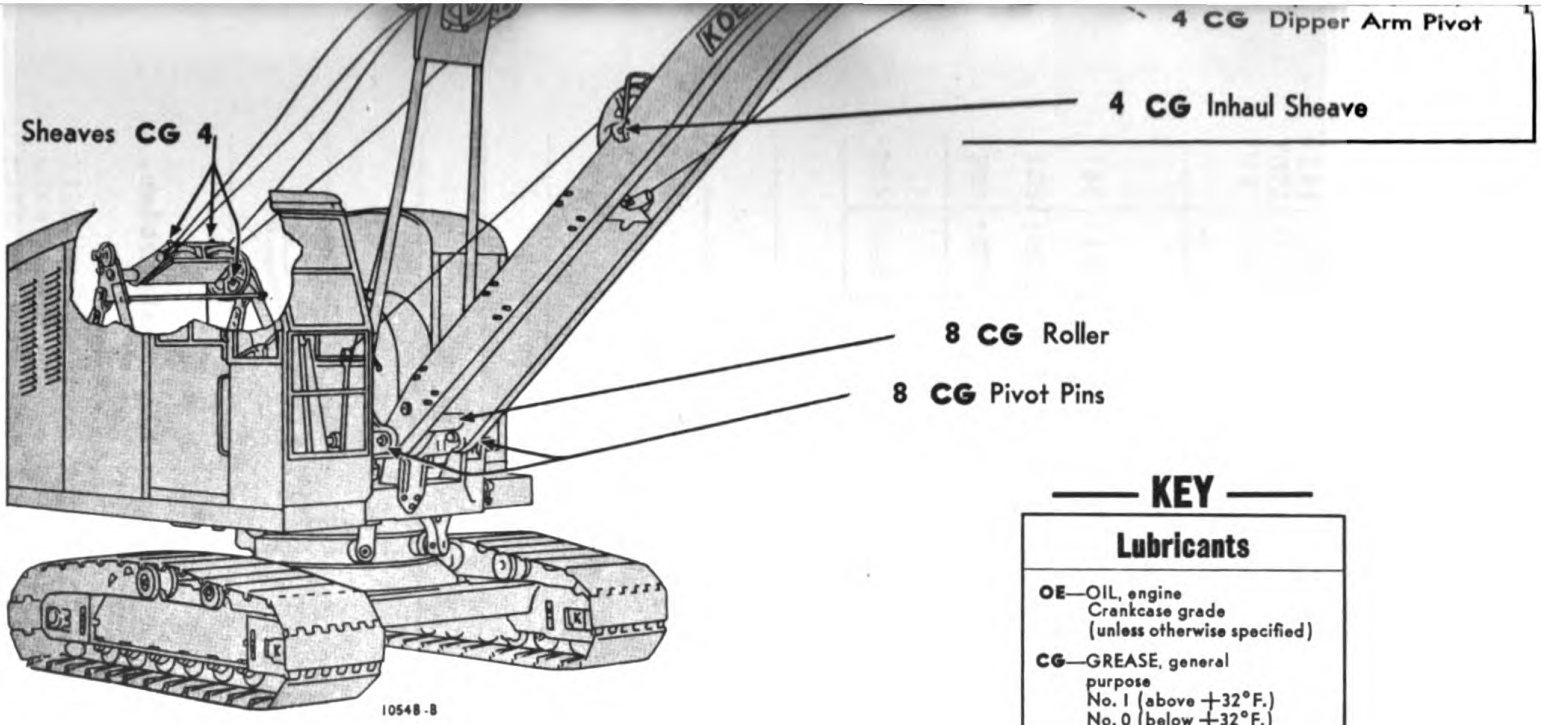
Reference TM 5-1168.

CAUTION Lubricate Dotted Arrow Points on BOTH SIDES

NOTE—See Reverse Side for lubrication of SHOVEL ATTACHMENT

CAUTION Lubricate Dotted Arrow Points on BOTH SIDES





KEY

Lubricants

OE—OIL, engine
Crankcase grade
(unless otherwise specified)

CG—GREASE, general purpose
No. 1 (above +32°F.)
No. 0 (below +32°F.)

POINTS ON PULL SHOVEL ATTACHMENT

(See Guides No. 1054 and No. 1054A for lubrication of points on CRAWLER, TURNTABLE and ATTACHMENTS)

NOTES Additional Lubrication and Service Instructions on Individual Units and Parts NOTES

1. **FITTINGS**—Clean before applying the lubricant gun.
2. **CLEANING**—SOLVENT, dry-cleaning, or OIL, fuel, Diesel, will be used to clean or wash all parts. Use of gasoline for this purpose is prohibited. All parts will be thoroughly dry before relubrication.
3. **HOURS**—The hours indicated are for normal service. For extreme conditions of heat, water, mud and dust, lubricate more frequently.
4. **CABLES**—Keep all cables and wire rope well lubricated with OE, except those coming in constant contact with dirt.

Requisition replacement guide from The Engineer Field Maintenance Office, P.O. Box 1679, Columbus, Ohio.

24 Nov. 43
Above guide supersedes all previous instructions.

CABLE LENGTHS FOR 304

NAME	Cable Dia.	Style	Boom Lengths 25'	30'	35'	40'	45'	50'	55'	60'
DRAGLINE			Cable Lengths							
Drag.	3/4"	X	39'	44'	49'	54'	59'	64'	69'	74'
Hoist	5/8"	O	62'	72'	82'	92'	102'	112'	122'	132'
CLAMSHELL										
Holding	5/8"	O	71'	81'	91'	101'	111'	121'	131'	141'
Closing	5/8"	O	100'	110'	120'	130'	140'	150'	160'	170'
Tagline (Rud-o-Matic)	3/8"	Ⓧ	60'	60'	60'	60'	60'	60'	60'	60'
HOOK BLOCK										
Hoist 1 Part	5/8"	O	71'	81'	91'	101'	111'	121'	131'	141'
Hoist 2 Part	5/8"	O	116'	131'	146'	161'	176'	191'	206'	221'
Hoist 3 Part	5/8"	O	153'	173'	193'	213'	235'	254'	273'	292'
BOOM HOIST 6 Part	1/2"	Ⓧ	210'	240'	270'	300'	330'	360'	390'	420'
SHOVEL			18'-0" BOOM - 15'-0" STICKS							
HOIST	5/8"	O	65'							
BOOM HOIST 4 Part	5/8"	O	120'							
TRIP	5/16"	Ⓧ	33'							
PULL SHOVEL										
BOOM HOIST	5/8"	X	75'							
DIPPER DIGGING	3/4"	X	60'							
JIB FRAME HOIST	1/2"	O	30'							

X 6 Str. - 19 Wire - Langlay - Flexible seale construction, independent wire rope center.

O 6 Str. - 19 Wire - Improved plow steel - hemp center,

Ⓧ 6 Str. - 19 Wire - Plow steel - hemp center.

CABLE HANDLING

When unreeling or uncoiling wire cable, it is important that no kinks be allowed to form. Once a kink is made, no amount of strain can remove it and the cable is unsafe for use. Many of the kinks that occur in a cable are started between the time the cable is being removed from reel or coil and the time it is reeved on the machine. Illustrated below are the proper and improper methods of handling cable.

FIGURE 50

Correct way to unreel cable.

Incorrect way to unreel cable.

FIGURE 51

Correct way to uncoil cable.

Incorrect way to uncoil cable.

FIGURE 52

CORRECT

INCORRECT

CLIPPED CABLE ATTACHMENTS

Illustrated above are the incorrect and correct ways for clipping attachments. U-bolts should bear against the short end of the rope with bases on the live side. Distance, center to center, between clips should be 6 times the rope diameter. Nuts should be tightened equally with rope under tension and retightened after the first few hours of continuous service.

REEVING OF BOOM SUSPENSION CABLE FOR CRANE-DRAGLINE-CLAMSHELL-PILE DRIVER

With the boom for any one of the above combinations attached to the turntable by the boom foot pins and lying horizontally on blocking under the boom point, you are ready to reeve the boom suspension cable. Place the spool of cable (at the left side of the machine) on a bar or pipe properly blocked up so that the cable may be unwound as it is being reeved on the machine. Take the end of the cable to the boom point; pass the cable underneath the outer left hand boom point sheave (A); from the top of sheave (A) bring the cable back to and around "A" frame sheave (E); then out and around horizontal boom point sheave (C); back and around "A" frame sheave (D); out and over the top of the outer right hand boom point sheave (B); from the underside of sheave (B) back to "A" frame and dead end with wedge and socket attached to "A" frame at anchor (H). Pull the rest of the cable from the spool, taking this end of the cable and passing it over the left hand "A" frame sheave (G) and down to the boom hoist drum (F) where it is anchored with a wedge as shown.

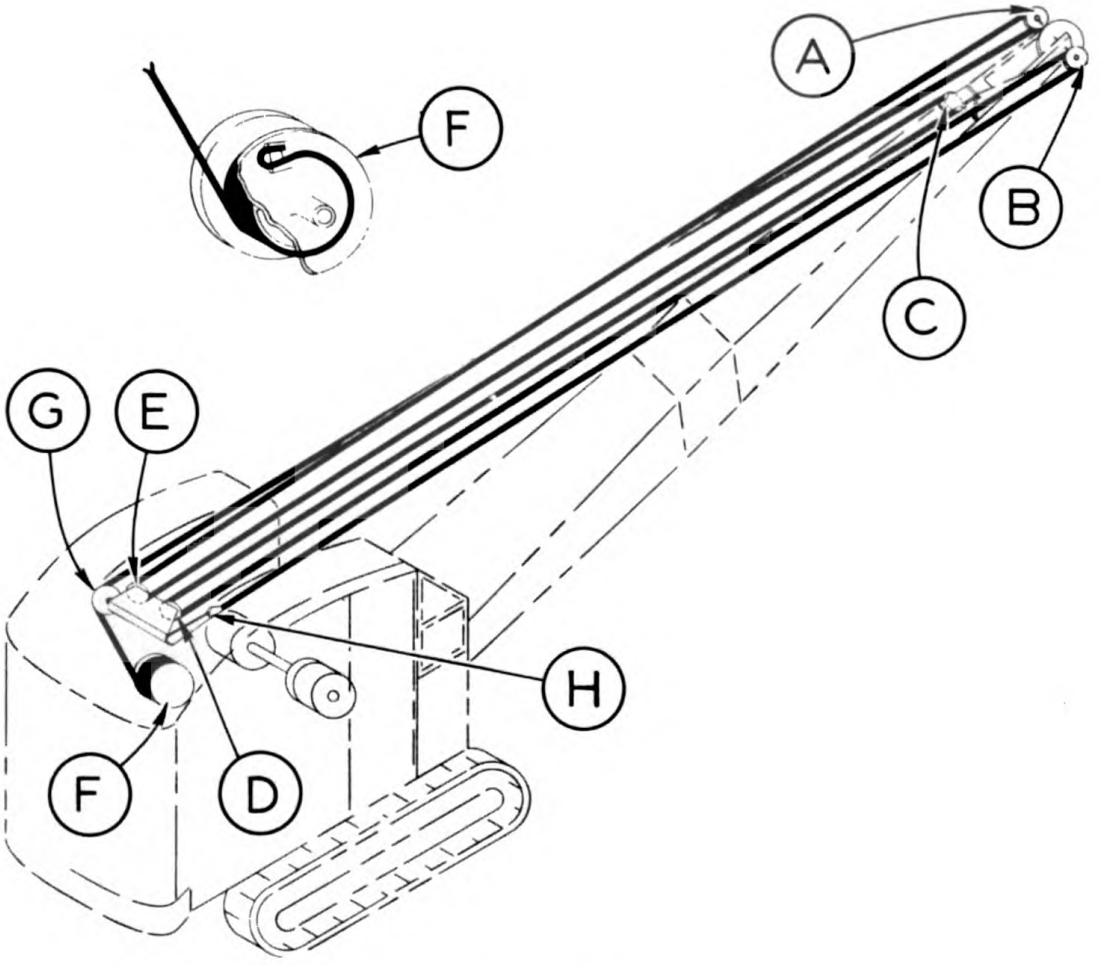


FIGURE 53

REEVING OF CABLES FOR VARIOUS OPERATIONS

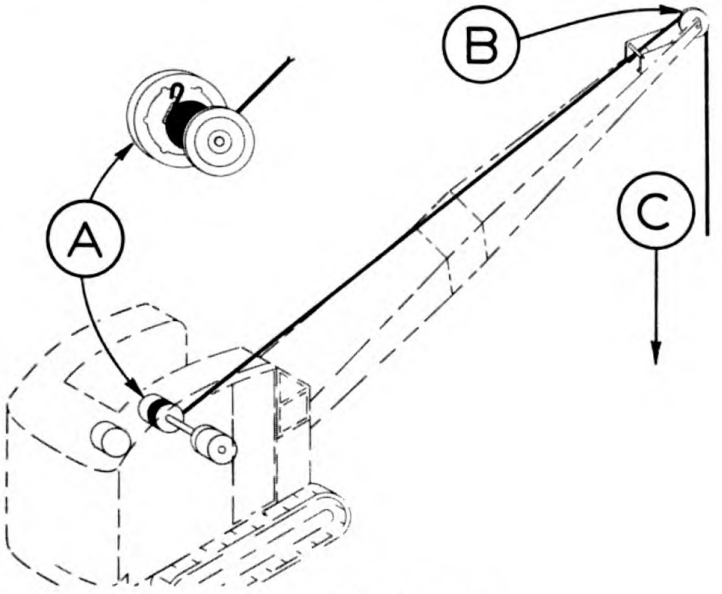


FIGURE 54

LOAD LIFTING CRANE (ONE PART LINE)

The load hoist cable is anchored to the left hand drum (A). Pass the cable underneath the drum (A) and over the large left hand boom point sheave (B) and down to the load (C).

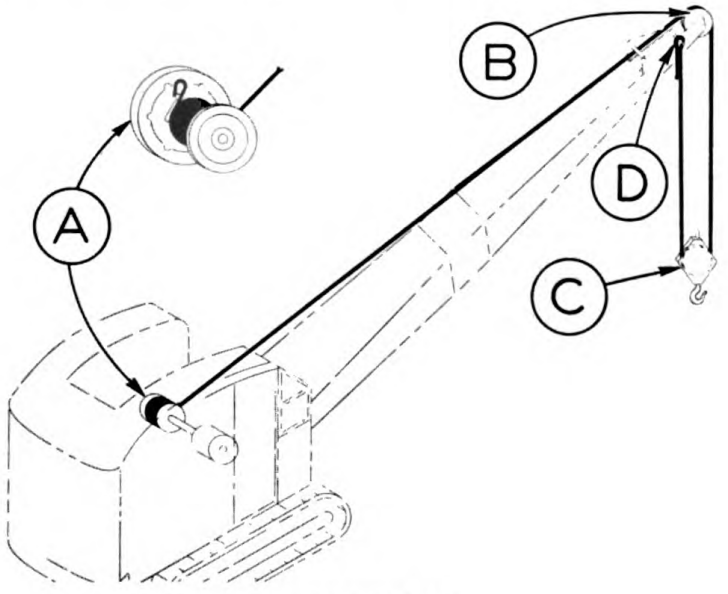


FIGURE 55

LOAD LIFTING CRANE (TWO PART LINE)

The load hoist cable is anchored to the left hand drum (A). Pass the cable underneath the drum (A) and over the large left hand boom point sheave (B), down and around hook block sheave (C) and back up to the boom point (D) where it is anchored with a wedge socket.

CABLE REEVING FOR VARIOUS OPERATIONS. (CONT'D.)

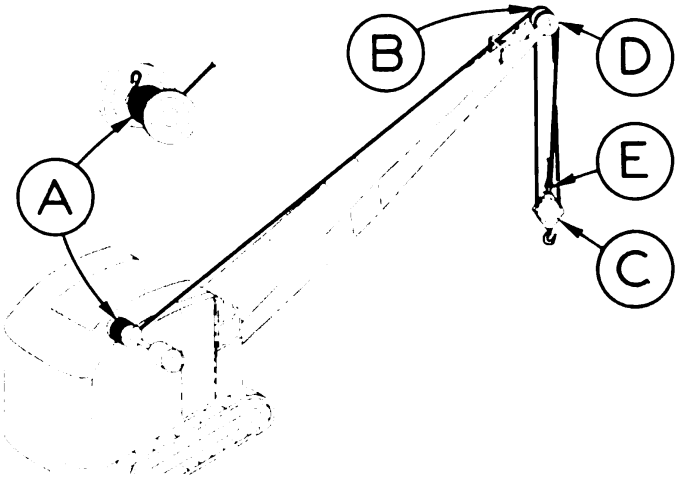


FIGURE 56

LOAD LIFTING CRANE (THREE PART LINE)

The load hoist cable is anchored to the left hand drum (A). Pass the cable underneath the drum (A) and over the large left hand boom point sheave (B); down and around hook block sheave (C); up and around the large right hand boom point sheave (D) and down to hook block where cable is anchored at (E).

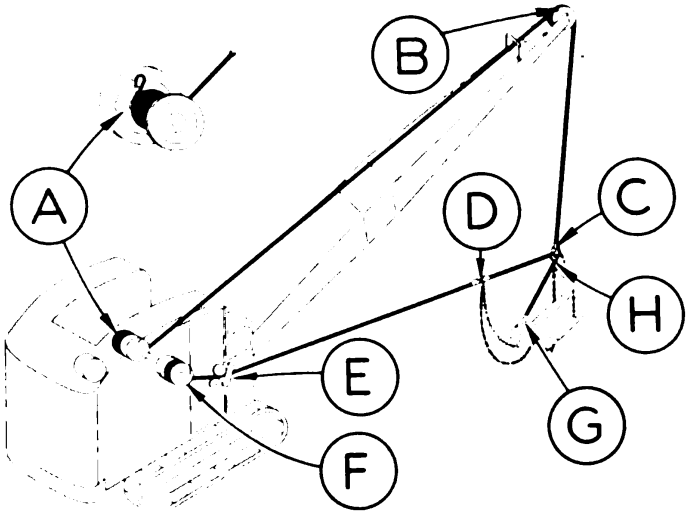


FIGURE 57

DRAGLINE

DRAG CABLE:

Fasten the live end of the drag cable to the dragline bucket chain at (D). Lead the drag cable through the dragline fairlead (E) and underneath and around the right hand drum (F) where drag cable is anchored to drum as shown. HOIST CABLE: Fasten the live end of the hoist cable to the dragline bucket bail chains at (C). Pass the hoist cable over the large boom point sheave (B) (use left hand sheave if there are two large ones at boom point). Then lead the cable down to and under the left hand drum (A) where the cable is anchored with a wedge socket as shown. DUMP CABLE: Dead end cable at bucket bail (G), pass under and over the bail sheave (H) and attach to dragline bucket chain at (D).

CABLE REEVING FOR VARIOUS OPERATIONS. (CONT'D.)

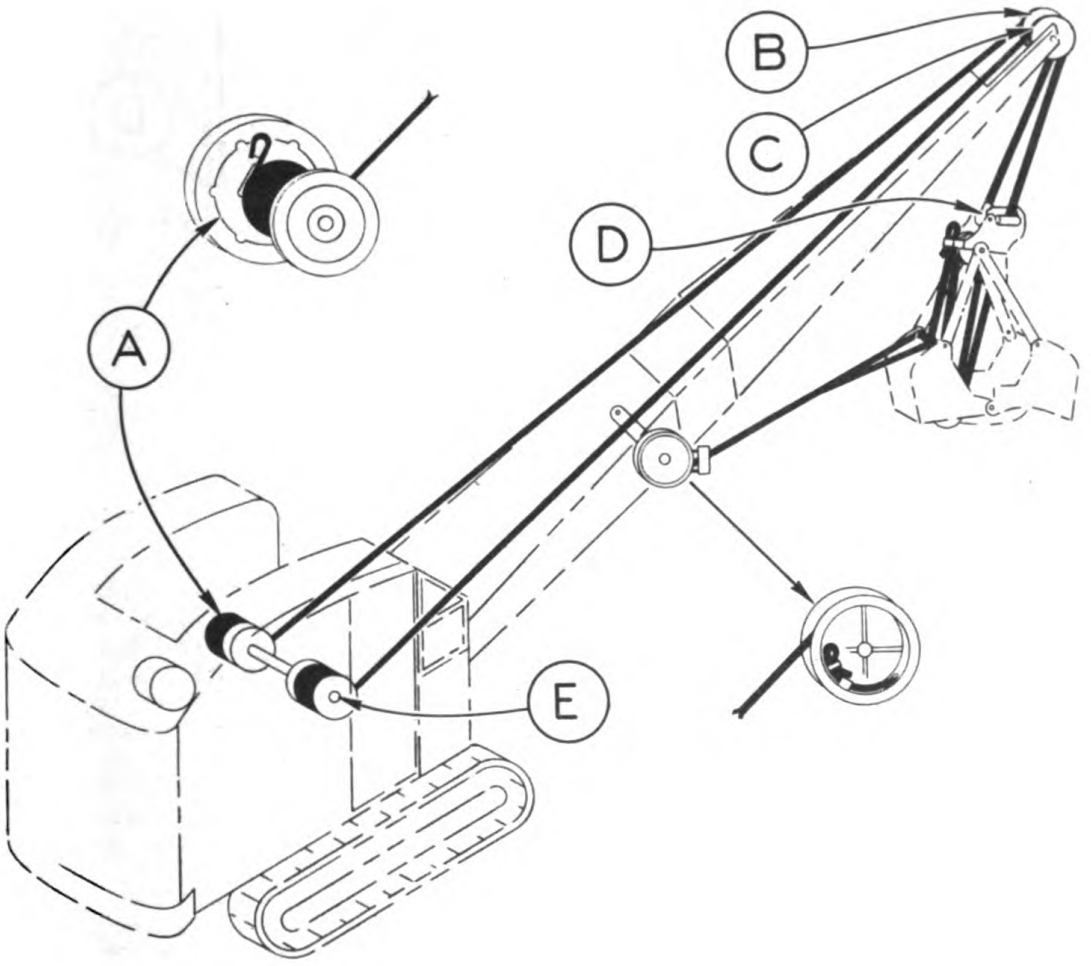


FIGURE 58
CLAMSHELL CRANE WITH TAGLINE

Fasten the clamshell hoisting or holding cable to the load pin or wedge socket on the bucket (D). Then pass the cable over the large left hand boom point sheave (B) and down to and under the left hand drum (A) where cable is anchored. Fasten one end of the clamshell closing cable to the right hand drum (E) with wedge socket. Lead the cable from under the drum (E) up to and over the large right hand boom point sheave (C) and down to the clamshell bucket. The reeving of clamshell buckets varies in accordance with the type of bucket used, therefore, reference must be made to reeving diagram supplied with bucket to be used. Tagline cable is hooked as shown.

CABLE REEVING FOR VARIOUS OPERATIONS. (CONT'D.)

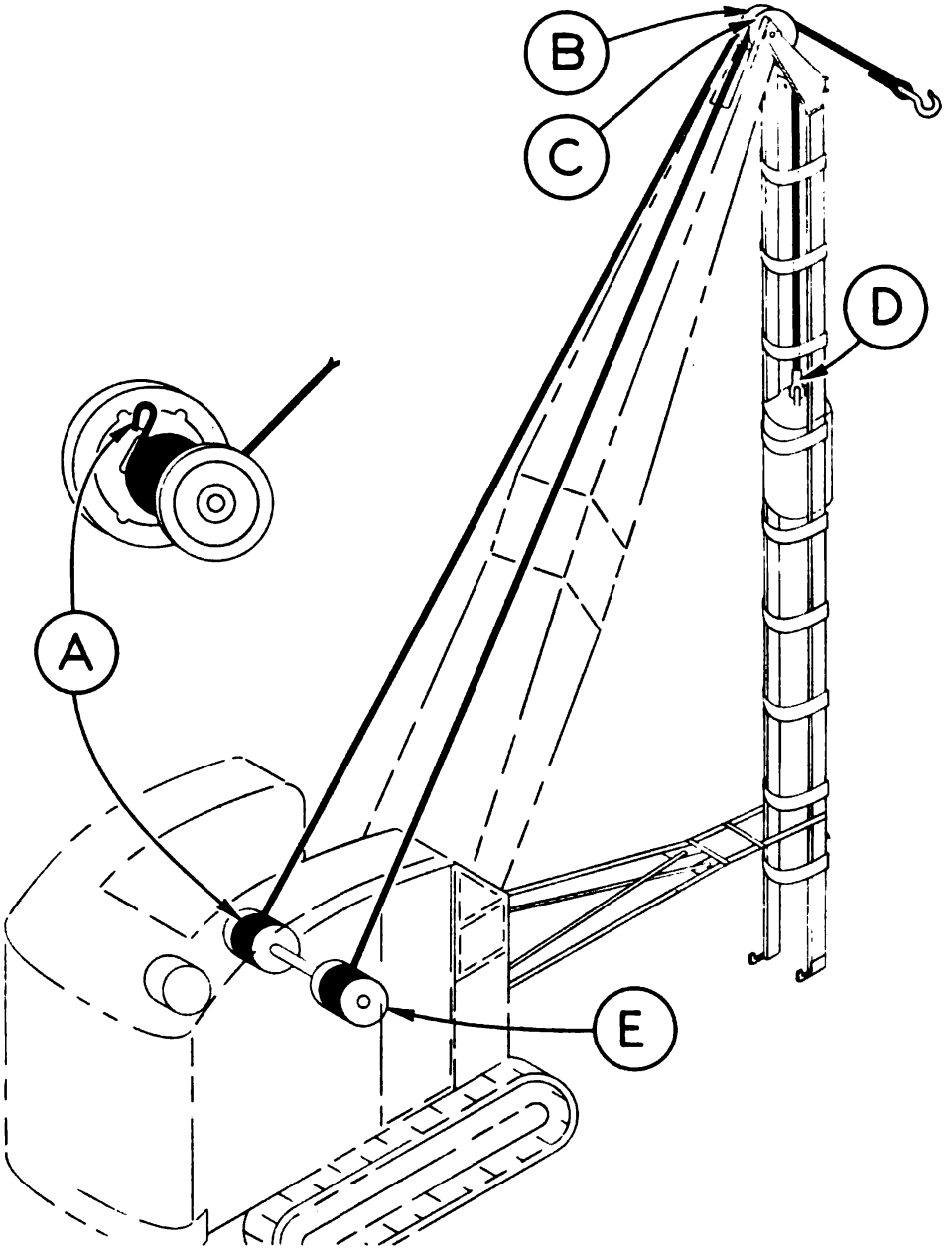


FIGURE 59
PILE DRIVER

Fasten one end of the hammer hoist cable to the hammer at (D) then lead the cable over the large left hand boom point sheave (B) and down to and under the left hand drum (A) where it is anchored with a wedge socket as shown. When stationary leads, as shown, are used, cable from the right hand drum (E) and over the large right hand boom point sheave (C) can be used to lift piling into place under the hammer (D). For swinging leads - not illustrated - fasten one end of the hoist cable to the leads, then pass the cable over the large right hand boom point sheave (C) and down to and under the right hand drum (E) where it is anchored with wedge socket.

CABLE REEVING FOR VARIOUS OPERATIONS. (CONT'D.)

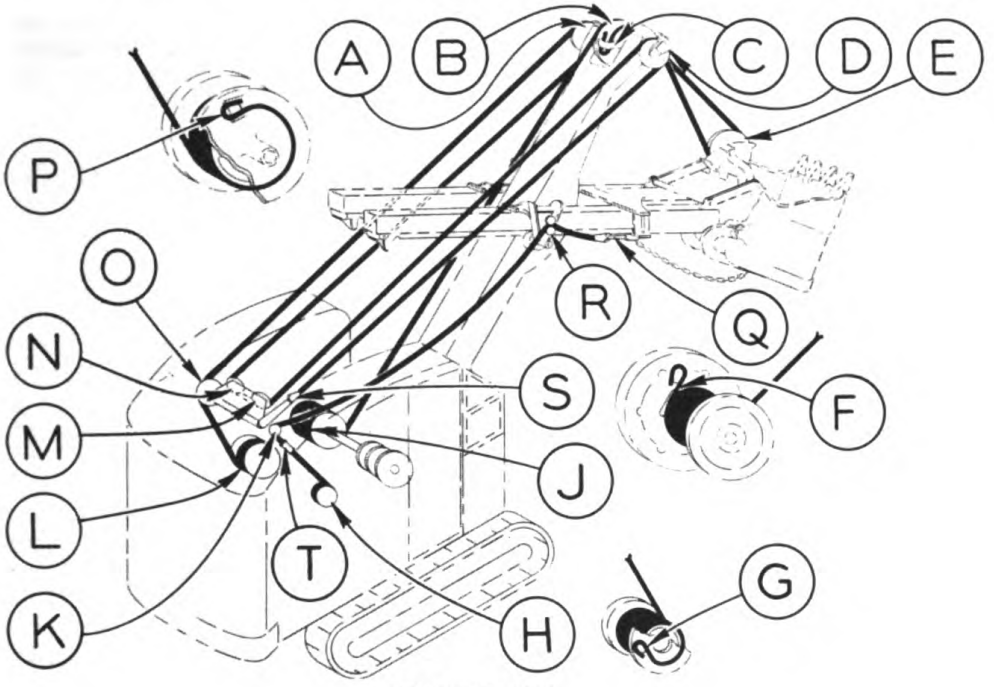


FIGURE 60

SHOVEL

To prepare a shovel for new cable reeving, crowd the dipper to extreme out position and lower it to the ground. Release the crowd and hoist brakes. With the dipper in this position, push the padlock sheave at the back of the dipper forward so that it is clear of the boom when boom is lowered. Now lower boom to a point where boom point sheaves rest on dipper stick spacer block. Remove old or worn cable. For the boom suspension cable place the spool of cable (at the left side of the machine) on a bar or pipe properly blocked up so that the cable may be unwound as it is being reeved on the machine. If the cable comes in a coil, roll it out like a hoop until the entire length is laid out straight. Take one end of the cable out to the boom point; pass the cable over and around the outer left hand boom point sheave (A). From the bottom of sheave (A) lead the cable back to and around sheave (N); across to and around sheave (M); out and over the top of the right hand boom point sheave (D); from the underside of sheave (D) back to the "A" frame where it is anchored with a wedge and socket (S). Pass the other end of the cable over the left hand "A" frame sheave (O) and down to the boom hoist drum (L) where it is anchored with a wedge as shown at (P). For the dipper hoist cable, lead the cable under the left hand drum (J) and anchor with wedge as shown at (F). Lead the other end of the hoist cable over the top of the boom point sheave (B) then down to dipper sheave block (E), through the sheave block from the front side, around the sheave then up and over the half sheave (C) where it is anchored with a wedge. For the dipper trip cable, attach a wedge socket to one end of the cable. Fasten the wedge socket to the dipper trip plunger casting (Q). Lead the other end of the cable through the saddle block guide sheaves (R); back over "A" frame guide sheave (K); through the guide tube (T), then over dipper trip drum (H) where it is anchored as shown at (G). (Follow same procedure for reeving new shovel attachment.)

CABLE REEVING FOR VARIOUS OPERATIONS. (CONT'D.)

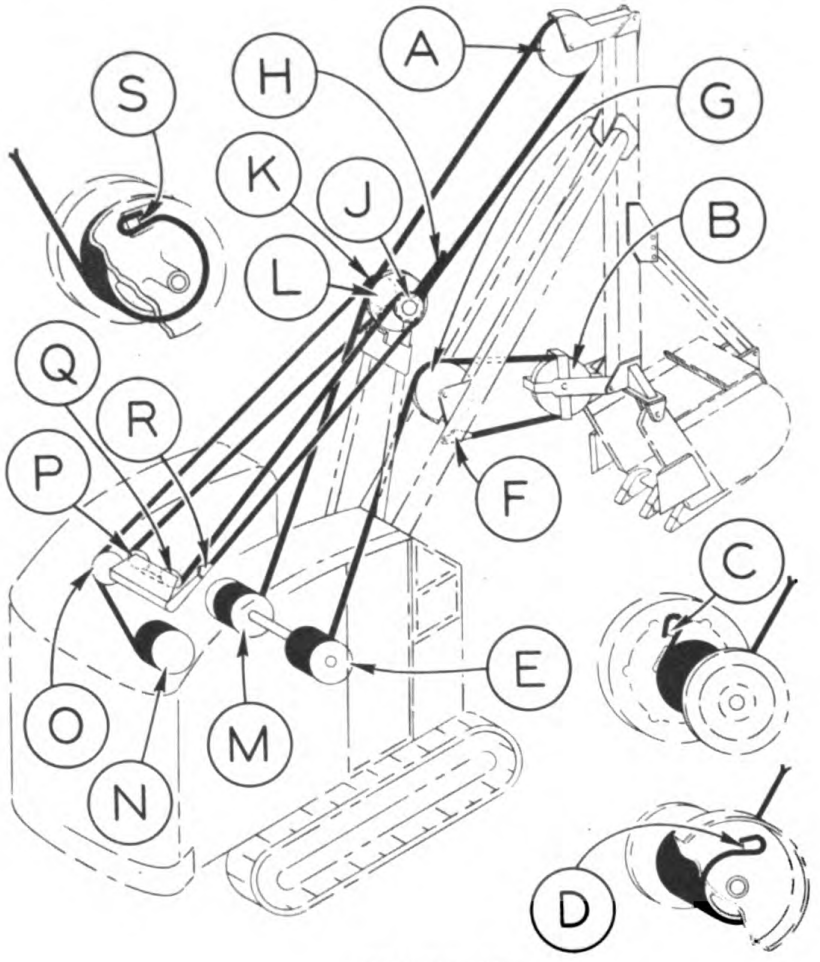


FIGURE 61

PULL SHOVEL

The jib frame cable on a pull shovel performs the same function as the boom hoist cable on a crane or shovel. To prepare a pull shovel for new cable reeving, pull in the dipper until the handle is vertical then lower the boom until the dipper is resting on the ground. For the jib frame cable, lead one end of the cable over the left hand jib frame sheave (K), from the bottom of sheave (K) back to and around sheave (P), across the sheave (Q), out and over the top of the right hand jib frame sheave (J), from the under side of sheave (J) back to the "A" frame and anchor with wedge and socket fastened to "A" frame at (R). Lead the other end of the cable over the "A" frame sheave (O) down to the boom hoist drum (N) where it is anchored with wedge as shown at (S). For the hoist cable, lead the cable under the left hand drum (M) and anchor with wedge as shown at (C). Lead the other end of the cable over sheave (L) on the jib frame, out and over sheave (A) on the dipper arm, from the under side of sheave (A) back to the jib frame and around anchor spool (H) where it is fastened with clamps. For the pull cable, lead the cable under the right hand drum (E) and anchor with wedge as shown at (D). Lead the other end of the pull cable over the top of sheave (G); out to the top of sheave (B) then from the bottom of sheave (B) back to the boom and anchor with a wedge and socket at (F). (Follow same procedure for reeving new pull shovel attachment.)

OPERATING ADJUSTMENTS

Every operator should know and understand the operating adjustments required to keep his machine in its best working condition. A properly adjusted machine is easier to operate and helps to avoid breakdowns or costly delays.

ADJUSTING THE ENGINE CLUTCH

The engine clutch is of the single plate disc type and is mounted at the flywheel end of the engine. It is important that the engine clutch backlocks when it is fully engaged for operation. This backlock or locking-in action is readily detected by the feel of a very slight kick in the hand by Lever No. 1, see page 42. If the backlock action cannot be felt, do not run the machine until proper adjustment is made to backlock the clutch. To adjust, pull out lock pin (A); turn the yoke (B) slightly to the right; release the lock pin and continue turning yoke to the right until the lock pin snaps into place in the next adjusting hole. Try clutch. If clutch slips, pull out lock pin; turn yoke slightly, then release lock pin and continue turning yoke to the right until lock pin snaps into the next adjusting hole. Try clutch again. If clutch still slips, repeat the adjustment but never turn the yoke more than one hole at a time. It is important that clutch is not adjusted so tightly that it cannot be backlocked. Ordinarily, turning the yoke one or two holes provides sufficient adjustment although a new clutch may require several similar adjustments before the friction plates wear smoothly enough for efficient operation. NEVER OPERATE WITH ENGINE CLUTCH SLIPPING. For further details see Engine Section.

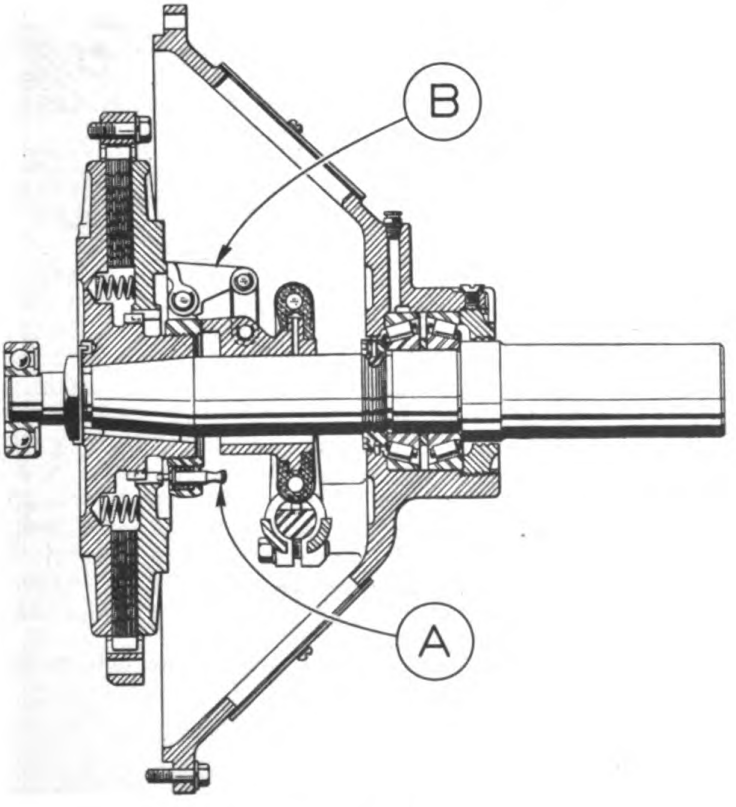


FIGURE 62

OPERATING ADJUSTMENTS. (CONT'D.)

FRICTION CLUTCH:

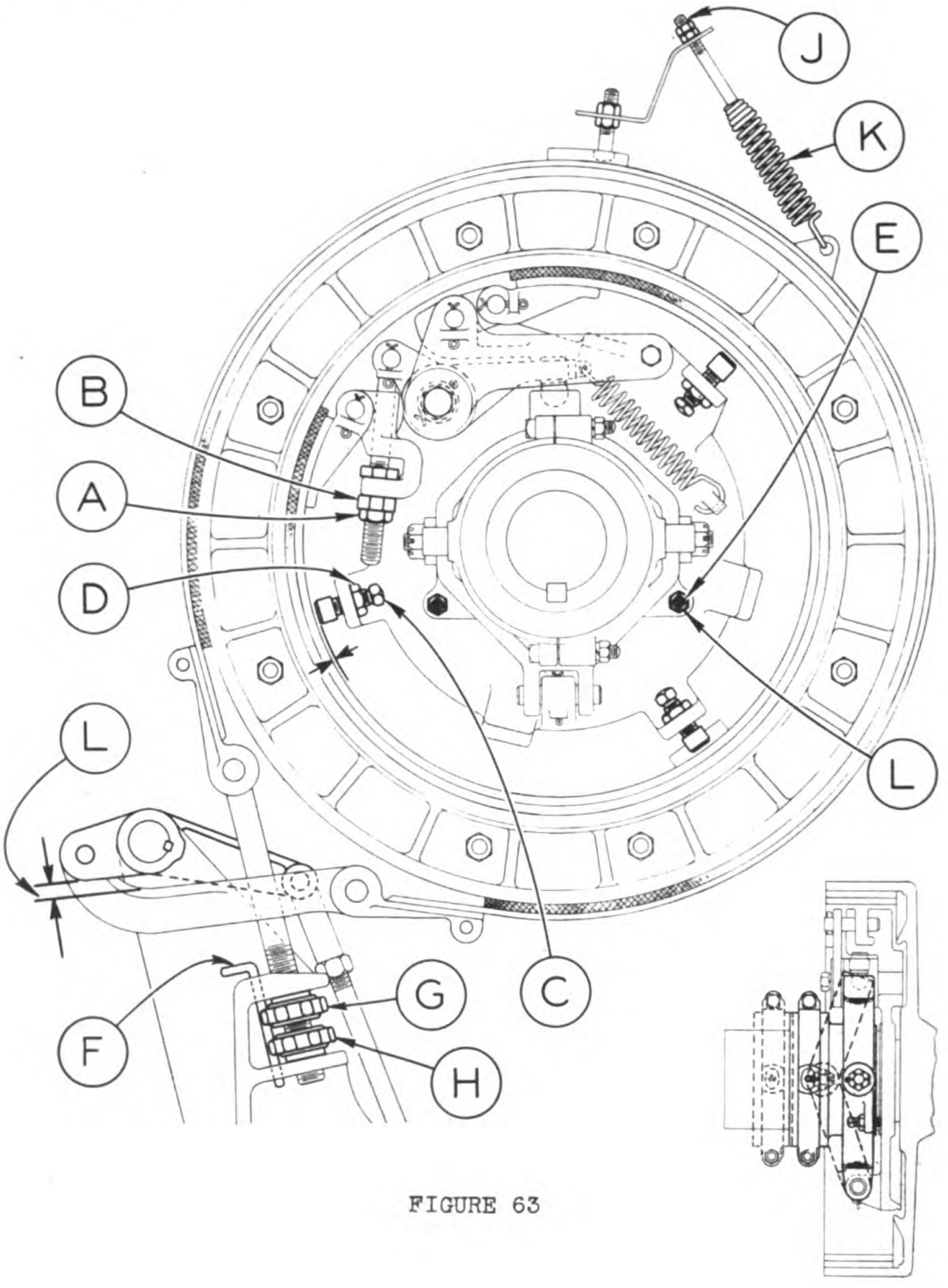


FIGURE 63

OPERATING ADJUSTMENTS (CONT'D.)

FRICTION CLUTCH ADJUSTMENTS (See Figure 63):
The swing and traction clutches, both drum clutches and the boom hoist clutch are similarly constructed and all are adjusted in the following manner:

Disengage all clutches, including the engine clutch. To tighten the clutch band, loosen the lock nut (A) and turn the adjusting nut (B) out toward the end of the eye bolt as far as is necessary for proper clutch operation. Tighten lock nut (A). NEVER set clutches so tight that they will not back-lock. A clutch that is too tight does not pull any better than one that is too loose and, furthermore, when a clutch is either too tight or too loose, the lining will burn and thus impair the efficiency of the clutch as well as shorten the life of the lining. Check the band carrier screws (C) and set them to a clearance of 1/32" between the screws and the clutch band WHEN THE CLUTCH IS ENGAGED. Be sure the lock nut on screw (D) is tightened after clearance adjustment is made.

Check the back-lock of the clutch. Set the back-lock adjusting screws (E) to provide a minimum amount of back-lock just enough to keep the clutch engaged.

To increase the amount of back-lock of the clutch, screw out on adjusting screws (E). To decrease back-lock screw in on adjusting screws (E). Both screws should be adjusted equally after which lock nuts must be securely tightened. The clutch will disengage itself when it does not have enough back-lock; hard to engage when it has too much.

When the clutch band linings are new or until they are smoothed down and properly seated, several clearance and back-lock adjustments might be required after which these adjustments should be made at regular intervals.

DRUM BRAKE ADJUSTMENTS (See Figure 63):
Both drum brakes and the boom hoist brake are of similar construction and are adjusted in the following manner:

Release all brake pedals. Be sure boom ratchet safety pawl is engaged (Lever No. 10 forward-see Page 42); lift brake pedal B-2 as high as it will go and place under it a block of wood or some other substantial support to hold the pedal up. To adjust the brake bands, pull out lock pin (F) and turn the adjusting nuts (G) and (H) up until the brake holds the required load. Turn lock nut (H) down against the casting and draw it tight. Replace lock pin (F). After boom hoist drum brake adjustment is made, be sure to remove support from under brake pedal B-2. Drum brakes should not be operated any tighter than necessary to hold the required loads. Check brake bands after adjusting to be sure they are releasing properly. If they drag, proper release is obtained by adjusting bolt (J) and spring (K).

NOTE: When brake is set clearance must be maintained at point (L).

OPERATING ADJUSTMENTS (CONT'D.)

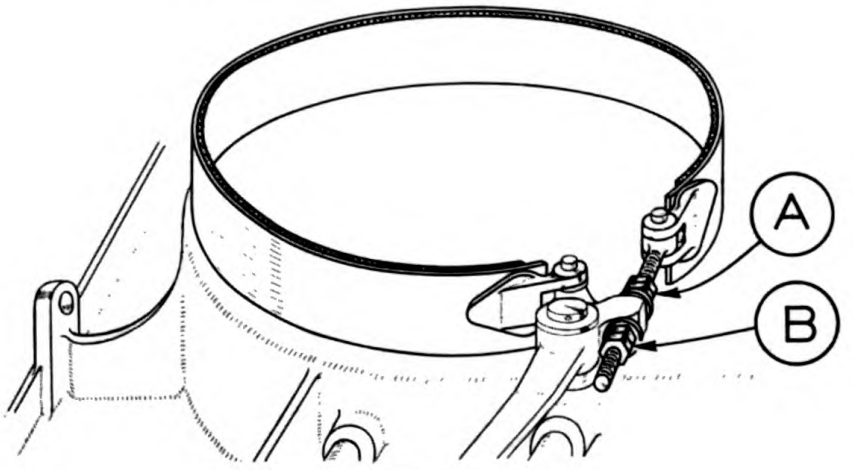


FIGURE 64

SWING BRAKE ADJUSTMENT

To tighten swing brake, push lever No. 6 (page 42) forward to release brake. Loosen lock nut (A) then tighten adjusting nut (B) just enough to make the brake hold. NOTE: The brake must not drag when released or while swinging the turntable.

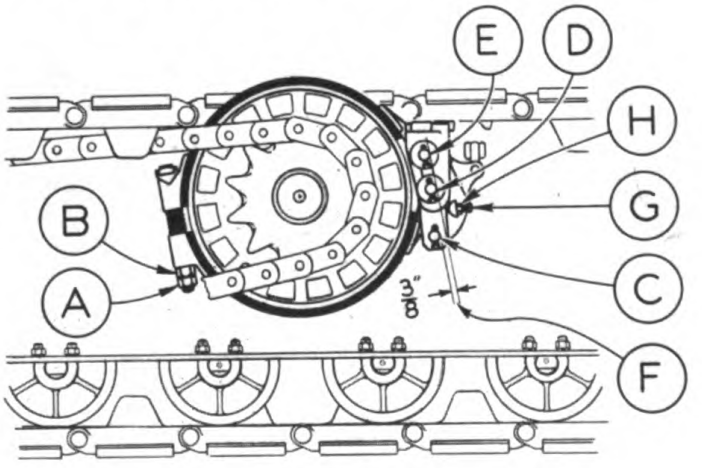


FIGURE 65

TRACTION BRAKE ADJUSTMENT

Disengage traction brakes (Levers No. 7 and No. 8 down-see page 42). Loosen lock nut (A) and turn adjusting nut (B) to tighten the band. After proper adjustment has been made, tighten nut (A). NOTE: Do not tighten brake too much without testing it. Ordinarily, turning the adjusting nut (B) from one flat side on the nut to the next flat side - or one-sixth of a turn - will be enough adjustment to make at one time before testing brake. Inspect the toggle action on the brakes at regular intervals to be sure the linkage has a sufficient amount of back-lock to keep the brakes set. Pin (C) should pass the center line of pin (D) and pin (E) about 3/8" as shown at (F) Figure 65 above, when the brake is set. To increase the amount of back-lock, turn out the adjusting set screws (G); to decrease the back-lock turn screws in. Always securely tighten the lock nuts on screws (H) after making adjustments.

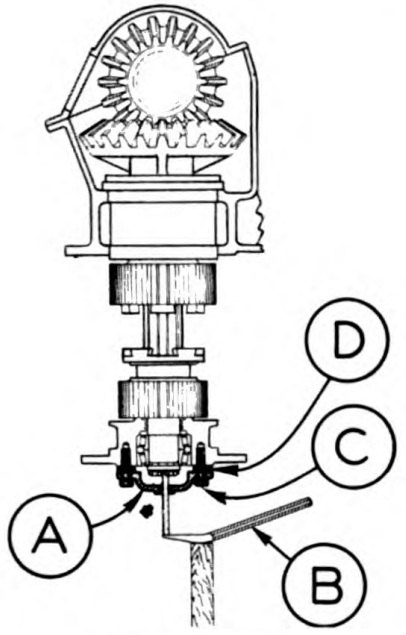


FIGURE 66

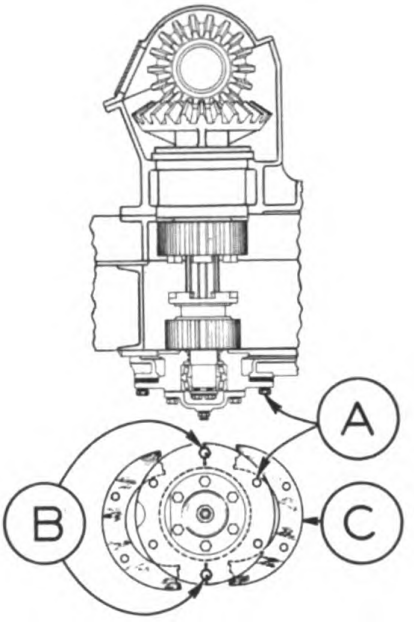


FIGURE 67

SWING AND TRACTION BEVEL GEAR SHAFT ADJUSTMENT (See Figure 66)

The swing and traction bevel gear shaft should be inspected at regular intervals to determine if any end play has developed. To check the shaft, remove the grease gun connection from the bearing retainer cap (A) and insert a 3/8" drift pin about 4" long into the grease gun connection hole, and under the pin set a pinch bar (B) supported by a timber as illustrated in Figure 66. Bear down and raise pinch bar and if shaft moves up and down from 1/16" to 1/8" or more, there is excessive end play which will require adjustment. To adjust, remove the six capscrews (C). This will allow the bearing retainer cap (A) to be removed. Be careful that the shims (D) do not drop down and become lost. Remove one shim (D). Replace the bearing retainer cap (A) and the capscrews (C). Be sure to tighten the capscrews evenly when screwing them back into place. Check shaft and if excessive end play remains, repeat the adjustment, removing only one shim at a time, until all but a very slight movement is eliminated.

SWING AND TRACTION BEVEL GEAR ADJUSTMENTS (See Figure 67)

To test the swing and traction bevel gears for excessive back lash or wear, set all operating levers at neutral, releasing all clutches and brakes. With one hand, hold the left hand drum stationary and with the other hand push the right hand drum back and forth in a rocking motion. Reverse this operation to test the left hand drum. In each case if the outer rim of the drum moves more than approximately 1/4", there is excessive wear on the swing and traction bevel gears and adjustment is required. To adjust, loosen all capscrews (A) and (B) and locate the cut in the split shims. Do not remove capscrews (B) which pass through shims at the cut. Remove capscrews (A) and pull out one shim (C). (Note that the shims are of different thicknesses to facilitate adjustment, and when removing one be sure it has identical halves.) Replace and tighten capscrews (A), then check the mesh of the bevel gears. There should be a clearance of from .012" to .040".

VERTICAL TRACTION SHAFT ADJUSTMENT

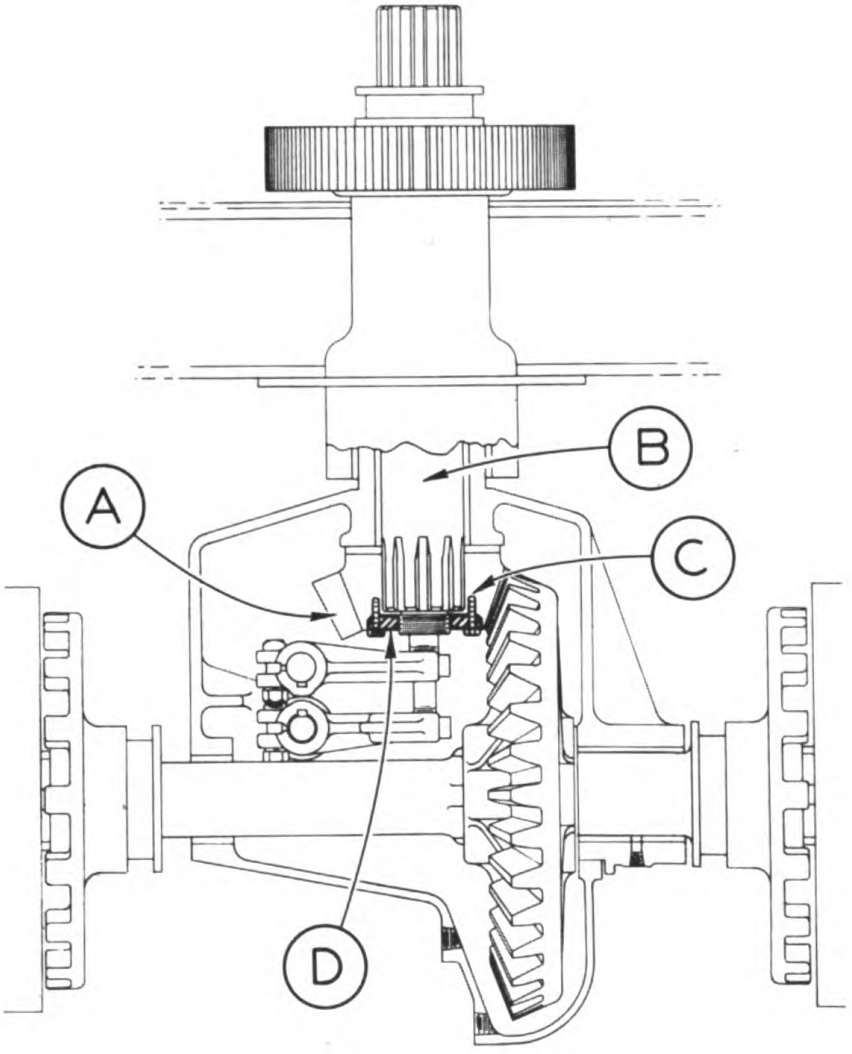


FIGURE 68

To check the vertical traction shaft for end play, place a timber or other obstruction in front of each crawler and run the machine against them - not over them - so that load is applied to the traction bevel gear which meshes with the vertical traction bevel pinion (A) at the bottom of the vertical traction shaft (B). Next remove nuts from the studs and take off dust cover so that top of vertical traction shaft can be seen. Release and apply power alternately by moving lever No. (3), page 42 back and forth, and if vertical traction shaft moves up and down 1/16" to 1/8" or more, there is excessive end play and adjustment is required.

To adjust, remove wire from the two capscrews (C); take out capscrews and turn the adjusting nut (D) clockwise until all but a very slight end play is eliminated. Replace the two capscrews (C) and wire them into place.

NOTE--It is advisable to check the vertical traction shaft for end play each time the bevel gear case cover has been removed to clean out the lower traction shaft bevel gear case.

OPERATING ADJUSTMENTS (CONT'D.)

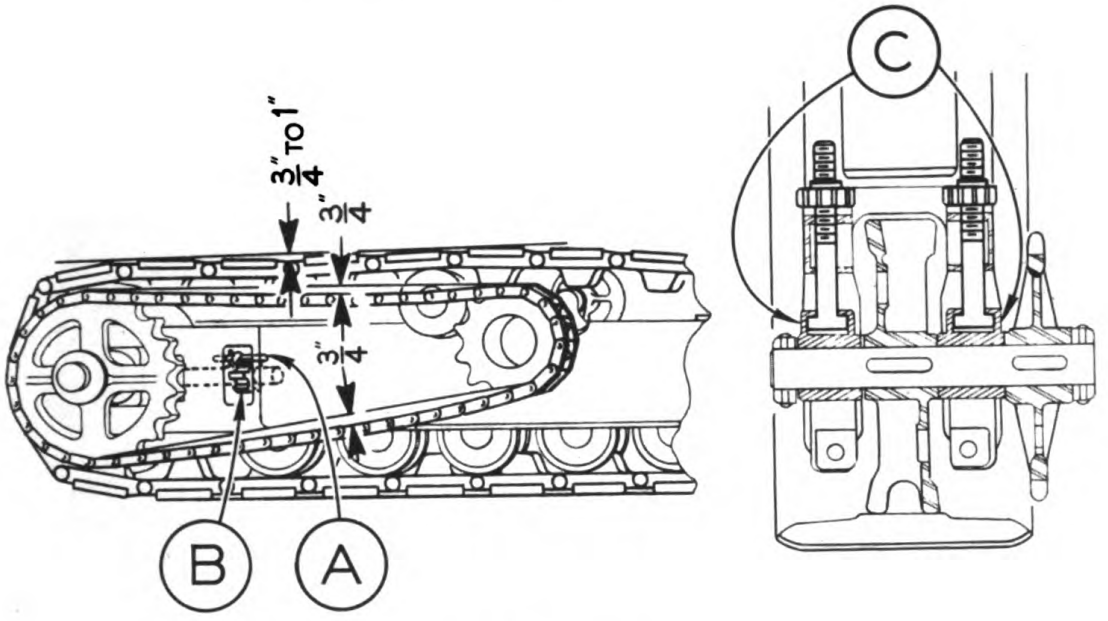


FIGURE 69

CRAWLER BELT AND DRIVE CHAIN ADJUSTMENT.

The right and left traction drive chains must have between 3/4" to 1" sag at top and bottom as shown in Figure 69. It is important that the amount of sag be equal in both chains to evenly distribute the loads they carry and to insure straight traveling. When adjusting the drive chain there must be slack in the crawler belt because tightening the chain also tightens the belt. Remove lock pins (A) and turn adjusting nut on both the inside and outside adjusting bolts as required. The inside and outside bearings (C) must be kept in perfect alignment so that the traction drive chains will run true on the drive sprockets. Replace lock pins (A). Travel the machine forward the length of the crawlers. This brings all slack in the crawler belt to the top where it can be checked for proper sag shich should be approximately 3/4" to 1" as indicated.

To adjust crawler belt, remove adjusting nut lock pin (A) and turn adjusting nut (B) on both inside and outside adjusting bolts as required. The inside and outside bearings (C) must be in perfect alignment so that the crawler belt runs true on the tumblers. Replace lock pin (A). Make adjustment opposite end of chains.

NOTE: When traveling in deep sand or other loose material it is advisable to have more slack in the chains and belt to avoid clogging.

LOCATION OF LIGHTS (For details see Parts Section)

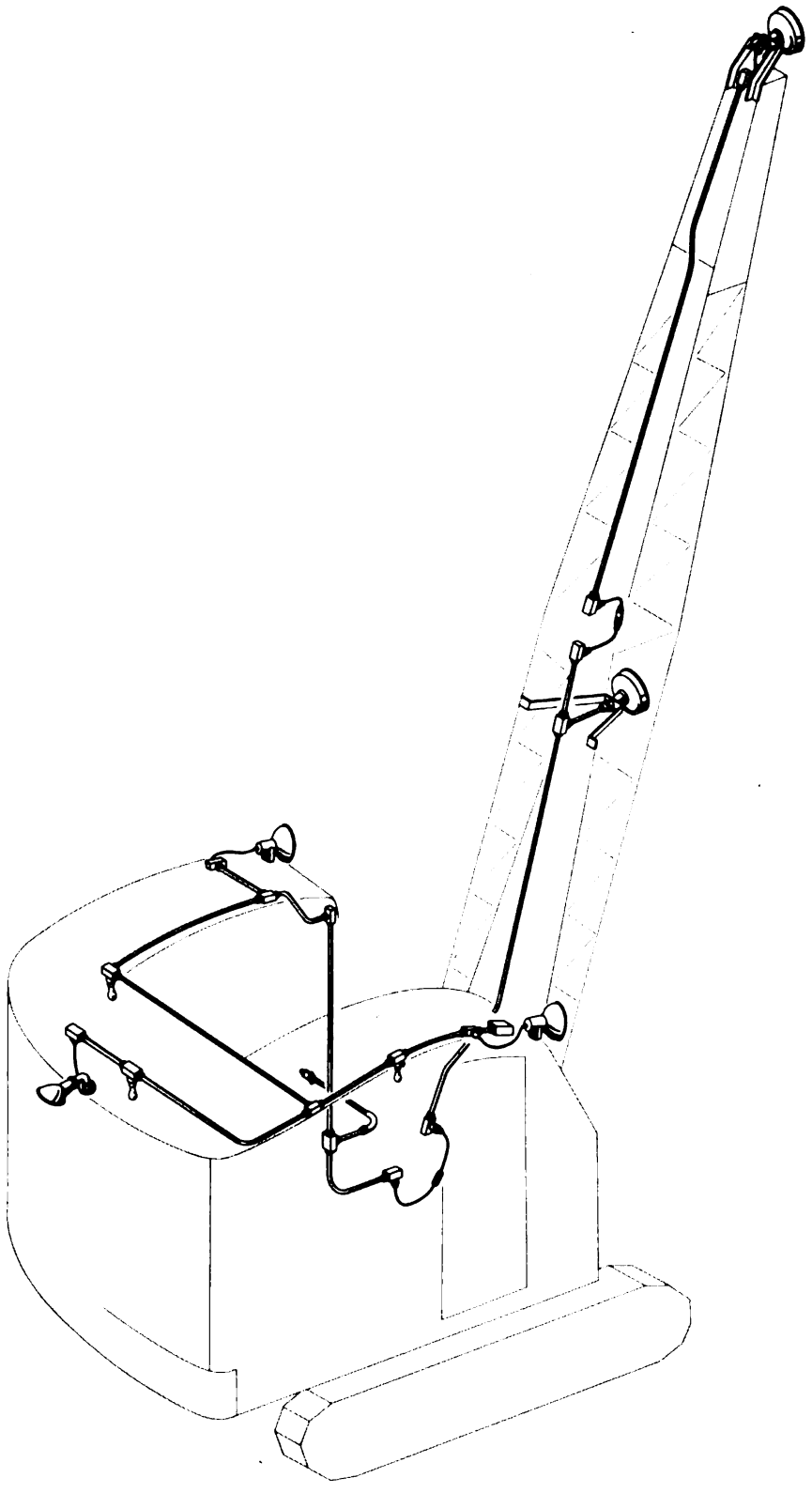
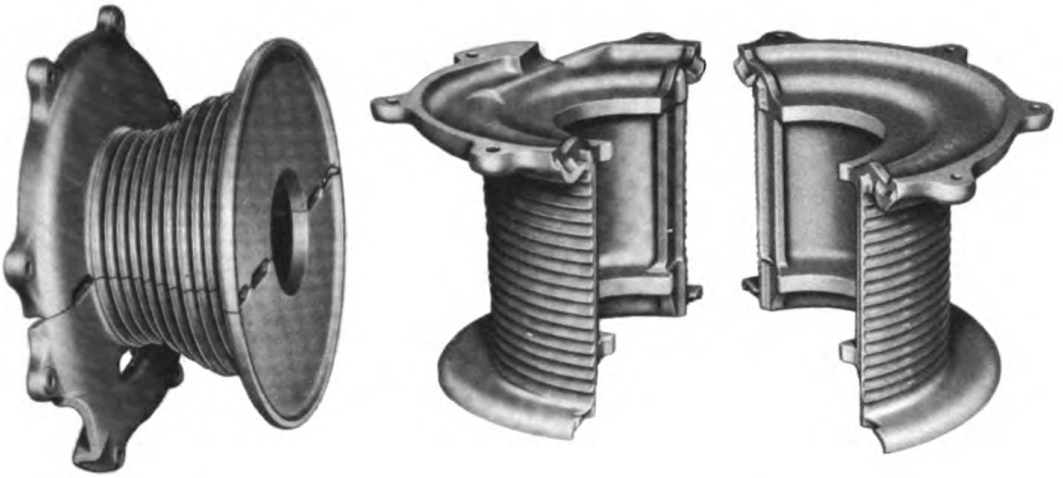


FIGURE 70

EQUIPMENT CHANGES FOR VARIOUS OPERATIONS

To convert the Koehring Crane to a clamshell, dragline, pile driver, shovel or pull shovel no changes are required in the mechanism to steer, travel or swing the machine.



"A" "B"

FIGURE 71

FIGURE 72 SHOVEL

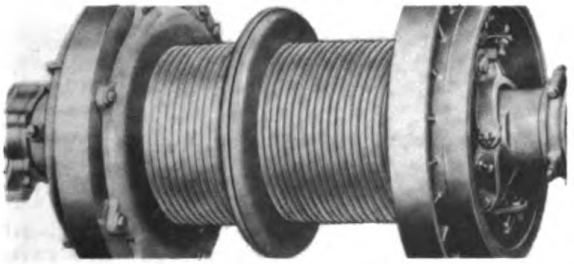


FIGURE 73 CRANE

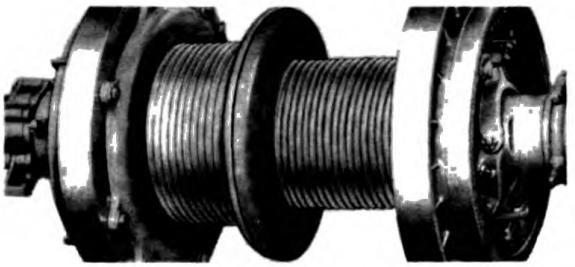


FIGURE 74 DRAGLINE

LAGGING

Drum and sprocket laggings are split to facilitate installation on the main shaft as shown in Figure 71 above. The two halves of each lagging should be used together as each pair is drilled to fit the drum before splitting. Each half is quickly and easily installed by placing it over the shaft and bolting to the drum. Figure 72 shows the drum shaft equipped to operate as a shovel. The tapered lagging for the dipper hoist cable is at the left, and the double sprocket lagging for crowding and racking-in the dipper is at the right. Figure 73 shows the drum shaft equipped to operate as a lifting crane, clamshell or pile driver. Both laggings are of the same diameter with the narrow one at the left and the wide one at the right. Figure 74 shows the drum shaft equipped to operate as a dragline or pull shovel. The larger diameter lagging for the hoist cable is at the left, and the smaller diameter lagging for the drag cable is at the right.

EQUIPMENT CHANGES FOR VARIOUS OPERATIONS (CONT'D.)

LIFTING CRANE:

Both drum laggings on the lifting crane main drum shaft are of the same large diameter. The narrow lagging is placed at the left and the wide lagging at the right. If only one drum is used, only one large diameter sheave is needed at the boom point. If both drums are used for load lifting, two large diameter sheaves are needed at the boom point. If the crane should be equipped with a fairlead for dragline work or an auxiliary front drum for pile driving work, it is not necessary to remove these two parts for lifting crane work.

CLAMSHELL CRANE:

Both drum laggings on the clamshell crane main drum shaft are of the same large diameter so that both the lifting cable and the closing cable wind on the drum at the same speed. The narrow lagging is placed at the left and the wide lagging at the right. Two large diameter sheaves are needed at the boom point, and a tagline drum attachment must be installed on the boom to operate the tagline or cable which prevents the clamshell from twisting around during hoisting and lowering operations. If the clamshell crane should be equipped with a fairlead for dragline work or an auxiliary front drum for pile driving, it is not necessary to remove these two parts for clamshell crane work.

DRAGLINE CRANE:

The left hand drum lagging on the dragline main drum shaft is used for hoisting the bucket and is of large diameter. The right hand drum lagging used for dragging the bucket is of small diameter. A dragline fairlead used to guide the drag cable to the drag drum is bolted at the place provided for it at the front-center of the turntable. Only one large diameter sheave is needed at the boom point for the hoist cable.

PILE DRIVER:

Both drum laggings on the pile driver main drum shaft are the same as used for the lifting crane. However, if the machine is already equipped as a dragline with one large diameter drum lagging and one small diameter drum lagging on the main drum shaft, no changes of lagging will be necessary as the pile driver attachment can be operated satisfactorily with the dragline drum laggings. If fairlead or tagline or both are attached to the machine, it will not be necessary to remove them. Two large diameter sheaves are required at the boom point.

CHANGING BOOMS FOR VARIOUS TYPES OF OPERATIONS

Following are the types of booms or front end attachments required for the various combinations to which the Koehring crane can be converted:

COMBINATION	FRONT END ATTACHMENT
CRANE	Crane boom with two large point sheaves
CLAMSHELL	Crane boom with two large point sheaves and tagline
DRAGLINE	Crane boom with two large point sheaves and fairlead
PILE DRIVER	Crane boom with two large point sheaves and auxiliary front drum.
PULL SHOVEL	Jib frame and boom, bucket arm and bucket.
SHOVEL	Shovel boom, dipper sticks and dipper.

To save time and heavy lifting, it is advisable to build a crib of timbers upon which the front end attachment to be installed on the machine should be placed. (See Figures 75 and 76 below and Figure 77 on Page 98.) The cribbing should be high enough to place the boom foot of the attachment at the same height as the boom foot pins on the turntable. The attachment to be placed on the cribbing should be handled by the attachment already on the machine. Another crib should be built for the storage of the attachment to be taken off the machine. The distance between cribs should not be too great as the machine is not designed to travel more than a short distance without a boom or front end attachment. Boom or attachment changes should be made on level ground.

STORING CRANE, DRAGLINE AND PILE DRIVER BOOMS ON CRIBBING

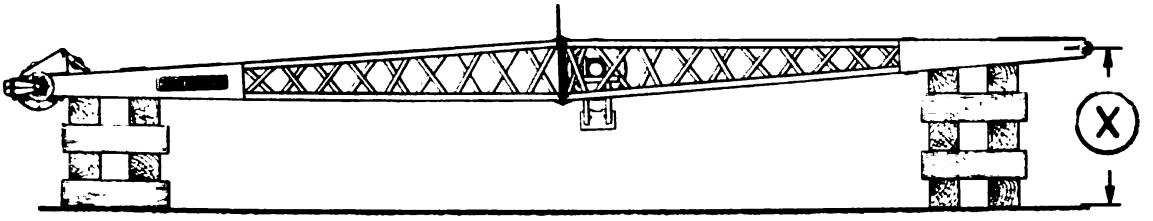


FIGURE 75

Cribbing as illustrated above is made up of 12" x 12" timbers. The distance (X) from the ground to boom foot should be approximately 5'-3".

STORING PULL SHOVEL ATTACHMENT ON CRIBBING

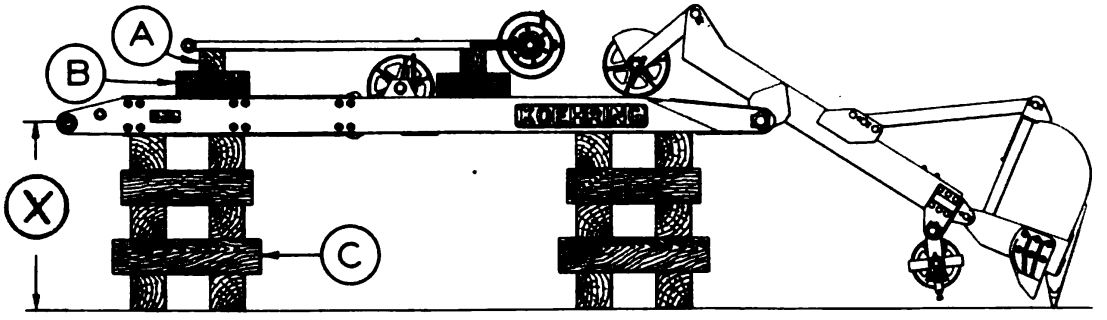


FIGURE 76

Cribbing as illustrated above is made up of 12" x 12" timbers (C), 8" x 8" timbers (B) and 6" x 6" timbers (A). The distance (X) from the ground to boom foot should be approximately 5'-3".

STORING SHOVEL ATTACHMENT ON CRIBBING

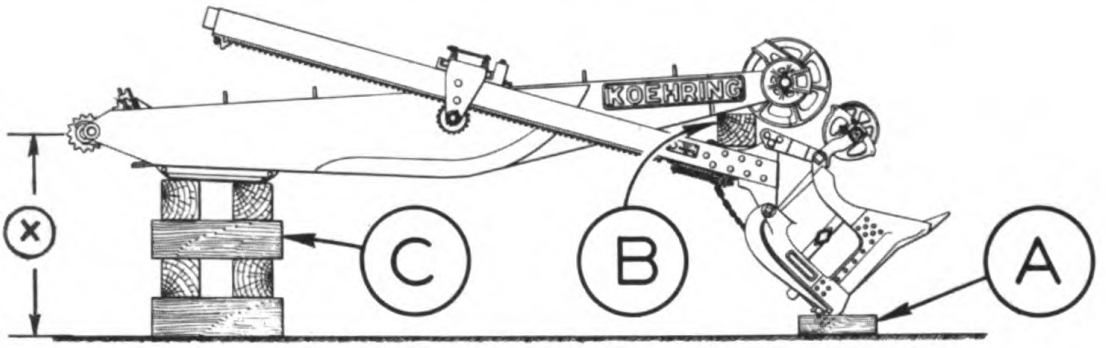


FIGURE 77

Cribbing as illustrated above is made up of 12" x 12" timbers (C), 8" x 8" timbers (B) and 6" x 6" timbers (A). The distance (X) from the ground to boom foot should be approximately 5'-3".

CHANGING BOOMS FOR VARIOUS TYPES OF OPERATIONS
REMOVING CRANE BOOM

After the machine has been moved to the proper position at the cribbing as illustrated in Figure 77 above, line up the turntable with the crawlers. Lower the boom on the cribbing which should be built high enough to permit easy removal of the boom foot pins. Remove pins, and after machine is backed away from boom, insert the pins in the boom foot casting for use with other booms. Remove the hoist cables and the boom hoist cable. Roll the cables in coils or wind them on cable spools, lubricating the cables as they are rolled or wound, and store.

MOUNTING SHOVEL ATTACHMENT

If a crane or a dragline is to be converted to a shovel, remove boom as directed under "Removing Crane Boom." In addition to the boom on a dragline, the fairlead must be removed by taking out bolts (A) shown in Figure 78, Page 99. Replace bolts in fairlead and store. Remove the right and left hand drum laggings from the main drum shaft and store. Bolt the tapered lagging (A), Figure 71, Page 95 at the left hand of the drum shaft. Bolt the double sprocket lagging at the right hand of the drum shaft. The shovel drum shaft assembly complete with tapered and sprocket lagging is shown in Figure 72, Page 95. Put the crowd chain around the left hand sprocket of the double sprocket lagging; fasten the ends of the crowd chain together with chain pin; insert cotter in chain pin and open. Do not try to adjust crowd chain until the boom is raised to an angle of approximately 40 degrees. To attach the reversing or racking-in chain which operates from the right hand sprocket of the double sprocket lagging on the main drum shaft to the single sprocket on the boom hoist shaft, remove the patch plate attached by four bolts to the curved section of the cab bulkhead. Put the chain around the sprocket on the boom hoist shaft; pass it through the hole in the cab bulkhead to and around the right hand sprocket of the double sprocket lagging on the main drum shaft; fasten the ends with a chain pin; insert cotter and open. Reeve the

CHANGING BOOMS FOR VARIOUS TYPES OF OPERATIONS (CONT'D.)

MOUNTING SHOVEL ATTACHMENT (CONT'D. FROM PAGE 98)

shovel boom hoist cable as described on page (85). Raise shovel boom to an angle of approximately 40 degrees. Wrap the end of the dipper hoist cable in a large loop around the ends of the dipper sticks - just ahead of the greenhorns on the racking to prevent slipping when hoisting - and clamp the cable securely. With the dipper resting on the ground, wind the dipper hoist cable until the rear ends of the dipper sticks are about two feet above the height of the shipper shaft on the boom. Travel the machine forward, guiding the boom between the sticks until far enough to lower sticks on the shipper shaft pinions. Check to be sure that the same number of rack teeth on each dipper stick are between the shipper shaft pinions and the end of the racking so that dipper sticks run square with the pinions. (See Figure 80, Page 100.) Release the left foot brake pedal. Lower boom and back up machine until the end of the dipper sticks are near the shipper shaft pinions. Check again on the number of teeth between pinions and end of rack to be sure there are an equal number on both sides. To place saddle blocks in proper position, remove nut (E), Figure 81, Page 101, on one end of the shipper shaft; remove thrust washer (F) behind the nut, then slide the saddle block out to a little beyond the width of the dipper stick. (Do not pull the saddle block off the shaft for this particular adjustment as it is heavy and will require added time and labor to replace.) Hold the gib (G) in place, and swing the saddle block up so the gib and saddle block will clear the top of the dipper stick, then slide the saddle block and gib in place so that gib is between saddle block and stick. Replace thrust washer and nut on the end of the shaft. Draw nut up tight, using a hammer on the special wrench furnished with the shcvel attachment. Insert cotter in shaft and open. Place the other saddle block in a similar manner. Remove dipper hoist cable from dipper sticks and reeve it through dipper sheave block as described on page (85). Grease the tops of the dipper sticks and the racking. Raise the boom to an angle of approximately 40 degrees. Wing the hoist cable and lift dipper about 3 feet off the ground. Shift lever No. 9 page 42, to racking-in position. Crowd out and rack-in the dippe: sticks several times using Lever No. 4. Do not strike the stops at either end of the dipper sticks. If racking teeth do not mesh properly with shipper shaft pinions, adjust saddle block gibs as described on Page 101. Adjust crowd chain as described on Page 102. Adjust right hand drum clutch as described on Page (88) to be sure it does not back-lock. Adjust dipper trip clutch as described on Page 103.

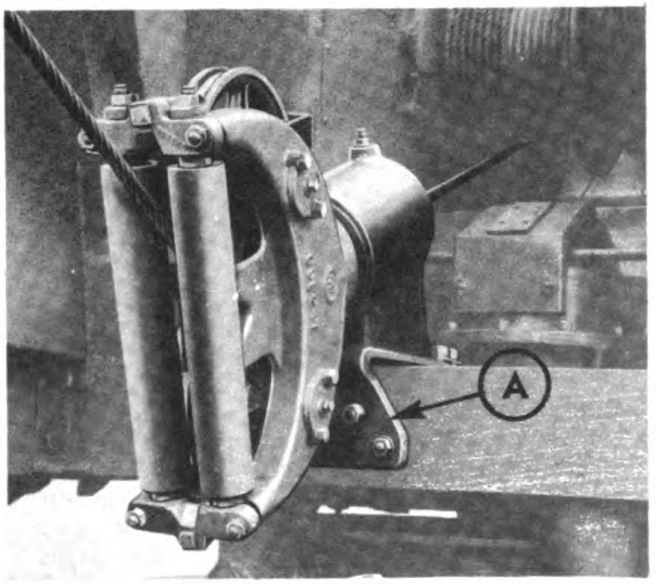


FIGURE 78

CHANGING BOOMS FOR VARIOUS TYPES OF OPERATIONS (CONT'D.)

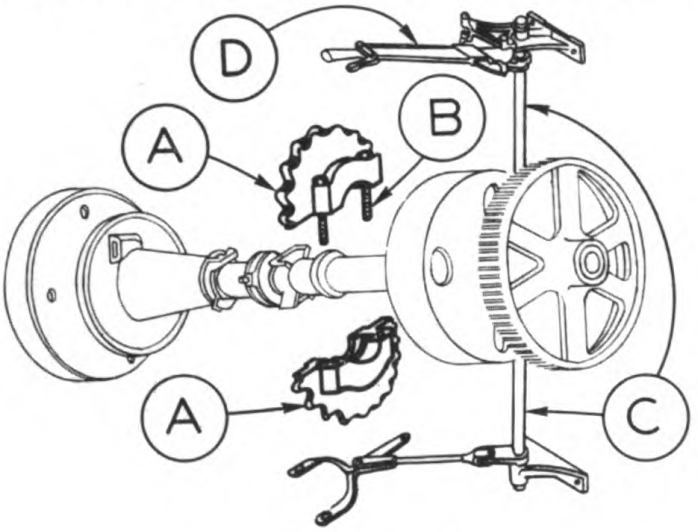


FIGURE 79

When a machine is shipped from the factory as a combination lifting crane and shovel, the racking-in sprocket and the operating mechanism to shift the sliding jaw clutch is already installed. When a machine is shipped as a crane only or dragline only, the racking-in sprocket and the sliding jaw clutch and lever linkage are omitted. To convert a crane or dragline to a shovel, move machine to cribbing prepared for storage of crane or dragline boom and remove boom as described on page (97). Remove crane or dragline laggings from the right and left hand drums of the main drum shaft and store. Bolt the tapered shovel hoist lagging to the left hand drum; place the two halves of the double sprocket lagging around the right hand drum and bolt securely (see Figure 72, Page 95.) To install the racking-in sprocket and sliding jaw clutch fork and lever linkage, as shown in Figure 79, place the two halves of sprocket (A) around the boom hoist shaft, on the shoulder provided for the sprocket, and bolt securely with bolts (B). Secure lever operating linkage (C) to turntable with bolts through holes provided on turntable and attach lever (D).

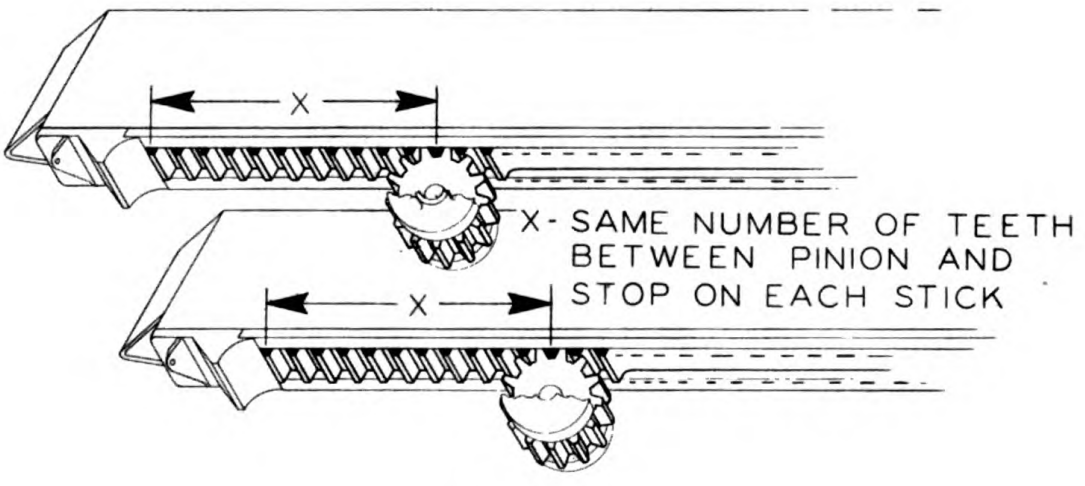


FIGURE 80

OPERATING ADJUSTMENTS (FOR SHOVEL)

For shovel operation, the right hand drum clutch - for crowding - should be adjusted so that it will not back-lock. To make this adjustment, screw in adjusting screws (E), Figure (63), Page (88), just far enough to keep the clutch from back-locking then set the lock nuts (L).

SADDLE BLOCK GIBS: (Figure 81)

Saddle block gibs must be adjusted regularly to keep the rack or shipper shaft pinions in proper mesh with the dipper stick racking. However, they must never be adjusted so tight that the sticks do not run freely. To check the saddle block gib adjustment, hoist the dipper until the dipper sticks are level. Release the crowd brake. Rock the saddle blocks backward and forward by crowding out and racking-in the dipper sticks. If the saddle blocks can be rocked more than one half inch, the gibs should be adjusted. To adjust, remove lock rod (A), loosen lock nuts (B) and (C) on both adjusting bolts (D). Turn both adjusting bolts (D) an equal distance using lock rod (A) as a wrench. Do not adjust too tight. When properly adjusted, the saddle blocks should rock forward and backward about 3/8". Be sure both adjusting bolts have been turned down the same distance. After adjustment has been made, replace the lock rod (A), then tighten lock nuts (B) and (C) on both adjusting bolts (D). Always adjust both right and left hand saddle blocks at the same time.

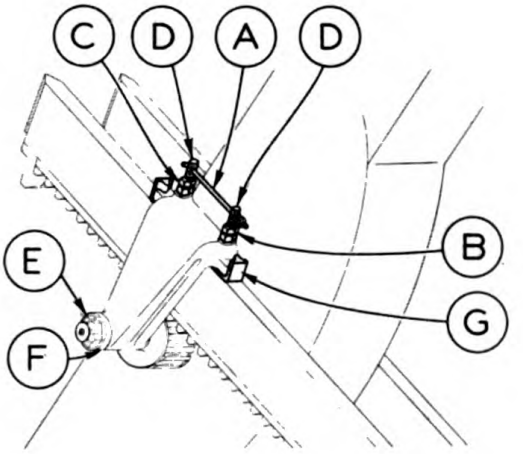


FIGURE 81

DIPPER ANGLE ADJUSTMENT AND SHEAVE BLOCK BUSHINGS: (Figure 82)

The angle of the shovel dipper, in relation to the dipper sticks, is adjusted with the adjusting links (A). To change the dipper angle, swing the turntable so that it lines up with the crawlers. Set the dipper flat on the ground as shown in Figure 82. Release the crowd drum brake (left brake pedal). Allow a little slack in the hoist cable. Remove bolt (B) from both links. To decrease dipper angle, travel machine forward; to increase dipper angle, travel machine backward - the distance traveled in either direction to be just enough to permit inserting bolt (B) into the next adjusting hole in the links. When the sheave block bushings (C) become badly worn they can be reversed for further use. To reverse the bushings, lower the dipper to the ground and release the hoist cable so that the sheave block (D) tilts forward, as shown in Figure 82. Remove bolts (E). Pull out bushings (C), turn them over and replace. Replace bolts (E) and tighten nuts.

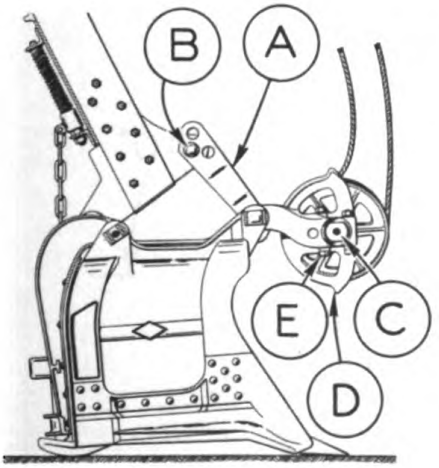


FIGURE 82

OPERATING ADJUSTMENTS (FOR SHOVEL)

DIPPER LATCH BAR:

Latch bar (A) must be set so that it goes into latch keeper not more than 1/2". To adjust, close and pull cotter (B). Loosen nut (C) and take up on nut (D) to raise latch bar out of latch keeper. Loosen nut (D) and take up on nut (C) to lower latch bar into keeper. When proper adjustment has been made tighten and cotter.

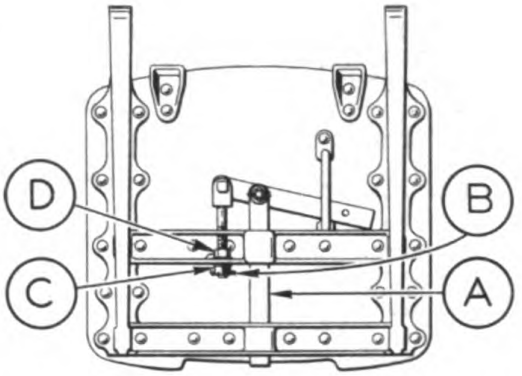


FIGURE 83

CROWD CHAIN: (Fig. 84)

To operate properly, the crowd chain must be adjusted with a sma ll amount of slack, and while making the adjustment, the boom must be set at an angle of approximately 40 degrees as indicated in Figure 84. To adjust crowd chain, crowd the dipper out almost to the end of the dipper sticks; set the crowd brake (left foot pedal), then lower the dipper to the ground. Crowding the dipper out puts all the slack in the top half of the chain and makes it easier to adjust. Loosen nuts (A) on both adjusting bolts (D). Loosen lock nuts (B) and tighten a djusting nuts (C) on both adjusting bolts to make the chain tighter. Be sure the same amount of adjustment is made on both adjusting bolts (D) so that the idler sprocket will run true in the crowd chain. After the proper adjustment is made, tighten nuts (A) and (B). Do not run the chain too tight. CAUTION: Never tighten crowd chain with the boom in horizontal position.

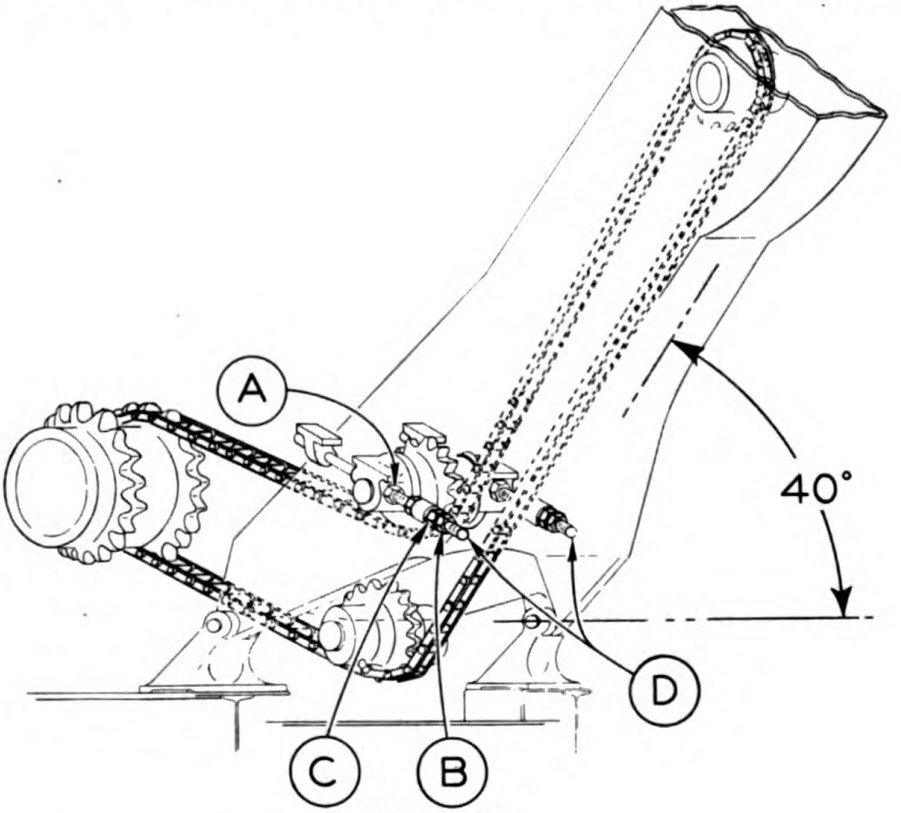


FIGURE 84

OPERATING ADJUSTMENTS (FOR SHOVEL)

DIPPER TRIP CLUTCH AND TRIP OPERATING CABLE: (Figures 85 and 86).

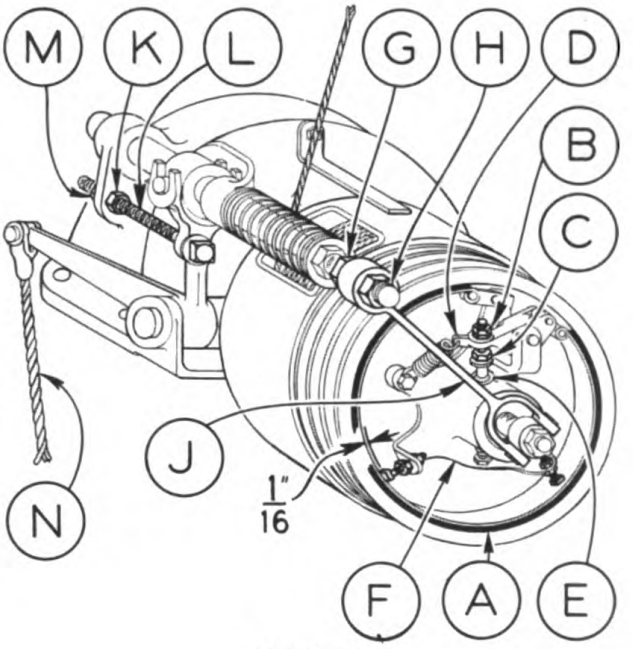


FIGURE 85

The dipper trip clutch (Figure 85) should be so adjusted that when the operator pushes down on the trip lever (Figure 86) which is mounted on lever No. 4 Page 42, the dipper door will open instantly. This clutch should have a slight amount of drag all the time to prevent slack in the trip cable during the cycle of operation. To adjust the clutch band (A) for dipper tripping, loosen lock nut (B) and turn the adjusting bolt (C) out of the band crank arm (D) toward the hub (E) of the clutch spider (F) to tighten the clutch just enough to open the dipper door when the trip lever is pushed down. When the adjustment on bolt (C) is used to its full extent, loosen lock nut (B), and screw bolt (C) up into band arm (D). Then loosen lock nut (G) and turn down nut (H) which moves the clutch shifter yoke (J) in toward the clutch far enough to take up the adjustment lost by screwing bolt (C) into the clutch arm. Tighten lock nut (G) and readjust clutch with bolt (C). To provide the proper amount of drag in the clutch to remove the slack in the trip cable, loosen nut (K) on bolt (L) and tighten nut (M), then test. If bolt (L) is drawn too tight, the dipper door will open during the operating cycle. Tighten lock nut (K) after proper adjustment of bolt (L) is made. The guide bolts should be so set that there is approximately 1/16" clearance between the head of the guide bolts and the clutch band when the clutch is fully engaged by holding the trip lever down. To adjust trip operating cable (N), shown in Figure 86, loosen lock nut (O) and move sheave (P) back far enough to make the cable taut. Tighten lock nut (O).

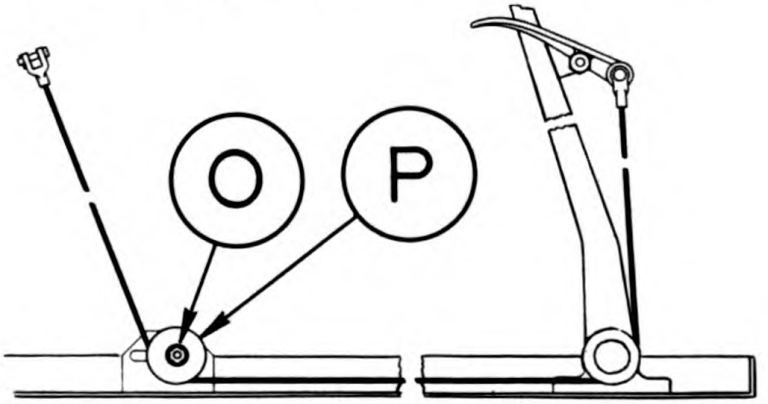


FIGURE 86

REMOVING SHOVEL ATTACHMENT

(Refer to "Storing Shovel Attachment on Cribbing, "Page 98)

If the shovel attachment is to be removed but not transported to another location for storage, it can be removed without disassembling the attachment. To remove, line up the turntable with the crawlers and lower shovel boom to an angle of approximately 30 degrees. Crowd the dipper out to the end of the dipper sticks and hold the dipper about 12" from the ground. Place two short timbers (A) on the ground directly under the dipper and about 18" apart. Lower the dipper to the timbers so that latch plate of the dipper is between the two timbers (A). Place a short timber (B) across the top of the dipper sticks under the boom, then lower the boom to the timber. This timber should be so located that it prevents the boom point sheaves from resting on the dipper sheave block. Build a substantial crib, as illustrated, under the boom near the boom foot with just enough clearance between boom and cribbing to permit the insertion of wooden wedges which are then driven in far enough to take the weight of the boom off the boom foot pins. Remove the dipper hoist cable, the boom hoist cable and the dipper trip cable from the machine. Lubricate cables, wind them in rolls and store with attachment. Remove the crowd chain from the crowd drum and place it on top of the boom securing it to the boom with wire. Remove boom foot pins and back the machine away from the boom. Drive the machine to the attachment to be used and which should be stored on cribbing as illustrated on page 97. Remove the reversing or racking-in chain from the boom hoist and load hoist shafts; remove the tapered lagging and the double sprocket lagging from the hoist drums and store all of these accessories with the shovel attachment. The dipper trip unit can remain on the machine unless it is to be used on another machine not equipped with a dipper trip. If the shovel attachment is to be removed for transportation to another location, it should b e disassembled as follows: Line up the turntable with the crawlers; set the boom at an angle of approximately 40 degrees; crowd the dipper out to approximately 18" from the end of the dipper sticks, then lower the dipper to the ground. Unfasten the dead end of the hoist cable at the dipper and pull the cable out of the dipper block sheave. With this free end of the cable make a loop around the dipper sticks just ahead of the rack teeth and fasten cable with clamps. Remove dipper trip cable. Remove the stops at the rear end of the dipper sticks. Wind the hoist cable until all slack is removed from the cable. Release the crowd brake. Back the machine away from the dipper, crowding out the dipper sticks until the sticks are free of the crowd pinions. Lower the sticks with the hoist brake. Replace stops on ends of dipper sticks. Remove the hoist cable from the dipper sticks and from the hoist drum on the machine. Lower the boom to cribbing which has been built high enough to permit easy removel of boom foot pins. Remove the boom hoist cable. Part the crowd chains and lay the ends of the chains on top of the boom then fasten with wire. Remove boom foot pins and back machine away from the boom.

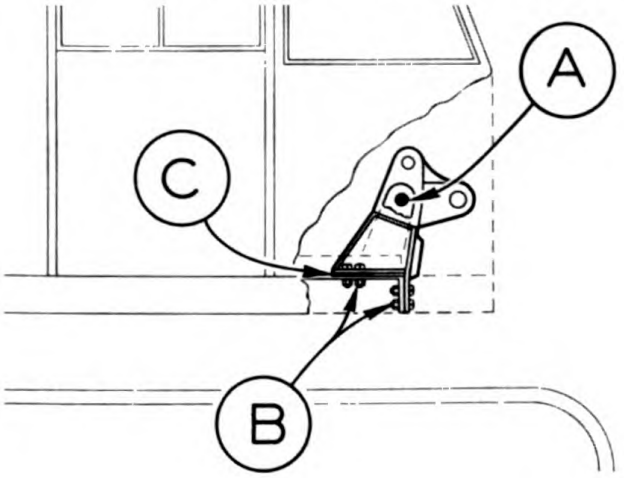
OPERATION OF BOOM HOIST AND RACKING-IN LEVER NO. 9
(For Shovel Operation Only - Page 42)

Lever No. 9 is not furnished with a machine shipped from the factory for use as a crane only. This lever shifts a jaw clutch on the boom hoist shaft. When pushed away from the operator to latched position, the jaw clutch on the boom hoist shaft engages the boom hoist drum, then by pushing forward on lever No. 4, the boom raises. When lever No. 9 is pulled toward the operator to latched position, the jaw clutch on the boom hoist shaft engages with the racking-in sprocket, they by pushing forward on lever No. 4, the dipper sticks will rack-in. To shift lever No. 9, have lever No. 4 in neutral position (engine clutch engaged by pulling lever No. 1 up); push lever No. 9 for boom hoist engagement and pull lever No. 9 for racking-in engagement. If lever No. 9 does not latch in notch for selected operation, keep pressure on it while lever No. 4 is pushed forward then back to neutral to line up the clutch jaws for engagement. The beginner will find it easier to shift lever No. 9 with the engine idling. Do not operate unless lever No. 9 is latched in selected position. Be sure boom safety ratchet pawl is engaged - lever No. 10 forward - before shifting from boom hoist to racking-in operation. When operating as a crane, lever No. 9 should be in boom hoist position all the time. The crowd and racking-in boom hoist lever No. 9 operates two friction clutches for three operations, two of which operations are selected by lever No. 9. Pulling lever No. 4 back from neutral engages the right hand drum or crowd clutch and crowds dipper sticks out. Pushing lever No. 4 forward from neutral engages the clutch on the boom hoist shaft and transmits power through the sliding jaw clutch operated by lever No. 9 to engage the boom hoist drum to raise the boom or to engage the reversing sprocket on the boom hoist shaft to rack-in the dipper sticks. The reversing sprocket is connected to the crowd drum with a roller chain which reverses the crowd drum to rack-in the dipper sticks. To select boom hoist or rack-in operation, see description of lever No. 10, Page (52). To operate lever No. 4 in crane work, see Page (47).

MOUNTING PULL SHOVEL ATTACHMENT

Pull shovel attachment should be placed on cribbing as illustrated on Page 97. If crane or shovel is to be converted to pull shovel, remove crane or shovel attachments and lagging as described on pages (98) and (104). If dragline is to be converted to a pull shovel, remove only the dragline fairlead by taking out six bolts (A) as shown in Figure 78, Page 99. Pull shovel operation requires the same drum lagging as a dragline - large diameter lagging on the left hand drum and small diameter lagging on the right hand drum. If a shovel is to be converted to a pull shovel, standard dragline laggings must replace the shovel laggings removed. If a lifting crane is to be converted to a pull shovel, keep the large diameter lagging on the left hand drum but replace the right hand lagging with the small dragline lagging.

MOUNTING PULL SHOVEL ATTACHMENT (CONT'D.)



Mount the pull shovel boom foot adapter on the turntable, using the boom foot pins (A) and bolts (B) through the bolt holes provided for the dragline fairlead, as shown in Figure 87. Use shims (C) at the bolt holes to fit adapter to the turntable.

FIGURE 87

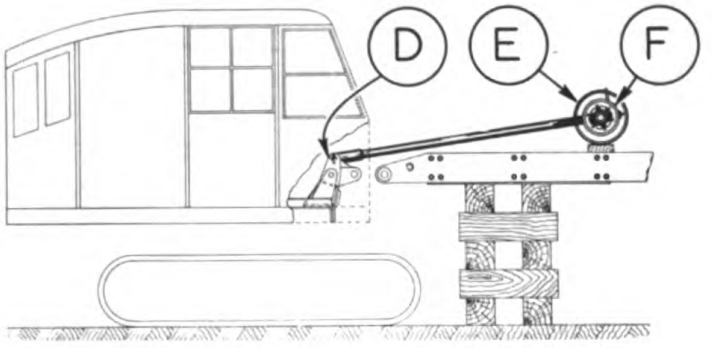


FIGURE 88

Mount the jib frame on the adapter with pins (D) as shown in Figure 88. The large sheave (E) should be at the left and the anchor spool (F) at the right.

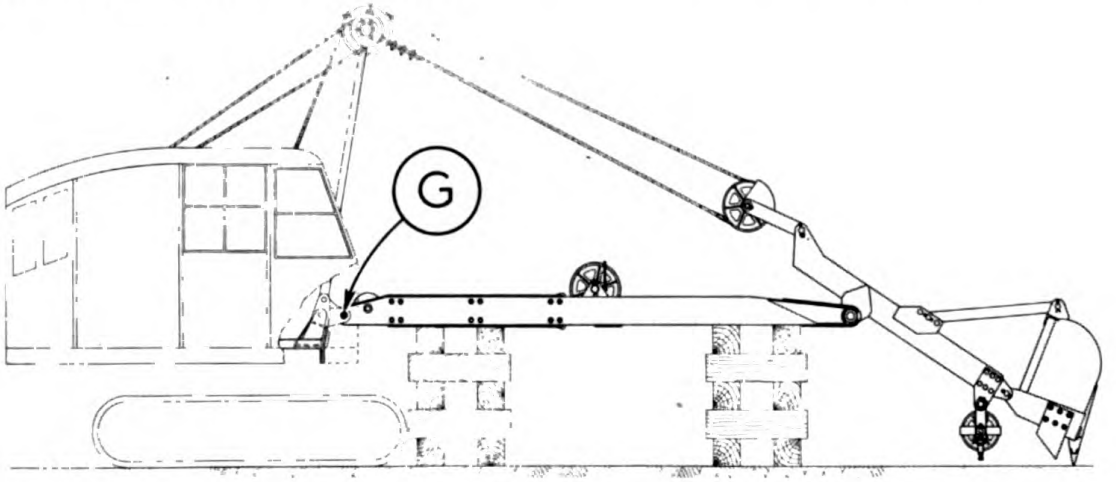


FIGURE 89

Reeve the jib frame cable as per instructions, Page (86). Raise jib frame using same levers for raising crane boom Page (47). Drive the machine to the pull shovel boom and attach boom to adapter with pins (G) as shown in figure 89. Reeve hoist and pull cables as per instructions, Page (86).

OPERATING ADJUSTMENTS FOR PULL SHOVEL

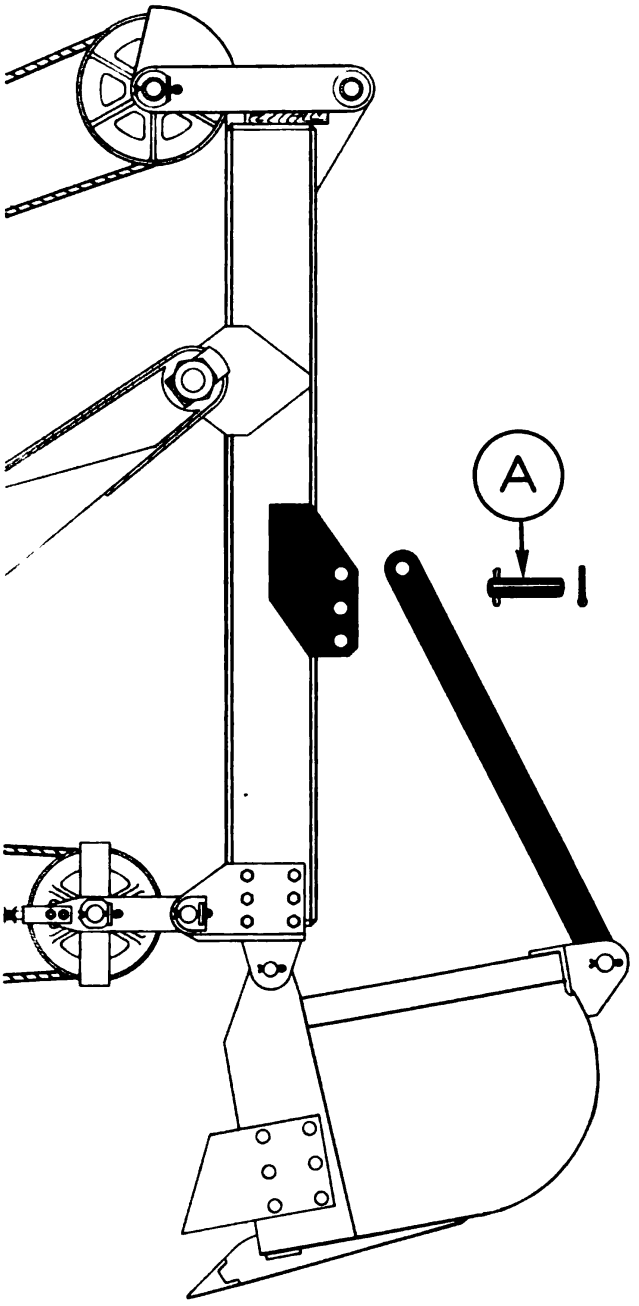


FIGURE 90

Machine operating adjustments are the same as described under "Operating Adjustments", Pages (87) to (93). If a shovel has been changed to a pull shovel, the drag clutch should be set to back-lock by screwing out on adjusting screw (E), Figure (63), Page (88). The angle of the dipper, in its relation to the dipper arm, can be adjusted by moving the dipper adjusting link Figure 90, up or down on the dipper arm. To adjust the angle, line up the turntable with the crawlers then lower the dipper to the ground. Release the hoist and drag brakes to allow a generous amount of slack in the cables. Remove link pin (A) and, with dipper on the ground, travel the machine backward or forward-depending upon the adjustment desired - until the pin (A) can be inserted into the selected hole. To remove pull shovel attachment, line up the turntable with the crawlers; extend the dipper arm out as far as it will go then lower the boom to position on two cribs as shown in Figure 76, Page 97. Remove the hoist and pull cables. Remove the boom foot pins then back the machine about one foot away from the boom. Place some blocking on top of the boom near the dipper arm and some 4" x 4" or similar timbers near the foot of the boom as shown on page 97. Lower the jib frame to this blocking and timbers, then remove jib frame mounting pins and jib frame cable. Back machine away from jib frame.

UNLOADING FROM FLAT CAR
(See Figures 92, 93 and 94, Page 109)

When unloading from a flat car, a ramp or unloading platform strong enough to support the weight of the machine is necessary. After flat car is spotted at unloading point, securely block all wheels of the flat car to prevent it from moving during the unloading operation. If machine is to be unloaded by ramp and no ramp is available, it will be necessary to build one of heavy, solid timbers as shown in Figures 92 and 94, Page 109. The ramp should be long enough to avoid a steep grade. When the machine is shipped as a crane, the regular method is to load the machine and block it at one end of the flat car, with the boom in sections, loaded on the same car behind the machine. In most cases, after the blocking which holds the machine to the car has been removed, the machine, less boom, is run down the ramp, then traveled to the other end of the car where the machine is turned to face the car and then traveled up to the car for boom attachment. The lower section of the boom is then moved toward the machine where the boom foot A is inserted into the boom foot clevises and fastened by the boom foot pins. The machine is then backed up until a short portion of the lower section is at the end of the car. Now the second section is bolted to the lower section and the machine backed up again until all sections have been mounted after which all necessary cables for the boom hoist are reeved. (For cable reeving see Pages 80 and 81.)

If conditions at the unloading point will not permit traveling machine on the ground from one end to the other, or unloading can be done from only one end of the car and the boom is loaded between that end and the machine, the following procedure will be necessary: block up solidly under both outside sills of the flat car to prevent car from tipping, then swing turntable around facing the boom sections. Assemble and mount the boom on the machine. Be sure all boom section bolts, (A) Figure 91, and cable guards are in place and tight. Reeve the boom cable as shown in Figure 53, Page 80. Raise the boom just enough to balance the machine as is traveled across the car and down the ramp.

For shovel unloading, follow the same procedure in preparing the flat car for unloading as with the crane. Shovels are shipped with shovel front end attached, and they should be unloaded with the shovel front end ahead. See Fig. 94, Page 109. After removing the blocking from the shovel and after checking all cables to see that both ends are securely fastened, raise the boom to an angle of about 40 degrees. Hoist the dipper about 3 feet from the car floor and set the hoist brake. Release the crowd brake and rack-in the dipper until it is back of the boom point, then set the crowd brake. The shovel is now ready to travel.

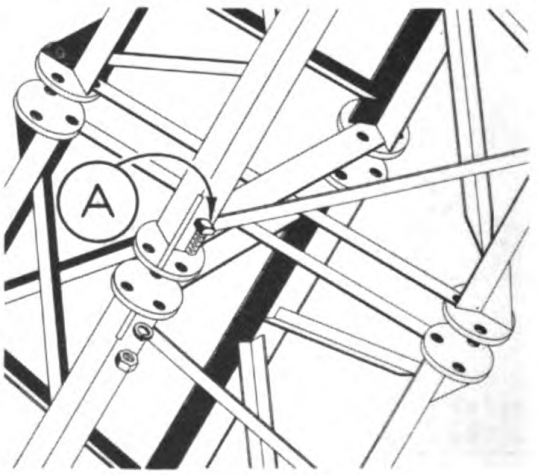
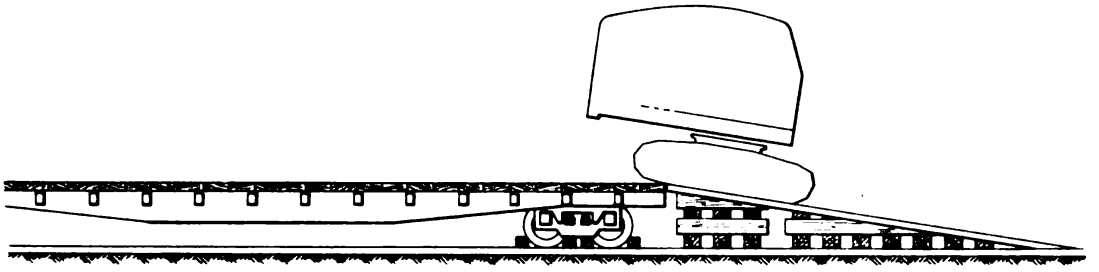


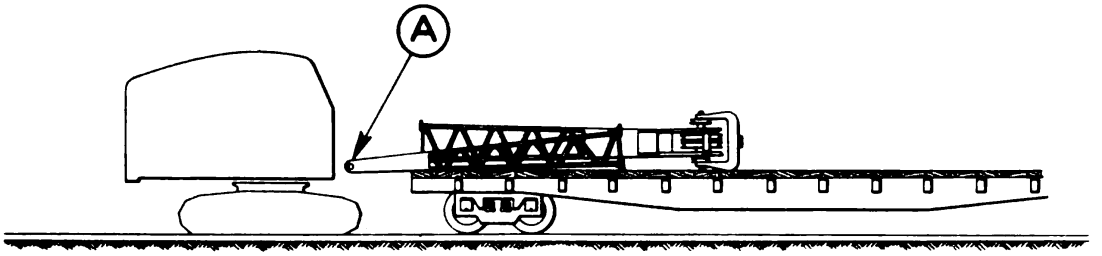
FIGURE 91

Draglines, Clamshells and Pile Drivers are unloaded in the same manner as Cranes. Pull Shovels are unloaded in the same manner as shovels.



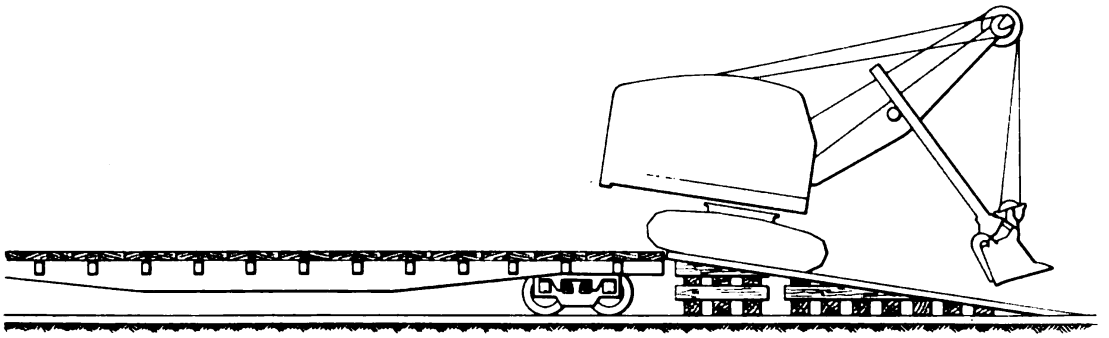
CAUTION: When unloading machine less attachment as above always face machine as shown with weight in rear to avoid tipping.

FIGURE 92



Suggested method of attaching boom after unloading machine from car.

FIGURE 93



Proper method of unloading machine with assembled attachment.

FIGURE 94

STORAGE

FOR SHORT PERIOD:
If possible, move machine under cover. Run machine up on blocking, and if shovel attachment is on machine, lower dipper to blocking. Clean crawlers and dipper thoroughly. Release tension from all cables. Grease all bearings, gears, etc. thoroughly enough to be sure all surfaces are coated to prevent rust. Grease all drum barrels being sure that surfaces under cables are coated. Grease all cables thoroughly. Install metal shields as provided with each machine, over windows. If shields are lost use boards. Set all brakes.

FOR FOUR MONTHS OR LONGER:
If storage is to be longer than four months, follow above instructions, and in addition replace paint which has worn off and exposes metal. Thoroughly clean and paint crawlers, crawler frames and dipper. Block crawlers at each end to prevent movement, and drive wooden wedges under each side of the two front turntable rollers to prevent swinging. Remove all clutch and brake bands and coat friction surfaces thoroughly with a rust preventative. CAUTION: Grease must be cleaned thoroughly from friction surfaces before replacing bands for operating use. For care of engine and engine accessories during storage, see Engine Section.

For further instructions refer to tentative technical manual TM5-9715 Preparation of Corps of Engineers Equipment for Storage issued by Engineer Field Maintenance Office, P. O. Box 1679, Columbus, Ohio.

SHIPMENT - DOMESTIC

NOTE--Working weights which should be used for field shipping weights are given in the specifications on Page 25. Overall lengths, heights, widths are shown in the specifications on Pages 28 to 36.

TO SHIP BY RAIL:
Order a flat car (42' or longer) having a capacity of 60,000 pounds or more. Machine and accessory equipment should be loaded and blocked as shown in illustrations on Page (111). Block car to prevent movement while loading. If platform loading facilities are not available, build a ramp from end of car to ground as illustrated on Page 109. The same type of ramp is necessary for side loading. Propel machine up ramp with the front end first, crawler drive chains to the rear and on to the car. Spot the machine as nearly as possible over the center of one flat car truck on center line of car at either end of the car. Block machine as illustrated. Using the boom of the machine, load other attachments or accessories over the other flat car truck to distribute or balance load, leaving space on the car to place crane boom after disassembly of boom or to lower and block shovel or pull shovel attachment. Check to be sure all machine brakes are set against swing, propelling or hoisting. Drain radiator and gasoline tank. Close cab and lock windows and doors, covering windows with metal shields provided for the purpose. CAUTION! Be sure all blocking is secure and adequate to prevent any movement of load.

TO SHIP BY TRAILER:
For short hauls or cross country hauls where railroads are not available, it will be necessary to ship by trailer. Manufacturers of trailers especially built for this purpose usually provide instructions for loading of equipment. If trailer is of ordinary flat bed, stationary axle type, it will be necessary to securely block trailer. Build a ramp of two 3" x 18" boards 16

METHOD OF BLOCKING

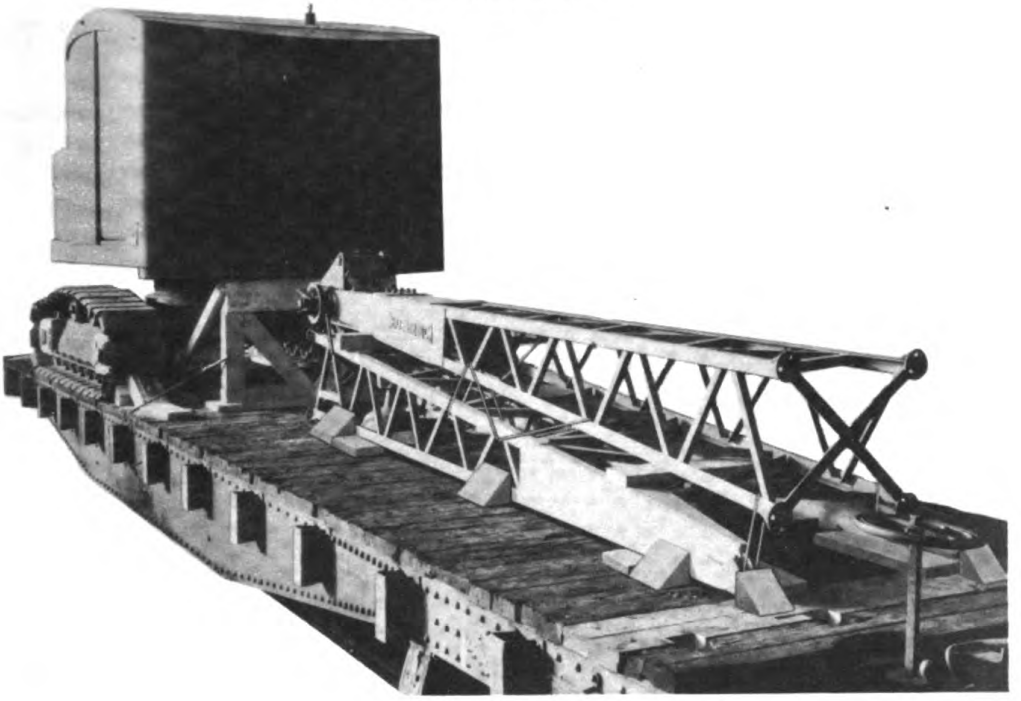


FIGURE 95

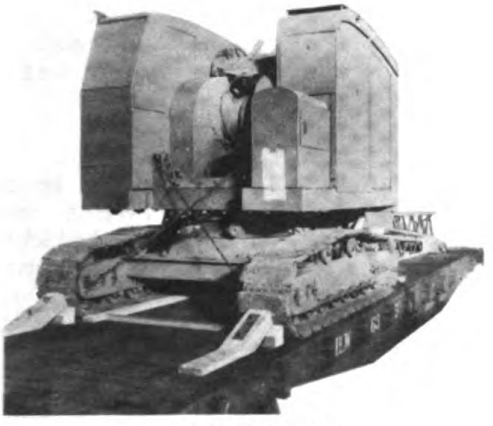


FIGURE 96

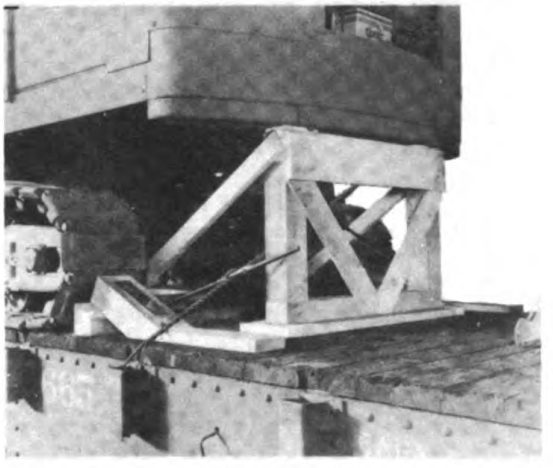


FIGURE 97

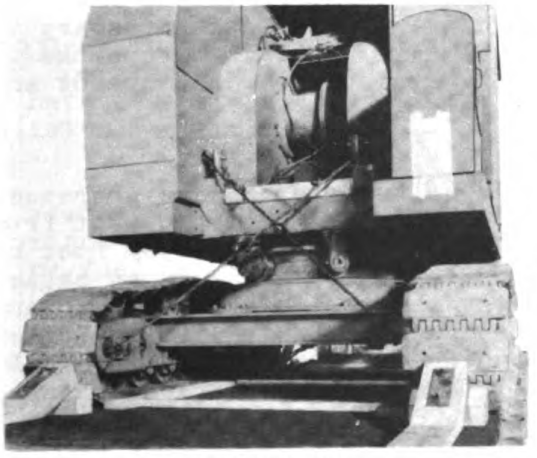


FIGURE 98

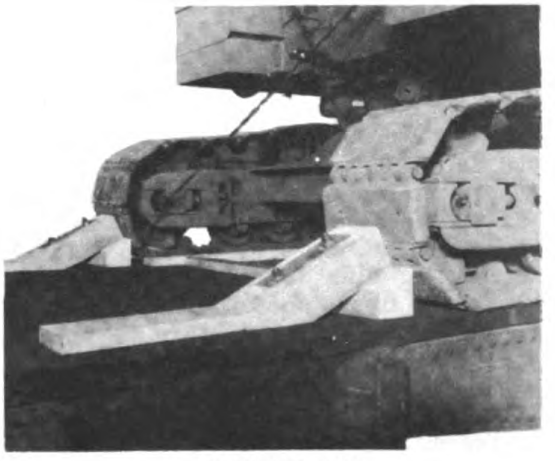


FIGURE 99

feet long supported by blocks from the ground to the trailer bed, then travel machine up ramp on to the trailer the same as for flat car loading.

NOTE: For export shipment refer to tentative technical manual TM5-9711 Instructions for Preparation of Corps of Engineers Equipment for export, issued by the Engineer Field Maintenance Office P. O. Box 1674, Columbus, Ohio.

IMPORTANT SUGGESTIONS

Keep machine clean. Dirt not only serves as a good cutting compound, when mixed with water or grease, to ruin bearings but also hides trouble in the making. A clean machine is easily and quickly inspected and is the mark of a good operator.

LUBRICATE REGULARLY ACCORDING TO INSTRUCTIONS:
Keep gasoline, lubricants and water for radiator clean. Inspect machine regularly every six shifts and tighten loose bolts. If cracks appear in heavy castings as a result of hard service, weld promptly to avoid serious breakdowns.

IN CRANE OPERATION:
Be sure footing is solid. Keep crawlers a little high on the load side. Do not exceed rated capacities. (See Page 29). Keep brakes and clutches in proper adjustment. Be careful when propelling machine with boom at high angle. Better traction is assured in soft going if the load is carried behind. When travelling with a suspended load, snub the load to the machine to prevent load from swaying. Be sure that all loads are properly secured before lifting - especially with boom close to vertical as sudden release of load might throw boom back over the cab. Always use proper cable lengths to prevent overwinding and excessive wear.

IN SHOVEL OPERATION:
Never "sweep" or swing shovel dipper sideways in cuts to level off. It is a quick way to bend sticks. Do not start swing motion of shovel until dipper is clear of bank. Avoid striking bumpers under shovel boom. If in time the armor support becomes badly bent or wood filler decays or becomes worn to about 1/2 of original thickness, support and wood filler should be replaced. Never leave machine in deep cut or pit or on stream side of a dam or levee overnight or any other time when not in operation. Flash floods or heavy rains may fill such low places. Keep dipper teeth sharp and fill the dipper at every pass. Take a relatively thin slice at a cut in hard digging so that the dipper hoists through the bank fast and easily. In soft digging it is not necessary to pull dipper through full length of bank to fill. In high banks of soft digging take top passes first. Move up and clean up cut and loosen hard material while waiting for trucks.

IN DRAGLINE OPERATION:
Keeping bucket teeth sharp and built up to proper size increases digging speed and prevents wear on bucket lip. Hoist bucket from digging as soon as it is filled. Piling dirt under boom foot by dragging full bucket too far is wasted time - wears drag cable. Inspect drag chains regularly, paying particular attention to end links which are subjected to greatest wear. Chain life can often be increased by reversal end-for-end and also top-for-bottom. DO NOT PULL DRAG CABLE SOCKET INTO FAIRLEAD. Keep fairlead sheaves and bearings well lubricated.

WAR DEPARTMENT - CORPS OF ENGINEERS
PREVENTIVE MAINTENANCE GUIDE

FOR USE WITH T. M. AND LUBRICATION GUIDES
(1054) (1054A) (1054B)
EXCAVATOR, POWERED, GASOLINE, 3/4
CUBIC YARD, KOEHRING MODEL 304.

PREVENTIVE MAINTENANCE IS THE SYSTEMATIC APPLICATION OF COMMON SENSE MEASURES IN "TAKING CARE OF WHAT YOU HAVE"

THE ECHELONS OF PREVENTIVE MAINTENANCE
(See Note 1)

FIRST ECHELON

Daily Preventive Maintenance.
1. Before operation services.
2. During operation services.
3. After operation services.
By operators (or crew)

SECOND ECHELON

64 hour (weekly) maintenance service.
By company or similar unit.
256 hour (monthly), maintenance services.
By regiment, battalion or similar units.
Operators will assist unit mechanics.

TECHNICAL INSPECTIONS

By commanding officer or staff representative.
Use Form W.D. A.G.O. 461-E

THE RESPONSIBILITY FOR THE PERFORMANCE OF PREVENTIVE MAINTENANCE SERVICES RESTS NOT ONLY WITH THE OPERATORS, BUT WITH THE ENTIRE CHAIN OF COMMAND FROM THE SECTION CHIEF TO THE COMMANDING OFFICER. AR 850-15.

DAILY BEFORE OPERATION SERVICES

Purpose - To determine if condition of equipment has changed since last operated. Water, oil or fuel may have leaked out. Sabotage may have been attempted or damage due to weather, enemy fire or collision may have occurred.

1. Examine machine for exterior damage, missing accessories or signs of tampering. Look underneath for signs of water, oil or fuel leakage. Check fuel tanks - see that they are full. Check oil level in engines and coolant in radiator. Do not fill radiator (when cold) to overflow - allow room for expansion.

2. Inspect reserve supplies of oil and lubricants - see that they are complete and emergency equipment, tools and spare parts are in good condition and in place.

3. If freezing has occurred since last operation - See that track is free.

4. Check bucket. See that all pins and keeper pins are in place. Check drag bucket chains and clevis for broken or badly worn links.

5. Start Engine. Be sure main engine clutch lever is in release position (down position). Keep engine at moderate idling speed. Do not race. After engine warms up oil pressure gauge should read 30 to 45 lbs. If pressure drops below 10, stop engine. Locate and correct trouble.

6. While engine idles at moderate speed to warm up, lubricate with OE the following points: All pins on bucket and dipper, latch keepers and lever, dipper trip control linkage, dragline bucket dump sheave, clutch shifter collars, and the crowd chains.

7. With light pressure on main engine clutch lever, start clutches and gears turning. Be sure they turn easily. By doing this, any obstruction in the machinery can be detected. With everything clear, snap engine clutch in.

8. Before starting operation test all clutches and brakes.

9. Check oil pressure gauge again and frequently during operation.

10. Engineer equipment is vital to the war effort. It is your duty to take care of it. Remember - "Battles are won by machines that run".

DAILY DURING OPERATION SERVICES

This is an operator responsibility -- to detect deficiencies in operation, unusual sounds, odors or other signs of out of normal operation that would indicate trouble ahead if not corrected promptly. Report deficiencies that develop during operation. Do not continue operation until breakdown occurs.

11. When moving machine for long distances lubricate horizontal and vertical traction shafts, clutch shifter shoes, front and rear tumblers and top and lower rollers every two hours. Keep crawler drive chains at rear of machine.

Stop Period in Middle of Shift.

12. This period is very important regarding lubrication. Follow lubrication chart closely. Lubricate all four (4) and eight (8) hour points. Make certain that all fittings are open and all bearings taking grease. Replace broken or defective fittings.

13. When making spot lubrication -- check machine for loose or broken bolts, broken strands in cables, worn or broken links in chains, pins, lock pins, cracks in castings, and worn brake and clutch linings.

14. Check engine radiator. Check crankcase oil level -- fill to full mark.

DON'TS

Don't leave engine clutch engaged when engine is stopped, or when leaving operator's seat.
Don't ride foot brakes when clutches are engaged.
Don't travel with machine when carrying close-to-maximum load with crane.
Don't pull boom too close to vertical, sudden release of load may throw boom over cab.
Don't sweep the pit with bucket to level off.
Don't start swinging until bucket is clear of pit.
Don't swing bucket over truck cab while loading.
Don't pile dirt in front of machine when using drag bucket.
Hoist when bucket is full.
Don't leave machine for extended period at edge of pit or bank.
Don't lubricate swing gear while machine is in operation.

DAILY AFTER OPERATION

The following daily after operation services are to be performed by the operator (or crew) immediately after the operation period and during continuous operation at 8-hour intervals.

15. Clean machine. Inspect for broken or loose bolts. Check sticks and boom for cracks.

16. Check dipper teeth. Turn over if partly worn. Renew if needed.

17. Check coolant in radiator. The level should be at or near overflow when hot. If contaminated with oil, rust or dirt, it should be changed. Check anti-freeze value when using.

18. Check crankcase oil level. Fill to full mark.

19. Remove air cleaner oil bowl - clean and refill with OE.

20. Fill fuel tank now. Use only clean fuel. Clean carburetor fuel screen and the sediment bulb on the fuel pump. Examine fuel system piping for leaks and loose connections.

21. Check fan belt for tension (3/4 inch slack). Check water pump and radiator for leaks. Examine all wiring - see that connections are tight, wires clean and not damaged.

22. Lubricate all four (4) hour points. If swing gear, top of sticks or rack pinions show bare spots, cover with CW.

23. If light plant is operated, check daily.

24. Avoid danger of heavy rain or flash floods by moving machine from deep pit. Place crawlers on firm footing, if necessary use rocks, brush or planking. (Follow this closely in freezing weather). Place bucket on ground - engage swing and traction brakes - set foot brakes and leave all clutches in neutral position. Close all doors and covers. See Notes 2 and 4.

64 HOUR OR WEEKLY MAINTENANCE
INCLUDING ALL 8 HOUR P.M. SERVICES.

25. Check saddle block gibs. Make adjustment if more than 1/16 inch play.

26. Check crowd chain. Make adjustment with boom at 40° angle.

27. Check crawler drive chain adjustment - 3/4 inch sag top and bottom.

28. Check crawler adjustment - 3/4 to 1 inch sag between top rollers and tumblers. See that all roller shaft U-bolts are tight - replace if broken.

29. Check swing rollers for flat spots and worn bushings.

30. Check boom foot pins and locking bolts for wear.

31. Check all reach rods, shifter yokes, linkage pins and cotter pins located in cab and under carbody for wear and damage lubricate with OE.

32. Check condition of all cables. Replace if badly worn or strands broken. Lubricate thoroughly with CW, except drag cable.

33. Check main engine clutch adjustment - tighten at first sign of slipping.

34. Check all operating clutches and brake bands for wear and adjustment. Renew lining when worn flush with rivets.

35. Check oil level in gear cases. Add oil if required.

36. Change oil in engine crankcase. Check oil filter, remove sludge. Change element if required. Lubricate all 4 to 64 hour points. (Refer Lubrication guide.)

37. Clean battery with brush and dampened cloth - apply thin film of CG over terminals - check solution with good hydrometer - add distilled water if required - keep air vent holes in caps open.

Kohler Light Plant.

38. Check crankcase oil level - must be up to filler plug opening. (Drain and change oil every 64 hours of operation).

39. Clean fuel pump bowl - check fuel lines and connections for leaks.

40. Start engine and check lights and wiring.

41. Clean and refill air cleaner cup with OE.

42. Check and clean commutator and brushes.

Note: On new equipment, at first 64 hour check, second echelon will tighten all bolts and capscrews including engine cylinder heads.

256 HOUR MAINTENANCE -(INCLUDING ALL 8 HOUR AND 64 HOUR P. M. MAINTENANCE SERVICES).

43. Check steering clutch adjustment - see that each clutch releases and engages brake.

44. Drain radiator. Flush and refill.

45. Remove and clean spark plugs - replace if broken or damaged. Adjust points to .025 inch.

46. Check valve tappet adjustment - clearance should be .010 inch for intake and .012 inch for exhaust valves when engine is hot.

47. Lubricate clutch pilot bearing.

48. Check distributor points. Adjust to .018". Add two or three drops of OE to wick beneath rotor.

49. Check and adjust governor and carburetor shafts and link ball joints. Lubricate with few drops of OE.

50. Check starter and generator commutator and brushes for wear or surplus oil deposit on commutator. Clean commutator with #00 sand paper if required.

51. Every 512 hours remove crankcase oil pan - wash out sludge - clean oil pump screen. Have third echelon motor check.

Note 1. The daily preventive maintenance services are so important that they should be performed as a matter of regular routine, and never be entirely omitted, even in extreme tactical situations.

Note 2. Sign the P. M. card record and note repairs made today.

Note 3. Engineer equipment or attachments to be stored, or otherwise out of service for more than 30 days will be processed and protected in accordance with P. M. manual "Storage of Engineer Equipment".

Note 4. Report to section chiefs at once any worn or damaged parts requiring replacement or repair.

NOTES

MAINTENANCE SECTION

INDEX - MAINTENANCE SECTION

MODEL 304 - EXCAVATOR BEARING TOLERANCES

LOCATION OF BEARING	TYPE & SIZE	TOLERANCES SHAFT		TOLERANCES HOUSING OR RETAINER BORE	
Crawler-Upper Idler Roller Shaft	Bronze Bushing XA-26	.011 .016	Loose Loose	.002 .006	Tight Tight
Crawler - Lower Roller	Bronze Bushing XA-32	.010 .016	Loose Loose	.004 .008	Tight Tight
Lower Traction Shaft	Bronze Bushing XA-60	.010 .015	Loose Loose	.000 .003	Loose Loose
	Bronze Bushing XA-78 and XA79	.013 .016	Loose Loose	.002 .006	Tight Tight
Carbody & Lower Traction Drive Sprocket	Bronze Bushing XA-53	.010 .016	Loose Loose	.000 .007	Loose Loose
Turntable Rollers	Bronze Bushing XA-149	.010 .015	Loose Loose	.003 .006	Tight Tight
"A" Frame Sheaves	Bronze Bushing XA-247	.010 .016	Loose Loose	.002 .006	Tight Tight
	Bronze Bushing XA-224	.008 .012	Loose Loose	.002 .005	Tight Tight
Clutch Bushings	Bronze Bushing XA-347	.008 .012	Loose Loose	.002 .004	Tight Tight
	Bronze Bushing XA-353	.006 .010	Loose Loose	.001 .005	Tight Tight
Dipper Trip Shaft	New Departure #7209	.0001 .0008	Loose Loose	.0002 .0014	Tight Loose
	New Departure #1209	.0001 .0008	Loose Loose	.0002 .0014	Tight Loose
	New Departure #7207	.0001 .0008	Loose Loose	.0002 .0010	Tight Loose
	Bronze Bushing XA-1318	.012 .008	Loose Loose	.001 .003	Tight Tight
Sheave for Trip Operating Cable	Bronze Bushing XA-1346	.007 .010	Loose Loose	.004 .007	Tight Tight
Rotating Dragline Fairlead	Roller Bearing XA-1481	.000 .005	Loose Loose	.000 .005	Loose Loose
	New Departure Balls XA-1482	.000 .005	Loose Loose	.000 .005	Loose Loose
Fairlead Guide Roller	Timken Roller Brg. 14137-14274 XA-1493	.0005 .0030	Loose Loose	.0005 .0030	Tight Tight
Rotating Frame	Bronze Bushing XA-1479	.005 .011	Loose Loose	.008 .013	Loose Loose
Clam & Crane Boom Point Sheaves	Bronze Bushing XA-912	.010 .015	Loose Loose	.002 .006	Tight Tight
Boom Point Suspension Sheaves	Bronze Bushing XA-889	.011 .017	Loose Loose	.002 .006	Tight Tight
Dragline Boom Point Sheave	Bronze Bushing XA-912	.010 .015	Loose Loose	.002 .006	Tight Tight
Boom Suspension Sheave Housing	Bronze Bushing XA-889	.011 .017	Loose Loose	.002 .006	Tight Tight

MODEL 304 - EXCAVATOR BEARING TOLERANCES

LOCATION OF BEARING	TYPE & SIZE	TOLERANCES SHAFT		HOUSING OR RETAINER BORE	
Swing & Traction Shaft	Fafnir #215WD	.0001 .0011+	Loose Tight	.0020 .0002	Loose Tight
	Fafnir #120WD-2N	.0001 .0014+	Loose Tight	.0020 .0002	Loose Tight
	Fafnir #120W-2	.0001 .0014+	Loose Loose	.0020 .0002	Loose Tight
	Fafnir #315-W	.0001 .0011+	Loose Tight	.0020 .0002	Loose Tight
Boom Hoist Shaft	Bronze Bushing XA-279	.013 .017	Loose Loose	.006 .002	Tight Tight
	Bronze Bushing XA-281	.012 .015	Loose Loose	.007 .003	Tight Tight
	Bronze Bushing XA-292	.012 .015	Loose Loose	.006 .002	Tight Tight
	Fafnir #7215	.0010 .0001+	Loose Tight	.0005 .0013	Loose Tight
	Fafnir #220W	.0001 .0014+	Loose Tight	.0018 .0002	Loose Loose
	Fafnir #7310	.0008 .0001+	Loose Tight	.0003 .0013+	Loose Tight
Two Speed Shaft	Hyatt #CD211	.0015 .0002	Loose Loose	.0023 .0005	Loose Loose
	Hyatt #CW211	.0015 .0002	Loose Loose	.0023 .0005	Loose Loose
Main Drum Shaft	Fafnir #215W	.0001 .0011	Loose Tight	.0020 .0002	Loose Tight
	Fafnir #120WD-2N	.0001 .0014+	Loose Tight	.0020 .0002+	Loose Tight
	Fafnir #122WD-2N	.0001 .0014+	Loose Tight	.0020 .0002+	Loose Tight
	Fafnir #218WD	.0001 .0014+	Loose Tight	.0018 .0002+	Loose Tight
Bevel Gear Shaft	Hyatt #A1216TS	.0008 .0006+	Loose Tight	.0002+ .0024+	Tight Tight
	Timken #462-453X	.0010 .0005+	Loose Tight	.001+ .003+	Tight Tight
Swing Shaft	Bronze Bushing XA-129	.009 .012	Loose Loose	.002 .006	Tight Tight
	Bronze Bushing XA-192	.012 .015	Loose Loose	.002+ .006+	Tight Tight
	Bronze Bushing XA-161	.012 .015	Loose Loose	.002+ .006+	Tight Tight
Vertical Traction Shaft	Bronze Bushing XA-66	.012 .015	Loose Loose	.002+ .006+	Tight Tight
	Bronze Bushing XA-162	.025 .020	Loose Loose	.007 .003	Tight Tight
Shovel Boom Idler Sprocket	Bronze Bushing XA-247	.010 .014	Loose Loose	.002 .006	Tight Tight
Saddle Block	Bronze Bushing XA-1215	.013 .017	Loose Loose	.002 .006	Tight Tight

MODEL 304 - EXCAVATOR BEARING TOLERANCES

LOCATION OF BEARING	TYPE & SIZE	TOLERANCES SHAFT	HOUSING OR RETAINER BORE
Shipper Shaft	Spacer	.002 Loose	
	XA-1216	.006 Loose	
	Bronze Bushing	.004 Loose	.002 Loose
	XA-1225	.008 Loose	.004 Loose
Dipper Trip Sheaves	Bronze Bushing	.008 Loose	.004 Tight
	XA-224	.012 Loose	.005 Tight
Shovel Boom Point Sheaves	Bronze Bushing	.010 Loose	.003 Tight
	XA-247 & XA1238	.014 Loose	.006 Tight
Dipper Stick	Bronze Bushing XA-1196	1/16" Loose	1/32" Loose
	Bronze Bushing XA-1209	1/16" Loose	1/32" Loose
Dipper	Bushing	.031 Loose	.001 Tight
	XA- 1183	.093 Loose	.008 Tight
	Bushing	.031 Loose	.001 Tight
	XA-1175	.093 Loose	.008 Tight
	Bushing	.031 Loose	.001 Tight
	XA-1175	.093 Loose	.008 Tight
Sheave Block	Bushing XA-1253	1/8" Loose	1/16" Loose
	Bushing	.003 Loose	
	XA-1241	.008 Loose	
Dipper Hinge	Bushing	.031 Loose	.001 Loose
	XA-1166	.093 Loose	.001 Tight
Pull Shovel Jib Frame Sheaves	Bushing	.010 Loose	.002 Tight
	XA-247	.014 Loose	.006 Tight
	Bushing	.011 Loose	.004 Tight
	XA-1364	.015 Loose	.007 Tight
Pull Shovel Dipper Arm Sheaves	Bushing	.011 Loose	.004 Tight
	XA-1364	.015 Loose	.007 Tight
	Bushing	.011 Loose	.002 Tight
	XA-1411	.018 Loose	.005 Tight
	Bushing	.012 Loose	.004 Tight
	XA-1414	.016 Loose	.008 Tight
	Sleeve	.031 Loose	
	XA-1398	.036 Loose	
	Bushing	.010 Loose	.003 Tight
	XA-1446	.017 Loose	.007 Tight
	Bushing	.011 Loose	.003 Tight
	XA-1441	.017 Loose	.010 Tight
	Bushing	.014 Loose	.007 Tight
	XA-1364	.013 Loose	.004 Tight
	Bushing	.031 Loose	.016 Loose
	XA-1384	.065 Loose	.051 Loose
	Bushing	.010 Loose	.006 Tight
	XA-1388	.012 Loose	.008 Tight
Ten Ton Hook Block	Bushing	.010 Loose	.002 Tight
	XA-921	.015 Loose	.004 Tight
	Rollway CT19	.009 Loose	
		.015 Loose	

THRUST WASHERS

PART NUMBER	INSIDE DIAMETER	OUTSIDE DIAMETER	THICKNESS	MATERIAL
XA-40	3-1/2"	5-1/2"	1/8"	Mild Steel
XA-24	1-3/4"	2-3/4"	1/8"	Mild Steel
XA-107	1-1/4"	2-1/2"	3/8"	Mild Steel
XA-87	3"	3-11/16"	#16 Ga.	Mild Steel
XA-121	2-21/32"	5-1/4"	1/4"	#64 Cast Bronze
XA-124	13/16"	2-7/8"	3/16"	Mild Steel
XA-123	13/16"	2-7/8"	1/8"	Mild Steel
XA-127	3-25-/32"	6"	1/2" (7/8"at lug)	#64 Cast Bronze
XA-140	4-1/32"	6-1/2"	1/2" (3/4" at lug)	#64 cast Bronze
XA-142	4.000" 4.005"	7-1/4"	.355 .340	#64 Cast Bronze
XA-150	3-1/2"	6"	1/16"	Mild Steel
XA-151	3-1/2"	6"	1/8"	Mild Steel
XA-152	3-1/2"	6"	#21 Ga.	Sheet Steel
XA-218	3"	4-1/2"	3/16"	Mild Steel
XA-918	2-7/32"	3-3/4"	3/8"	#64 Cast Bronze

NOTE

Set Clutch Band Release Screws 1/32" Clearance. (Between Screws and Clutch band.)
Set Guide Bolts on Dipper Trip to 1/16" Clearance. (Between Bolts and Clutch Band.)
All Lever Shafts in Drilled Holes Have .002" to .010" Loose Fit.
All Lever Shafts in Babbitted Bearings Have .007" to .010" Loose Fit.
All Crawler Journal Bearings are Babbitted with a Tolerance of 1/32" Loose Fit on Diameter.

SHOVEL STICK AND BOOM CLEARANCE AND SADDLE BLOCK GIB ADJUSTMENT

1/4" Minimum Clearance between inside faces of sticks and outside overall of boom including 3/8" pads on both sides of boom.

Because of variations in the depth of stick and rack welded together the gib in the saddle block is to be adjusted so the stick clears at the deepest section. The variation in some places may be 1/8" clearance.

FOR ALL BRONZE BUSHINGS - DISREGARD SHRINKAGE.

TURNTABLE (UPPER DECK)
MODEL 304 LIFTING CRANE

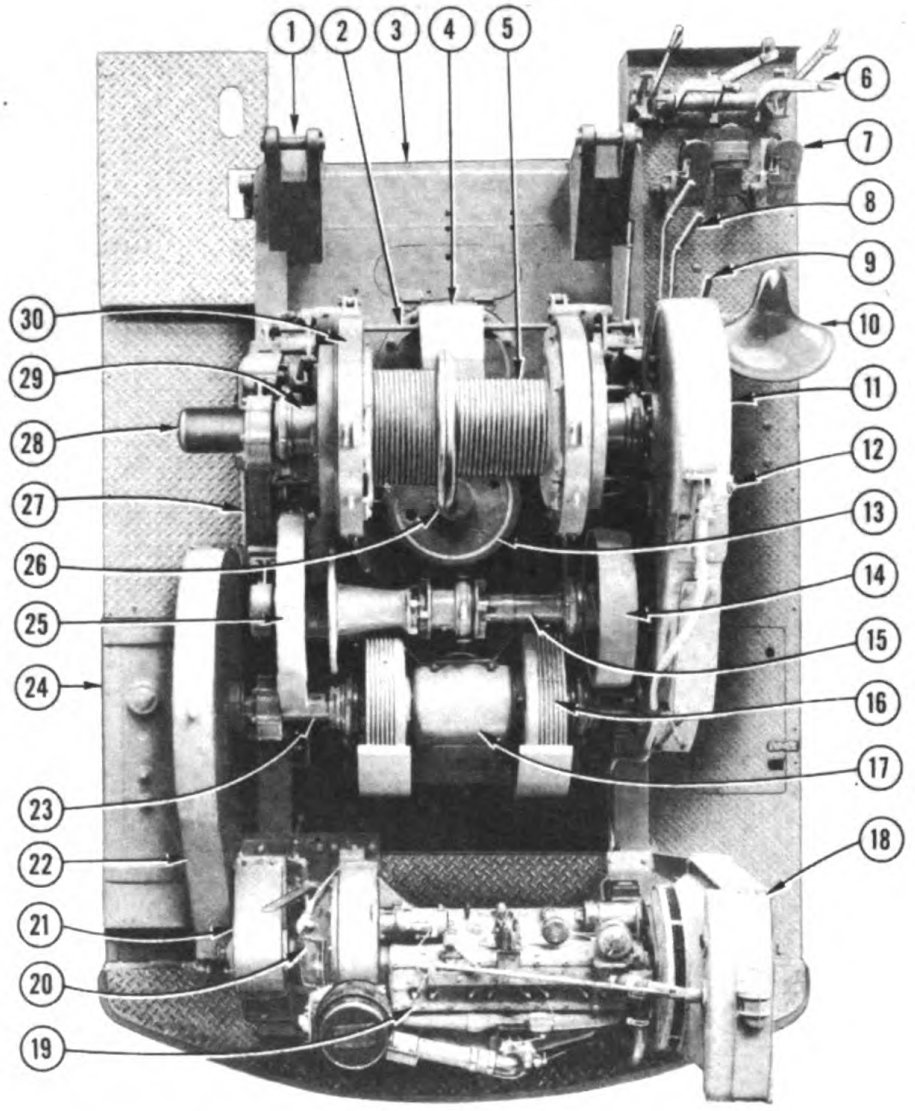


FIGURE 100

1—BOOM FOOT BIN
2—TURNTABLE GEAR CASE
3—TURNTABLE
4—INSPECTION COVER
5—DRUM LAGGING
6—OPERATING LEVERS
7—OPERATING BRAKES
8—STEERING LEVERS
9—ENGINE CLUTCH LEVER
10—SEAT
11—MAIN GEAR CASE
12—INSTRUMENT PANEL
13—SWING BRAKE DRUM
14—BOOM HOIST CLUTCH DRUM
15—BOOM HOIST SHAFT
16—SWING AND TRACTION CLUTCH DRUM
17—BEVEL GEAR HOUSING AND COVER
18—RADIATOR
19—ENGINE
20—ENGINE CLUTCH
21—REDUCTION CASE
22—CHAIN CASE
23—SWING AND TRACTION SHAFT
24—FUEL TANK
25—BOOM HOIST BRAKE DRUM
26—VERTICAL SWING SHAFT
27—SIDE STAND
28—MAIN DRUM SHAFT
29—CLUTCH SHIFTER SLEEVE
30—DRUM BRAKE

TURNTABLE (UPPER DECK)
MODEL 304 SHOVEL

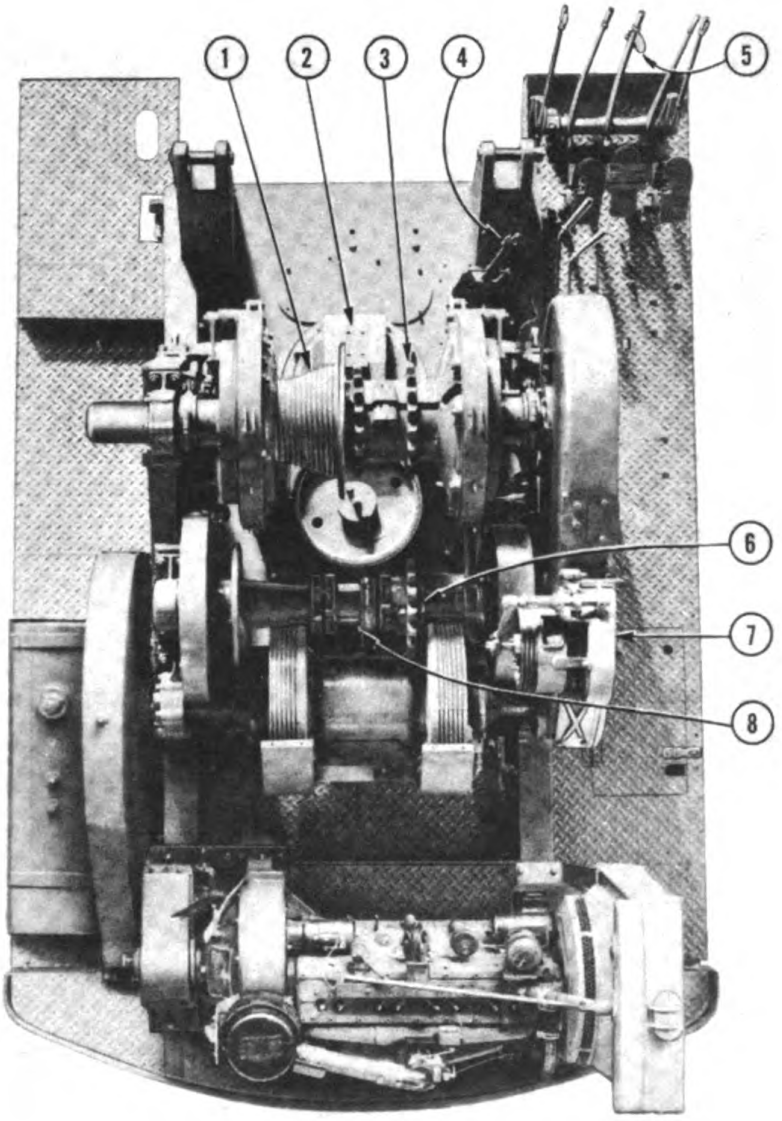


FIGURE 101

1—TAPERED HOIST LAGGING
2—CHAIN GUIDE
3—CROWD DRIVE SPROCKET
4—BOOM HOIST JAW CLUTCH LEVER
5—DIPPER TRIP CONTROL LEVER
6—RACK-IN SPROCKET
7—DIPPER TRIP MECHANISM
8—BOOM HOIST JAW CLUTCH

TOP SIDE OF TURNTABLE—LESS MACHINERY

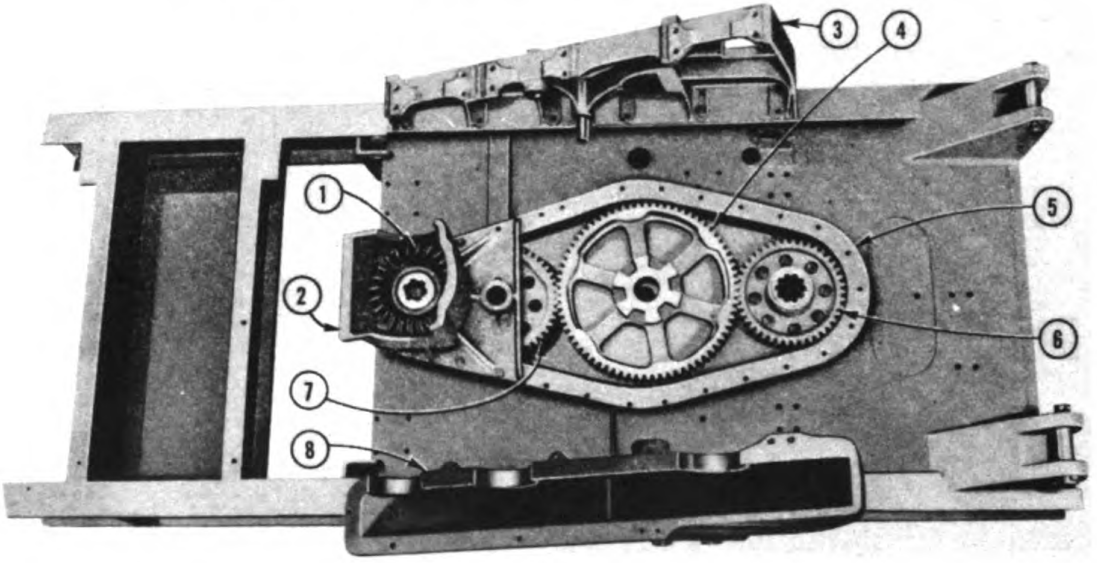


FIGURE 102

1—SWING & TRACTION BEVEL GEAR
2—BEVEL GEAR HOUSING
3—SIDE STAND
4—SWING SHAFT GEAR
5—TURNTABLE GEAR CASE
6—TRACTION GEAR
7—TWO SPEED GEAR
8—MAIN GEAR CASE

BOTTOM SIDE OF TURNTABLE

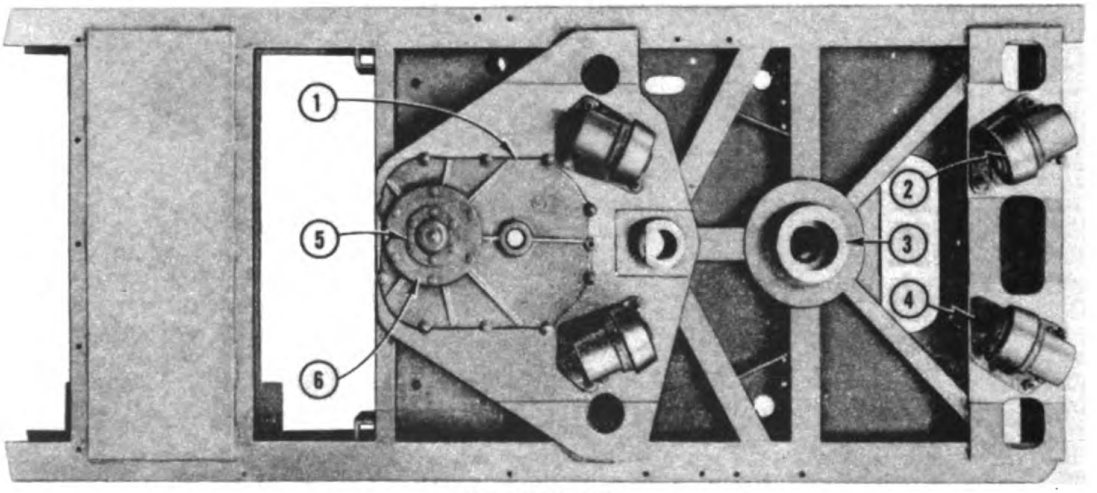


FIGURE 103

1—LOWER GEAR CASE
2—TURNTABLE ROLLER
3—TURNTABLE PIVOT
4—TURNTABLE ROLLER BRACKET
5—BEARING CAP (VERTICAL SWING SHAFT)
6—BEARING RETAINER (VERTICAL SWING SHAFT)

TOP SIDE OF CARBODY

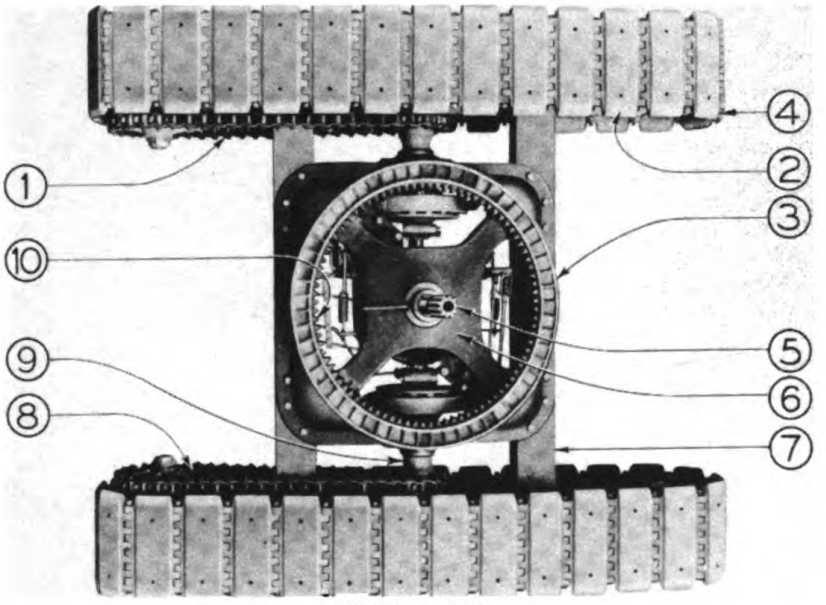


FIGURE 104

1—CRAWLER DRIVE CHAIN
2—CRAWLER SHOE
3—ROLLER TRACK
4—CRAWLERS
5—VERTICAL TRACTION SHAFT
6—CARBODY
7—CRAWLER FRAME
8—CRAWLER DRIVE SPROCKET
9—TRACTION DRIVE SPROCKET
10—SWING GEAR

BOTTOM SIDE OF CARBODY

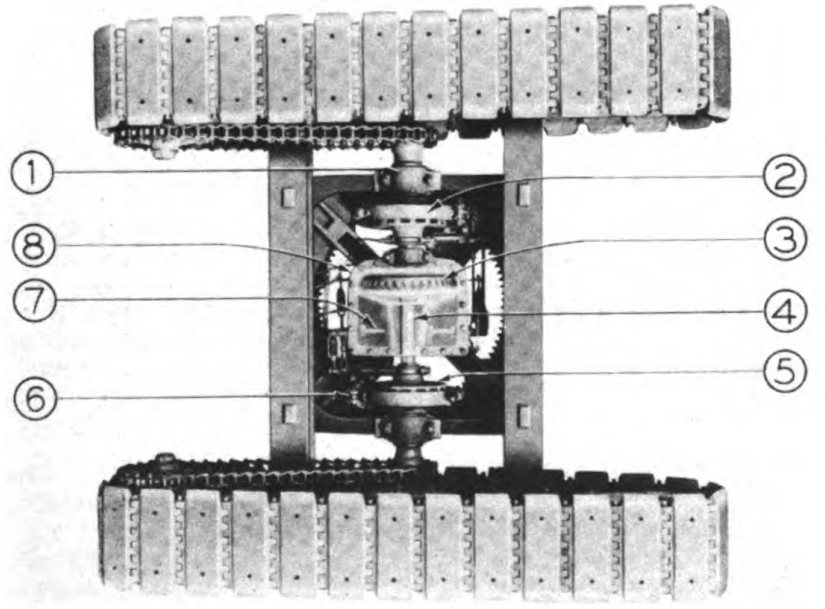


FIGURE 105

1—LOWER TRACTION SHAFT BEARING
2—TRACTION BRAKE
3—TRACTION BEVEL GEAR
4—LOWER TRACTION SHAFT
5—JAW CLUTCH (STEERING)
6—TRACTION BRAKE TOGGLE LINKAGE
7—SHIFTER SHAFT
8—LOWER TRACTION GEAR CASE

CLUTCH BANDS

Both drum clutch bands and the boom hoist clutch band are of the same size and interchangeable. Both swing and traction clutch bands are of the same size and interchangeable. Both ends of all clutch bands are alike, therefore when a relined or new band is installed either end can be started at the dead end. A further advantage of this type of construction is the ability to take out a band, turn it end for end, and replace it when the lining at the dead end of the band becomes worn. This practically doubles the life of a lining because the dead end of the band wears faster. Never allow the lining to wear down until the rivets in the lining touch the drum as the rivets might score the surface of the drum.

CLUTCH BAND ASSEMBLY

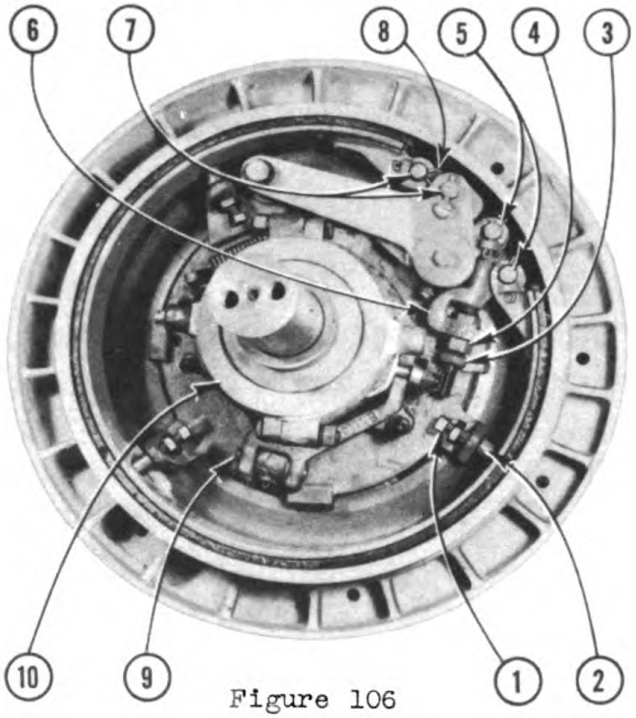


Figure 106

TO REMOVE:

Unscrew carrier screws (1) until carrier screw caps (2) can be taken out. Loosen lock nut (3) and turn adjusting nut (4) up to loosen the band adjustment. Remove cotters and take out pins (5) then adjusting link (6) can be removed. Remove pins (7) then dead end link (8) can be removed. Now slide the band out and lift it off the shaft.

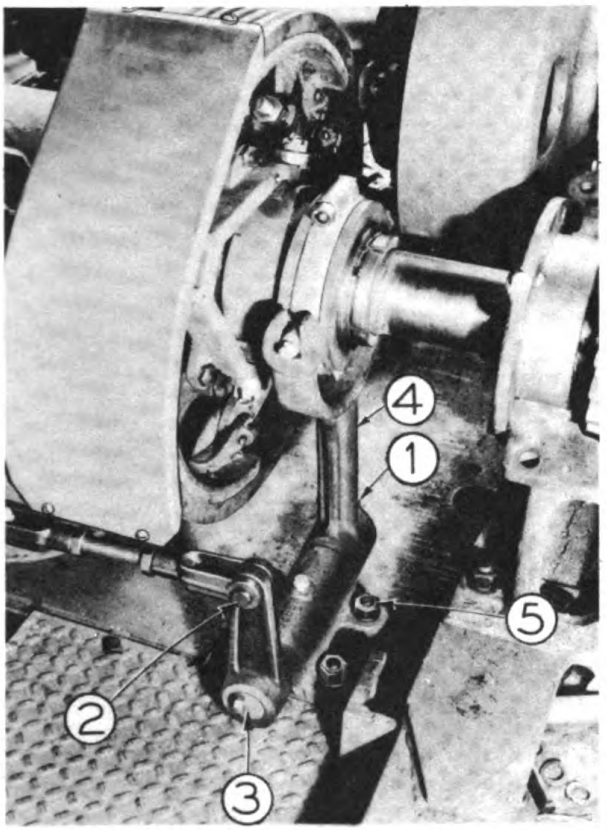
TO INSPECT:

Check carrier screws for worn or damaged threads. Check lining for wear and replace if necessary. (For relining bands, see Page 130).

TO REPLACE:

Place the band over the shaft and slide it into place in the drum. Insert dead end link (8) and secure with pins (7). Place adjusting link (6) in position; insert pins (5) and secure with cotters. Replace carrier screw caps (2) and turn carrier screws (1) in just far enough to prevent caps from falling out. (Adjust the clutch as described under "Clutch Adjustment", Page (88), Operation Section.) This procedure applies to both drum clutches, the boom hoist clutch and both swing clutches.

CLUTCH BANDS (Continued)



REMOVAL OF RIGHT HAND SWING CLUTCH BAND: (Figure 107.)

The right hand swing clutch band can be removed much easier if the right hand swing clutch fork is taken out. This can be done by pulling gib key (1) and pin (2), then pulling shaft (3) out of fork (4). Or it can be done by taking out pin (2) and the four bolts (5) holding the fork bearing to the turntable, then removing the fork and bearing as a unit. CAUTION - Do not lose shims that are under the fork bearing and be sure the shims are in the right place when assembling.

Figure 107

DRUM BRAKE BANDS

The drum brakes are similar to the design of the clutch bands in that either end can be started at the dead end or the lining turned end-for-end when partially worn at the dead end. The boom hoist brake is made in two halves bolted together. The boom hoist brake band is removed and installed the same as the drum brakes except that it is unbolted in the middle. The drum brake bands are alike and interchangeable. NOTE - Be careful not to spring the brake bands out of shape while removing, relining or installing them. Use lining as recommended and furnished by the factory. Always reline the bands before they wear down far enough for the rivets to score the drums.

TO REMOVE: (See Figure 108, Page 130)

Release the brake pedal operating the brake band to be removed. Take out lock pin (1) and screw adjusting nuts (2) and (3) toward the end of the adjusting bolt to release the band more completely. Remove cotters and take out pins (4) and (5). Unhook spring (6) and screw up guide bolt (7). Slide the band off the drum and lift it out.

TO INSPECT:

Check pins for damage and screws and nuts for worn or damaged threads. Check lining for wear and replace if necessary. (For relining bands, see Page 130).

TO REPLACE:

Place band on the drum, hook up the operating linkage with pins (4) and (5) and secure with cotters. Hook release spring (6) to the band and adjust guide bolt (7). Adjust brake as described under "Adjusting Brakes", Page (89), Operating Section.

BRAKE BAND ASSEMBLY

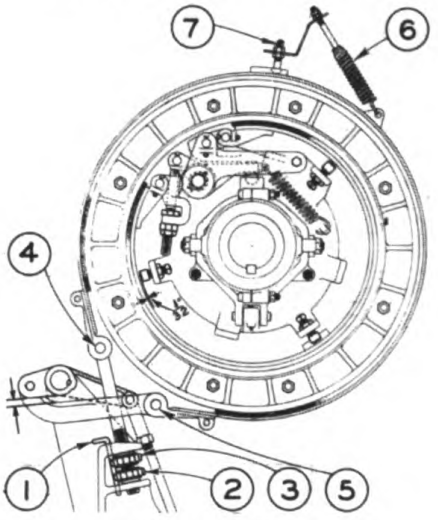


Figure 108

RELINING BANDS:

Cut the rivets holding the lining to the band with a hammer and cold chisel as shown in Figure (109) below. Drive out the rivets with a pin punch the same size as the rivets. After the lining has been removed, clean the band with a wire brush. To reline lay the band on a flat surface and fit the lining to the band, using "C" clamps to hold the lining in place as shown in Figure (110), below. NOTE - If the new lining has no rivet holes to match the holes in the band, use a drill with a bit the same size as the holes in the band and drill the lining using the band holes as guides. Counterbore the rivet holes one-half the thickness of the lining so that rivet heads will seat properly. If not equipped with a rivet machine, place a drift punch or pin of the same diameter as the head of the rivets in a vise. Insert a rivet through the lining and band, (rivet head on lining side) turn band up and place the rivet head on the punch in the vise. Strike the band with a hammer around the rivet to draw the rivet head all the way into the counterbore to pull the lining tight to the band then peen rivet with hammer. CAUTION - Care should be taken not to bend or twist the band to avoid uneven wear on the lining. Always use lining approved or furnished by the manufacturer. Be very careful not to spring band out of shape.

FIGURE 109-REMOVING LINING

FIGURE 110-RELINING BAND

TURNTABLE (UPPER DECK) UNITS

Each shaft with all of its operating parts is considered an assembly and is so treated throughout this section of the manual. The machine is so designed that one particular assembly may be removed without disturbing the other units. With proper operation, care, lubrication and adjustment, it should not be necessary to remove any of the assemblies until after a long period of service when the machine is given a major overhauling.

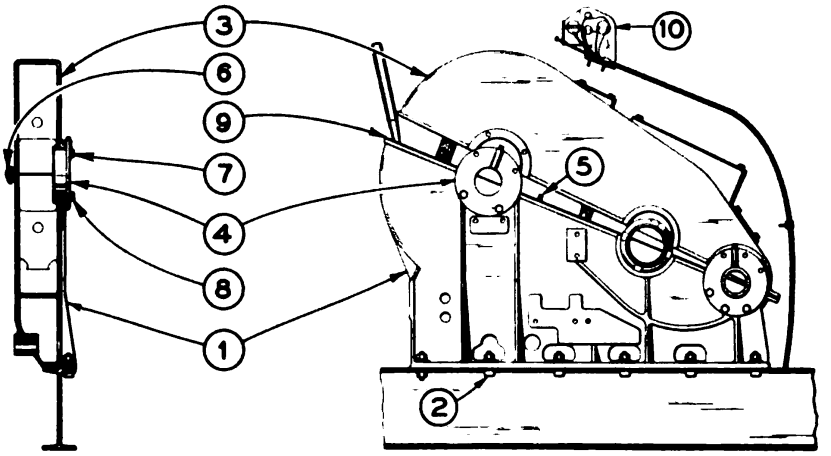


Figure 111

MAIN GEAR CASE: (Figure 111).

The main gear case on the right hand side of the turntable houses the vertical gears and acts as a side stand and bearing mounting for the horizontal shafts. The case is split in two halves - upper and lower - on a line through the center of the bearing mountings. The lower half of the case (1) is set in perfect alignment and bolted to the turntable - these bolts (2) should be kept tight. The upper half of the case (3) is aligned with the lower half by the bearing retainers (4) and two dowel pins (5) and is fastened to the lower half by eight bolts and two capscrews.

TO REMOVE UPPER HALF OF MAIN GEAR CASE:

Remove control panel assembly (10) as a complete unit and lay to one side. Remove bolts (6) and capscrews holding upper half to lower half. Remove the cap screws (7) in each bearing retainer flange in upper half and loosen the cap screws (8) in each bearing retainer flange in the lower half of case. Raise upper half with bar or chisel and insert wooden wedges to allow space for gripping with hands. Remove upper half - a two man lifting job. Be careful of gasket (9).

TO INSPECT:

Check case for cracks and weld if necessary. Check bolts and capscrews for worn or damaged threads. Check gasket for damage and if not in perfect condition, replace with new one.

TO REPLACE UPPER HALF OF GEAR CASE:

After thoroughly cleaning edges of upper and lower cases, replace gasket, lining up holes in gasket with holes in lower case. Place upper half of case in position on lower half and after lining up holes, insert all capscrews and bolts in their proper places. Tighten all bolts and capscrews evenly. NOTE - It is a good idea to go over these bolts and capscrews again after machine has been operated a few hours.

SWING AND TRACTION JACK SHAFT

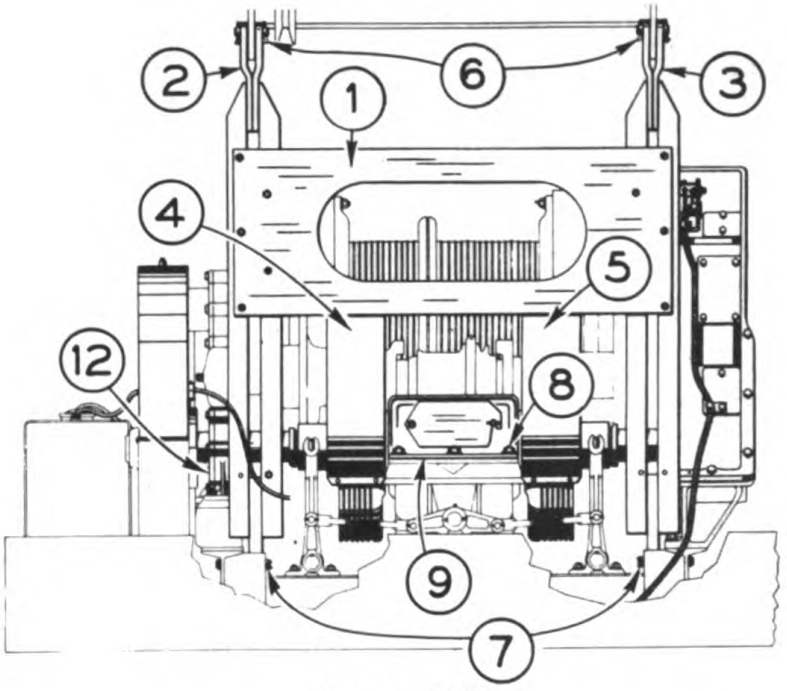


Figure 112

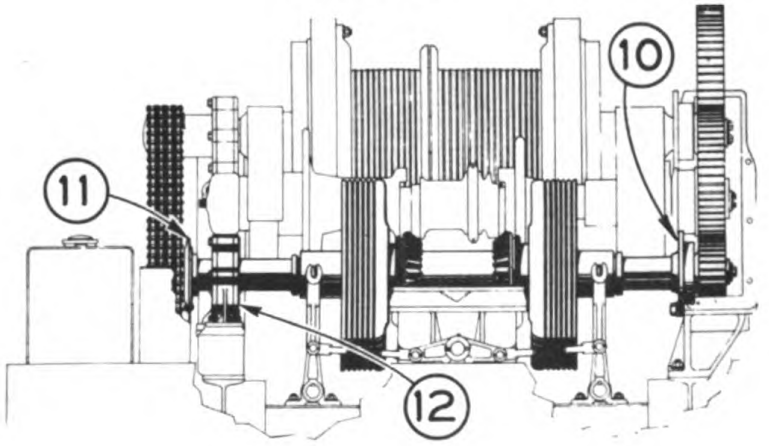


Figure 113

TO REMOVE:

Lower boom to cribbing as shown on pages 97 and 98, Operation Section. Pull enough of the boom suspension cable off boom hoist drum to relieve the "A" frame of any load. Remove plate (1) which is bolted to both "A" frame tension members (2) and (3) and to clutch guards (4) and (5). Remove "A" frame tension members (2) and (3), by taking out pins (6) and (7) at the top and bottom of each "A" frame tension member. Disconnect boom pawl spring near lower end of member (2). Take out bolts (8) at the front and rear edges of gear case cover (9). Now the swing clutch guards (4) and (5) and gear case cover (9) will come out. Remove the upper half of main gear case as described on Page 131. Take out the capscrews that hold the jack shaft bearing retainer flange (10) to the lower half of the main gear case. Remove the upper half of the jack shaft chain case and chain as described under Power Transmission Chain page (197). Remove two stove bolts holding felt retainer (11) to lower half of chain case. Lay the chain back off the sprockets.

Remove the four bolts holding the bearing retainer pillow block (12) to the left side stand. The entire shaft assembly now is ready to be lifted up. If a chain hoist is to be used, remove the curved section of the cab (32) as described on Page 166, Maintenance Section, then lay a timber across the "A" frame shaft and on blocks placed at top of cab. Fasten chain hoist to the cross timber and lift shaft. Cover the main gear case with clean rags or paper to keep out dirt while working on the shaft.

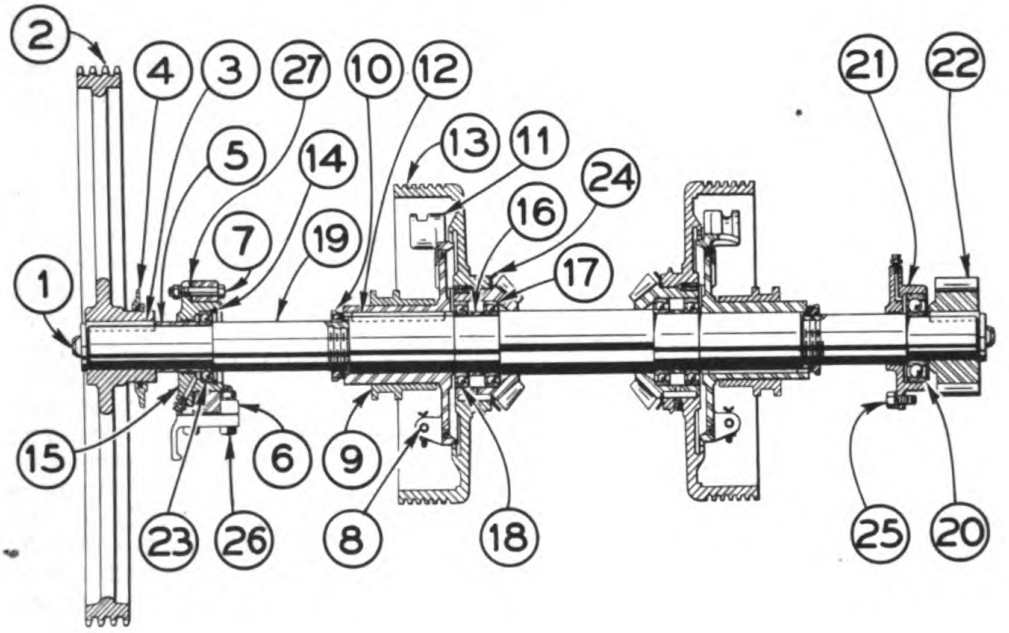


Figure 114

TO DISASSEMBLE: (See Figure 114)

The shaft assembly should be lifted high enough for the chain sprocket to clear the chain case and gasoline tank. Remove the two capscrews, capscrew lock plate and keeper plate (1) from left end of the shaft then either drive or pull off sprocket (2). Remove sprocket key (3), felt retainer (4) and spacer (5). To remove bearing retainer pillow block (6) take out two of the bolts (7) one on each side - that hold the bearing retainer and pillow block together and replace them with two long bolts through a bar placed across the end of the shaft. Then by screwing up nuts on the long bolts plate acts as a puller to remove pillow block assembly from the shaft. Remove pin (8) and slide clutch sleeve assembly (9) off the shaft. Remove lock nut and lock washer (10). Screw two long 5/8" studs into drilled and tapped holes in clutch spider (11) and with bar across the end of the shaft, pull the clutch spider. Remove clutch spider key (12). The clutch drum and pinion (13) can be pulled the same way by extending rods through the holes in the clutch drum with a flat plate or washer and nuts on the ends of the rods. The right hand end of the shaft assembly is disassembled in the same manner. CAUTION - The clutch spiders are right and left handed and must be replaced in their correct locations on the shaft. All ball bearings can be driven from their housings by using a hardwood block or brass driving rod. Snap ring (14) must be removed from the pillow block bearing retainer (15) before driving out bearing.

Do not lose the spacers (16) between the bearings in the clutch drum pinion assemblies.

TO INSPECT:

Wash all parts with cleaning fluid. Inspect ball bearings for wear or broken balls and chipped races. Oil the bearings and wrap them in clean rags or paper until they are ready to be installed again. To check for a bent shaft, place shaft on "V" blocks and rotate it, using a dial indicator. Check swing drums for scoring and if in bad condition, replace. (The drum can be pressed off the bevel pinion hub and a new drum pressed on.) Be sure all keys fit snugly. See page (121), Maintenance Section, for bearing tolerances.

TO ASSEMBLE:

Coat the inside of bearing retainer with a film of white lead and oil and place bearing (17) in position to be driven into retainer by pounding on the outer race of bearing with a brass driving rod. Install spacer (16) and fill recess with WB grease. Put in bearing (18) with grease shield to the outside, driving only on the outer races to avoid damaging grease shield. Coat shaft (19) with film of white lead and oil and place left hand clutch drum and pinion assembly on the shaft and press or drive on the inner race of the outer bearing. Be sure the inner bearing is tight against the shoulder on the shaft. After filing smooth any places in the clutch spider key (12) that may have been damaged in removal, replace it. Coat shaft and inside of clutch spider hub with white lead and oil and put clutch spider (11) on the shaft, being sure right and left hand spiders are replaced in their correct locations and that they are driven up tight against bearing (18). Put on lockwasher and lock nut (10) and clutch sleeve assembly. Secure assembly with pin (8). Install right hand clutch assembly in the same manner. Coat right hand end of shaft with white lead and oil; insert bearing (20) in bearing retainer (21); place retainer and bearing on shaft and drive them up against shoulder, using a brass driving rod on the inner race of the bearing. NOTE - Grease seal side of the bearing should be toward the end of the shaft. Insert pinion key in right hand end of shaft; coat shaft, key and inside of pinion (22) with white lead and oil, then drive pinion (22) tight against ball bearing (20). Put on keeper plate, lock plate and capscrews. Draw capscrews up tight then bend the lock plate over the capscrews.

Install bearing (23) in bearing retainer and put in snap ring (14), shielded side of the bearing toward the snap ring. Coat the shaft with white lead and oil; place bearing retainer on the shaft then place spacer (5) against the bearing. Use brass driving rod to drive the spacer and bearing on the shaft and against shoulder. Insert sprocket key (3) in left end of shaft, coat end of shaft, key and inside of the sprocket hub with white lead and oil. Put felt retainer (4) on the inside of sprocket hub. Drive the sprocket (2) on the shaft and against the spacer (5). Put on keeper plate, lock plate and capscrews (1). Draw the capscrews tight and bend lock plate over capscrews. The shaft is ready to be replaced as a unit.

TO REPLACE:

Drain and wash jack shaft chain and chain case. Clean bevel gear and case. Clean the bore in the main gear case where the right hand bearing retainer rests. Clean the left side stand where pillow block (6) rests. Lower the shaft assembly into place, being sure the countersunk grease plugs in the bevel pinion hubs are both up when the pinions mesh with the bevel gear to make the greasing operation easier. NOTE - If oil slinger (24) is bent by lowering the shaft, be sure to bend it back to its original shape. Start the two cap screws (25) into the lower half of the main gear case through bearing retainer (21) but do not tighten the colts. Be sure grease connection is up. Insert the four bolts (26) into the left side stand and pillow block. Check the backlash of the bevel pinions and bevel gear to be sure there is the same amount of backlash in both pinions. Draw pillow block bolts (26) down tight. For further adjustment of the bevel pinion backlash, add or remove shims (27) as needed. Adding shims will move both pinions to the left - removing shims will move both pinions to the right. When the shaft has been properly assembled with all bearings against their respective shaft shoulders, the distance between the bevel pinions is permanently set. When the backlash of both pinions is equal but in excess of what is required the bevel gear can be raised to decrease the backlash. Bolt felt retainer (4) to lower half of the chain case. NOTE - Use new felt if needed. Replace the chain. It will be easier to couple the chain ends together if the coupling is done on top of the large sprocket. (See instructions under "Chains", Page 197.) Replace chain case and fill case with oil as per lubrication instructions, Page (67), Operation Section. Remove the countersunk plugs in the bevel pinion hubs and screw in a grease connection. Pump WB grease into the pinion connection-the amount of grease depending upon how well the bearings were grease packed when assembled. Remove grease connections and replace countersunk plugs. Pump WB grease into pillow block and gear case ball bearing. Replace gear case cover. Replace "A" frame tension members with pins (6) and (7) and secure with cotter. (Figure 112.) Replace bevel gear case cover and swing drum guards. Replace plate (1) on the "A" frame and bolt swing drum guards to it.

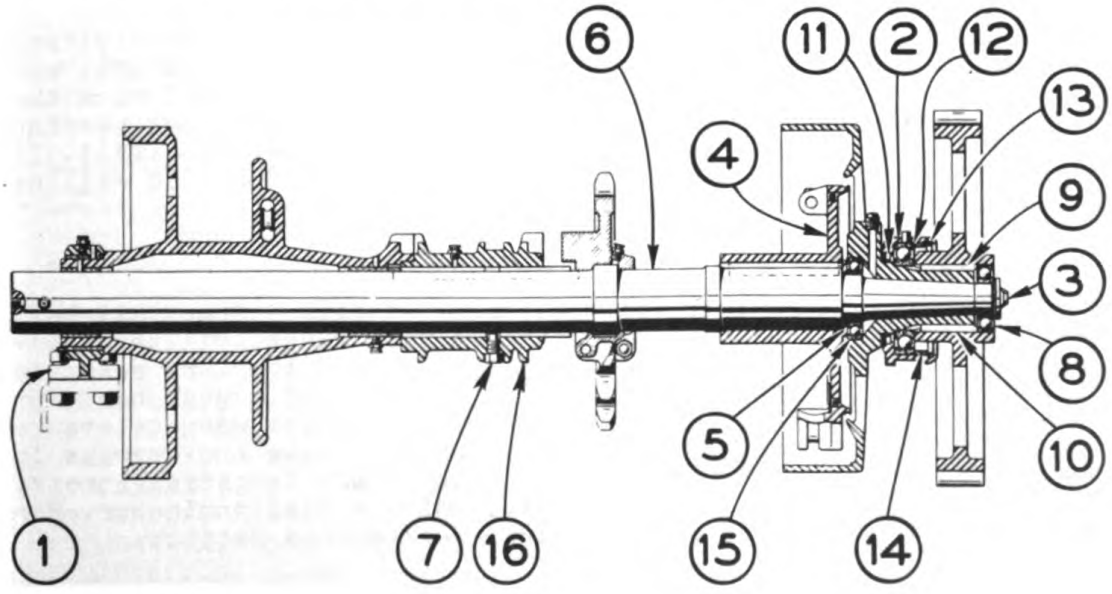


Figure 115

BOOM HOIST SHAFT (Figure 115)

TO REMOVE:

Lower the boom to cribbing as shown on Page 97, Operation Section, and pull all cable off the boom hoist drum, then knock out the cable wedge and pull cable loose from the drum. Remove plate (1) Figure 112 which is bolted to "A" frame tension members and to clutch guards (4) and (5). Remove pins (6) and (7) Figure 112 at top and bottom of "A" frame right hand tension member and remove the tension member. Remove upper half of the main gear case as described on Page (131), Maintenance Section. If a chain block is to be used for lifting, remove the curved section of the bulkhead just below the "A" frame shaft and fasten the chain block to the "A" frame shaft. Remove bolts from pillow block (1) at the left end of the shaft. Remove boom pawl spring from the left hand "A" frame tension member - near the bottom. Take out the pins in both ends of the boom hoist brake band and remove the band. Attach the chain block to the shaft and lift the shaft until the gear and clutch drum will clear the lower half of the gear case. Tilt the shaft assembly slightly as it is being raised in order to clear the boom hoist drum from the boom hoist drum ratchet pawl. Cover the main gear case to keep dirt out of it while working on the shaft assembly. CAUTION - Do not lose the dowel pin in the outside of bearing retainer (2).

TO DISASSEMBLE:

Remove the capscrews, lock plate, keeper plate and shims (3) from the right hand end of the shaft. Remove the clutch drum and gear assembly with bearings from the shaft by pulling on the gear with a gear puller or a chain and jack. The assembly now can be carried out of the cab. Remove clutch spider (4) by using studs and a bar as described on Page (133), Maintenance Section. Keep spacer ring (5) with the clutch spider. Wrap a chain around the boom hoist drum and secure the chain. Attach a chain block to the chain and raise drum high enough to permit pulling shaft (6). Loosen the lock screw (7) in jaw (16) and slide the jaw off the left end of the shaft. The clutch drum and gear assembly can be dismantled by pressing the clutch drum hub out of the gear hub after ball bearing (8) has been driven out of the gear hub with a hardwood block or brass driving rod. Drive out bearing (15). Remove keys (9) and (10) and pull bearing retainer (2) off the shaft, being careful not to damage the grease seal (11). To remove bearing (12) from the bearing retainer, take out snap ring (13) and drive out bearing and spacer (14), being careful not to damage grease seal (11). If grease seal (11) is removed from the bearing retainer it will be ruined and must be replaced with a new one.

TO INSPECT:

Wash all parts thoroughly with cleaning fluid. Check all ball bearings for wear or broken balls and chipped races. Oil the bearings and wrap them in clean rags or paper until they are ready to be installed. Inspect clutch drum for scoring and clutch band for damage or worn lining. Check boom hoist drum for wear or cracks and pillow block bushings for wear. Check all keys and keyways in the shaft for rough sides or edges. To check shaft for straightness, place it on "V" blocks and rotate it, using a dial indicator. For ball bearing tolerances see Page 121, Maintenance Section.

TO ASSEMBLE:

If new grease seal (11) is to be installed in bearing retainer (2), be sure it is placed with the edge of the leather pointing to the ball bearing. Grease seal can be driven in with a hammer and wood block or it can be pressed in. Apply a thin coat of white lead and oil on the outside of the grease seal and the inside of the bearing retainer. Coat the inside of the bearing retainer (2) with white lead and oil then drive bearing (12) into the retainer with a brass driving rod. CAUTION - Drive only on the outer race. Put in spacer (14) and snap ring (13). Rub some light oil on the leather of the grease seal. Coat the hub of the clutch drum with white lead and oil, then put the bearing retainer assembly on the hub of the clutch drum with the grease seal next to the drum. Drive the bearing on with a brass driving rod. Drive on the inner bearing race. Put in keys (9) and (10) then press the gear on the clutch drum hub. Coat the bearing recess in the outside of the gear and the inside of the clutch drum hub with white lead and oil and drive in bearings (8) and (15). CAUTION - Drive on the outer race only, using brass driving rod. Put jaw clutch (16) on shaft with the shifter ring groove to the right end of the shaft. Grease the bushings inside the boom hoist drum and slip the shaft into the drum. Coat the inside of clutch spider hub (4) with white lead and oil and drive the spider on the shaft against shoulder. Be sure the spider fits snugly on its key. Put ring (5) on the shaft. Pack WB grease in bearing (15). Put clutch drum and gear assembly on the shaft and force it on until bearing (15) is tight against ring (5). Put shims, keeper plate, lock plate and capscrews (3) on the end of the shaft. Draw the capscrews tight and bend lock plate over them. There should be just enough shims under the keeper plate to fill the space between the keeper plate and the end of the shaft when the keeper plate is against the inner race of bearing (8). The shaft assembly is ready to be replaced.

TO REPLACE:

With shaft raised by chain block in position to be replaced, tilt the boom hoist drum down, as the shaft is being lowered, to engage the boom ratchet pawl in the boom drum ratchet. When the ratchet pawl is engaged, lower the shaft almost to the main gear case bearing. Then check to be sure the boom clutch shift collar will engage with its shifting fork and that the dowel pin in the outside of bearing retainer (2) will engage with the notch cut for it in the lower half of the gear case. Let the shaft down into place, checking dowel pin and bearing retainer again. NOTE- The dowel pin must be in its notch to align the gear case cover for proper fit. Bolt pillow block (1) on left side stand. Replace boom drum brake band, insert brake band pin and secure with cotters. Replace upper half of main gear case cover as described on Page (131). Replace "A" frame tension members (2) and (3) Figure 112 and plate (1) Figure 112. Insert pins (6) and (7) Figure 112 and secure with cotters. Hook boom ratchet pawl spring to left "A" frame tension member and replace curved section of cab under "A" frame shaft. Fasten boom cable to boom hoist drum with wedge. Adjust boom hoist brake as described under "Brake Adjustments," Page (89), Operation Section. Check boom hoist safety ratchet pawl to see that it is operating properly. Replace grease connection in pillow block (1), then pump grease into all grease connections on the shaft. Remove pipe plug in clutch drum hub, screw in grease connection, then pump in WB grease. Remove grease connection and replace pipe plug.

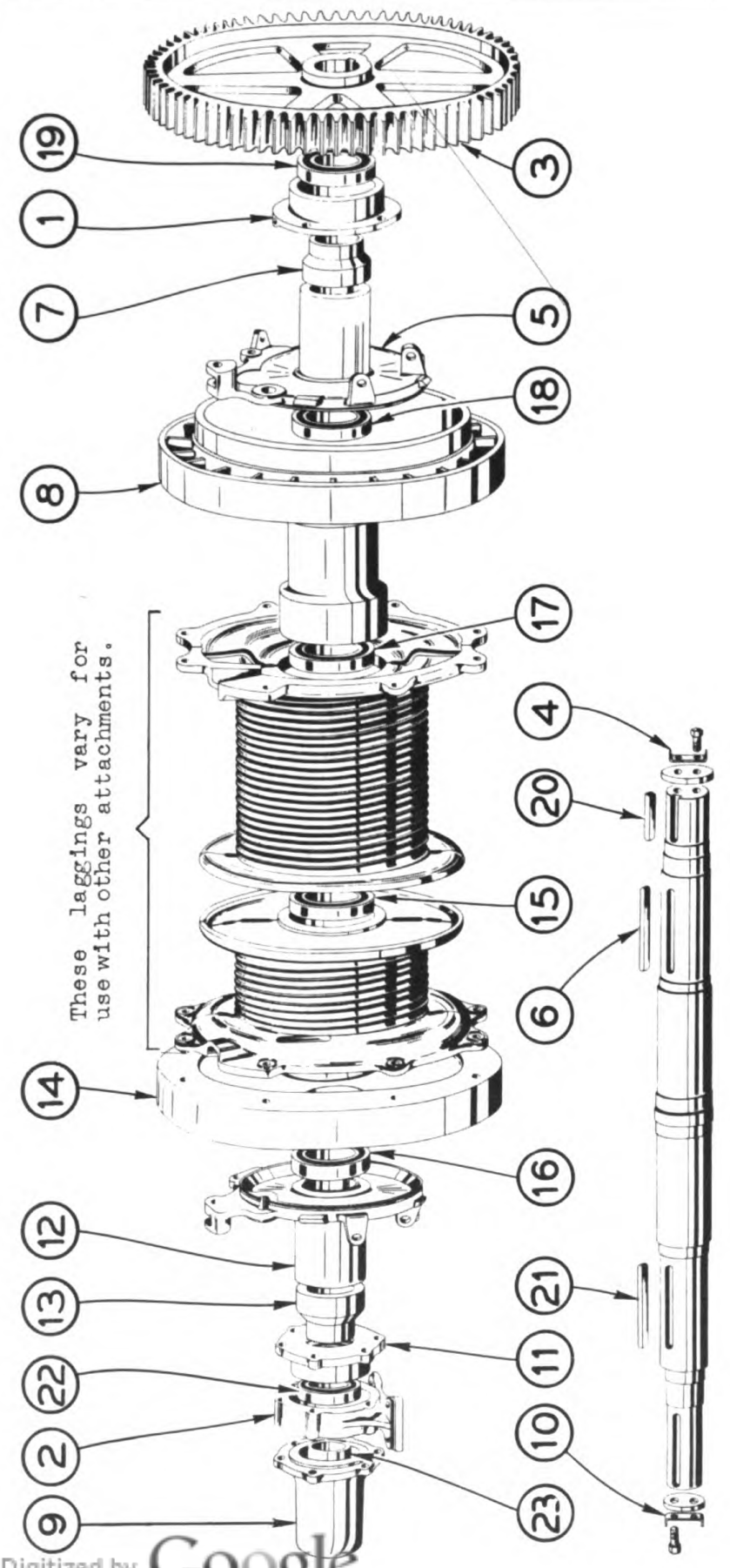


Figure 116

MAIN DRUM SHAFT ASSEMBLY
Koehring Model 304
Lifting Crane

MAIN DRUM SHAFT ASSEMBLY
Figure 116 - Page 138

TO REMOVE:

If no crane is available for lifting the drum shaft from the machine, construct an appropriate type of lifting device as described under "Handling of Heavy Parts", Page (204). Lower boom to cribbing as shown on Page 97, Operation Section. Pull off enough boom cable to permit tying the cables to the outside of the cab roof (three cables to a side) and thus provide ample clearance for lifting the shaft assembly from the machine. Remove the vertical section (28), bulkhead sections (34) and (37) and vertical section (26) at the left of the bulkhead of the cab as shown on Page 165, Maintenance Section. Remove drum guards. Remove upper half of main gear case as described on Page (131). Remove the two capscrews holding the flange of bearing retainer (1) to the lower half of main gear case. Remove both brake bands as described on Page 130. Remove bolts of pillow block (2) in left side stand. Attach chain or cable slings around the clutch sleeves and shafts at both ends of the assembly; attach chain block hook to sling and hoist the assembly high enough for drum gear (3) to clear the gear case, then swing the shaft endways to the machine and lift it out. CAUTION - Cover the main gear case to keep dirt out of it.

TO DISASSEMBLE:

Remove the capscrews, lock plate and keeper plate (4) at the gear end of the shaft. Drive or pull off gear (3) and remove gear key. Pull bearing retainer off shaft with a bar and bolts as described on Page (133). Remove pin (9) and slide clutch sleeve assembly (10) Figure 106 off shaft. Pull right hand clutch spider (5) with rods screwed in tapped holes as described on page (133). Remove clutch spider key (6). Keep spacer (7) and spider (5) together and mark them for the right hand end of the shaft. The right hand drum (8) can now be pulled off with bar and rods in the same manner as described on Page (133). Remove the shaft and bearing cover (9) on the left end of the shaft. Remove capscrews, lock plate and keeper plate (10). Pull off pillow block (2) and bearing retainer (11) as a unit. Remove pin and slide clutch sleeve assembly off the shaft. Pull left hand clutch spider (12) with rods screwed into tapped holes in the clutch spider and a bar as described on Page (133). Spacer (13) will come off with the clutch spider. Keep spider (12) and spacer (13) together, marking them for the left hand end of the shaft. The left hand drum (14) can now be pulled off the shaft in the same manner as the right hand drum was pulled or the shaft can be driven out of the drum by bumping the left end of the shaft with a heavy block. Drive the ball bearings out of the bearing retainers and drum, using a hardwood block or brass driving rod.

TO INSPECT:

Wash all parts thoroughly with cleaning fluid. Check the ball bearings for wear, broken balls and chipped races. Oil the bearings and wrap them in clean rags or paper until they are ready to be installed again. To check shaft for straightness, place it on "V" blocks and rotate it, using a dial indicator. Check all keys and keyways to be sure all keys fit snugly on the shaft. For bearing tolerances see Page 121.

TO REASSEMBLE:

Coat the bearing recesses in the drums with white lead and oil and install the drum bearings. NOTE - All drum bearings are installed with the shielded side of the bearing to the outside of the drum hub. Use brass driving rod on outer bearing race and do not damage bearing shield. Pack each drum hub with new WB grease, referring to Page (66), Operation Section, Note 8 for quantity. The grease should be packed tight around both ball bearings in each drum. To replace the left hand drum, coat the drum bearing bosses on the shaft with white lead and oil, then mount the drum on the shaft or drive the shaft into the drum by bumping the right hand end of the shaft with a wooden block. Bearing (15) should be tight against its shoulder on the shaft. Drive bearing (16) against its shoulder on the shaft, using brass driving rod on inner bearing race. To replace the right hand drum, coat the drum bearing bosses on the shaft with white lead and oil, then mount the drum on the shaft or drive the shaft into place with a wooden block against the hub of the drum and a brass driving rod against the inner race of bearing (17). Replace spider key (6); coat the key and shaft and the inside of the hub of spider (5) with white lead and oil, then drive the spider on the shaft. The spider should be tight against bearing (18) which should be tight against the bearing shoulder on the shaft. Put spacer (7) on the shaft against the spider hub. Place clutch sleeve on the spider hub and replace pin and secure with cotter. Install bearing (19) in the bearing retainer (1) with shielded side of the bearing to the gear case. Coat shaft with white lead and oil, then mount bearing and retainer on the shaft. Put in key (20); coat key, shaft and inside of the hub of gear (3) with white lead and oil, then drive the gear on the shaft against bearing (19). Put on keeper plate, lock plate and capscrews (4). Draw capscrew tight and bend the lock plate over the capscrew. NOTE - Be sure bearing (19) is against its shoulder on the shaft. Put in key (21). Coat the key, shaft and inside spider hub (12) with white lead and oil, then drive the spider on the shaft against bearing (16). Put spacer (13) on the shaft against the spider hub. Put clutch sleeve on the spider hub, insert pin and secure with cotter. Install bearing (22) in retainer (11). Drive bearing on shaft against spacer (13), using brass driving rod and driving against inner race of the bearing. Put on spacer (23), keeper plate, lock plate and capscrews (10). Draw capscrews tight and bend lock plate over capscrews, mount pillow block (2) and shaft bearing cover (9) on bearing retainer (11). Pump sufficient WB grease into end shaft bearings (22) and (19). The shaft, now completely assembled as a unit, is ready to be replaced on the machine.

TO REPLACE:

Clean the bore in the main gear case for bearing retainer (1). Clean the left side stand for pillow block (2). Lower the shaft assembly into place, being sure the clutch collars engage shifting forks and that the grease connection on bearing retainer (1) is up. Start the capscrews in lower half of main gear case through the flange of bearing retainer (1). Line up the gears in the main case and bolt pillow block (2) to the left side stand. Check the amount of grease in the main case and replace upper half of the case as directed on Page (131). Replace brake bands and adjust brakes. Replace cab and bulkhead parts.

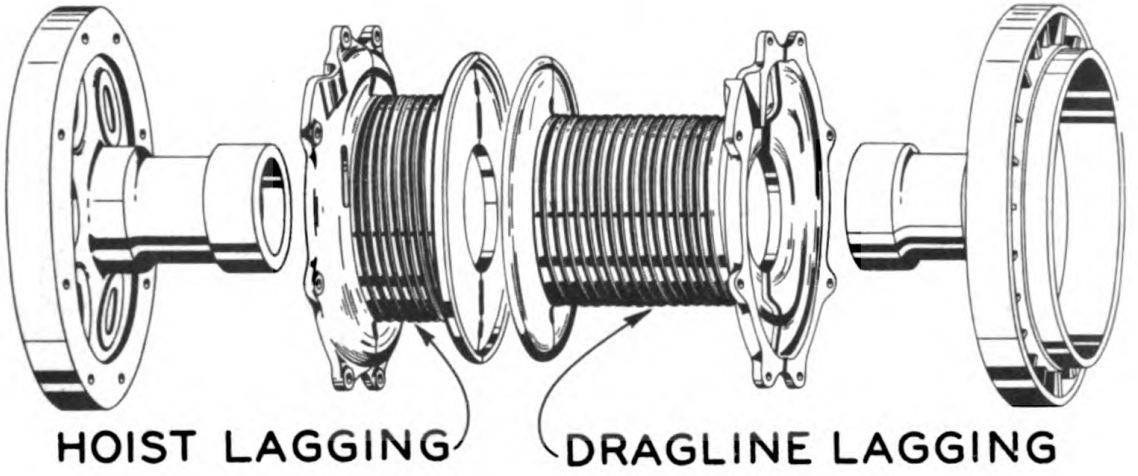
MAIN DRUM SHAFT ASSEMBLIES

(Dragline, Clamshell, Pile Driver, Pull Shovel and Shovel)

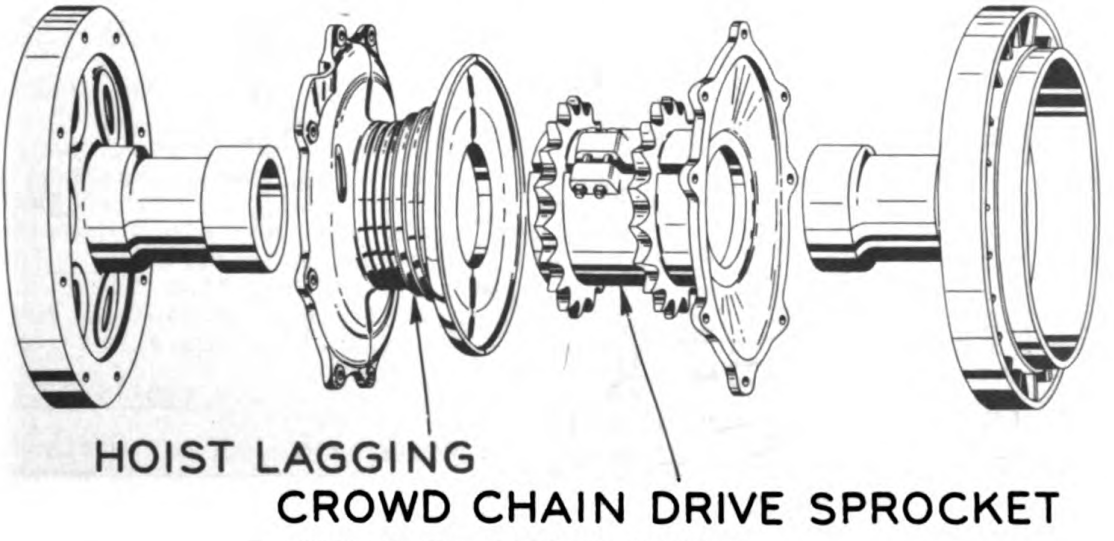
For removal, disassembly, inspection, reassembly and replacement of drum shaft assemblies for dragline, clamshell, pile driver, pull shovel and shovel, follow same procedure as outlined under "Main Drum Shaft Assembly," Page 139 Maintenance Section.

For removal and replacement of the drum laggings on these various combinations see the following pages in the Operation Section:

Crane.....	Page (96)
Clamshell.....	Page (96)
Dragline.....	Page (96)
Pile Driver....	Page (96)
Pull Shovel....	Page (96)
Shovel.....	Page (95)



DRUM SHAFT ASSEMBLY (DRAGLINE)
Figure 117



DRUM SHAFT ASSEMBLY (SHOVEL)
Figure 118

SWING AND TRACTION BEVEL GEAR AND SHAFT

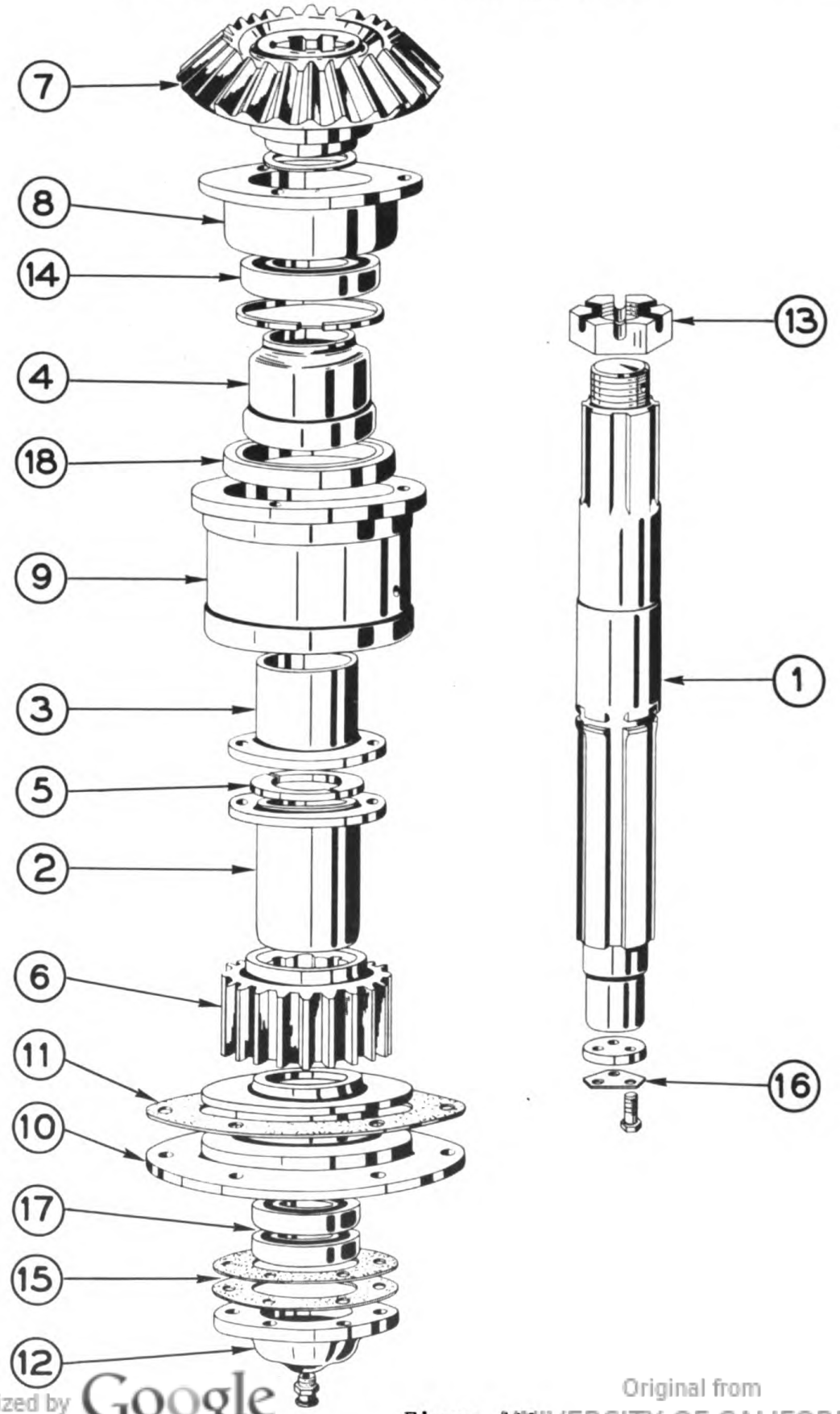


Figure 119

SWING AND TRACTION BEVEL GEAR AND SHAFT

TO REMOVE:

Shaft (1), spacers (2), (3), and (4), washer (5) and gear (6) may be taken out through the bottom, leaving bevel gear (7), bearing retainer (8) and grease seal retainer (9) in place without lifting the swing and traction jack shaft. To remove bevel gear (7), bearing retainer (8) and grease seal retainer (9), it will be necessary to raise swing and traction jackshaft assembly as described on Page (132). To remove the shaft with its parts, take out the capscrews in bearing retainer (10). Be careful not to damage shims (11). Place a jack under bearing cap (12). Remove cotter and nut (13). Lower jack about 2 inches and if the shaft does not follow the jack down, drive on top of shaft with wooden block. Be careful the entire shaft assembly does not fall out. If the swing and traction jackshaft has been raised, bevel gear (7) can be lifted off after nut (13) has been removed. Remove grease pipe leading to bearing (14) and set screw holding grease seal retainer (9), then take out bearing retainer (8) and washer.

TO DISASSEMBLE:

Remove bearing cap (12), being careful not to damage shims (15). Remove capscrew, lock plate and keeper plate (16). The shaft can now be pressed out of bearing retainer (10). Slide gear (6) off the shaft. Remove bolts from spacers (2) and (3) and take out split washer (5). Spacer (2) will slide off the lower end of the shaft and spacers (3) and (4) and bearing (14) and retainer (8) will slide off the top end of the shaft.

TO INSPECT:

Wash all parts thoroughly in cleaning fluid. Inspect bearings for wear, broken rollers and chipped races. Oil the bearings and wrap them in clean rags or paper until they are ready to be installed. To check shaft for straightness, place shaft on "V" blocks and rotate, using a dial indicator. Inspect grease seals. If grease seals have been removed from their retainers, they must be replaced with new ones. Inspect all other parts for wear. Clean old grease out of turntable.

TO REASSEMBLE:

Place spacers (2) and (3) on shaft. Insert split washer (5) and bolt spacers (2) and (3) together. Slide gear (6) on shaft, then bearing retainer with outer race of upper half of bearing (17) in retainer. Drive inner races of bearing (17) on shaft, being sure the taper is in the same direction as when taken off shaft. Attach keeper plate and lock plate with cap screws (16). Draw capscrews tight and bend the lock plate over them. Install the outer race of lower half of bearing (17) but do not draw it up too tight. Put on bearing cap (12) and shims (15). Pull cap screws up snug but not tight until final adjustment is made later.

TO REPLACE:

Replace the assembled shaft in the machine. Put in shims (11) and screw capscrews through bearing retainer (10). Replace grease seal retainer (9). Put in set screw and grease pipe. Put in bearing (14), washer and bearing retainer (8) with grease seal (18) inserted in retainer. Replace bevel gear (7) and nut (13) and secure with cotter.

TO ADJUST:

Bearing (17) is adjusted first by removing grease gun connection from bearing cap (12) and inserting a drift pin into the grease connection hole and pushing it up against the shaft. With a crow bar against the lower end of the drift pin try lifting and lowering the shaft to test for end play. Draw bearing cap cap screws tight, being sure the cap screws are tightened evenly. Check shaft again for end play. NOTE - End play should be very slight. If there is too much end play, remove bearing cap (12), take out a thin shim (15), replace bearing cap and check end play again. After bearing adjustment is completed, replace grease connection and pump bearing full of WB grease. Check the mesh of the bevel gear (7) with the bevel pinions on the swing and traction jack shaft. The entire bevel gear shaft assembly can be raised to eliminate excessive backlash or wear in the gears. To decrease the backlash, loosen the cap screws in bearing retainer (10). Locate the cuts in shims (11). The cap screws passing through the cuts in the shims should not be removed. Take out the rest of the cap screws. Pull out one shim (11), being sure both halves of the same shim are removed. Replace the cap screws and draw them up evenly and tight. Check the backlash in the bevel pinions again. Take two pieces of newspaper and, with lever (2) page (42) in neutral, run them through the teeth of both bevel pinions and the bevel gear. There should be the same amount of clearance between the teeth for the full length of each tooth face. For bevel pinion adjustment, see Page (91), Operation Section. Pump WB grease into bearing (17). Grease bevel gear and pinions. (See lubrication instructions, Page (67), Operation Section, for quantity and type of oil to be used in turntable.)

TWO SPEED GEAR AND SHAFT

TO REMOVE:

NOTE - Although it is not necessary to remove the bevel gear shaft to take out the two speed gear it can be more conveniently taken out if the shaft is removed. Take off bearing cap (12) and shims (15) Figure 119. Remove cap screws, lock plate and keeper plate (16). Put wooden wedges under bevel gear (7). Take cap screws out of bearing retainer (10) and pull the bearing retainer and bearings off the bevel gear shaft. Gear (6) will come off the shaft when bearing retainer is removed. Place a bar through inspection opening in left side of the turntable and hold the double gear up.

Remove dowel pin (1) Figure 120. (For method of removal see Figure 140). Take cap screws out and remove lower gear case cover (2). Thrust washer (3) will now come off. Remove bar and let the two speed gear (4), down - do not drop it. Remove seal ring (5). To remove the shaft (6), take bolt out of the end of the shaft. NOTE - Thrust washer (3) can be replaced by raising shaft (6) up and working through inspection opening and drain hole. To keep the gears in place while doing this, use small wedges under the lower gear. Be sure to remove the wedges after new washer has been installed and shaft pushed back into place.

TO DISASSEMBLE:

Remove bearings (7), (8) and spacer (9), Figure 120.

TO INSPECT:

Wash all parts thoroughly in cleaning fluid. Check bearing for wear, broken rollers and chipped races. Oil the bearings and wrap them in clean rags or paper until they are ready to be installed. Check thrust washers and seal.

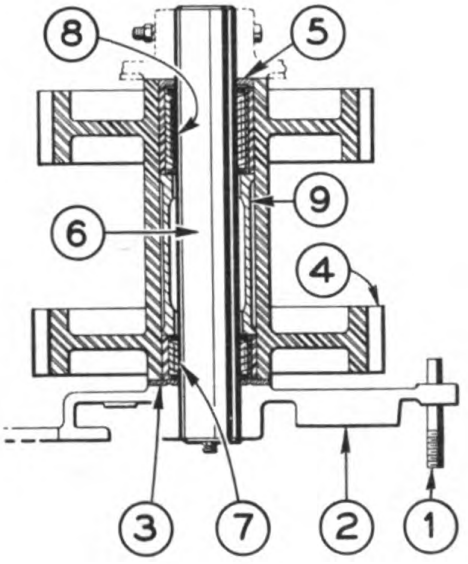


Figure 120

TO REASSEMBLE:

Install bearings (7) and (8) and spacer (9) as illustrated.

TO REPLACE:

Replace shaft (6) and put bolt through top of it. Put on seal ring (5), then slide the gear (4) up on the shaft. Replace thrust washer (3) and gear case cover (2). Put in capscrews and dowel pin (1). (See Page (163), Maintenance Section for Dowel Instructions.) Replace gear (6), shims (11) and bearing retainer (10) Figure 119. Install bearings (17), keeper plate, lock plate then screw in capscrews (16). Put on bearing cap (12) and remove wedges under bevel gear (7). Adjust bearings and shaft as described on Page 144.

SWING PINION (Figure 121)

TO REMOVE:

Place machine on firm, level ground and swing turntable so that swing pinion is directly over one of the openings in the carbody. Lower boom to a temporary support on the ground to prevent machine from turning around while the pinion is off. Remove capscrews, lock plate and keeper plate (1) then pinion (2) will slide off the shaft. NOTE - Care should be exercised to avoid injury when the pinion falls to the ground.

TO INSPECT:

Wash pinion thoroughly with cleaning fluid. Check pinion for wear on teeth.

TO REPLACE:

Slide pinion (2) up on shaft. Put on keeper plate, lock plate and capscrews. Draw capscrews tight and bend lock plate over the capscrews. When putting on new pinion, inspect splines on the shaft and file off any burrs that might be found. If the pinion teeth and carbody teeth and shaft splines and pinion splines do not line up, the shaft can be turned by having swing gears engaged and rolling one of the swing clutch drums by hand. CAUTION-Do not turn shaft by engine power when lining up assembly.

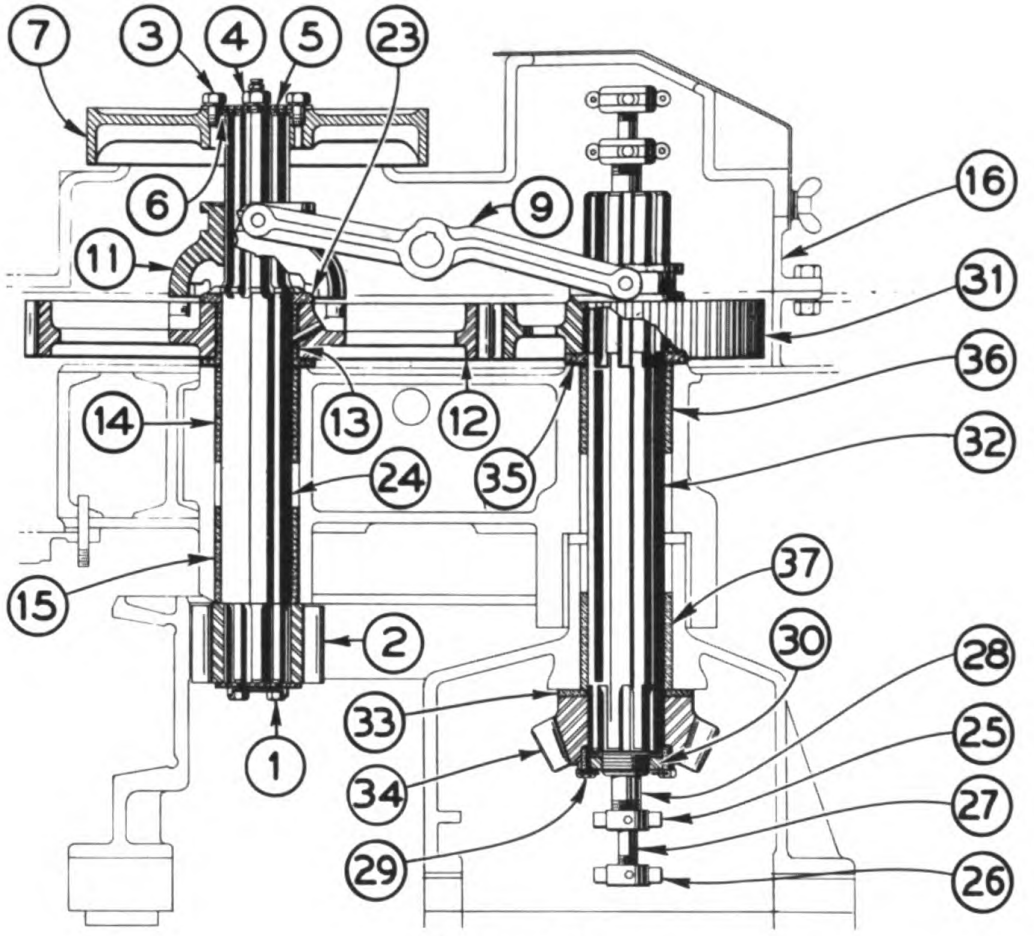


Figure 121

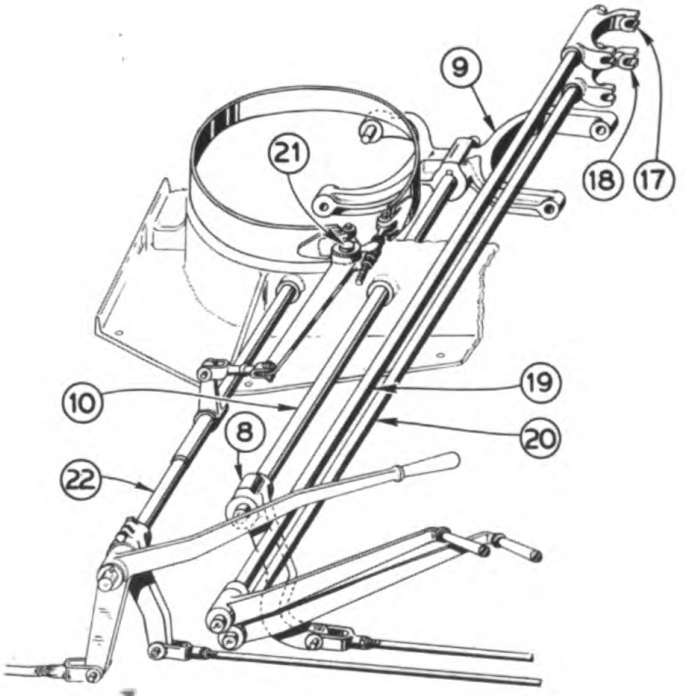


Figure 122

VERTICAL SWING SHAFT
Figure 121 and 122 Page 146

TO REMOVE:

Place machine on firm, level ground and remove swing pinion as described on Page 145, Maintenance Section. Remove curved section of the bulkhead under and behind the drums. Remove capscrews (3) and (4), plate (5) and washers (6). Lift out swing brake drum (7), exposing upper end of swing shaft and jaw clutch. Remove gib keys in crank (8) and yoke (9), then pull shaft (10) out of yoke (9). Now yoke (9) can be removed through the opening around the vertical swing shaft. Note carefully which end of the yoke is to the front as it must be replaced in the same position. Lift off jaw clutch (11). Remove half of the right hand drum lagging then turn the drum so the shaft will clear it. Screw an eye bolt or "T" bolt in the center of the shaft (24) and lift the shaft out. To remove the swing gear (12) for replacement of flanged bushing (13), or swing shaft bushings (14) and (15), the entire gear case cover (16) must be removed. To remove gear case cover, take off right and left hand curved sections of cab bulkhead and drum guards. Remove keys from yokes (17) and (18). Pull steering lever shafts (19) and (20) to the right out of gear case cover (16). Take entire swing brake assembly off at pin (21). Pull shaft (10) out of the case cover. Pull shaft (22) out of its case cover bearing. Remove all bolts holding the case cover (16) to the turntable. Take the bolts out of the right hand brake stand and shift the stand to the right or remove it entirely. Now the gear case cover can be pulled out under the hoist drums. Lift gear (12) exposing bushings (14) and (15). Do not remove the bushings unless new bushings are to be installed. All bushings are dowelled and new dowel pins should be used with new bushings. (See Page (164), Maintenance Section, for dowel instructions.)

TO INSPECT:

Wash all parts thoroughly with cleaning fluid. Inspect the jaws on the jaw clutch (11) and gear (12) to see that jaws are not cracked or the corners rounded off as there is danger of a worn or cracked jaw clutch disengaging under a heavy load. Inspect thrust washers and bushings for wear. Check grease pipes to see that they are open. Inspect swing brake lining for wear.

TO ASSEMBLE:

Pack the recess between bushings (14) and (15) full of grease. Place gear (12) in the case. Lay thrust washer (23) on the gear. Slide the shaft down through the thrust washer and gear (12) and its turntable bushings. Put on jaw clutch (11). Replace shifting yoke (9) on jaw clutch (11). Replace traction gear on vertical traction shaft. Replace swing pinion. Replace gear case cover and put in all bolts but do not tighten them. Replace yokes (17) and (18), shafts (19) and (20), shaft (10) in yoke (9) and shaft (22). Tighten case cover bolts evenly, checking often to see that none of the shafts are binding in the case cover. Replace swing brake assembly and swing brake drum. Put on washer (6), plate (5) and capscrews (3) and (4). Replace drum lagging and bulkhead. Pump grease into swing shaft bushings and into grease connection on top of swing brake drum.

VERTICAL TRACTION SHAFT
Figures 121 and 122

TO REMOVE:

Remove turntable gear case cover as described on Page 147. Remove swing and traction shifter yoke (9). Remove lower traction bevel gear case cover. Remove lock screws from shifter lugs (25) and (26). Unscrew pipe (27) and lift it out. Unscrew pipe (28) and lift it out. The shifter lugs may now be taken out of their forks. Remove lock screws (29) and unscrew adjusting nut (30) from the lower end of the vertical traction shaft. Lift gear (31) off the shaft. Pull shaft (32) out through the top. Remove thrust washer (33), bevel pinion (34), and thrust washer (35) will be loose below the carbody.

TO INSPECT:

Wash all parts thoroughly with cleaning fluid. Check all parts, bushings and thrust washers for wear. Check grease pipes to be sure they are open.

TO REPLACE:

Pack the recess between bushings (36) and (37) with grease. Grease thrust washer (35) and slide it on the shaft. Grease thrust washer (33) then hold it and bevel pinion (34) in place while the vertical traction shaft is lowered down through its bushings, thrust washer (33) and pinion (34). Put on adjusting nut (30) and screw it up tight then back it off just enough to give a slight amount of up and down end play in the shaft. Replace lock screws (29) and wire them together. Put gear (31) on the shaft. Place shifter lug (25) in the top fork of the lower bevel gear case, then screw pipe (28) into the lug. Put in lock screw. Replace lug (26) and pipe (27), then put in lock screw. Replace lower traction bevel gear case cover. Refill case with lubricant as per Lubrication Instructions, Page (68), Operation Section. Replace swing and traction shifter yoke (9). Replace turntable gear case cover as described on Page 147.

TURNTABLE ROLLERS

TO REMOVE:

Place the machine on firm, level ground and be sure all four rollers are resting on the lower roller path. Place a jack under the turntable, near the roller to be removed, and jack it up enough to let the roller turn free. Remove bolt (1) from the roller bracket (5) and roller pin. Screw bolt (1) into the drilled and tapped hole in the end of roller pin (2), and using the bolt as a handle, pull out the roller pin. Move the roller (3) to one side of the roller bracket and lift it out.

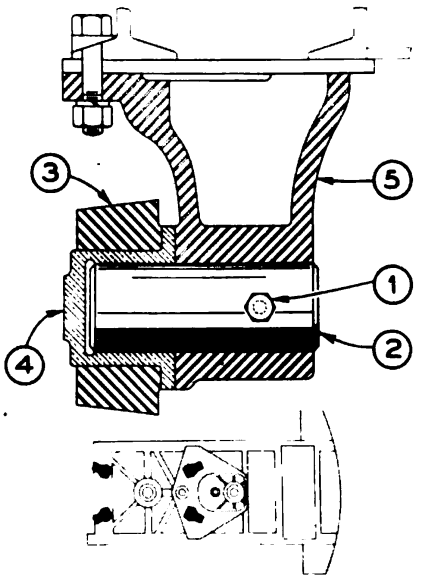


Figure 123

TO INSPECT:

Wash all parts thoroughly in cleaning fluid. Check roller bracket to be sure it is securely bolted to the turntable. Inspect shaft, bushing and thrust flange for wear. The bushing and thrust flange (4) are one piece and can be pressed out of the roller for replacement.

TO REPLACE:

Place the roller (3) in the roller path and roll it into position behind the roller bracket (5). To compensate for wear on the roller and roller paths, place a steel washer between the thrust flange of bushing (4) of the roller and the roller bracket (5) to crowd the roller deeper into the "V" shaped roller path and reduce the tipping action of the turntable. The roller should not touch both the top and bottom roller paths at the same time. When the roller is resting on the bottom roller path, there should be a clearance above the roller of about 1/32" to 1/16". After the roller is in place, put the roller pin through the roller bracket and steel washer, if one is used - and into the roller bushing. Put a punch in the bolt hole to hold the pin in line while removing the bolt from the pin. Remove the punch and put the bolt through the roller bracket and pin and draw the nut tight on the bolt. NOTE - Removing the grease connection from the end of the pin will make it easier to take the pin out and put it back into place. Pump grease into roller after installing.

TURNTABLE AND PILOT BUSHING

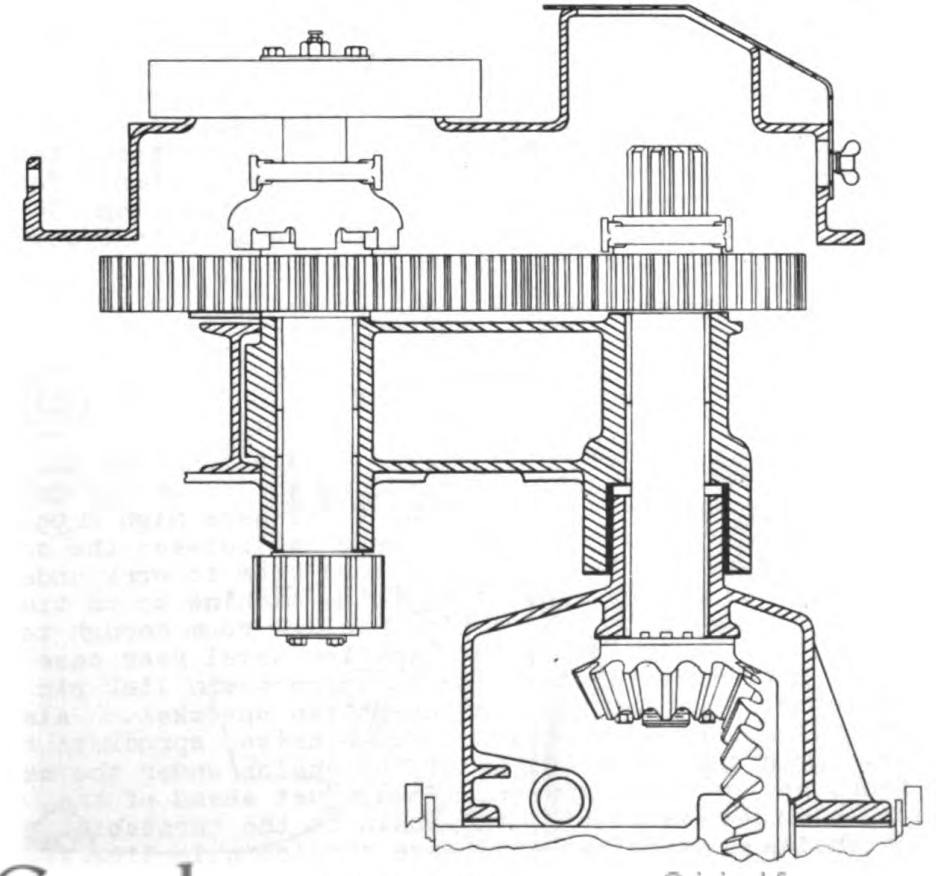


Figure 124

TURNTABLE AND PILOT BUSHING

TO REMOVE:

Place the machine on firm level ground. Line up the turntable so that the boom is over the center of either end of the crawlers. Lower the boom to cribbing or other suitable support. Pull enough boom cable off the boom hoist drum to allow considerable slack in the boom cables. Remove vertical traction shaft as described on Page (148). Build a crib under the counterweight and jack up the counterweight until the rear turntable rollers are free. Place jacks at the front of the turntable and jack it up until the front rollers are free. Remove all four turntable rollers as described on Page (148). Jack up the turntable evenly at both ends until the front end is high enough to put a strong timber under the turntable and over the carbody just back of the front turntable roller brackets. This timber or steel beam should extend out beyond the crawlers, on both sides, about four and five feet. Build a crib under each end of the timber or beam, then, using jacks at both ends of the timber or beam and under the counterweight, jack up the turntable high enough to allow the carbody and crawler assembly to move from under the machine out toward the boom. Remove old bushing. CAUTION - Keep the cribs built up close to the counterweight and under the timber ends at all times. See that the boom cable does not get tight as the turntable is lifted. The traction jaw clutches should be disengaged and traction brake adjustments loosened before moving the lower traction assembly.

TO INSPECT:

Check bushing for wear.

TO REPLACE:

Install new bushing as described on Page (162). Move the lower traction assembly back under the turntable and lower the turntable until the turntable rollers can be installed as described on Page (149), Maintenance Section. Replace vertical traction shaft as described on Page (148), Maintenance Section. Readjust traction brakes as described on Page (90), Operation Section. Grease pilot bushing as described under "Lubrication Instructions", Page (71), Operation Section.

LOWER TRACTION SHAFT ASSEMBLY
Figure 125, 126 and 127

TO REMOVE:

Before removing the lower traction shaft assembly, study the shaft and its related parts to get a clear understanding of its arrangement. Drive the machine up a ramp on to timbers high enough to clear the bevel gear and traction brake drums between the crawler axles and the ground. This also gives more room to work under the machine. If it is not possible to get the machine up on timbers, a trench can be dug under the machine to allow room enough to roll the assembly out. Remove the lower traction bevel gear case cover (1). Split both drive chains by removing a chain link pin just above the center of the chain on the driven sprocket. Also tie that part of the chains just back of the drive sprockets to the turntable. Drag the lower halves of the chains under the machine to the front end of the crawlers. Then, just ahead of the drive sprockets, tie the remainder of the chain to the turntable. NOTE - Tying the chains as described will save considerable time if it is not necessary to remove the chains.

LOWER TRACTION SHAFT

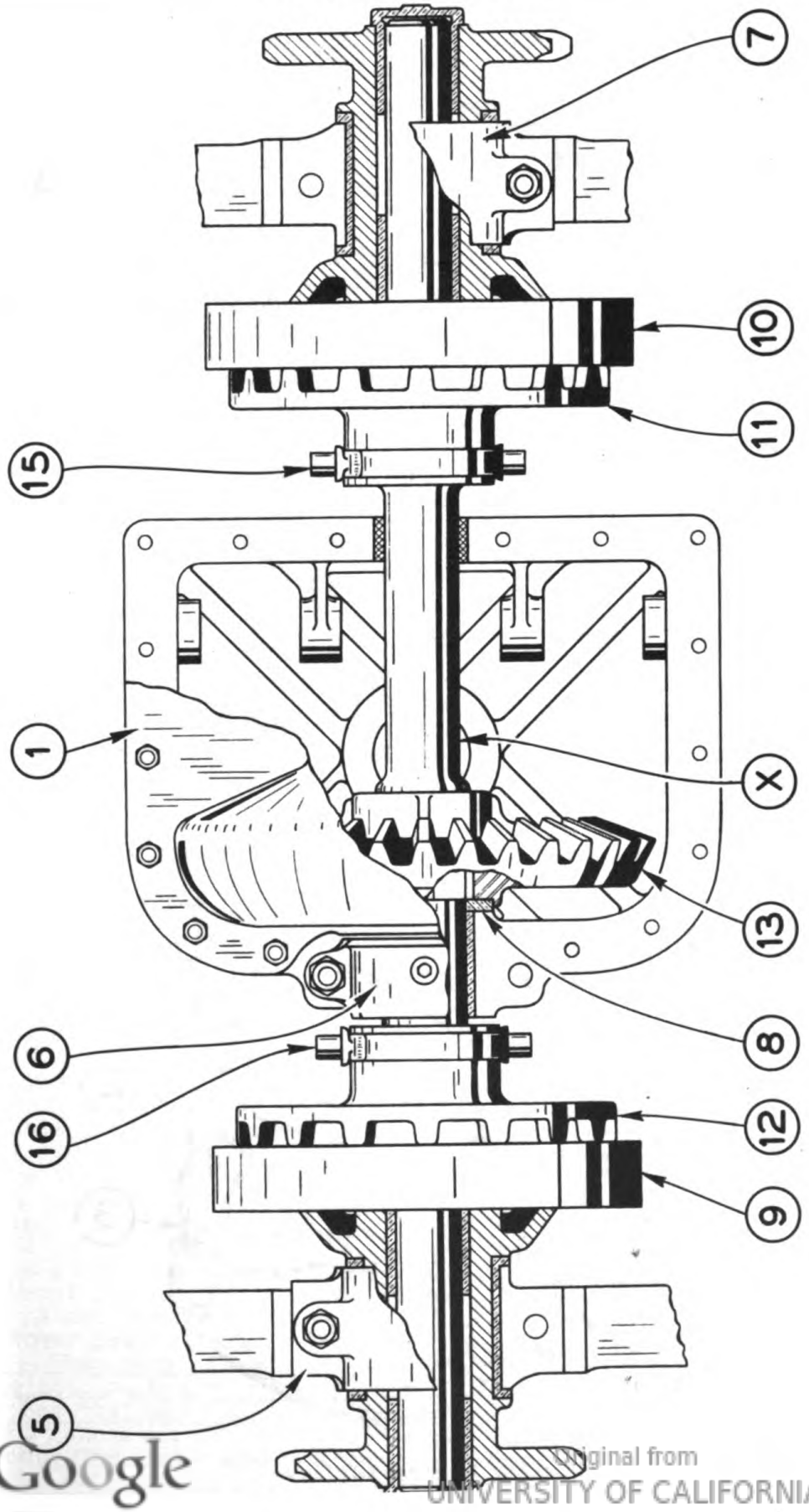


Figure 125

LEFT HAND TRACTION BRAKE BAND ASSEMBLY

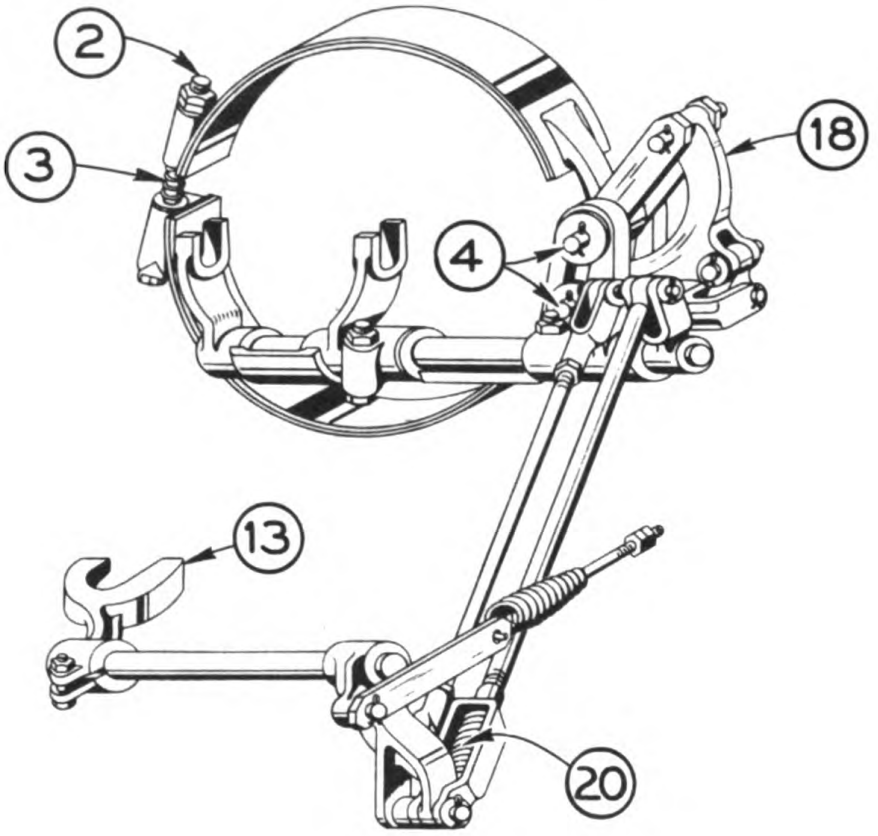


Figure 126

RIGHT HAND TRACTION BRAKE BAND ASSEMBLY

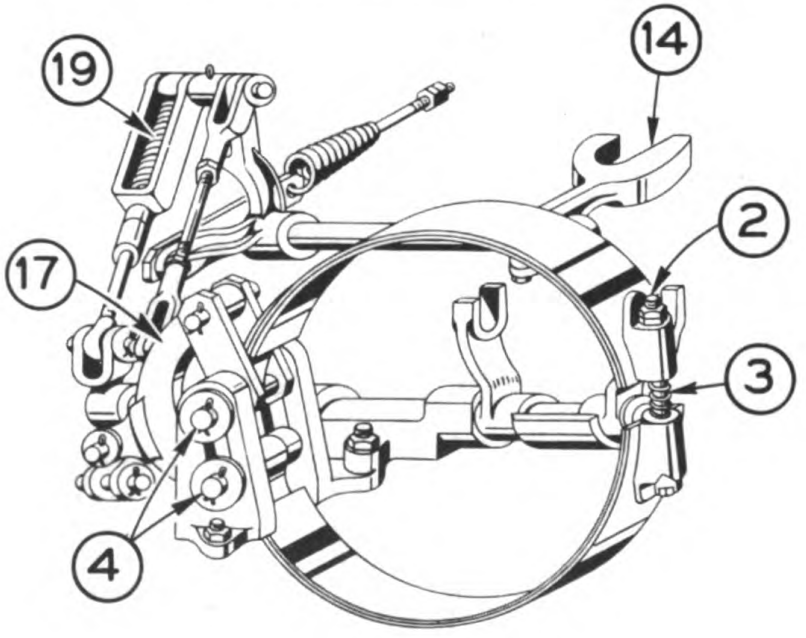


Figure 127

LOWER TRACTION SHAFT ASSEMBLY (Continued)

Remove traction brake band adjusting bolts (2) and springs (3). Take out band end pins (4) and remove brake bands. Place a good jack (hydraulic jack is best) on blocks of wood large enough to provide a good support for the jack. On top of the jack place a "V" block to contact the traction shaft at "X" next to the bevel gear. Put a slight pressure on the jack. Remove bearing caps (5), (6) and (7), keeping the bushing halves and shims with each cap as it is taken off. Thrust washer (8) is made in two pieces and can be removed after cap (6) is off. Build up a safe pile of blocking under each brake drum (9) and (10). Lower each pile of blocking about 2" as the shaft is let down 2" at a time. Keep wedges or blocks in front of and behind each brake drum on each blocking pile. When the blocking under the jack needs to be changed to set the jack lower, the brake drums and shaft will be supported by the blocks under the drums. When the shaft has been lowered to the ground it can be turned and rolled - on the brake drums and bevel gear - until it is worked out from under the machine. The brake drum and sprocket units and the steering jaw clutches (11) and (12) can be taken off the shaft while it is under the machine and brought out in units if desired. Sprockets and brake drums will slip off the shaft much easier if the grease fittings in the end of the sprocket hubs are removed. Bevel gear (13) is pressed on the shaft.

The bevel pinion (34) Figure 121 and thrust washer (33) Figure 121 may be removed while the lower traction shaft is out by removing yokes (13) and (14), then removing lock screws (29) and unscrewing adjusting nut (30) Figure 121 and sliding the pinion and thrust washer off. When the thrust washer and pinion are replaced, tighten adjusting nut (30) Figure 121 so that the vertical traction shaft has a slight amount of end play, then replace lock screws and wire them together.

TO INSPECT:

Wash all parts thoroughly with cleaning fluid. Inspect all parts for wear. Check steering jaw clutches for excessive taper on the jaws or in the jaw clutches. Excessive taper will cause these jaws to disengage under heavy loads when traveling. Square the jaws by welding. Inspect lining on traction brakes and if worn, reline brakes as described on Page (130).

TO REPLACE:

Pack the recesses between the bushings in the drive sprocket sleeves with grease. Place the shaft - assembled with its jaw clutches and drive sprockets - under the machine and jack up the shaft almost into place, being sure shifter rings (15) and (16) engage their shifting forks. When the shaft is approximately 7/8" of an inch short of being in place, wipe all dirt and dust off the bearing surfaces and bearing shells. Grease the upper bearing shells and slip them into place. Finish jacking the shaft into place. With a pinch bar, crowd bevel gear (13) as far as possible toward the bevel pinion. Grease thrust washer (8) and slip the two halves into place. Put on bearing cap (6) and shims for safety. Grease the lower bearing shells and put on caps (5) and (7) and shims. NOTE - When caps (5) and (7) are drawn up tight it should be possible to turn brake drums (9) and (10) with a short bar while jaw clutches (11) and (12) are disengaged. If the brake drums are too loose, remove one thin shim from each side of each brake drum bearing cap, then check again. After the brake drum bearings have been

properly adjusted, remove the jack and draw up the bevel gear bearing and check it by placing a short bar in one of the disengaged jaw clutches then rocking the traction shaft and bevel gear. If it is too loose, remove one shim from each side of the bevel gear bearing cap. All these bearings should be snug but not so tight that the units cannot be turned with a short bar. Replace grease connections in the ends of the drive sprockets and pump some grease into all grease connections on the shaft and the operating linkage under the machine. Replace traction brake bands. Oil all operating link pins. The traction jaw clutches should fully engage or bottom in their jaw clutch drums. Traction brakes should be completely released when the jaw clutches are engaged. Engage the right hand jaw clutch (11). Check lug yoke to see that it does not strike the lower traction shaft. Check shifter yoke (13) to see that it does not strike shifter yoke (14) when the right hand jaw clutch (11) is engaged and the left hand jaw clutch (12) is disengaged. When working both jaw clutches alternately, there should be no interference at either the top or bottom end of steering pipes. Interference can be corrected by adjusting the jaw clutches operating the linkage (17) or (18). Springs (19) and (20) make it possible to apply the traction brakes even though the traction jaw clutches may not disengage. Each traction brake toggle linkage should backlock when the corresponding jaw clutch is disengaged. Adjust traction brakes as described on Page (90), Operation Section. Replace lower traction bevel gear case cover and fill case as directed on Page (70), Operation Section.

Replace drive chain as directed in "Traction Drive Chain", Page (198).

TOP AND BOTTOM CRAWLER ROLLERS
FRONT AND REAR CRAWLER TUMBLERS
CRAWLER SHOES

MAINTENANCE TEXT PAGES 156, 157, 158, and 159.

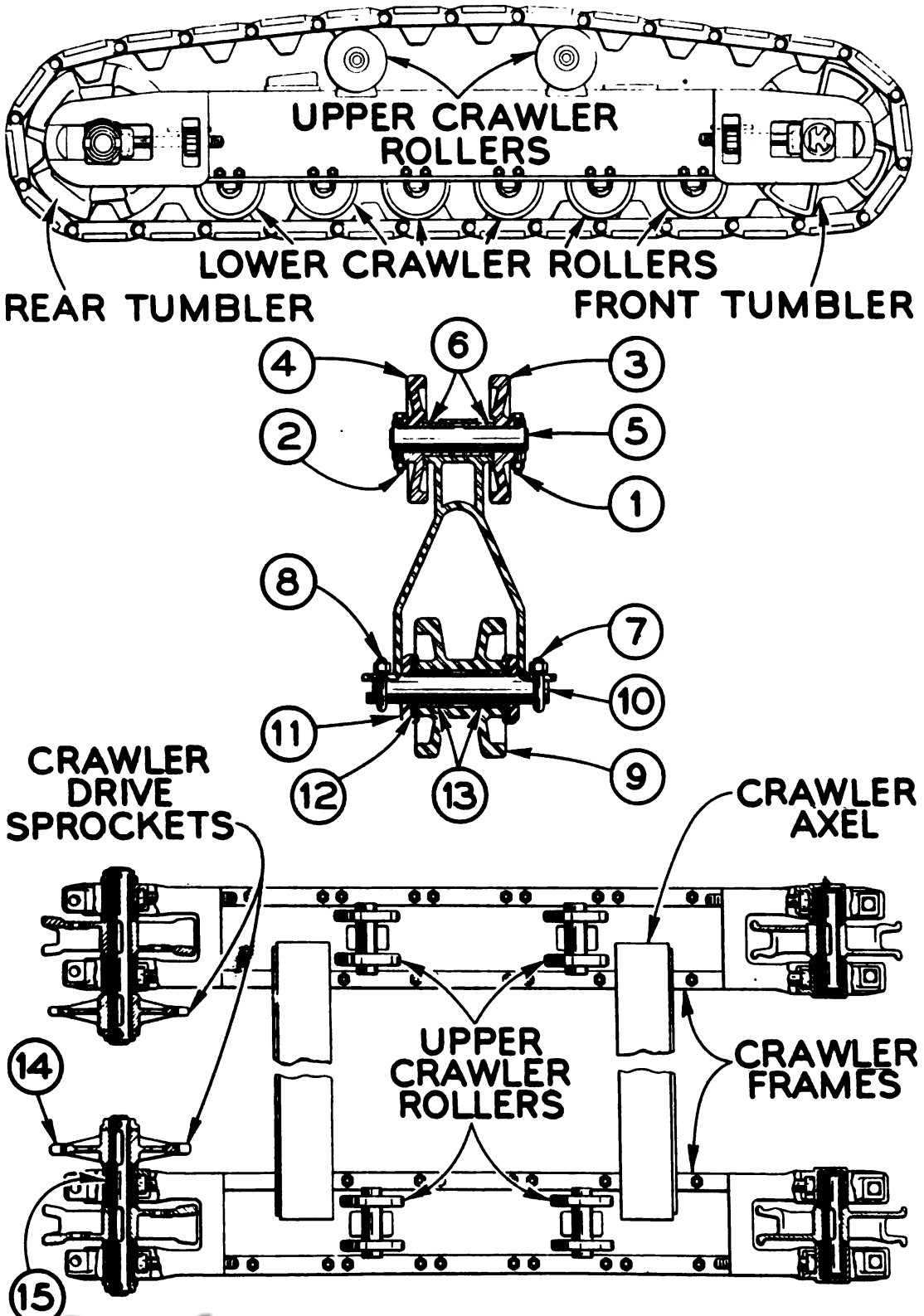


Figure 128

TOP CRAWLER ROLLERS
Figure 128

TO REMOVE:

With the machine on firm level ground, travel it forward for a distance equivalent to the length of the crawlers so that all the slack in the belt is at the top. Use a crowbar to lift the crawler belt off the top crawler roller to be removed. Block up the crawler shoes in front and in back of the roller. NOTE - If more slack is needed, release front tumbler adjustment. After the shoes are blocked up high enough, take out bolts (1) and (2), then rollers (3) and (4) and shaft (5) can be taken off. Bushings (6) can be driven out and new bushings installed. Drive in new bushings with a hardwood block or draw them in with a bushing puller using the method as described and illustrated on page (162) figure (136).

TO INSPECT:

Inspect rollers, shafts and bushings for wear.

TO REPLACE:

Fill the recess between the bushings with grease. Put the shaft (5) in bushings (6); mount the rollers (3) and (4) on the shaft and put in bolts (1) and (2). Pump grease into the grease connection.

LOWER CRAWLER ROLLERS
Figure 128

TO REMOVE:

Place machine on firm level ground. Release front tumbler adjustment entirely to provide ample slack in crawler shoes. If necessary, release the rear tumbler adjustment for additional slack. Place an 8" block of wood in front of crawler from which lower rollers are to be removed and back machine until rear tumbler is on top of block to provide clearance for removal of rollers. If jacks are used instead of blocking, place jacks under crawler axles just inside of the crawler belts. Now remove "U" bolts (7) and (8), which allow the roller and shaft assembly to drop down. Roll the assembly out from under the crawler frame. Pull the shaft (10) out of the roller (9) and thrust washers (11).

TO INSPECT:

Wash parts with cleaning fluid. Check the shaft (10), washers (12) and thrust washers (11) and bushings (13) for wear. Check roller (9) for cracked flanges.

TO REPLACE:

If new bushings are needed, drive out the old ones. Drive in new ones with a hard wood block, press them in with a press or draw the bushings in with a bolt. Fill the recess between the bushings with grease. Put in shaft (10). Place washers (12) on shaft at each side of roller. Place thrust washers (11) on the shaft. Lift shaft and roller assembly up in place and put in "U" bolts (7) and (8). Tighten "U" bolts. Pump grease into the grease connection. Lower machine to normal position and adjust crawlers as described on Page (93), Operation Section.

FRONT CRAWLER TUMBLER
Figures 129 and 130

TO REMOVE:

Place the machine on firm level ground. Travel the machine forward for a distance equivalent to the length of the crawlers to get the slack of the crawler belt on top. Place a 2" board (1) on the ground in front of the crawler from which tumbler is to be removed and travel machine over the board until the board is directly under the first roller back of the tumbler as shown in Figures 129 and 130. Place blocks (2) between crawler frame and shoe as shown to prevent belt from sagging when split for tumbler removal and thus facilitate driving out crawler shoe pin. Select a shoe pin at about (3), and remove pin. Allow the lower end of the shoes to drop to the ground and roll the top end back and tie with wire Figure 130. Remove shim and the bar (4) from both sides of the crawler frame end. Take out lock pins (5) and screw adjusting nuts (6) off adjusting bolts (7) on the inside and outside of the crawler frame. Roll tumbler forward out of the frame. Both bearings

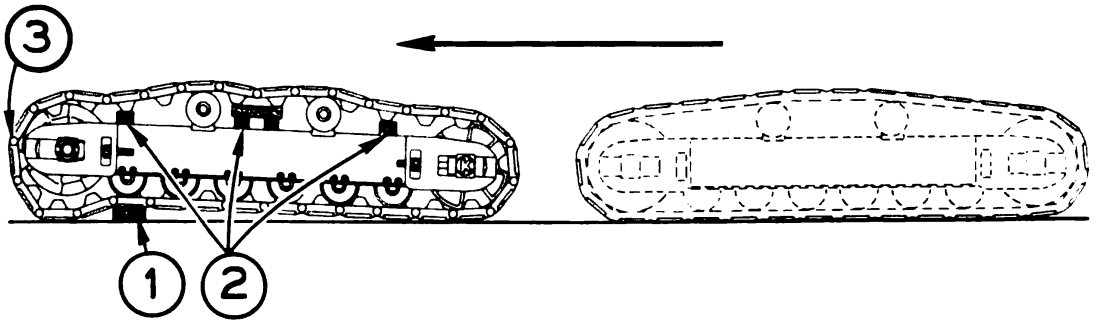


Figure 129

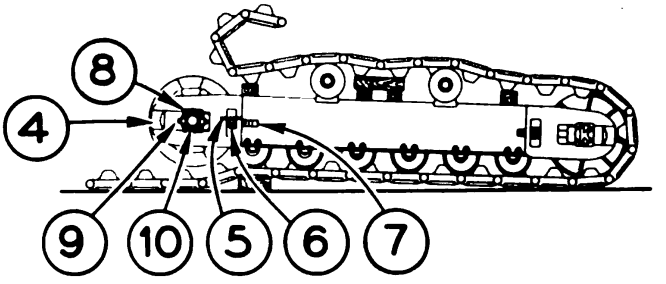


Figure 130

(8) and their adjusting bolts (7) can be pulled off for inspection. NOTE - If a new tumbler or shaft is to be installed, it will be necessary to press the shaft out of the tumbler. Tumbler and shaft are assembled at approximately 10 tons press fit.

TO INSPECT:

Inspect bearing boxes and shaft for wear. Rebabbit bearing boxes if necessary, being sure grease connection holes are open. Inspect adjusting bolts to be sure they are straight and that threads are in good condition.

TO REPLACE:

Put grease in bearing boxes, insert adjusting bolts and place the assembly on the shaft. Oil the threads on the adjusting bolts. Roll the tumbler into the crawler frame while guiding the adjusting bolts and bearing boxes into place. Start adjusting nuts (6) and screw them as far as possible, pulling the bearing boxes to the rear end of their guides. Replace shims and tie bars (4). Let the top shoes down to the tumbler. Lift up the bottom shoes and hold them with a bar or jack while lining the shoe hinges together. Put in shoe pin and key. Remove blocks from under the shoes at the top of the crawler frame. Adjust crawler belt as directed on Page (93), Operation Section.

REAR CRAWLER TUMBLER
Figures 129 and 130

TO REMOVE:

Place the machine on firm level ground and prepare crawlers by blocking and by slacking the top crawler shoes the same as for removal of front crawler tumbler described on Page 157. Remove lock pin (5) and screw adjusting nut (6) on adjusting bolt (7) - on both sides of tumbler - thus releasing the chain and shoe adjustment. Select a shoe pin at (3), and drive out pin. Let the lower end of the shoes fall to the ground and roll the upper end back off the tumbler, tying it with wire. Split traction chain as described on page (202). Remove tie bar and shim (4) on both sides of the multiplane frame. Remove adjusting nuts (6) from adjusting bolts (7) on both sides of the tumblers. Roll the tumbler assembly out. Remove pins (9) and drive collars (10) off the shaft. Slide bearing box (8) off the shaft. Press sprocket (14) Figure 128 off the shaft and remove sprocket key. Slide bearing (15) Figure 128 off the shaft. NOTE - Tumbler and shaft are assembled at approximately 10 tons press fit.

TO INSPECT:

Wash all parts thoroughly with cleaning fluid. Inspect bearings and rebabbit if necessary, being sure grease connection holes are open. Inspect sprocket teeth for wear. Inspect drive tumbler for cracks and worn driving sections. Inspect adjusting bolts to see that they are straight and that threads are in good condition.

TO REPLACE:

Slide bearing (15) Figure 128 on the shaft. Put in sprocket key and press sprocket (14) Figure 128 on the shaft. Put bearing (8) on the shaft. Oil the threads of the adjusting bolts (7) and put the bolts into bearing boxes. Roll the assembly into place in the crawler frame, put on adjusting nuts (6) and screw them up as far as possible to draw the bearing boxes and tumbler into the frame. Put on collars (10) and pins (9). Put some washers behind collars (10) to compensate for thrust wear if necessary. Replace shims and tie bars (4). Replace drive chain on sprocket and put in chain pin and key. Lower top crawler shoes to the tumbler. Lift the bottom shoes into place on the tumbler and hold them with a bar or jack while lining up shoes and inserting pin (3). Insert key in shoe pin. Pump grease into bearings. Remove blocks from under the shoes at the top of crawler frame. Adjust drive chains as directed on Page (93), Operation Section.

CRAWLER SHOES

TO REMOVE COMPLETE CRAWLER BELT: (SEE FIGURES 129 AND 130)

Remove lock pins (5) and slack off tumbler adjustments at both ends of crawler frame by turning adjusting nuts (6) to the right. Select a shoe pin (3) about half way up on either tumbler; take out lock pin and remove shoe pin. Roll top half of crawler belt back off crawler frame and then, after jacking machine up so that lower rollers clear shoes, drag crawler belt out from under crawler frame. NOTE - If jacks are not available, crawler frame may be raised by tipping the machine with hoist cable. To do this swing boom over opposite crawler, attach cable to tree or some other substantial object and hoist. CAUTION - Block machine securely under axles before attempting any further work. Crawler belt may be pulled clear of crawler frames with power by swinging boom point in line with crawler belt and attaching hoist cable. NOTE - Lower boom to horizontal before applying hoist clutch.

TO REMOVE ONE CRAWLER SHOE:

Move machine until selected shoe is just below center on either tumbler and slack off on tumbler adjustment as described above in "To Remove Complete Crawler Belt." Take out shoe pin on each side of shoe and remove shoe.

TO INSPECT:

Examine shoes for wear or other damage and inspect pins for wear or misalignment. Replace worn shoes and pins and repair cracked shoes by welding.

TO REPLACE OLD CRAWLER BELT:

Drag belt under crawler frame using procedure described in "To Remove Complete Crawler Belt" and lower machine to shoes. Move machine so that tumbler rests on third shoe from one end and then bring the other end of belt around over crawlers. Remove slack from the top side of belt by inserting blocking between crawler frame and belt, then bring the two end shoes together; insert shoe pin (3) and lock with lock pin. NOTE - For adjustment of chain see Page (93), Operation Section. Belt may be pulled over top of crawler frame with hoist cable. When doing this be sure that boom is lowered to horizontal and that boom point is properly lined up with belt.

TO REPLACE ONE CRAWLER SHOE:

Place shoe in position on lower part of crawler belt; line up holes; insert shoe pin and lock with lock pin. Move machine so that tumbler rests on third shoe from the end and then connect belt using procedure described in "To Replace Old Belt."

TO REPLACE WITH NEW CRAWLER BELT:

Split old belt over rear tumbler using procedure described in "To Remove One Crawler Shoe" and connect end shoe of new belt to top end shoe of old belt. Move machine forward as shown in Figure 131 until the new belt is in place and then connect ends as described in "To Replace One Crawler Shoe".

METHOD OF INSTALLING COMPLETE NEW CRAWLER BELT

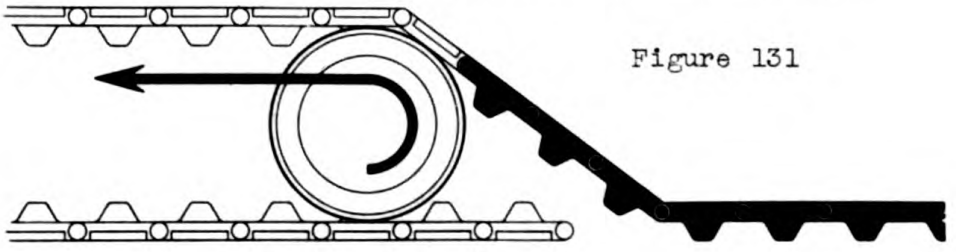


Figure 131

BRONZE BUSHINGS
LOCATIONS OF BRONZE BUSHINGS AND DOWEL TYPES

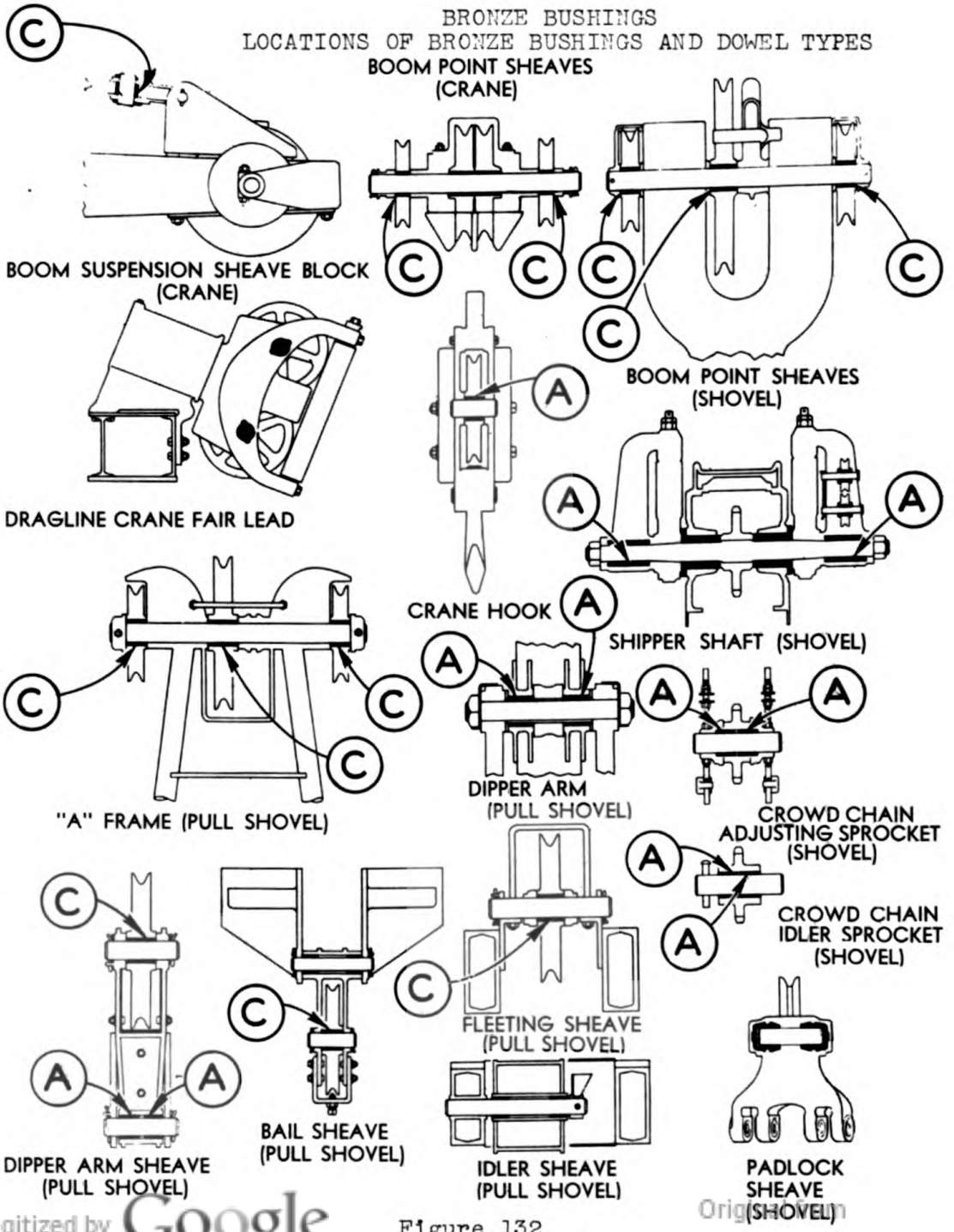


Figure 132

LOCATIONS OF BRONZE BUSHINGS AND DOWEL TYPES

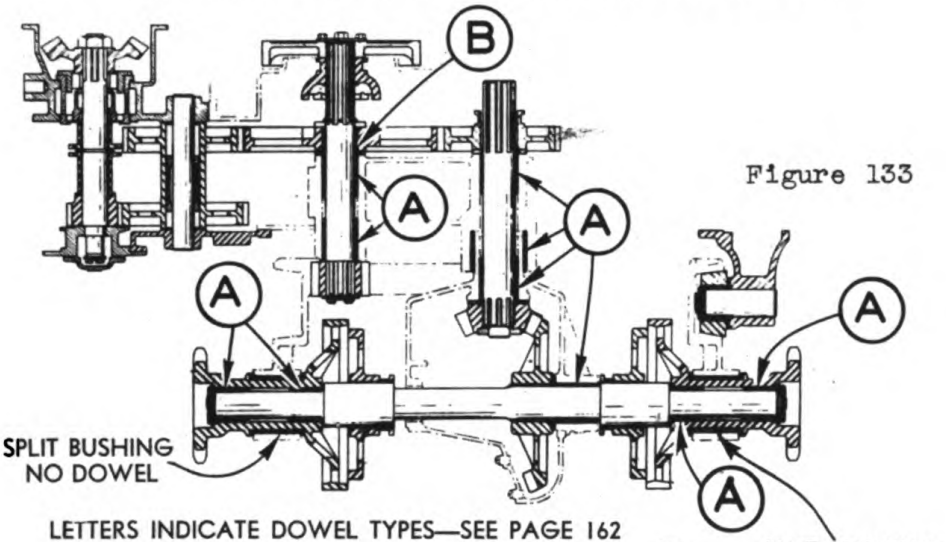


Figure 133

LETTERS INDICATE DOWEL TYPES—SEE PAGE 162

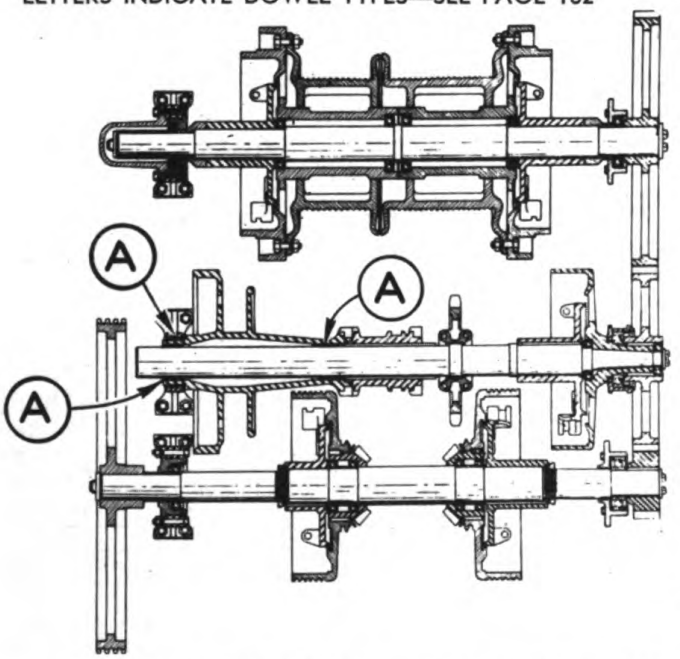
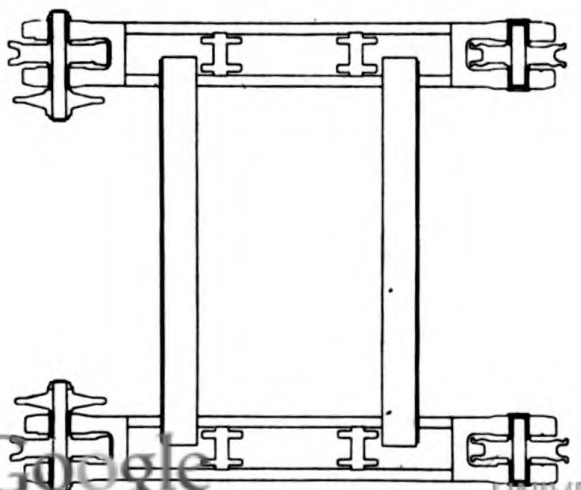


Figure 134

LETTERS INDICATE DOWEL TYPES—SEE PAGE 162



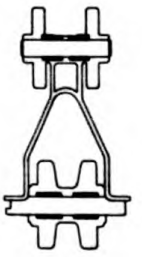


Figure 135

BRONZE BUSHINGS

Replaceable bronze bushings are used at many points in the Koehring Model 304 as shown in Figures (132), (133), (134), and (135).

In normal operation and with proper care these bushings will last indefinitely but occasionally - due to abnormal conditions or improper lubrication - replacements are necessary. Repair bushings are carefully machined so that when correctly installed they will fit the shafts without reaming or scraping. The three methods most generally used for replacing bushings are pressing, pulling and driving. All bushings can be removed and replaced by driving but it is recommended that a press or puller be used wherever possible to reduce the danger of distortion or other damage that frequently occurs when driving bushings in or out of retainers. A simple and easily constructed puller is shown in Figure (136).

TO REMOVE:

Clean part thoroughly by washing with cleaning fluid and examine bushing for dowel pins. NOTE - Figures (132), (133), (134) and (135) show which bushings are dowelled and the types of dowels used. If one or more dowels are present and are of types "A" or "B", drive them out with a hammer and a punch. (It is not necessary to remove type "C" dowel to remove bushing.) Then, using the method best suited to the job, pull, press or drive bushing out. NOTE - In some cases where the bushings are extremely tight or frozen due to abnormal operation, it may be necessary to split the bushings using a round nose or diamond point chisel. WHEN SPLITTING BUSHINGS BE CAREFUL NOT TO DAMAGE THE SURFACES OF THE RETAINING BORES.

TO REPLACE:

File ends of retaining bore and outside surface of bushing just enough to take off sharp edges, then clean all burrs from surfaces of bore and bushing and coat with white lead. Start bushing straight, tapping it lightly with a hammer and then press, pull or drive it in. NOTE - It is extremely important that bushing be started and kept straight. Forcing a bushing - when not started straight - will cause distortion and make it necessary to ream or scrape for fit.

After bushing is in place, drill dowel and grease holes as described under "Dowel Instructions," Page (164).

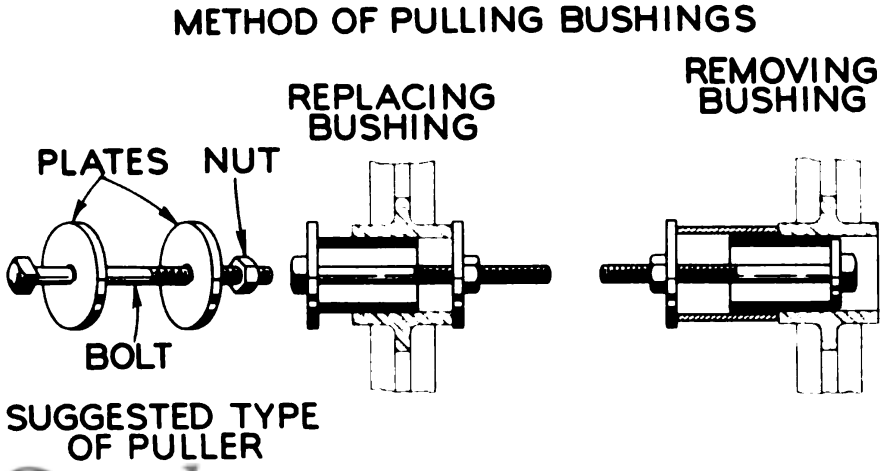
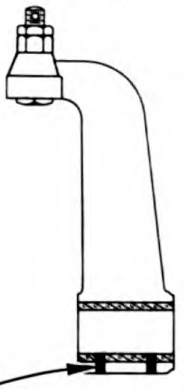


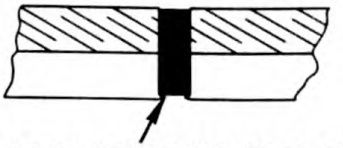
Figure 136

TYPE "A" DOWEL



DOWEL MUST BE DRIVEN OUT BEFORE BUSHING CAN BE REMOVED

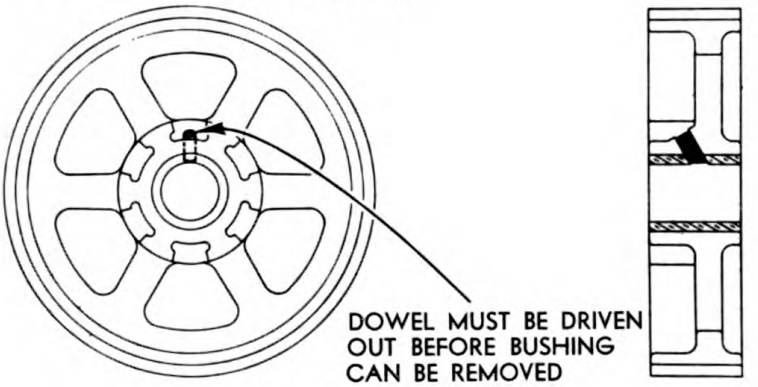
Figure 137



PEEN ENDS OF DOWEL HOLES SO THAT DOWEL PIN IS LOCKED IN PLACE AS SHOWN

TYPE "B" DOWEL

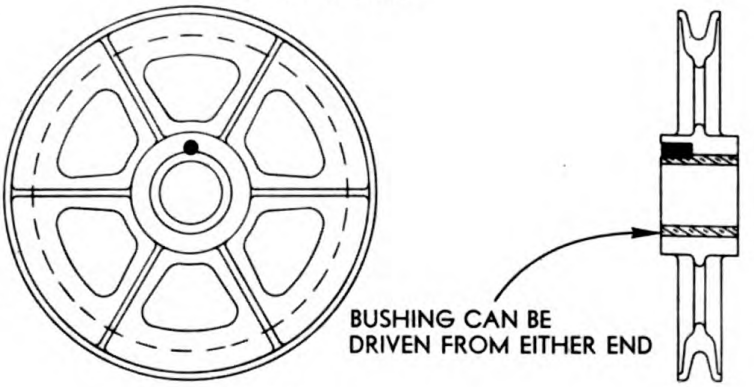
Figure 138



DOWEL MUST BE DRIVEN OUT BEFORE BUSHING CAN BE REMOVED

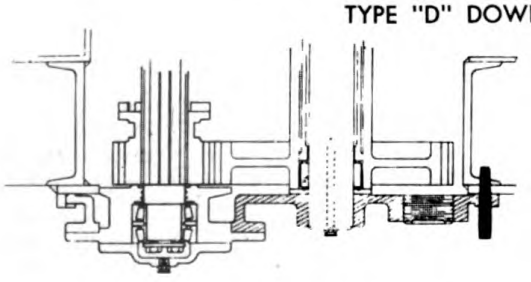
TYPE "C" DOWEL

Figure 139



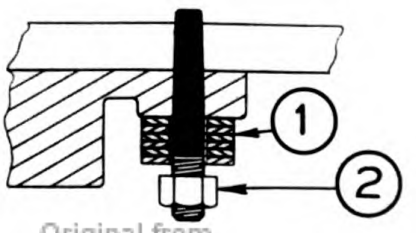
BUSHING CAN BE DRIVEN FROM EITHER END

TYPE "D" DOWEL



TO REMOVE TAPERED DOWEL PIN, PLACE WASHERS OR SPACERS (1) AT POSITION SHOWN THEN TIGHTEN NUT (2) UNTIL PIN RELEASES.

Figure 140



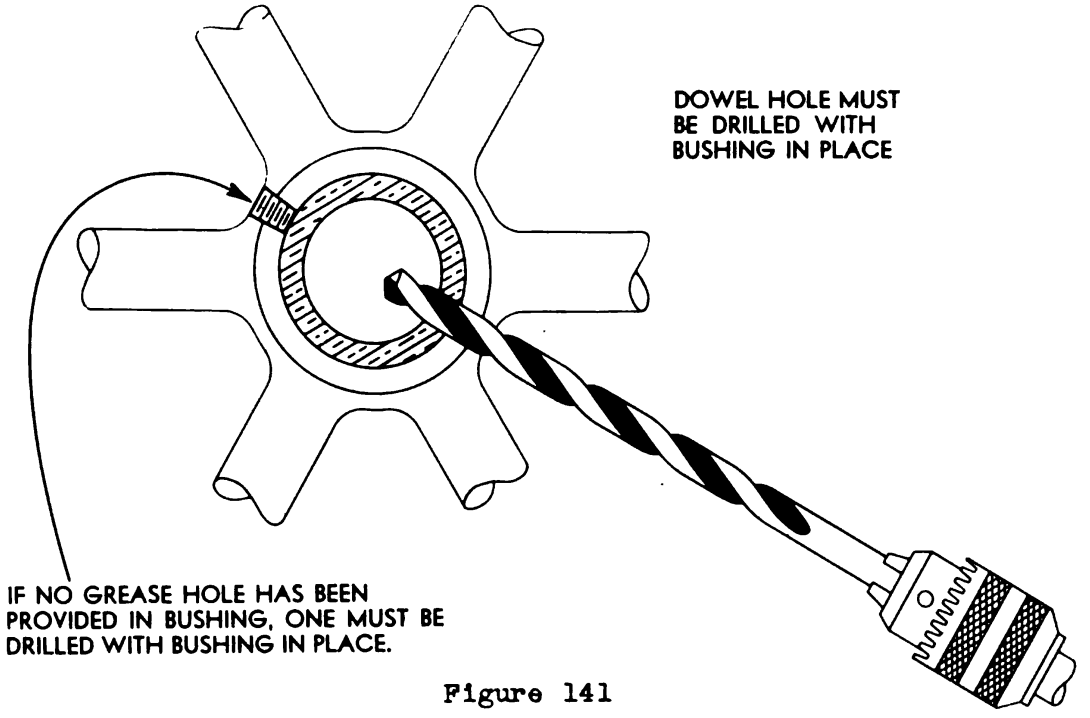


Figure 141

DOWEL INSTRUCTIONS

Dowel pins are used either to retain parts in fixed positions or to preserve alignment.

The various applications of the dowels in the Koehring 304 excavator are shown in Figures (137), (138), (139) and (140), Page (163). All repair parts requiring dowel pins must be drilled on the job as shown in Figure (141).

Where 1/2" or 3/8" brass dowel stock is used at the factory, dowel holes are drilled 1/64" undersize and then reamed to size to assure a good snug fit. This procedure is recommended for repair work in the field whenever the proper tools are available.

Where proper drills and reamers are not available dowel holes may be drilled to size but, as a precautionary measure, dowel stock should be cut slightly short so that ends of dowel hole can be peened to a smaller diameter than the pin so as to lock the pin securely in place. See inset, Figure (137).

Peening should be done with a small ball peened hammer and in such a way that surface of bearing is not distorted. In the event that bearing surface has been distorted by drilling or peening, a bearing scraper or reamer should be used to cut away irregularities. A good smooth surface must always be obtained to assure a satisfactory job. NOTE - Not all bronze bushings are doweled. Size, tolerance and application are factors in determining the use of the dowel pin. Schematic drawings showing the location of all doweled bushings and the type of dowel used can be found on Page (160) and (161).

After a part has been rebushed always check grease hole and grease fitting to be sure they are open, and always coat bushing with clean grease before mounting on shaft. NOTE - <u>If no grease hole has been provided bushing must be drilled. It is best to drill grease hole after bushing is in place.</u>

Figure 142

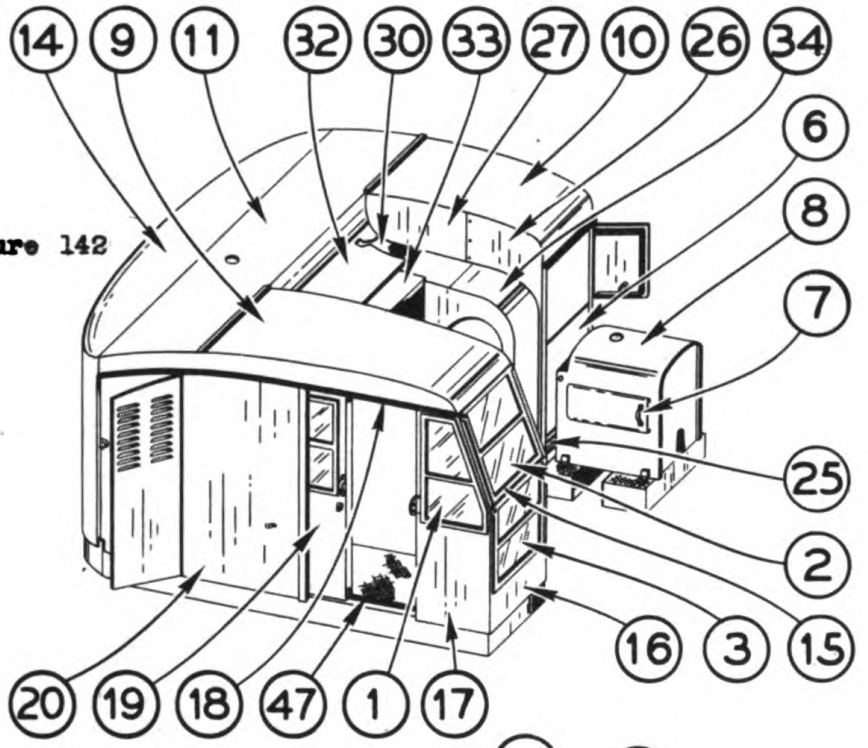


Figure 143

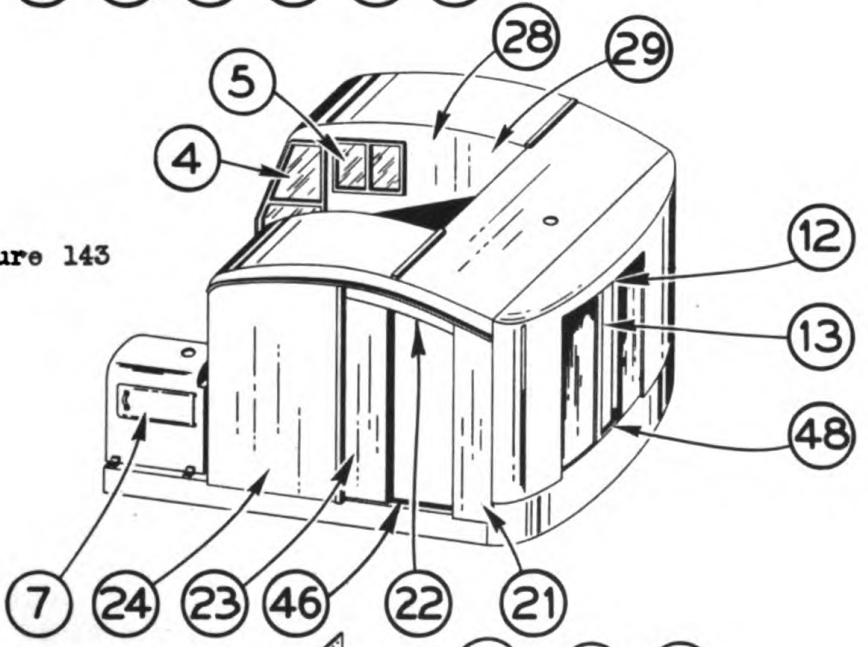
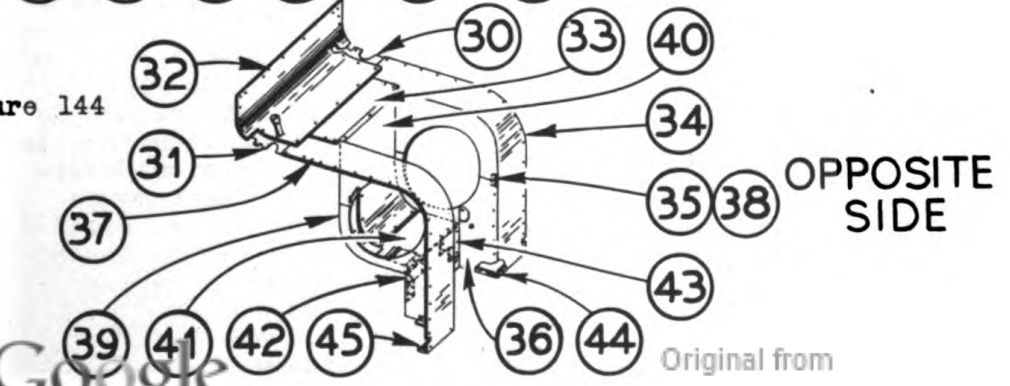


Figure 144



CAB - Figures (142), (143), (144), Page (165)

TO DISASSEMBLE:
The cab is made of steel sheets cut and shaped to fit into the design and in sizes which permit easy removal and replacement of any particular section or of the entire cab. To completely disassemble cab, take off windows (1), (2), (3), (4) and (5), then remove doors (6) and (7). Next take out bolts and remove each section of the cab in the order named below:

8 - Light Plant House
9 - Roof Section
10 - Roof Section
11 - Roof Section
12 - Door Guide
13 - Rear Doors
14 - Cab Back
15 - Tie Bolt and Spacer
16 - Plate
17 - Panel
18 - Door Guide
19 - Door
20 - Panel
21 - Panel
22 - Door Guide
23 - Door
24 - Panel
25 - Member
26 - Panel
27 - Panel
28 - Panel
29 - Panel
30 - Bulkhead Plate
31 - Bulkhead Plate
32 - Bulkhead Section
33 - Bulkhead Plate
34 - Bulkhead Section
35 - Bulkhead Plate
36 - Bulkhead Section
37 - Bulkhead Section
38 - Bulkhead Plate
39 - Bulkhead Section
40 - Bulkhead Section
41 - Bulkhead Section
42 - Bulkhead Plate
43 - Bulkhead Plate
44 - Bulkhead Support
45 - Bulkhead Support
46 - Door Track
47 - Door Track
48 - Door Track

TO INSPECT:
Check all parts for damage. Straighten all bent plates. Paint bare spots to avoid rust. Replace broken glass in windows.

TO REASSEMBLE:
Replace each cab part in the order named below. NOTE - Several small drift pins will help materially in the lining up of holes in the various parts.

48 - Door Track
47 - Door Track
46 - Door Track
45 - Bulkhead Support
44 - Bulkhead Support
43 - Bulkhead Plate
42 - Bulkhead Plate
41 - Bulkhead Section
40 - Bulkhead Section
39 - Bulkhead Section
38 - Bulkhead Plate
37 - Bulkhead Section
36 - Bulkhead Section
35 - Bulkhead Plate
34 - Bulkhead Section
33 - Bulkhead Plate
32 - Bulkhead Section
31 - Bulkhead Plate
30 - Bulkhead Plate
29 - Panel
28 - Panel
27 - Panel
26 - Panel
25 - Member
24 - Panel
23 - Door
22 - Door Guide
21 - Panel
20 - Panel
19 - Door
18 - Door Guide
17 - Panel
16 - Plate
15 - Tie Bolt and Spacer
14 - Cab Back
13 - Rear Door
12 - Door Guide
11 - Roof Section
10 - Roof Section
9 - Roof Section
8 - Light Plant House
7 - Door
6 - Door
5 - Window
4 - Window
3 - Window
2 - Window
1 - Window

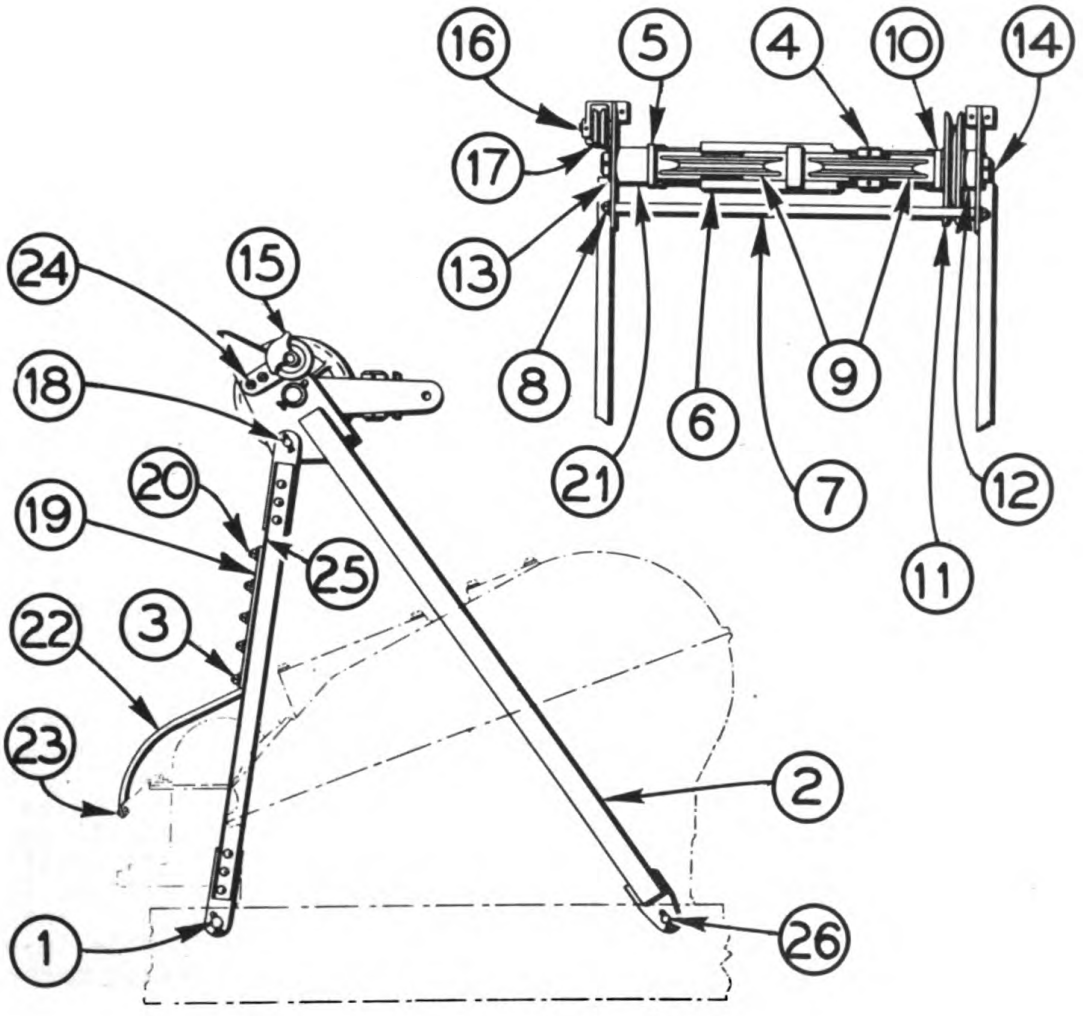


Figure 145

"A" FRAME (GANTRY)

TO REMOVE:

If crane or some other means of lifting complete assembly from machine is available, detach guards (22) by removing bolts (23) and (3). Pull cotters of pins (1) and (26) and remove pins from bases of compression members (2) and tension members (25). Raise assembly high enough to clear machinery, swing to one side and lower assembly to the ground.

If "A" frame cannot be lifted off as a complete assembly it can be disassembled on the machine.

TO DISASSEMBLE:

Close and pull cotters of pins (4) and remove pins and sheaves (9). Pull cotter of pin (16) then remove pin and sheave (17). Take out bolts (24) and remove sheave bracket (15). Next close and pull cotters of shaft (14), remove washer (13) and take out shaft, removing spacer (21), dead end hanger (5), "A" frame yoke (6), spacer (10), sheave (11) and spacer (12) as they are freed. Remove tie rod (8) and spacer (7). Take out bolts (20) and remove support plate (19). Next close and pull cotters of pins (18) and remove pins. NOTE - If disassembled on the machine, remove cotters of pins (26) and remove pins, then lift out compression members (2). Now remove pins (1) from tension members and lift out members.

TO INSPECT:

Check all sheaves, bushings and pins for wear. Examine compression members (2), tension members (25) and yoke (6) for cracks and repair, by welding, any that may be found. Check shaft (14) and if bent, straighten or replace. If spacer (7) or tie rod (8) is bent it may be straightened but if badly damaged, it should be replaced. Examine grease fittings to be sure they are open and replace any that are damaged.

TO REASSEMBLE:

If reassembly is being done on the machine, place tension members (25) into position; line up holes in the members with holes in the turntable and insert pins (1).

Next place compression members into position on the turntable; line up holes in compression members with holes in the turntable and insert pins (26). To reassemble the remaining parts on the machine or on the ground, continue as follows: Line up holes of compression member with holes in tension member; insert pin (18); insert and open cotters. Place support plate (19) into position and fasten with bolts (20). Place spacer (7) into position; line up holes in spacer with holes in compression members (2); insert tie rod (8) and tighten. Start shaft (14) through hole in one compression member (2) and push shaft through to opposite member, mounting spacer (21), dead end hanger (5), yoke (6), spacer (10), sheave (11) and spacer (12) in the order shown in Figure (145). Slip one of the washers (13) on each end of the shaft; insert and open cotters. Place sheave (17) into position in bracket (15); line up bore of sheave with holes in bracket; insert pin (16); insert cotters and open. Lift sheave assembly into place on compression member (2); line up holes, insert bolts (24) and tighten. Lift sheaves (9) into position in yoke (6); line up holes and insert pins (4), locking them into place with lock pin and cotter.

TO REPLACE:

If "A" frame is assembled on the ground, use a crane or other means to lift and swing it into position. Line up holes at bases of tension and compression members with holes in turntable; insert pins (1) and (26); insert cotters into pins and open.

Place guards (22) into position; line up holes of guards with holes of support plate (19); insert bolts (23) and (3) and tighten.

If "A" frame is assembled on the machine, replacement is made when reassembly is completed.

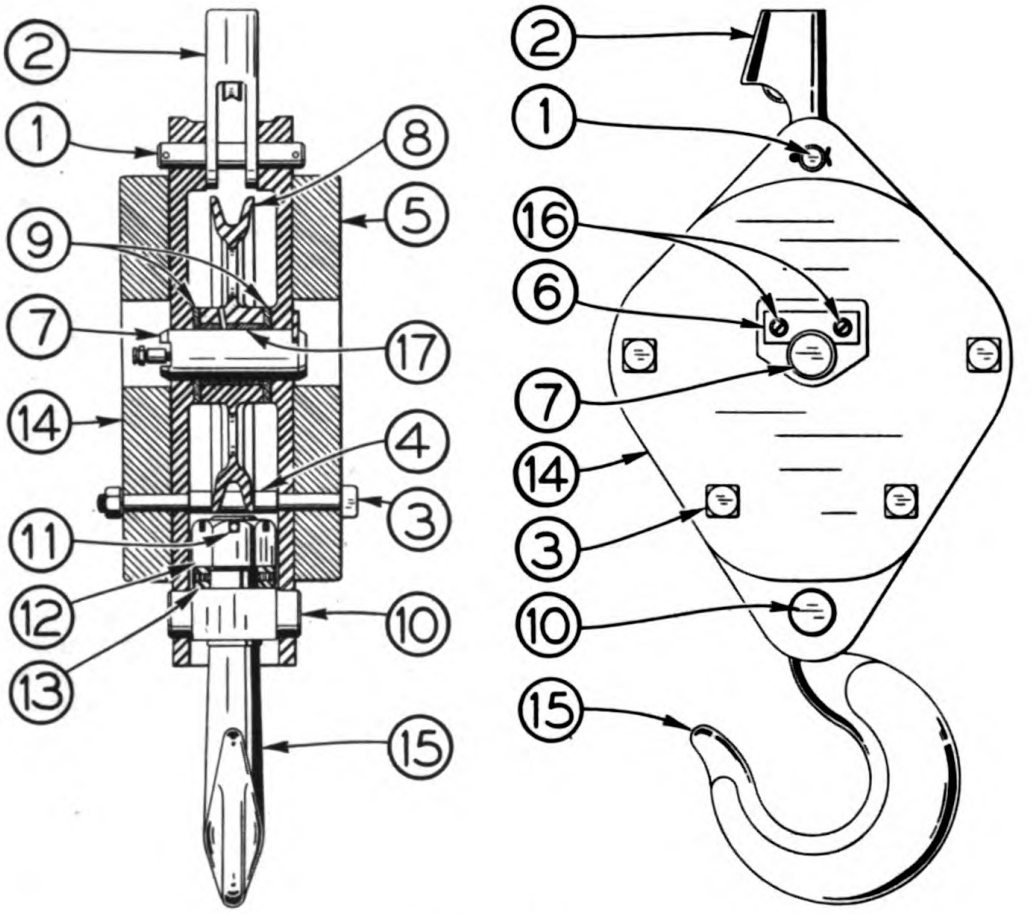


Figure 146

CRANE HOOK

TO REMOVE:

For removal of hook block (two or three part line) see Operation Section, Pages (81) and (82).

TO DISASSEMBLE:

Close and pull cotter of pin (1) and remove pin and rope socket (2). Take out four bolts (3) and remove cheek weights (5) and four pipe spacers (4). Remove capscrews (16); take off keeper plate (6) and pull pin (7). Lift off housing plate (14) being careful not to damage flat washer (9). Straighten and pull locking pin (11); unscrew nut (12) and slip bearing (13) and pin (10) from shank of hook (15).

TO INSPECT:

Examine housing plates (14) and hook (15) for cracks. Cracks in housing plate may be welded and reinforced but if any are found in hook, discard and replace with new one. Check sheave (8), bushing (17), pins (1), (7) and (10) and bearing (13) for wear and renew if necessary. If bushing (17) is renewed see "Dowel Instructions", Page (164). Check grease fitting and renew if damaged.

TO REASSEMBLE:

Slip pin (10) and bearing (13) on shank of hook (15), screw on nut (12) until snug and secure with lock pin (11). CAUTION - Pin (10) must rotate freely on shank of hook (15). Insert bolts (3) in one cheek weight (5) and lay on flat surface with bolts up. Line up holes in one housing plate (14) with bolts in cheek weight and lower into place. Next, enter pins (7) and (10) into holes provided for them in housing plate and slip sheave (8), with one flat washer (9) on each side, on pin (7). Put pipe spacers (4) on bolts and then set second housing plate (14) in place. Secure pin (7) with lock plate (6) and capscrews (16), then set second cheek weight (5) in place and screw nuts on bolts (3) and tighten. Place cable socket (2) in position in hook block, insert pin (1) and secure with cotter.

TO REPLACE:

For replacement of hook block (two or three part line), see instructions on Pages (81) and (82), Operation Section. Be sure to grease well before using.

TO REMOVE: TAGLINE

Lower boom to a point that will bring tagline into the most convenient position for removal, then set swing, travel and hoist brakes securely. Detach cable (1) from clamshell bucket. Remove "U" bolt (2) and four machine bolts (3) from boom brackets. Pull tagline out of boom, drum end first, and lower it to the ground.

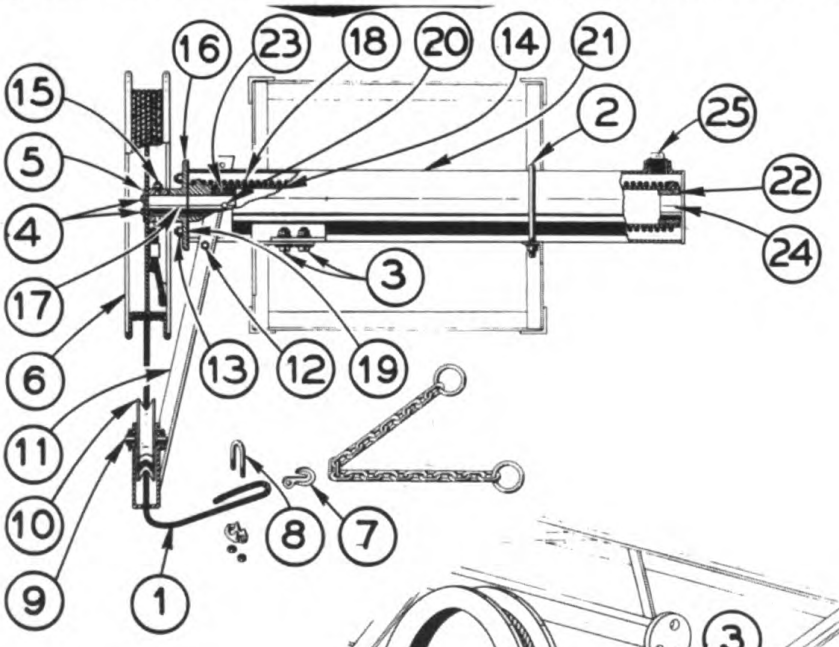


Figure 148

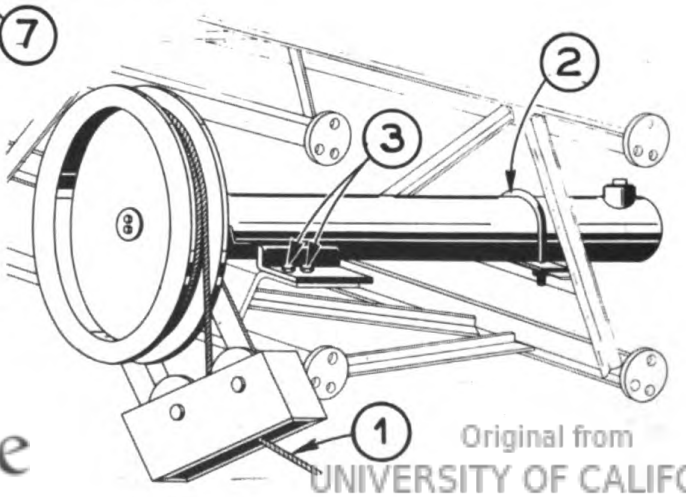


Figure 147

TO DISASSEMBLE:

Take off hook (7) by removing cable clamps (8) and remove cable (1) from drum. Close and pull cotters from pins (9) and remove pins (9) and sheaves (10) from tagline fairlead (11). Remove two capscrews (4), keeper plate (5), bolt (15), and take off drum (6). Next take out two machine bolts (12) and remove fairlead (11). Then remove four nuts (13) and pull off bearing (16), twisting it to the right or clockwise to disengage spring (18) from bearing. Be careful not to damage gasket (19). Remove tube assembly (14) and spring (18) from housing (21) by pulling on shaft (17). Spring (18) now is free to be pulled from tube assembly (14). Shaft (17) is then removed by taking out pin (20). Propeller (22) and bushing (23) may be removed from tube (14) by burning them loose with a cutting torch.

TO INSPECT:

Clean thoroughly and closely examine drum (6), fairlead (11) and housing (21) for cracks and if any are found, repair by welding. Check shaft (17) and bearing (16) for wear and renew if necessary. If hooks at either end of spring (18) are broken, new hooks may be formed by heating and bending spring ends. If spring is broken near center, replace with new one. Examine sheaves (10) and sheave pins (9) for wear and renew if necessary. Check propeller (22) and if propeller lug has broken off, repair by welding and if worn badly, replace.

TO REASSEMBLE:

If bushing (23) and propeller (22) have been removed, place new parts in position in tube (14) and weld. Next place shaft (17) in position in bushing (23); line up holes and secure with pin (20). Slip spring (18) on tube assembly (14), starting it over shaft end and slide spring and tube into housing (21). Make sure that propeller (22) is in place on pilot (24) by removing pipe plug (25) and looking through opening. Mount bearing (16) on shaft (17); line up holes with housing bolts and tighten with nuts (13) after making sure that gasket (19) is in place. Mount fairlead (11) in position on housing and secure with bolts (12). Place sheaves (10) in position in fairlead (11); insert sheave pins (9) and lock into place with cotters. Be sure grease holes and grease fittings are open. Mount drum (6) on shaft (17); line up hole in hub of drum with hole in shaft; insert bolt (15) and tighten. Place keeper plate (5) in position on end of shaft (17); line up holes; insert cap screws (4) and tighten.

TO REPLACE:

Place tagline in position on brackets in boom. Line up holes in tagline bracket with holes in boom bracket; insert four bolts (3) and "U" bolt (2) and tighten. Reeve cable as shown.

CRANE - DRAGLINE - CLAMSHELL - PILE DRIVER BOOM
FIGURES (149), (150), (151) and (152), PAGE 173

TO REMOVE:

For removal of the complete crane boom assembly - which is the same as used for dragline, clamshell and pile driver service - follow instructions on Page (97), Operation Section.

TO DISASSEMBLE:

With boom well supported on cribbing, as shown in Figure (149), Page (173), split boom into two sections by removing bolts (1) at each joint. (NOTE - Cable guard (2) can be taken off separately.)

Crane, Clamshell, Dragline and Pile Driver boom point sheave assembly shown in Figure (150), Page (173), is disassembled by taking out bolts (3), removing cable guard (4), taking out eight bolts (5) and removing guards (6) and (7). Next, take out cotters (8) and remove washer (10) and spacers (11). Slowly drive shaft (9) out of yoke (12), taking off boom suspension sheaves (13), spacers (14), hoisting sheaves (15) and thrust washer (16) as they are freed from the shaft (9). To disassemble boom suspension sheave block assembly, figure 149, close and pull cotter from pin (17); take out pin and remove block assembly from bracket (18). Next close and pull cotter in pin (19); take out pin and remove sheave (20) from housing (21). Remove bolts and take off bracket (18).

To remove boom point yoke (12) and reinforcing pad (22) cut or burn off heads of rivets (23) and punch them out.

TO INSPECT:

Examine babbitted bearings in boom foot and if worn badly, renew. NOTE - When rebabbitting use a shaft of the same diameter as the boom foot pins extending through both holes in the boom foot to locate centers so that boom will be in proper alignment when mounted on the machine.

Check boom foot pins for wear. Check boom carefully for cracks and bent chords (24) or struts (25). Repair cracked members by welding and if there is any question about strength after welding, add a reinforcing member by welding it to the weakened member as shown in Figure (151). The quickest method of straightening bent struts is to use a jack as shown in Figure (152). Blocking must be used with a jack to distribute the straightening loads over several members on the opposite side of the boom. NOTE - Always locate blocking so that load is taken at the ends of struts near the chords rather than at centers between chords. When straightening heavier members such as chords or extremely sharp and angular kinks in lighter members, always apply heat with welding torch to soften steel for straightening. To inspect boom point sheave assembly examine shaft (9), thrust washer (16) and bushings of sheaves (15) and (13) for wear. (See "Dowel Instructions", Page (164).) Note condition of sheave grooves and if sides of groove are worn thin or sharp, renew. Examine boom point yoke (12) closely for cracks and weld any that are found. If yoke is damaged beyond repair, replace. Check boom suspension sheave (20), bushing and pin for wear. If housing (21) or bracket (18) are cracked, repair by welding.

CRANE, CLAMSHELL, DRAGLINE, PILE DRIVER BOOM

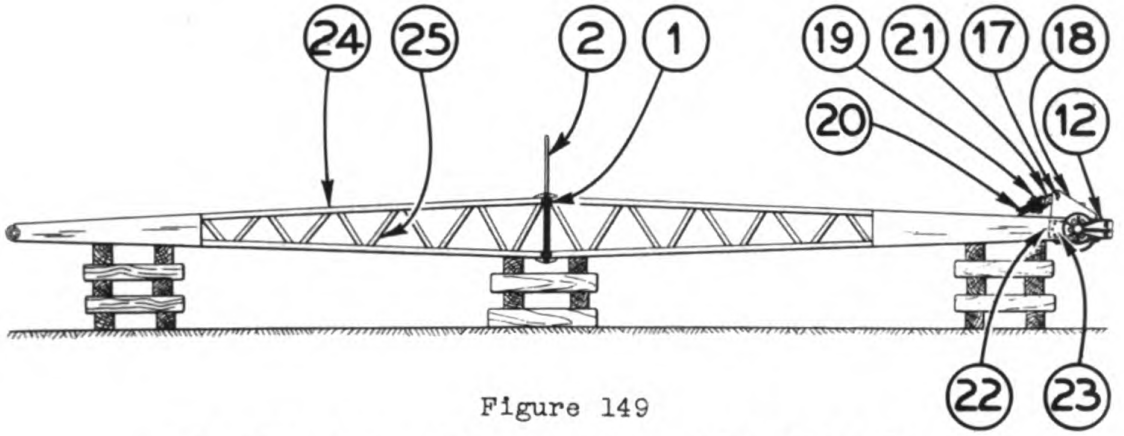


Figure 149

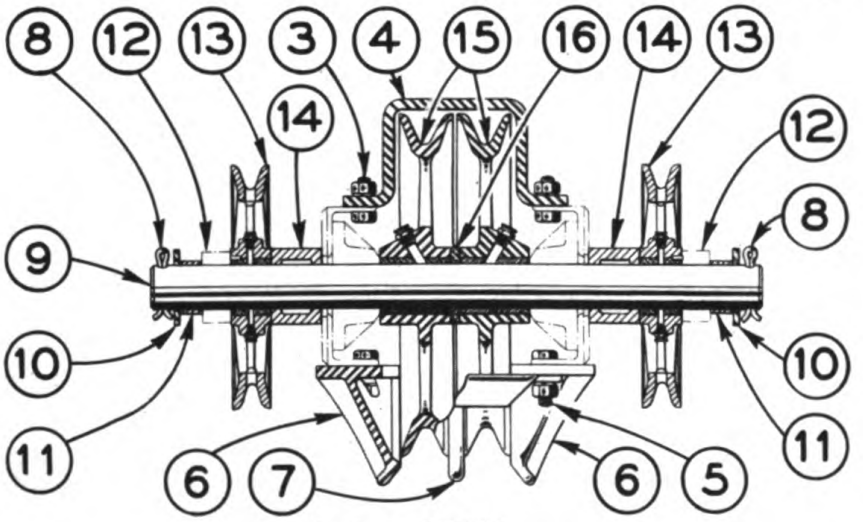


Figure 150

Figure 151

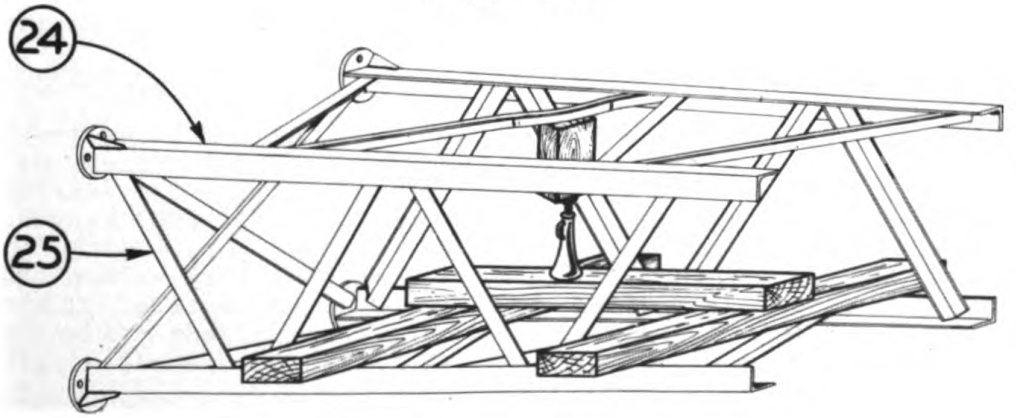


Figure 152

TO REASSEMBLE:

If boom point yoke (12) has been removed for repair place it and the reinforcing pad (22) in position on boom point; line up rivet holes; insert four machine bolts - two on each side - to hold yoke in place for riveting. NOTE - Be sure all holes will take 3/4" rivets. It might be necessary to file or ream some of the holes for fit. Heat rivets to a bright cherry red, insert into holes - one at a time - and rivet. If riveting tools are not available, use a sledge hammer for riveting and another heavy hammer or shaft for bucking up.

Start shaft (9) through boss in yoke (12) and mount sheaves, spacers and thrust washer for crane, clamshell, dragline or pile driver in the order shown in Figure (150), Page (173), replace spacer (11), washers (10) and cotters (8). Mount guard (4) and secure with bolts (3). Place guards (6) into position and line up inside holes of guard with holes in boom point. Insert two bolts in center holes of each guard and tighten. Lift guard (7) into position; line up holes with the end holes of each guard (6); insert four bolts (5) and tighten.

Mount bracket (18) and fasten with bolts. Place housing (21) into position in bracket (18), line up holes; insert pin and lock in place with lock pin and cotter. Be sure bent end of lock pin is entered into hole provided for it in bracket before inserting and opening cotter. Place sheave into housing; line up holes; insert pin and secure with lock pin and cotter. Place sections of boom into position; line up holes in butt plates of each section; insert bolts (1) and tighten. Mount cable guard on the sides of boom; line up holes with side holes in butt plate; insert bolts and tighten.

TO REPLACE:

To replace crane, clamshell, dragline or pile driver boom see instructions on Page (97), Operation Section.

DRAGLINE FAIRLEAD
Figures 153 and 154

NOTE - Because of the weight of the dragline fairlead it can be disassembled more conveniently by suspending it at a suitable height with the drag cable as shown in Figure (154), Page (176).

TO REMOVE:

Remove bolts (1) and allow fairlead to roll down on drag cable to desired height from the ground.

TO DISASSEMBLE FAIRLEAD:

Remove plug (2) from opening at top of base (3), then tip base enough to allow the removal of balls (4) through opening. After balls have been removed, pull frame (5) out of base (3) slightly and remove rollers (6). CAUTION - Do not lose balls or rollers. The correct number - 22 balls and 31 rollers - will be needed for reassembly. Fairlead may now be lowered to the ground for more convenient disassembly. Detach drag cable (7) from cable socket (8) and remove cable from fairlead. Take out capscrews (9) and remove bushings (10). Next drive out sheave pins (11) and remove sheaves (12). Take out cap screws (13) and remove caps (14) and roller assemblies (15).

TO DISASSEMBLE ROLLER ASSEMBLIES:

Remove gease fitting (16); bend down lock plate (17) then take out grease studs (18), lock plate (17), washer (19), shims (20) and spacer (21). Pull shaft (22) out of roller tube (23). To remove grease retainer (24), bearing (25) and grease seals (26), drive them out with a small shaft. NOTE - When driving out bearings, retainers and seals, shaft should be inserted into one end of the tube to drive parts from the opposite end. Tap driving shaft just hard enough to release parts for removal. BE CAREFUL NOT TO BEND RETAINERS.

TO INSPECT ROLLER ASSEMBLIES:

Check roller tubes (23) for wear and shafts (22) for alignment. If shafts are bent, replace. Check grease seals for damage or wear and replace if necessary. Bearings (25) should be checked for wear and chipped or cracked rollers. Retainers (24) might have been bent in removal and if unable to straighten, replace.

TO REASSEMBLE ROLLER ASSEMBLIES:

Insert retainers (24) in tubes (23) - one retainer in each tube - then start outer races of bearings (25), large diameters of beveled surfaces up, and tap into place on tops of retainers (24). Place bearings (25) into position in outer races and start grease seals (26) into tubes, tapping them down into place with a hammer. Insert shafts (22) into roller tubes being sure that shoulders at ends of shafts enter grease shields (26). Next place, at the other ends of the shafts, retainers (24), bearings (25) and grease shields (26) in the tubes. Next slip spacers (21) over shafts and into

DRAGLINE FAIRLEAD

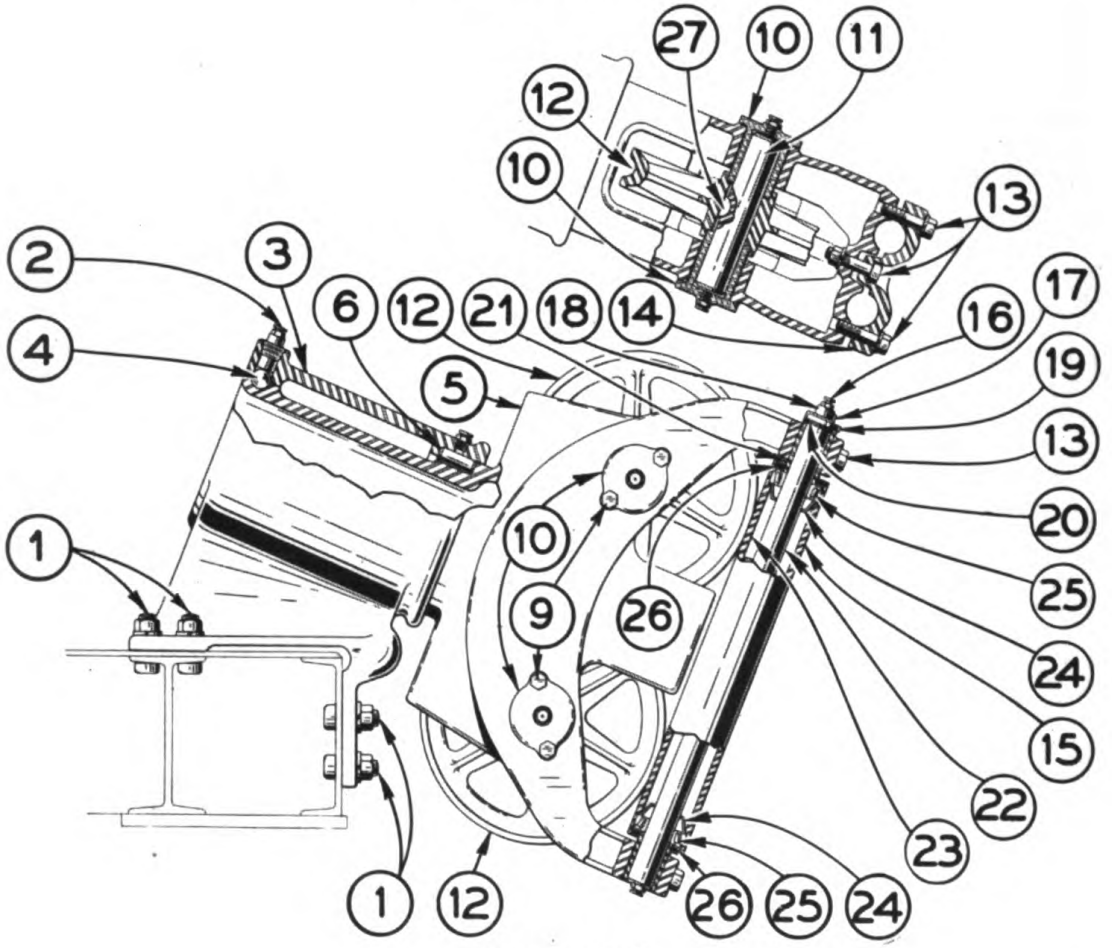


Figure 153

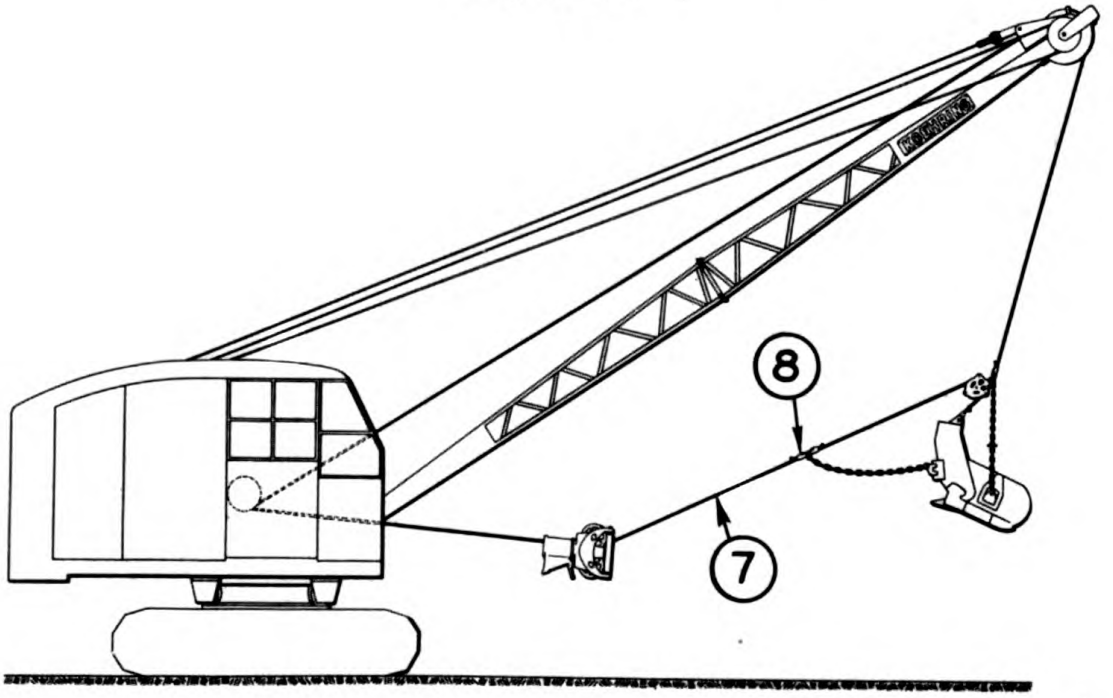


Figure 154

grease seals, then place shims (20), keeper plate (19) and lock plates (17) into position and tighten with grease studs (18). Now test roller assemblies and if they revolve freely on shafts, with no end play, they are in proper adjustment. If adjustment is necessary, add more shims (20) if rollers are tight on shafts or take out shims if rollers have end play or are too loose on shafts. Next bend up lock plates (17).

TO INSPECT FAIRLEAD:

Check bushings (10), pins (11) and sheaves (12) for wear. If fairlead base (3) or frame (5) is cracked, repair by welding or, if damaged beyond repair, discard and install new parts. If rollers (6) or balls (4) are worn or chipped, replace. Check all grease fittings to be sure they are open and replace all that are damaged.

TO ASSEMBLE FAIRLEAD:

Mount roller assemblies on fairlead frame (5), line up holes and secure with caps (14) and capscrews (13). Tap keys (27) into place in sheave pins (11) and then, after positioning sheaves (12) in fairlead frame, insert pins, making sure that keys (27) line up with keyways in sheaves before tapping them in. Place bushings (10) in position on sheave pins (11) and secure to fairlead frame with capscrews (9). Next place rollers (6) in groove of fairlead frame hub and tie with wire to temporarily hold them in position while slipping the hub of frame into fairlead base. Remove temporary tie wire when rollers start into base. Next drop balls (4) into opening in fairlead base, then close opening by screwing in plug (2).

TO REPLACE FAIRLEAD:

Thread free end of drag cable through fairlead and attach cable to dragline bucket; hoist bucket until drag cable is high enough to permit sliding fairlead into position; line up holes in base of fairlead with holes in turntable; insert bolts (1) and tighten. Be sure fairlead is well greased before using.

SHOVEL ATTACHMENT

NOTE - Before removal of dipper for repairs, it is more convenient to disassemble dipper while attached to dipper sticks. Lower dipper to the ground so that it rests on the dipper latch keeper with teeth about 2 feet from the ground, then proceed as follows:

DIPPER TEETH

TO REMOVE:

Close and pull out cotter (1). Insert wedge as shown in inset ("A") (Figure 155) and drive with sledge hammer until tooth is released from socket. Pull out tooth and remove wedge.

TO INSPECT:

Check for wear. If dull or not worn more than 2" from original length, sharpen by heating and drawing. If worn more than 2", rebuild by welding or renew.

TO REPLACE:

Insert tooth in socket and drive down with sledge hammer until cotter can be inserted in hole.

NOTE - Koehring dipper teeth are reversible and if only slightly worn, they may be taken out, turned and replaced to bring cutting edge to bottom side.

DIPPER FRONT (Figure 155)

The dipper front is of one piece and all manganese. Replacement of the front due to wear is rarely necessary. Accidents or abuse might cause cracks which will necessitate replacement.

TO REMOVE:

Remove teeth as described under "Dipper Teeth". Next burn or cut off all rivets (2) and remove front.

TO REPLACE:

Line up holes of dipper front with holes in dipper side and rivet. Install teeth as described under "Dipper Teeth".

DIPPER LATCH (Inset "B") (Figure 155)

TO REMOVE:

Detach chain (3) from lever (4). Remove bolts (5) and (6), take off lever (4) and lift out latch bar (7). Remove adjusting bolt (10) by unscrewing nuts (8) and (9).

TO INSPECT:

Check all bolts and holes for wear. If latch bar shows extreme wear at latch end, build up by welding and grind smooth to prevent bar from sticking in latch keeper at bottom of dipper front.

TO REPLACE:

Place latch bar (7) through members (24) and (11). Replace adjusting bolt (10) leaving nuts (8) and (9) loose (for adjustment after assembly). Position lever (4). Insert bolts (5) and (6), tighten them and lock with cotters. Attach chain and adjust as described under "Operating Adjustments", Page 102.

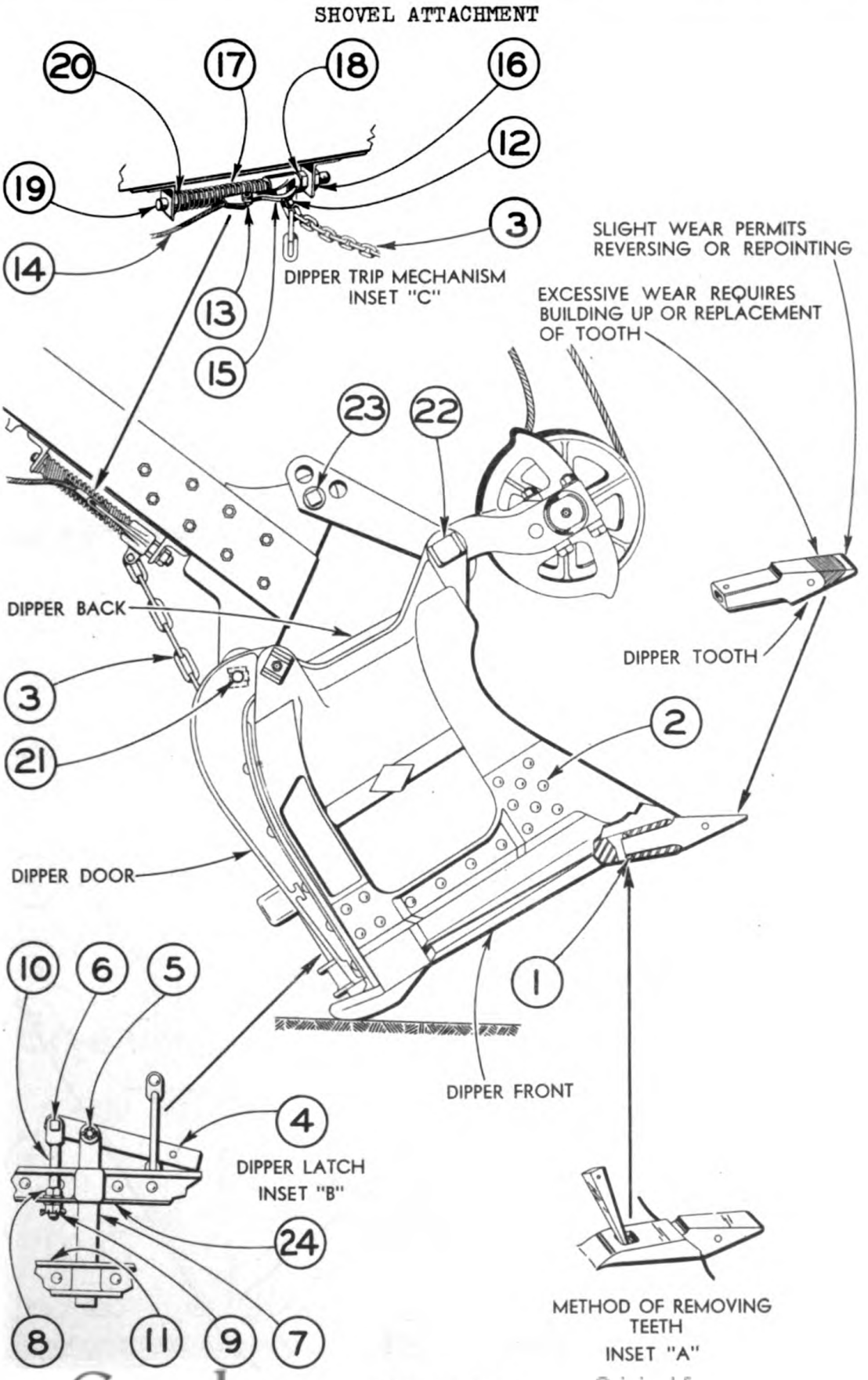


Figure 155

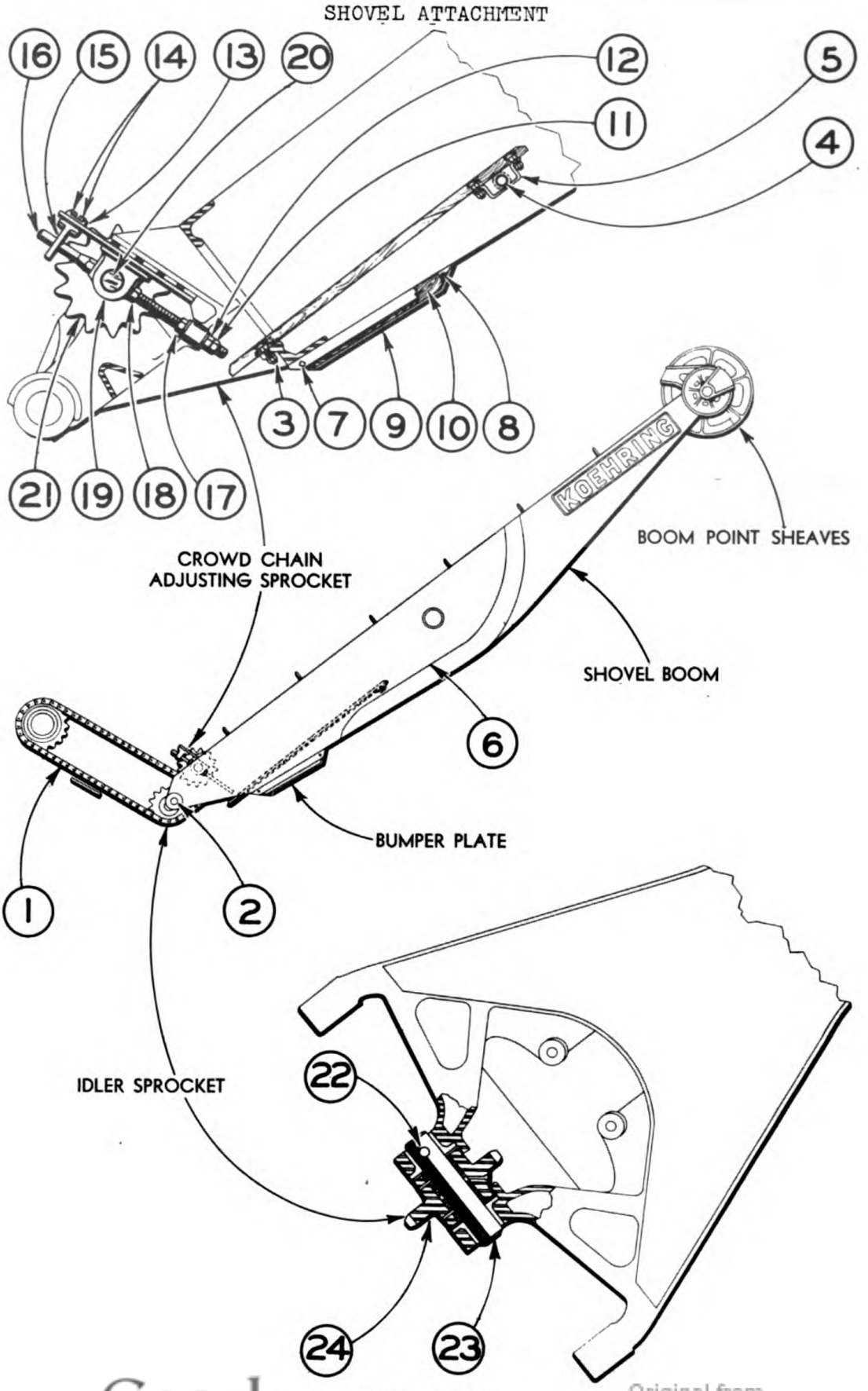


Figure 156

SHOVEL ATTACHMENT

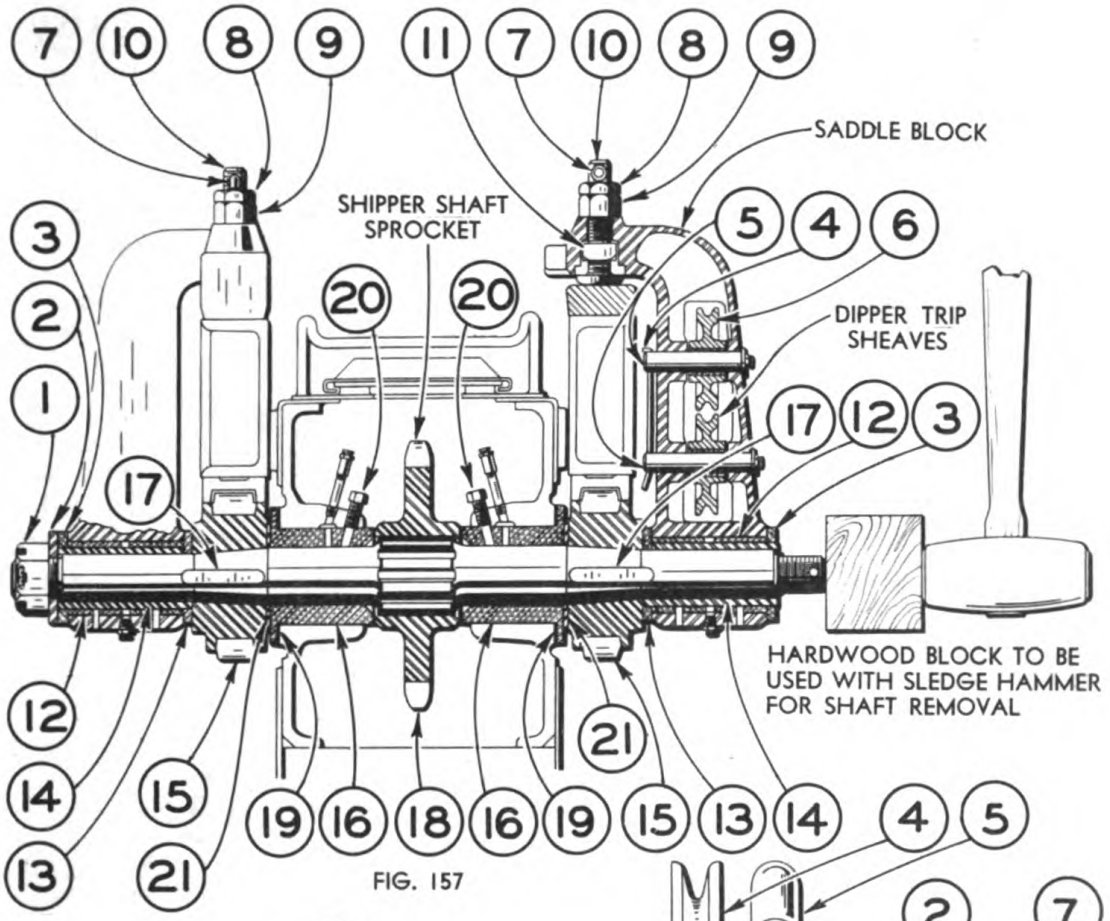
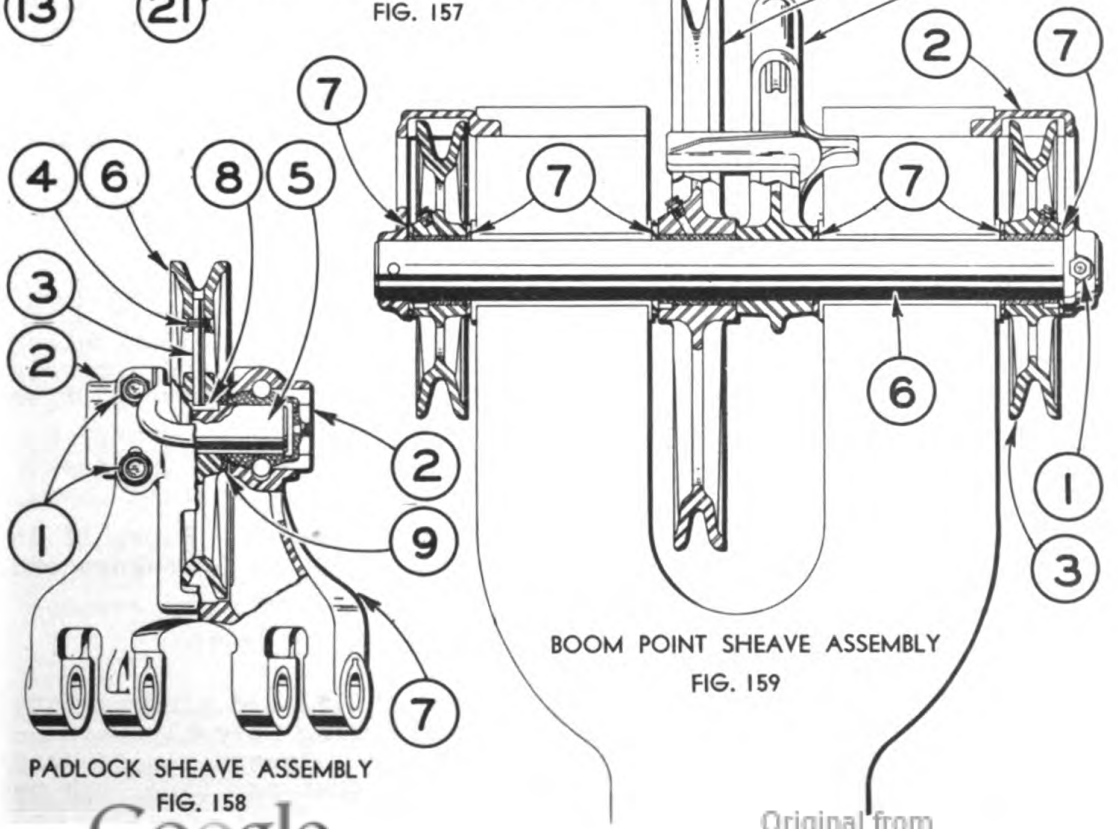


FIG. 157



BOOM POINT SHEAVE ASSEMBLY

FIG. 159

PADLOCK SHEAVE ASSEMBLY

FIG. 158

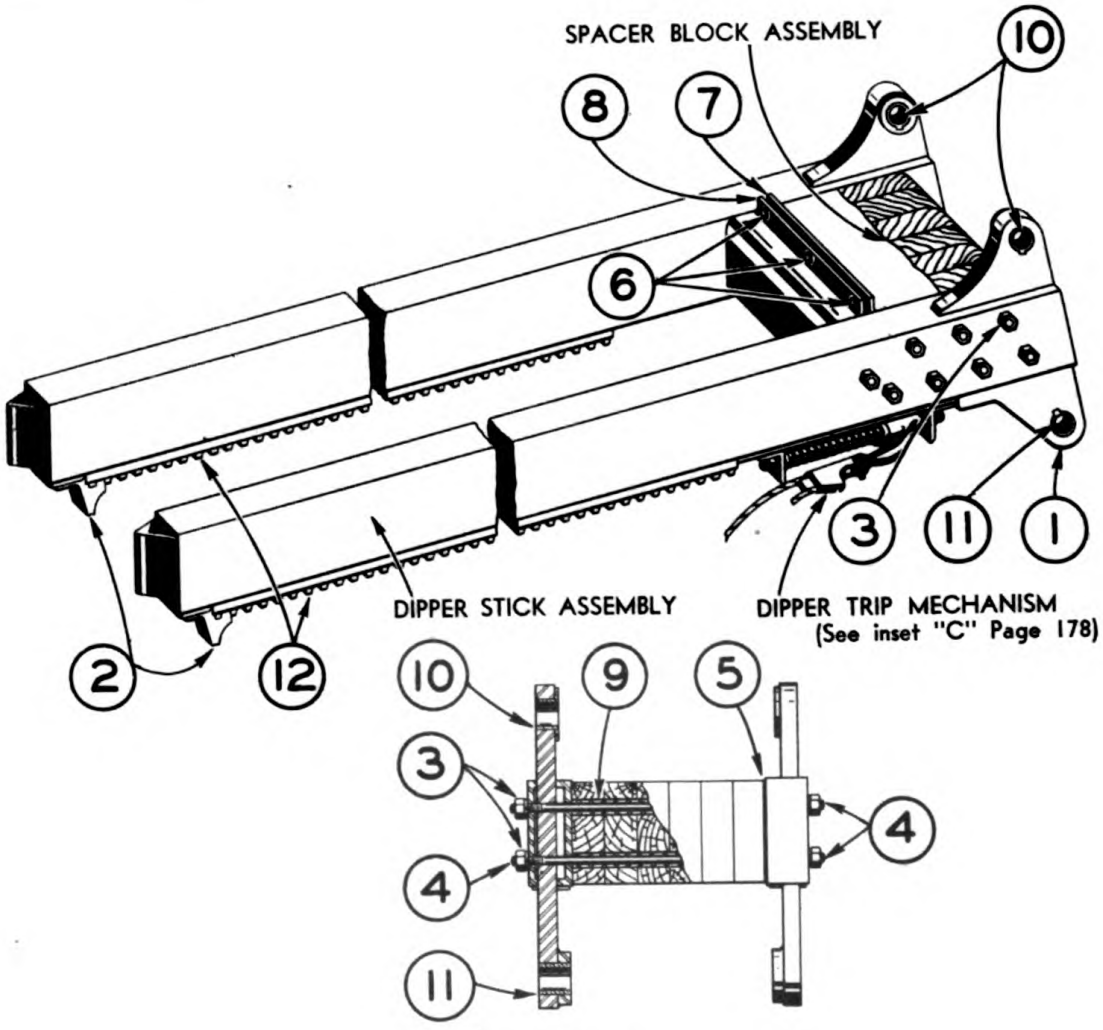


Figure 160

DIPPER TRIP MECHANISM (See Inset "C"), Page (179).

TO REMOVE:

Remove bolt (12) and detach chain (3). Remove bolt (13) and detach trip cable (14) from plunger (15). Remove nut (16) and compress spring (17) enough to allow removal of nut (18). Remove plunger rod (19), plunger (15), spring (17) and washer (20).

TO INSPECT:

Inspect plunger rod and plunger for wear or damage. Renew if in bad condition. Inspect spring for compression or breakage and replace if required.

TO REPLACE:

Insert washer (20) into one end of spring (17) and plunger (15) into other end. Place washer, plunger and spring assembly between brackets on the sticks and line up the holes. Insert plunger rod (19), then compress spring (17) enough so that nut (18) can be screwed on plunger rod (19) approximately 2". Place threaded end of plunger rod (19) through bracket and fasten with nut (16).

DIPPER DOOR (See Figure 155, Page 179).

TO REMOVE:
Place dipper on ground so that it is flat on its front. Detach chain (3) at latch lever (4). Close and pull cotters from door hinge pins and remove pins. Step to one side for safety, then with pinch bar placed between hinge and dipper back, pry door out and let it fall to ground.

TO INSPECT:
Check hinge bushings for wear and replace if necessary. Check door for distortion and cracks around hinges and reinforcing members. If bent, heat and straighten with sledge hammer. If cracked, repair by welding.

TO REPLACE:
With the assistance of a helper, place front of door on latch keeper, then raise door and insert hinges into hinge bosses, line up holes, insert hinge pins, insert cotters and open.

DIPPER BACK (See Figure 155, Page 179).

TO REMOVE:
Close and pull cotters on stick foot pins (21) and remove pins. Remove pins (22). Using pins (22) for the purpose, connect dipper sheave block to adjusting links, then hoist sticks clear of bucket.

TO INSPECT:
Check all bushings and pins for wear. Examine dipper back for cracks and weld any that appear.

TO REPLACE:
Lower sticks into position; line up holes in stick foot with holes in bottom bosses of dipper back; insert stick foot pins; insert cotters and open. Allow enough slack in hoist line to lower adjusting links to position; remove pins (22) releasing adjusting links from dipper sheave block and drop adjusting links into place; line up holes, insert pins, insert cotters and open.

DIPPER ADJUSTING LINKS (See Figure 155, Page 179).

TO REMOVE:
With dipper resting on the ground on its front, remove adjusting link bolts (23) and spacers. Remove sheave block pins (22). Lift adjusting links off.

TO INSPECT:
Check all holes, bolts, spacers and pins for wear and if badly worn, replace.

TO REPLACE:
Replace adjusting links; line up all holes and insert bolts, spacers and pins.

DIPPER SHEAVE BLOCK (See Figure 158, Page 181).

TO REMOVE:
Lower dipper to ground so that it rests on its front. Remove dipper sheave block pins (22) Figure 155. Swing block clear of bucket and lower to ground. Next remove 4 bolts (1) and take out journals (2). Remove cotter from pin (3) and pull pin, being careful not to lose washers (4). Shaft (5) can now be removed and sheave (6) and washers (8) can be lifted from block (7). Remove key (12) from shaft.

TO INSPECT:
Check journals, shaft, bushings and sheave groove for wear. If journals show wear on one side, they can be reversed. If sheave shows excessive wear in groove or groove wedges are worn sharp, replace. If shaft is worn excessively or scored, replace.

TO REPLACE:
Place sheave and washers into position (with hoist cable in groove) in sheave block, line up hole with holes in block and insert shaft (5). NOTE - Replace key (8) in keyway with hole side up so that hole in key will line up with hole in sheave for pin (3). Insert pin (3) through hole in sheave until it is seated in key (8); insert cotter in pin and open. Using hoist cable, lift sheave block into place on dipper, line up holes and insert pins (22) Figure 155.

DIPPER STICKS (See Figure 160, Page 190)

TO REMOVE:
(Complete dipper stick assembly, less dipper trip mechanism). For removal of Dipper Trip Mechanism, see Page (182). Lower dipper to ground so that it is flat on its front. Remove dipper as described under "Dipper Back", Page (183), making sure that dipper trip chain is disconnected as described under "Dipper Trip Mechanism", Page (182). Lower sticks so that bosses (1) rest on timbers or other suitable blocking. Release crowd brake and back machine until shipper shaft pinions are within approximately 2" from the stops (2) at the end of the sticks. Next release saddle blocks as described under "Saddle Blocks", Page (186) so that saddle blocks can be swung clear of sticks, being careful to remove saddle block gibs before pushing saddle blocks clear of sticks. Next remove padlock sheave from lower end of sticks. Remove dipper adjusting links as described under "Dipper Adjusting Links", Page (183). Using old cable or chain for a sling which should be placed around the sticks about two feet away from the under side of the boom, attach sheave block to sling. IMPORTANT - To avoid distortion of sticks, place a timber 15-3/8" long between the sticks at point where sling is placed. Hoist sticks far enough to pull rack teeth out of mesh with the shipper shaft pinions; back machine far enough to clear sticks from shipper shaft pinions then lower sticks to blocking on the ground. Remove sling and either swing boom to clear sticks or back machine away.

TO DISASSEMBLE:
Remove eight nuts (3) and drive out eight tie bolts (4). Dipper stick spacer block assembly is now free and can be removed. Do not bend shims (5) between spacer blocks and sticks.

TO DISASSEMBLE SPACER BLOCK ASSEMBLY:
Remove six bolts (6) and take off cover plate (7) and (8). Drive out eight pipe spacers (9).

TO INSPECT SPACER BLOCK ASSEMBLY:
Examine blocking for decay or damage. Replace if necessary. Cover plates may be damaged. If distorted straighten.

TO REASSEMBLE SPACER BLOCK ASSEMBLY:
Line up holes in spacer blocks. Insert eight pipe spacers (9) and drive them through until ends are flush with blocking. Place spacer block cover plates (7) and (8) over blocking, line up holes and insert six bolts (6) and tighten.

TO INSPECT:
(Dipper sticks less dipper trip mechanism and spacer block assembly). Thoroughly clean sticks by washing them with cleaning fluid and examine closely for cracks. Repair cracks by welding. Check stops (2) for wear or breakage. Check bushings (10) and (11) for wear. Check racking (12) for wear or damage. Worn or damaged segments of racking are renewed by burning off old segments and welding on new. CAUTION - Before replacing rack segments be sure all irregularities on the rack surface of sticks are chipped and ground to a smooth surface. Be sure new racking is properly lined up with old racking and that it is securely clamped before welding.

TO REASSEMBLE:
Line up the eight bolt holes in the dipper sticks with the holes in the spacer block assembly and insert tie bolts (4). Replace nuts on bolts and tighten. IMPORTANT-.The inside dimension between dipper sticks must be held at 15-3/8" so that bosses (1) on dipper sticks line up properly with bosses on dipper back. Special shims (5) are provided to reduce or increase the dimension between sticks as required to obtain 15-3/8".

TO REPLACE: (Complete dipper stick assembly).
Attach sling of old cable or chain around sticks approximately 5 feet from the stops (2). IMPORTANT- To prevent distortion of sticks insert a timber 15-3/8" long between the sticks at point where sling is placed. Hoist sticks high enough to clear shipper shaft pinions. With sticks placed so that boom will enter opening between sticks move machine toward sticks to a point where sticks may be lowered into position and the racking properly meshed with shipper shaft pinions as described on Page (100), Operation Section. Detach dipper sheave block and remove sling. Swing saddle blocks into place and adjust as described under "Saddle Blocks", Page (101), Operation Section.

NOTE - For replacement of dipper, see description under "Dipper Back," Page (183).

SHOVEL BOOM (Less Dipper sticks) (Figure 156)

NOTE- For removal of dipper sticks, see description on Page (184).

TO REMOVE:
Lower boom to cribbing, (example on Page 97), Operation Section. Remove cable. Split upper part of crowd chain (1) by removing chain pin midway between boom foot and crowd drum. Chain may now be removed with power by engaging the crowd clutch and crowding out and at the same time guiding the chain so that it lies flat on top of the boom. Remove boom foot pin bolts and pull out boom foot pins (2). Back machine away from boom.

CROWD CHAIN GUIDE (Figure 156)

TO REMOVE:
Remove bolt (3). Remove lock plate pin (4). Chain guide is free and can be pulled out through opening at foot of boom. Remove lock plate (5) from chain guide.

TO INSPECT:
If chain guide is deeply grooved or cracked, replace. Check lock plate for wear.

TO REPLACE:
Attach lock plate to chain guide and slide guide into position in the boom, lining up lock plate opening with holes in boom. Insert lock plate pin, attach nut to each end and tighten, being sure that ends do not extend beyond the thickness of the wearing plate (6). Insert and tighten bolt (3) at foot of boom.

BUMPER PLATE (Figure 156).

TO REMOVE:
Remove bolts (7) and (8) and take off bumper plate (9) and block (10).

TO INSPECT:
Examine bumper plate for distortion or damage. If bent, straighten with sledge hammer; if badly damaged or block is cracked, replace.

TO REPLACE:
Lift bumper plate and bumper plate block into place; line up holes with holes in boom; insert and tighten bolts.

SHIPPER SHAFT ASSEMBLY (Figure 157).

SADDLE BLOCKS

TO REMOVE:
Remove cotter and take off nuts (1) with special wrench and hammer. Take off washer (2) and thrust washer (3). Saddle block is now free but requires two men to remove because of weight. Place saddle block on ground.

TO DISASSEMBLE:
Remove lock pin (4) then pull out sheave pins (5). Sheaves (6) can now be removed. Remove lock pin (7). Next remove lock nut (8) and nut (9), then bolt (10) can be removed.

TO INSPECT:
Wash all parts thoroughly with cleaning fluid and check all parts for wear. If sheaves, sheave bushings or sheave pins are badly worn, replace. If head of adjusting bolt (10) is badly worn or threads of the bolt or of nuts (8), (9) and (11) are damaged, replace. If saddle block bushings (12) or thrust washers (3) and (13) are badly worn or scored, replace.

TO REASSEMBLE:
Screw nuts (11) down to head of bolts (10) with flat surfaces of nuts away from head of bolts. Insert adjusting bolts into place so that flat sides of nuts (11) contact flat surfaces in saddle block recesses. Then secure adjusting bolts with adjusting nuts (9) and (8) and when sticks are in place adjust as described under "Saddle Block Adjustment", Page (101), Operation Section. Place sheaves (6) in saddle block and line up sheave bores with holes in saddle blocks; insert pins (5) and lock with lock pin (4).

SHIPPER SHAFT

TO REMOVE:
Remove sleeve (14) and thrust washer (13). Drive metal wedges between pinion (15) and flange bushing (16). Place hardwood block at end of shipper shaft as shown in Figure (157), and

drive shaft with sledge hammer until pinion (15) is released. CAUTION - Do not strike shaft after pinion (15) is released as it might cause damage to flange bushing (16) by key (17). Remove pinion (15) and with hammer and chisel, remove key (17) from shaft. Use same procedure at other end of shaft to remove opposite pinion. Remove set screws (20). Place hardwood block against end of shaft and drive with sledge hammer until flange bushing (16) on opposite side of sprocket (18) has been driven from its retainer. Use same procedure at other end of shaft to drive out opposite bushing. NOTE- Be careful not to lose or damage shims (19). Remove shipper shaft. Sprocket (18) being free on shaft will come off inside the boom and can be removed through inspection opening.

TO INSPECT:
Check sleeves (14), all thrust washers and flange bushings (16) for wear or scoring and replace if necessary. Check pinions (15) for cracks, or bent or worn teeth and replace if necessary. Check sprocket (18) for tooth wear or for cracks. If teeth are worn too badly for rebuilding, replace sprocket.

TO REPLACE:
Place sprocket (18) in boom through inspection hole; line up sprocket bore with shipper shaft holes in boom and insert shaft from either end until splines on shaft are fully meshed with splines in sprocket. Replace shims (19) on flange bushing (16) and fit bushing over end of shaft, then start it toward sprocket (18) through hole in boom and drive it in by bumping until flange of bushing fits tight all the way around against machined surface on boom. Follow same procedure to replace opposite flange bushing. Place steel washers (21) on shaft against flange bushing. Insert keys in keyways, tapping them down until they are fully seated. Be sure surfaces of keys are smooth - using a file for the purpose if necessary - before replacing pinions (15). Replace pinions on shaft - lining up keyway with key - with large end of tapered bore in pinions toward boom. Place thrust washer (13) on shaft, making sure that slot in washer fits over key (17). Slide sleeves (14) on shaft. Next replace saddle blocks; thrust washer (3); flat washers (2), then replace nuts (1) and tighten, using special wrench provided for the purpose and which can be hammered to get maximum tightness.

NOTE - After mounting dipper sticks as described on Page (185), saddle blocks are adjusted as described under "Saddle Blocks", Page (101), Operation Section.

BOOM POINT SHEAVES (See Figure 159, Page 181).

TO REMOVE:
With boom lowered on cribbing and cables slack, remove bolts (1); take off guards (2) and boom suspension sheaves (3). Drive out shaft (6) which releases sheaves (4) and (5). Take out sheaves. IMPORTANT - Note positions of flat washers (7) and be sure these are replaced as shown when replacing sheaves.

TO INSPECT:
Check bushings and shaft for wear and replace if worn. Check sheave (4) particularly for wear in groove and if edges are thin or groove is worn deeply, replace. Sheaves (3) get very little use in shovel work and seldom if ever need replacement. This is also true of dummy sheave (5) which is used only as cable anchor. Check grease fittings in each sheave to be sure they are open.

TO REPLACE:
Place sheaves (4) and (5) in position, line up sheave bores with bores in boom point and insert shaft (6), placing flat washers (7) on shaft. Place boom suspension sheaves (3) on each end of shaft; place guards (2) in position and insert bolts (1).

CROWD CHAIN ADJUSTING SPROCKET (See Figure 156, Page 180).

TO REMOVE:
Remove nuts (11) and (12). Bend lock plate (13) down so that capscrews (14) can be removed. Slide guides (15) off bolt (16). Sprocket assembly can then be lifted off and placed on ground. Then remove nuts (17) and (18) from bolts (16). Bolts can now be taken out of bearing blocks (19) and then bearing blocks can be removed. Next slide shaft (20) out of sprocket (21).

TO INSPECT:
Check sprocket bushing and if badly worn or scored, replace by pressing or driving bushing out of sprocket and press or drive new one in. If sprocket teeth are worn beyond rebuilding, replace. Inspect sprocket grease fitting to be sure it is open.
NOTE - See instructions on Pages 162 and 164 if new bushing is to be installed. If threads on bolts (16) are badly worn or damaged, replace bolts and if bolts are bent, they must be straightened. Inspect bearing blocks (19) for wear.

TO REPLACE:
Insert shaft (20) through bushing which is pressed into sprocket (21) and mount bearing blocks (19) on shaft, lining up bolt holes in bearing blocks with bolt holes in shaft (20). Insert bolts (16) and fasten with nuts (18) which should be screwed tight against bearing blocks. Screw nuts (17) to within approximately 2" of nuts (18). Lift assembly to position where the threaded ends of bolts (16) can be inserted into bolt holes in boom foot. Slide guides (15) on plain ends of bolts (16); line up guide holes with holes in foot casting; place lock plates (13) over holes; insert capscrews (14); tighten and lock capscrews by bending ends of lock plates up against capscrew heads. Screw nuts (11) and (12) on ends of bolts (16). Proceed with adjustment as described under "Crowd Chain Adjustment", Page 102, Operation Section.

STATIONARY IDLER SPROCKET (See Figure 156, Page 180).

TO REMOVE:
Remove pin (22) and drive out shaft (23), being careful not to drop sprocket (24).

TO INSPECT:
Check sprocket for wear and if teeth are beyond rebuilding, replace with a new one. Check sprocket bushing and if worn, press out and replace, being sure to line grease holes. Check grease fitting to be sure it is open. Check shaft for wear.

TO REPLACE:
Lift sprocket into position, line up bore with holes in boom foot and push in shaft. Insert pin and secure with cotter.

NOTE - To replace completely assembled shovel attachment, follow instructions on page (98), Operation Section. Stripped shovel boom, mounted on cribbing, may be attached in the same manner.

PULL SHOVEL ATTACHMENT

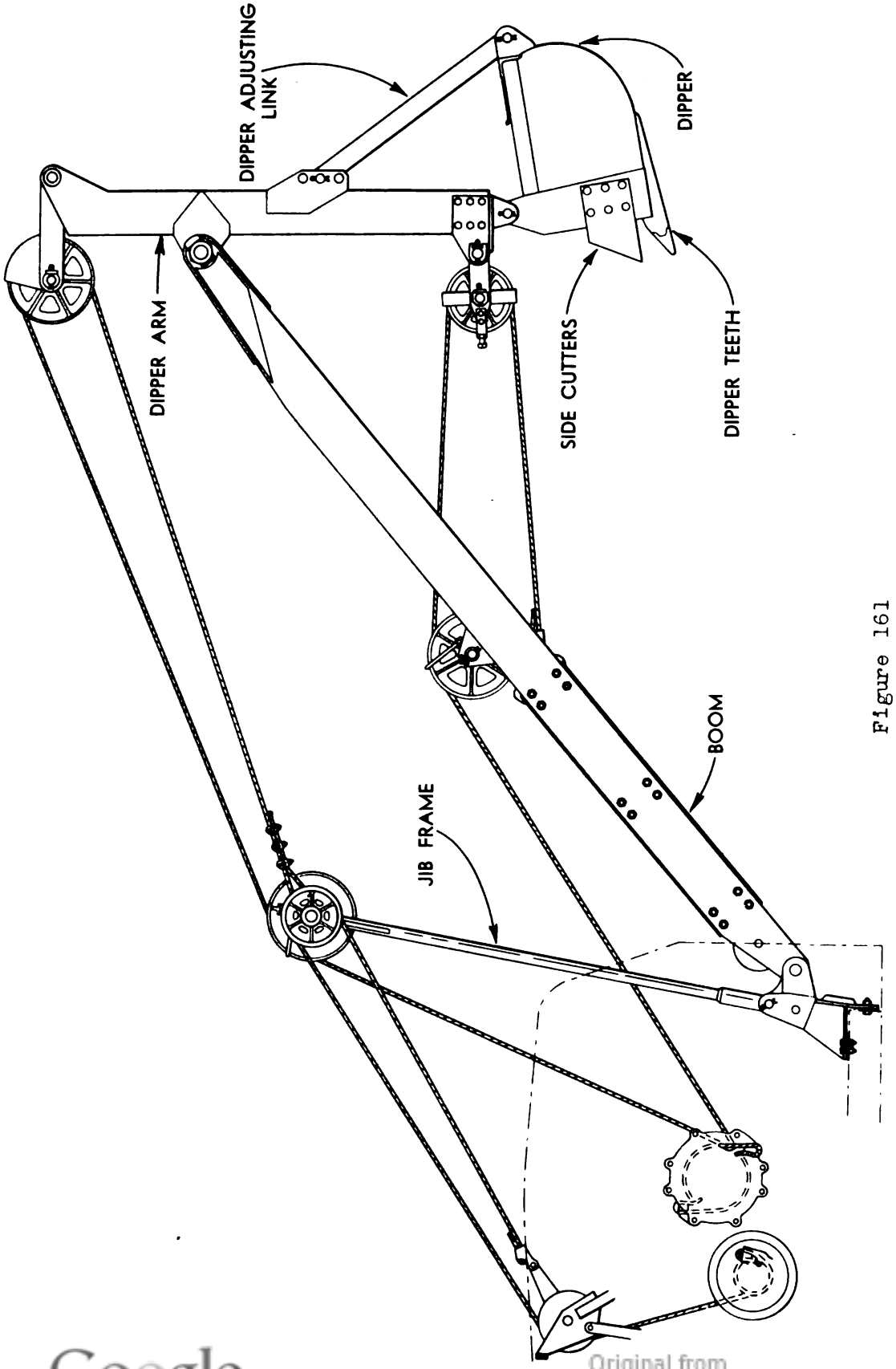


Figure 161

PULL SHOVEL ATTACHMENT

PULL SHOVEL DIPPER (See Figure 162, Page 191).

TO REMOVE:

Lower dipper until it rests flat on its bottom on the ground. Close and pull cotters in pin (7) and swing adjusting link (6) to the ground. Close and pull cotters in pin (5) and remove pin, detaching adjusting link from dipper. Close and pull cotters from pins (1) and hoist dipper arm clear of bucket.

TO DISASSEMBLE:

Remove six bolts (8) from each side cutter (2) and take off side cutters. Thread a cable through one pin hole in dipper and one pin hole in dipper arm and securely clamp ends of cable. Now raise dipper until it rests on its side. Remove cable and swing attachment clear of dipper. Close split end of wedges (9) and drive wedges out. Remove tooth points (3).

TO INSPECT:

Check adjusting link (6) for wear in pin holes. If link is bent it must be straightened. Check all pins for wear. Check side cutters (2) for wear on cutting edges. To sharpen side cutters, heat and reshape. If tooth points (3) are slightly worn, reverse; if worn beyond rebuilding, replace. If tooth bases (10) show excessive wear they should be replaced, making sure all rivets (11) are tight. If wearing plates (4) are excessively worn, they must be removed and new plates installed by welding.

TO ASSEMBLE:

Insert tooth points (3) in bases (10); drive in wedges (9) and open. Lower dipper arm until it contacts top side of dipper, then swing dipper arm against dipper and push dipper over so that it rests on its bottom or tooth base side. Place side cutters (2) into position, line up holes, insert bolts (8) and tighten. Lower dipper arm into position on dipper, line up holes, insert pins (1), insert cotters and open. Place one end of adjusting link (6) into position on dipper, line up adjusting link hole with holes in dipper boss, insert pin (5), insert cotter and open. Swing adjusting link (6) into position on dipper arm, line up hole in adjusting link with proper holes in dipper arm; insert pin (7); insert cotter and open. (See Pull Shovel Dipper Angle Adjustment, Page 107, Operation Section.)

PULL SHOVEL ARM (Less Dipper) (See Figure 163, Page 192).

NOTE - For removal, disassembly, inspection, reassembly and replacement of pull shovel dipper, see "Pull Shovel Dipper."

TO REMOVE:

Pull dipper arm in close to boom. Lower boom until arm rests on blocking as shown in Figure (163), Page (192). Drive wedge from wedge socket (1) and remove cable (2), pulling cable clear of

PULL SHOVEL ATTACHMENT

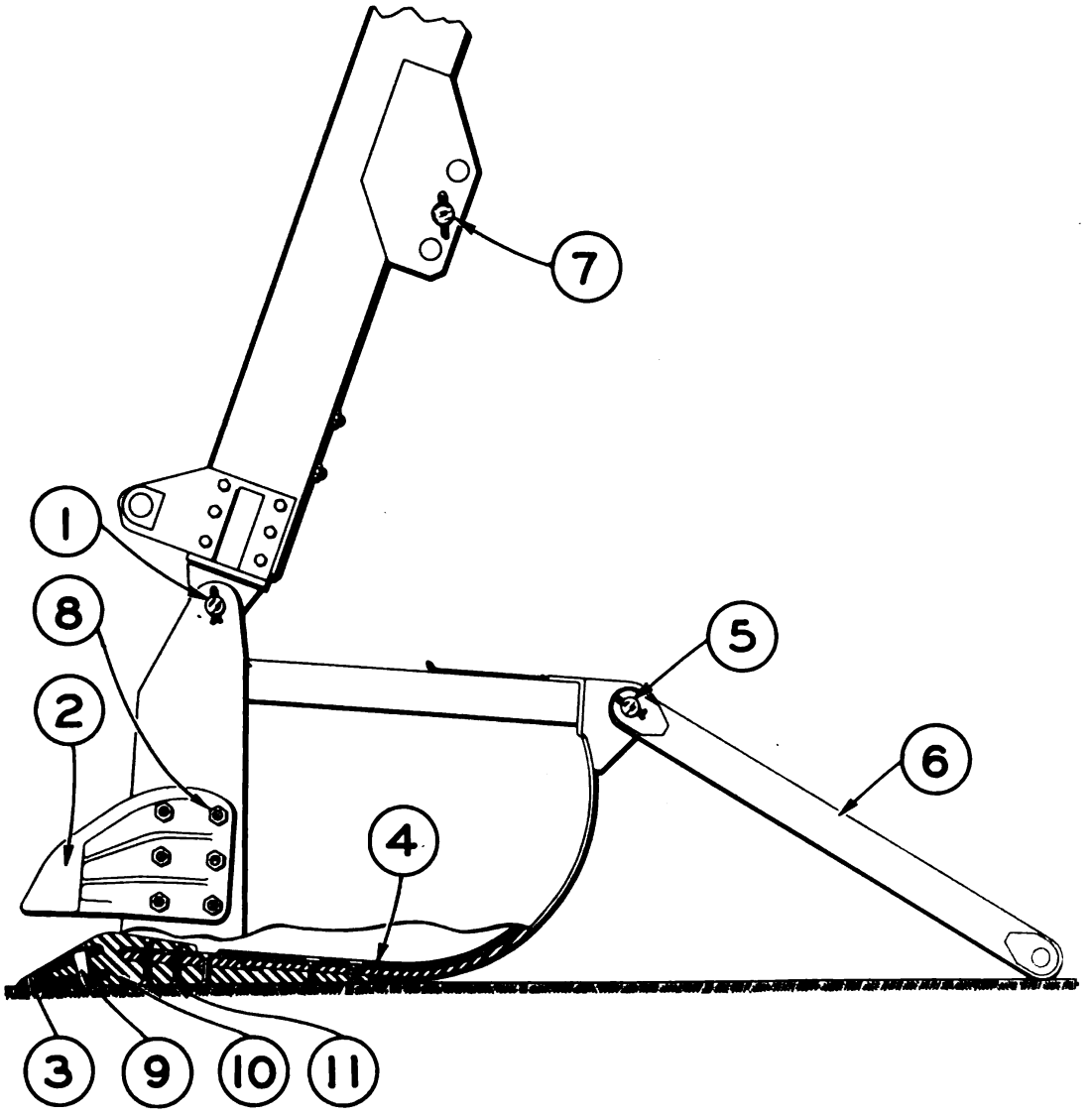


Figure 162

sheaves (3) and (4). Close and pull cotter from pin (5) and remove pin which releases sheave (6). Take out sheave. Remove guard (7) by taking off nuts. Unscrew set screws in set collars (8) until collars are loose on shaft (9). Close and pull cotters in shaft (9) and remove shaft which releases sheave (4) and set collars (8) for removal. Replace sheave (4) after having placed cable (1) as shown in Figure 164, in sheave grooves and take up slack in cable by winding it on drum with power. (After removal of dipper arm, boom can be raised and lowered with cable and can be safely used as a crane for the handling of dipper or dipper arm. Do not use as crane for any other purpose.) Bend down lock plates (10) and remove nuts (11). Using a short bar as a driver, place one end against the shaft (12) at the end opposite the shaft key and drive out shaft (12) with sledge hammer. Hoist boom and swing clear of dipper arm.

TO INSPECT:

Clean dipper arm thoroughly and examine closely for cracks, distortion of other damage. Inspect roller (13), sleeve (14), thrust washers (15) and bushing (16) for wear. To remove sleeve and roller for inspection, take off thrust washers (15); remove set screw (17) and pull out sleeve (14) being careful not to drop roller (13). If bushings (16) must be replaced see "Dowel Instructions", Page (164). To remove sheave block (18) close and pull cotter in pin (19) and remove pin which releases sheave block. Place sheave block on the ground. To disassemble sheave block (18), remove bolts (20) which release scraper bracket (21). Close and pull cotter in pin (22) and remove pin. Lift out sheave (3). To inspect, examine sheave pin, sheave bushing, block pin and block bushing for wear. Inspect sheave groove for damage or wear and scraper bolt for wear or damaged threads. If necessary to rebush sheave or sheave block see "Dowel Instructions," Page (164). To reassemble sheave block (18), place sheave in block, line up bores and insert sheave pin, locking it in place with cotters. Next, place scraper bracket into position in sheave block; line up holes in bracket with holes in sheave block and insert 4 bolts (20) and tighten. Screw bolt (23) into scraper bracket so that it just clears the bottom of sheave groove and lock in place by tightening nut. Check all grease fittings to be sure they are open. To remove sheave block assembly (24), close and pull cotter in pin (25) and remove pin.

TO DISASSEMBLE:

Close and pull cotter of pin (5) and remove pin, releasing sheave (6). Next take out bolts (26) and remove sheave housing (27). Bumper (28) may be removed by taking out two bolts.

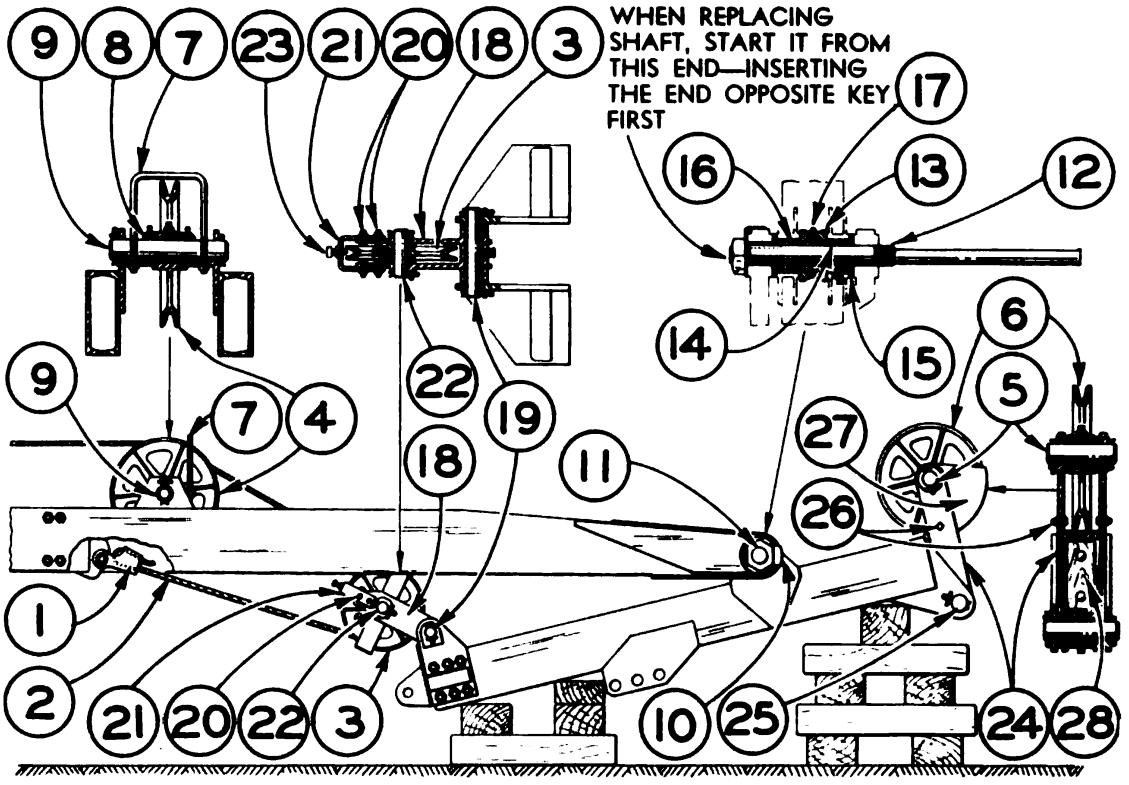


Figure 163

TO INSPECT:

Examine bushings, pins and sheave groove for wear. If bumper (28) is worn or damaged, renew. If it is necessary to rebush sheave or bracket see "Dowel Instructions", Page (164).

TO ASSEMBLE:

Place housing (27) in position on bracket (24). Place sheave (6) in housing; line up holes and insert sheave pin (5), locking it in place with cotters. Next insert bolts (26) and tighten. Place bumper (28) into position on bracket (24); line up holes and insert bolts and tighten. To replace sheave assembly line up bore of assembly with bore in dipper arm; insert pin (25) and lock with cotters.

TO REPLACE:

Place roller (13) in position in dipper arm bracket and insert sleeve (14) so that one of thrust washers (15) can be slipped on each side. Swing boom into position over dipper bracket assembly and lower it slowly into place taking care not to disturb thrust washers (15). Line up holes and insert shaft (12), (end opposite keyway first) into keyway shaft hole in boom as shown. Insert key into keyway in shaft and after lining up key with keyway in the shaft hole in boom, bump shaft in until centered. Screw on nuts and tighten so that there is approximately 1/16" clearance in assembly. Bend up lock plates (10).

PULL SHOVEL BOOM (Less Dipper Arm) See Figure (164), Page (194).

NOTE - Reeve hoist cable as described under "Pull Shovel Arm", Page (190).

TO REMOVE:

Lower boom to cribbing as shown. Detach cable (1) from dead end by removing cable clamps (2) and remove cable from sheaves. Take out locking bolts and remove boom foot pins (3). Back machine away, leaving boom resting on cribbing.

TO DISASSEMBLE:

Remove lock bolt and pull shaft (4) which releases idler sheave for removal. Next take out cotter of shaft (5) and after loosening set screws of collars remove shaft. Sheave (6) and set collars can now be taken out. Remove twelve tie bolts (7) releasing torsion box (8) from two boom members (9).

TO INSPECT:

Clean boom and torsion box thoroughly and examine closely for cracks. If any cracks are found repair by welding. Inspect twelve tie bolts (7) for wear or damage to threads and renew if necessary. Examine babbit bearings in boom foot and boom foot pins (3), also bushings and pins of idler sheave and fleeting sheave (6). If any bushings are worn badly they must be renewed; see "Dowel Instructions", Page (164).

PULL SHOVEL BOOM (LESS DIPPER ARM)

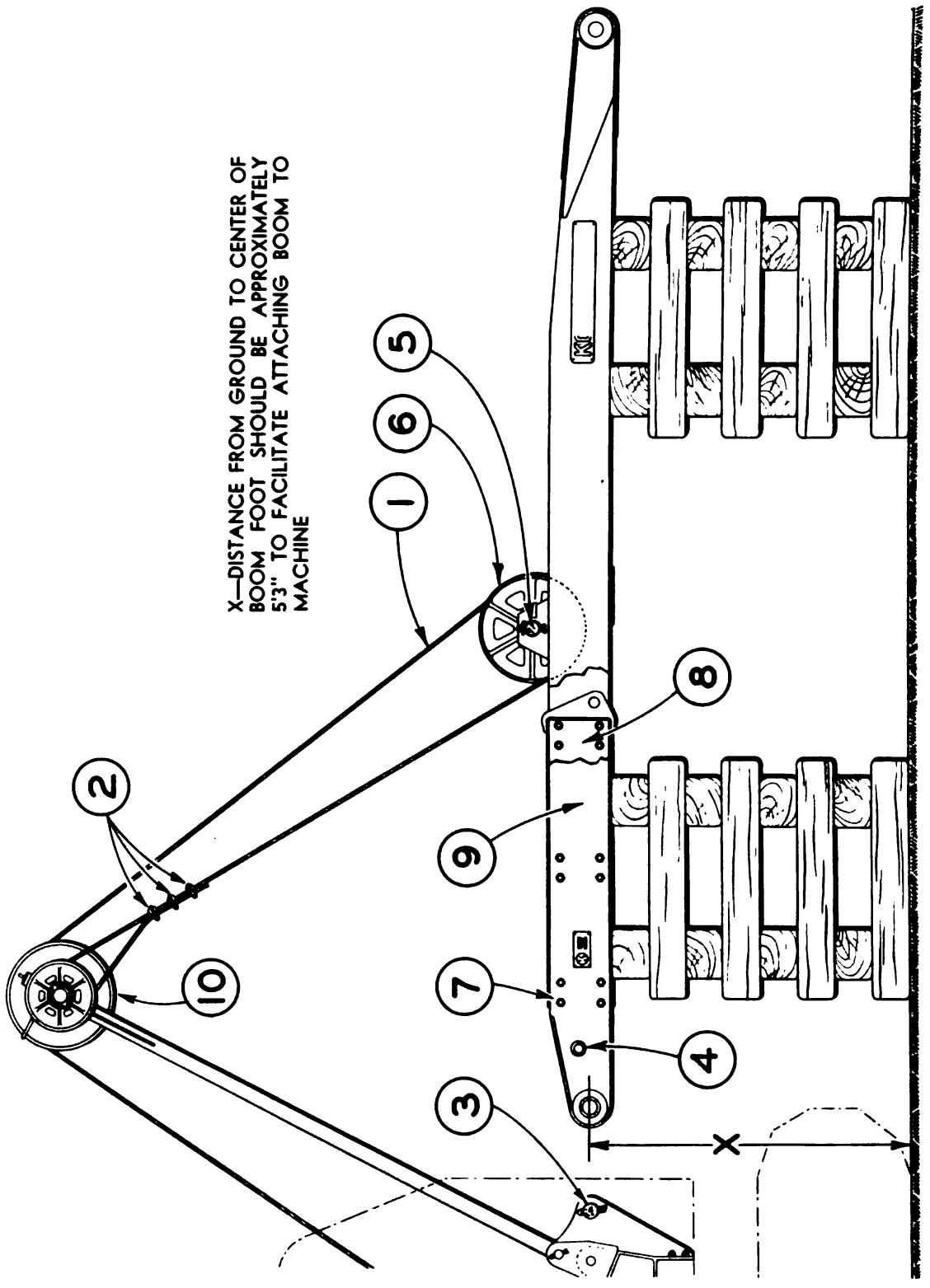


Figure 164

TO REASSEMBLE:

Place torsion box (8) in position between two boom members (9) and line up the twelve bolt holes. Insert twelve tie bolts (7) and tighten. Lift idler sheave into position in boom, insert shaft (4) and lock in place with bolt. Start shaft (5) through one bracket hole on boom and mount first one set collar then fleeting sheave (6) and second set collar on shaft, while moving the shaft through the bracket toward the other bracket. Insert cotters and open.

TO REPLACE

Move machine up to cribbing on which boom is resting and with front of machine in alignment with boom foot bring holes in pull shovel adapter into line with holes of boom foot. It might be necessary to raise or lower boom foot with the aid of bars or jacks or wooden wedges, or to swing machine slightly to bring holes into proper alignment. Insert pins (3) and secure with cotters.

If it is necessary to raise boom less dipper arm use cable (1) for hoisting. To do this draw cable (1) from jib frame sheave (10), placing it around fleeting sheave (6) and anchoring it to dead end casting securing it with cable clamps (2). When this is done raise boom by winding cable (1) on drum with power.

PULL SHOVEL JIB FRAME
(Less Boom, Dipper Arm and Dipper)

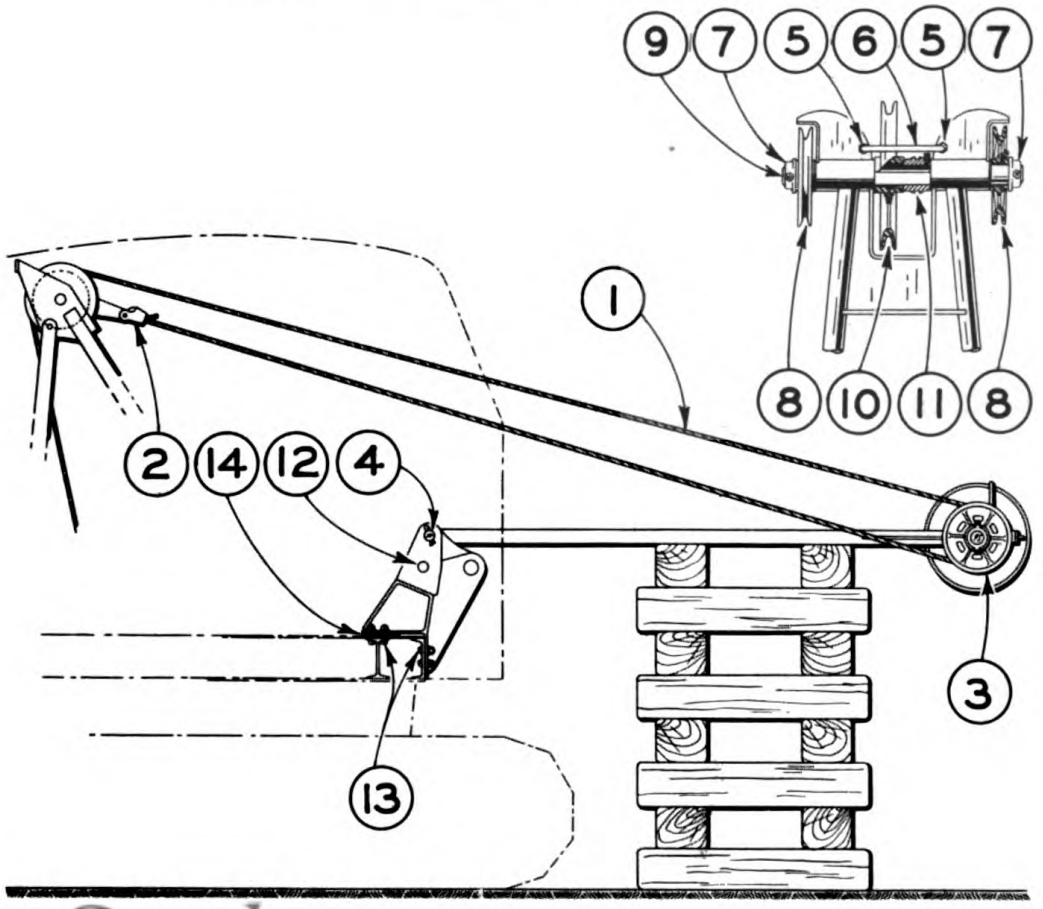


Figure 165

PULL SHOVEL JIB FRAME (Less Boom, Dipper Arm and Dipper) See Figure (165).

TO REMOVE:

Lower jib frame so that it rests on cribbing. Detach cable (1) by removing one end from cable socket (2) and remove it from jib frame suspension sheaves (3). Close and pull cotters of pins (4) and then remove pins. Back machine clear of frame.

TO DISASSEMBLE:

Take off nuts (5) and remove cable guard (6). Take out bolts and remove collars (7) and sheaves (8) from shaft (9). Next remove shaft (9) from jib frame being careful not to drop sheave (10) and dead end casting (11) as they are released.

TO INSPECT:

Examine sheave bushings and shaft (9) for wear. If it is necessary to rebush sheaves see "Dowel Instructions", Page (164).

TO REASSEMBLE:

Place sheave (10) and dead end casting (11) in position in jib frame and insert shaft (9). Then slip one of sheaves (8) on each end of shaft and replace collars (7), lining up holes in collars with holes in shaft; insert bolts and tighten.

TO REPLACE:

Move machine up to cribbing on which jib frame is resting and, with front end of machine in alignment with legs of jib frame, bring holes of pull shovel adaptor into line with holes in legs of jib frame. It may be necessary to raise or lower jib frame legs or swing machine slightly to bring holes into proper alignment. Insert pins (4) and lock with cotters. Reeve cable as described in Operation Section, Page (86), and raise jib frame.

PULL SHOVEL ADAPTOR (Less Boom, Dipper Arm, Dipper and Jib Frame) See Figure (165).

TO REMOVE:

Close and remove cotters from pins (12) and remove pins. Take out bolts (13) and let adaptor fall to the ground being careful to stand clear to avoid injury. Be sure that space to which adaptor will fall is clear of any parts that may be damaged by the adaptor. Also be sure that no shims (14) are lost.

TO INSPECT:

Clean adaptor thoroughly and examine closely for cracks. If any are found repair by welding.

TO REPLACE:

Lift adaptor into place on machine and insert pins (12) securing them with cotters. Place shims (14) into position; line up holes and insert and tighten bolts (13).

CHAINS

POWER TRANSMISSION CHAIN

The power transmssion chain which transmits power from the engine to the swing and traction jack shaft is located at the left rear of the upper deck machinery and enclosed in an oil tight chain case as shown in Figure (167), Page (199). It is a 3/4" pitch, four strand, roller type chain.

With the exception of the connecting link pins, all pins are assembled with a heavy press fit and should not be disturbed unless repair links are to be installed. Connecting links are provided with slip fit center plates to facilitate shortening or removal of chain and are easily distinguished by cotters which hold the links in place.

TO REMOVE:

Drain oil from chain case by removing drain plug (1). Disconnect fuel lines (3) and (7) at fuel tank, then take out four bolts (5) and remove upper half of chain case (6). Locate connecting link (4) and place it in position over top center of sprocket (2). Remove cotters and using small drift or punch, drive both pins of pin link (15) through cover plate (19), then pull link pin out of chain being careful not to lose center plates (16). Remove chain.

TO INSPECT:

Clean chain thoroughly with cleaning fluid and inspect for wear and broken rollers (17), roller links (18) or pin links (15). If, due to wear, chain has lengthened 3/4" or more beyond its original length of 148½", it may be shortened by substituting a preassembled 4 pitch section for the 5 pitch section. (To remove 5 pitch section, take out connecting links on each side of section as described above in "To remove chain". To connect 4 pitch section, place section between ends of chain and insert connecting links as described below in "To replace chain".) To replace roller links, press or drive out pin links on each side of damaged roller link and replace with repair roller links and connecting links. CAUTION - Grind heads of pins flush with cover plates before driving or pressing them out.

TO REPLACE:

Place chain on sprocket (2) and drop one end, to which a piece of wire has been attached, into chain case ahead of sprocket. Using the wire fastened to the end of the chain, pull chain through and under both sprockets in case, then over sprocket (14) to top center of sprocket (2). Engage engine clutch - Lever (9) - engine not running - and by turning sprocket (2) by hand, take all slack from top chain and mesh it with sprocket teeth at the same time. This brings the ends of chain together at top of sprocket (2). Next, start pin link (15) through roller links (18) and, placing two center plates in the spaces between each roller link bring pin link through chain. Place cover plate in position and tap it on to pin link pins and secure with cotters. Place top of chain case (6) in position; line up holes with holes in bottom of case; insert bolts (5) and tighten. Connect fuel lines (3) and (7). Replace drain plug (1). For lubrication of chain case, see Page (66) Operation Section.

REDUCTION CHAIN

TO REMOVE:

Drain oil from reduction case by removing drain plug. Take out four bolts (10) and remove cover (8). Locate connecting link (11) and place it in position over top of sprocket (12). Remove cotters and using a small punch drive out pin link, being careful not to lose center plates. Remove chain.

TO INSPECT:

Inspect as described above in "Power Transmission Chain".

TO REPLACE:

Place chain over sprockets (13) and (12) with ends together at the top of sprocket (12). Connect as described above in "Power Transmission Chain". Place cover (8) in position on case and fasten with bolts (10).

CROWD, RACK-IN AND TRACTION DRIVE CHAINS

The crowd, rack-in and traction drives are equipped with steel thimble roller drive chains. Crowd and rack-in chains are identical except for length and the individual links are interchangeable. The traction drive chain links, due to a difference in size and design are not interchangeable with crowd and rack-in links. Each link of the above chains is pinned and cottered individually for quick and easy replacement of worn or damaged links.

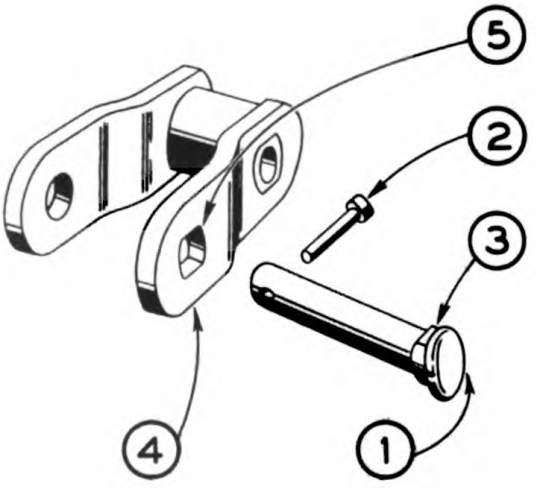


Figure 166

TO SPLIT CHAIN: (See Figure 166)

Select link pin (1) to be removed, take out lock pin (2) then drive out link pin with hammer and punch, bucking up the opposite side of the link with a heavy hammer or shaft.

TO CONNECT CHAIN:

Place ends of chain in position; line up holes and start pin (1), tapping it in until square shoulder (3) touches side bar (4). Turn pin so that shoulder (3) matches hole (5) and drive link pin in - bucking up opposite side bar of link with heavy hammer or shaft. Insert lock pin (2) and bend.

TO INSPECT CHAIN:

Clean chain thoroughly using cleaning fluid, and examine all pins, rollers and side bars for wear or damage and replace if necessary.

TO REMOVE CHAIN LINK:

Take out a link pin (1) on each side of damaged link following procedure as described under "To split chain", and remove link.

TO REPLACE CHAIN LINK:

Place link in position in chain and line up holes and follow procedure as described under "To connect chain."

CHAINS

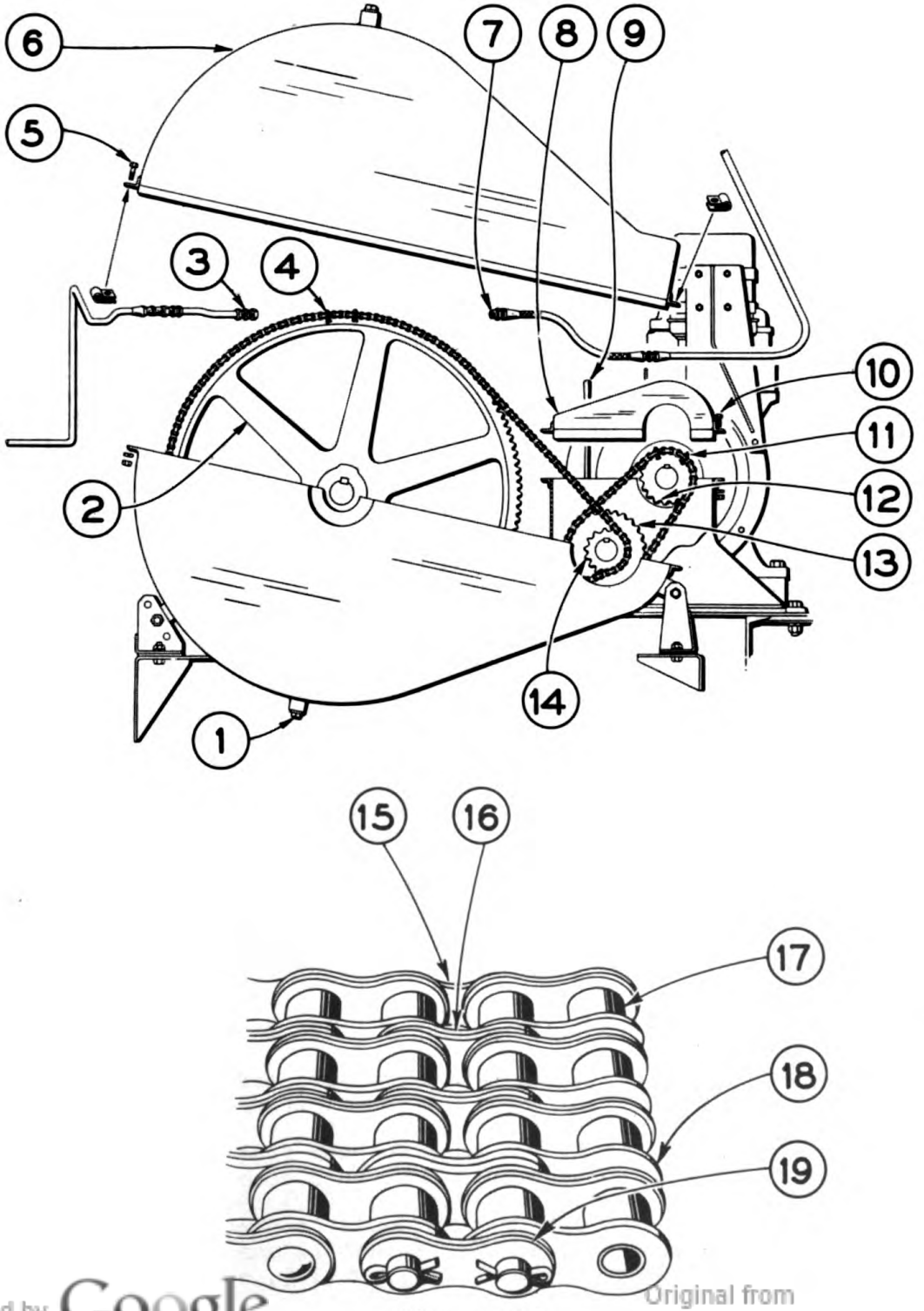


Figure 167

CROWD CHAIN (See Figure 168, Page 201).

TO REMOVE: (Without Power).

Unscrew nuts (2) to extreme out position on bolts (17) to slack off crowd chain adjustment. Split chain as described under "To split chain", Page (198), near sprocket (3) and lift section nearest the machine over sprocket (4), pulling it from sprocket (10) at the same time and let it fall to the ground.

Then remove cover (8) from opening in boom and lift chain over shipper shaft sprocket (9), allowing it to slide down guide and fall to the ground between boom foot and crawlers. NOTE - If boom is horizontal, or nearly so, it will be necessary to pull chain from boom foot opening.

TO REMOVE: (With Power).

Swing boom to a central position over front of crawlers and lower dipper to the ground so that it rests directly under shipper shaft. Slack off on crowd adjustment by unscrewing nuts (2) to extreme out position on bolts (17). Lower boom until it rests on dipper stick spacer block, split chain, as described under "To split chain", Page (198), near sprocket (3). Then, after releasing hoist brake, travel machine away from dipper, pulling chain out of boom foot opening while doing so. After chain has been removed from boom, engage racking-in clutch and slowly turn crowd sprocket (4) to pull off remainder of chain at idler sprocket.

TO INSPECT:

Follow instructions under "To inspect chain", Page (198).

TO REPLACE CHAIN: (With Power).

Fasten a rope or wire to open end of chain and pass it through boom foot opening to opening (8) at top of boom. Then, with link pin heads to the right or operator's side, pull chain through boom until it is meshed with shipper shaft sprocket (9). Next, pass rope or wire back through opening to boom foot opening and travel machine toward dipper, pulling chain through boom at the same time. Pass other end of chain around sprocket (10) and mesh it with sprocket (4) then engage crowd clutch and slowly turn crowd sprocket until all slack is taken out of the bottom of crowd chain (1). Bring ends of chain together and connect as described under "To connect chain", page (198). To adjust, see Page 102, Operation Section.

TO REPLACE CHAIN: (Without Power):

Place chain on top side of boom with roller end of chain toward boom point with heads of link pins to the right or operator's side. Fasten a rope or wire to roller end of chain and pass it through boom from opening (8) at top of boom to boom foot opening. Feed chain through opening (8) and pull it through boom with rope until it extends about two feet beyond sprocket (10). Next, fasten rope or wire to the other end of chain and pull it through boom in the same manner, passing it over crowd sprocket (4) and bringing ends of chain together between sprockets (4) and (10), approximately 18" from sprocket (10). Block sprocket (10) to keep it from turning

CHAINS

and remove all slack from chain by turning sprocket (4) and applying crowd brake. With the aid of a board (12) between sprockets (10) and (4) bring ends of chain together and connect as described under "To connect chain", Page (198). To adjust, see Page (102), Operation Section.

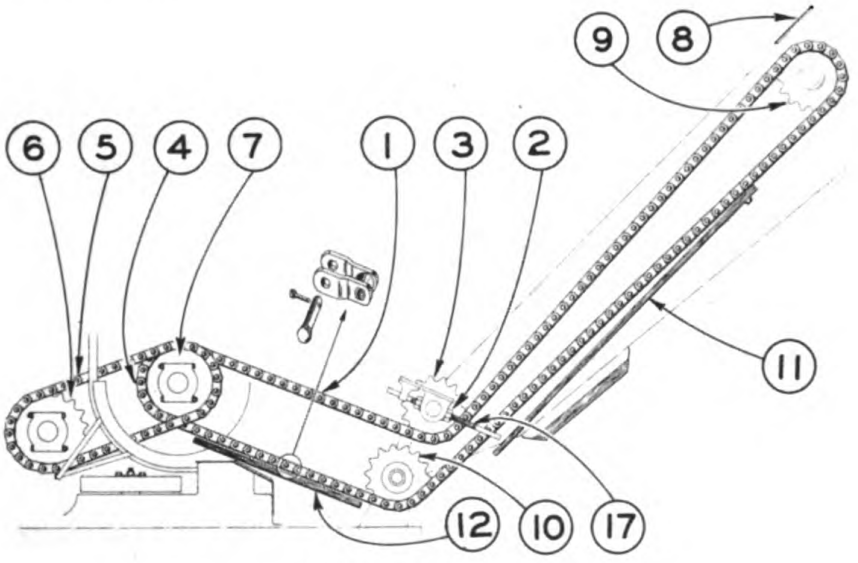


Figure 168

TO SHORTEN CHAIN:

After adjusting sprocket (3) has been taken up all the way and crowd chain runs with considerable slack, it is necessary to shorten chain by removing a link. Unscrew nuts (2) to extreme out position on bolts (17) and remove slack in upper part of chain by revolving sprocket (4) with racking-in clutch. Select a link, (see inset Figure 168,) about 18" from sprocket (10) and remove link as described under "To remove chain link", Page (198). To connect chain follow procedure described under "To replace chain", Page (198). To adjust chain, see Page (102), Operation Section.

RACK-IN CHAIN (See Figure 168).

NOTE - Due to its short length and relatively light loads, no provision has been made for the adjustment of the rack-in chain. If abnormal conditions result in excessive wear, chain may be shortened by removing link as described under "To remove Chain link", Page (197).

TO REMOVE: (See also "To split chain", Page 198).

Split rack-in chain (5) at any convenient link and remove from sprockets (6) and (7).

TO INSPECT:

(See "To inspect chain", Page 198).

TO REPLACE: (See also "To connect chain", Page 198).

Place chain on sprockets (6) and (7) with roller end of top links toward rear of machine and connect at any convenient point.

TRACTION DRIVE CHAIN (See Figure 169).

NOTE - The traction drive chains transmit power from the lower traction sprocket to the crawlers. Although they are made of special materials to withstand the abrasive qualities of the soil and designed to withstand unexpected overloads, frequent inspections should be made.

TO REMOVE:

Take out lock pins (1) and turn adjusting nuts to slack off the drive chain adjustment. Select a link pin (3) - a little above center on drive sprocket (4) - and remove it as described under "To split chain", Page (198). Lift the top end of chain forward off drive sprocket (4) then by revolving sprocket (5) (forward traction direction) with power, remove chain by pulling lower part of it from under drive sprocket (4).

TO INSPECT:

See, "To inspect chain", Page (198).

TO REPLACE:

Lay the chain flat on the ground directly behind the sprockets with open end of links toward machine and the heads of pins toward crawlers. Fasten a rope or wire to one end of the chain and pass it under and around sprocket (5) then out behind the machine. Revolve sprocket (5) - reverse traction - and pull on rope or wire to wind chain into position so that upper end of chain lays in teeth of sprocket (4) as indicated by arrow (3). Then revolve sprocket (5) (forward traction) just enough to take slack out of upper part of chain and lift bottom end of chain into place on drive sprocket (4). To connect chain follow procedure as described under "To connect chain", Page (198). To adjust chain see Page (93), Operation Section.

TO SHORTEN:

After adjusting bolts have been taken up all the way and chain runs with excessive slack, chain must be shortened by removing a link. Split chain as described under "To remove", Page (198). To remove link, follow procedure as described under "To remove chain link," Page (198). Connect chain as described under "To replace", Page (198). To adjust, see Page (93), Operation Section.

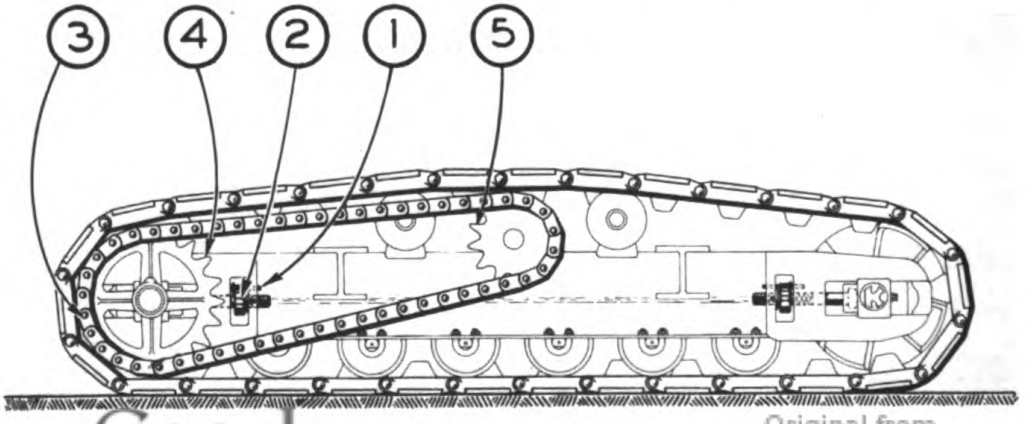


Figure 169

HANDLING OF HEAVY PARTS

When repair work is done in the field it is often necessary to handle heavy parts such as shafts, drums, castings, etc., with no crane available. In such cases various types of lifting devices, as illustrated on Pages (204), (205) and (206) must be used. Due to the varying weights of parts to be handled, the height to which such parts must be lifted or the availability of materials for construction of such devices, the type selected must depend upon the judgment of the operator or the mechanic. The successful operation of these 'home-made' lifting devices will depend largely upon the skill and ingenuity of the operator. The illustrations of the four most common types of lifting devices are given merely as a guide in constructing them and because each lends itself to many variations, or the materials used will depend upon the kind available, no definite specifications or dimensions can be given.

Materials of ample strength combined with good common sense will provide the proper type of lifting device to meet a specific requirement.

THE "GIN" POLE (Figure 170).

The "gin" pole is perhaps the most widely used device for the handling of heavy repair parts in the field maintenance of excavators. It is simple in construction, adaptable to the majority of conditions and, in most cases, the material for its construction is available.

The 'set-up' shown in Figure (170), consists of a stout timber or pole (1), studs (4) and (5), rope tackle (2), guy lines (6) and a chain hoist (3). To adapt the gin pole and the other devices illustrated to local conditions frequent substitutions may be made. For example, the pole (1) may be replaced by a steel beam or pipe, the rope tackle (2) by cables anchored to trucks or tractors and the chain hoist (3) by snatch block and cable which may be operated by a winch.

SAFETY RULES:

In the hands of a careless mechanic the "gin" pole can be a dangerous tool and for the safety of himself and others, the following rules should be observed:

Always use materials of adequate strength.
Always loop cables around pole several times before clamping.
Always use good cable clamps and a sufficient number of them.
Always anchor guy lines to objects of adequate strength and stability.
Always hitch loads securely.
Never allow slack in any guy line - when paying out on one line immediately take up slack in the others.
Never make a lift with pole at more than a 20 degree angle from vertical without pole (1) sitting in a shallow hole or without anchoring it securely in some other way.

GIN POLE

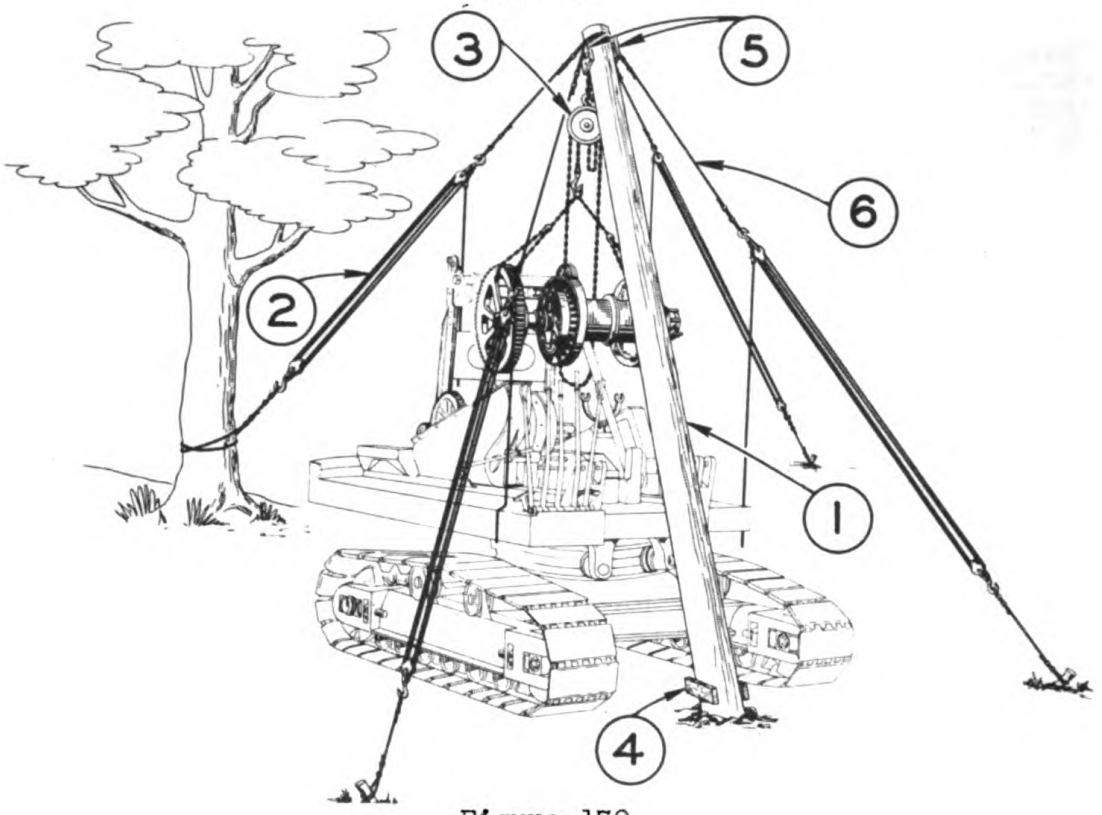


Figure 170
"A" FRAME

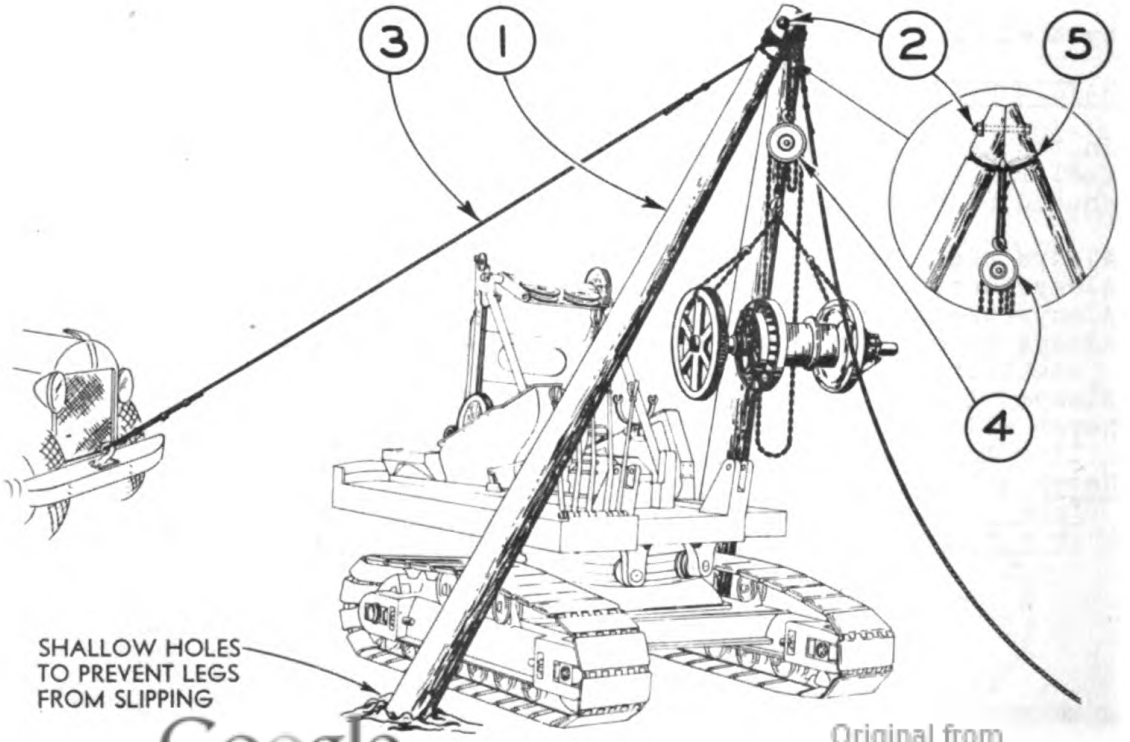


Figure 171

THE "A" FRAME (Figure 171, Page 204).

The "A" frame differs from the "gin" pole in that it is constructed of two compression members instead of one. While this design is not so flexible and therefore somewhat limited in its applications as compared with the "gin" pole, it is operated more easily and safely by the inexperienced mechanic. The "A" frame consists of two timbers (1), two suspension cables (3) and a chain hoist (4). Inset shows method of fastening timbers together with bolt (2) and method of attaching chain hoist (4) with a cable sling (5). As with the "gin" pole, substitution of materials may be made as local conditions require.

"Gin" pole safety instructions apply here - read them carefully.

THE TRIPOD (Figure 172)

The tripod is similar in construction to the "A" frame with the exception that an extra compression member or leg has been added to take the place of the suspension cables. It is usually made up of poles or steel pipe and is used as shown in the illustration. Inset shows a method of fastening the three legs (1) and clevis (2) with long bolt (3)-the clevis being used to support the chain block (4).

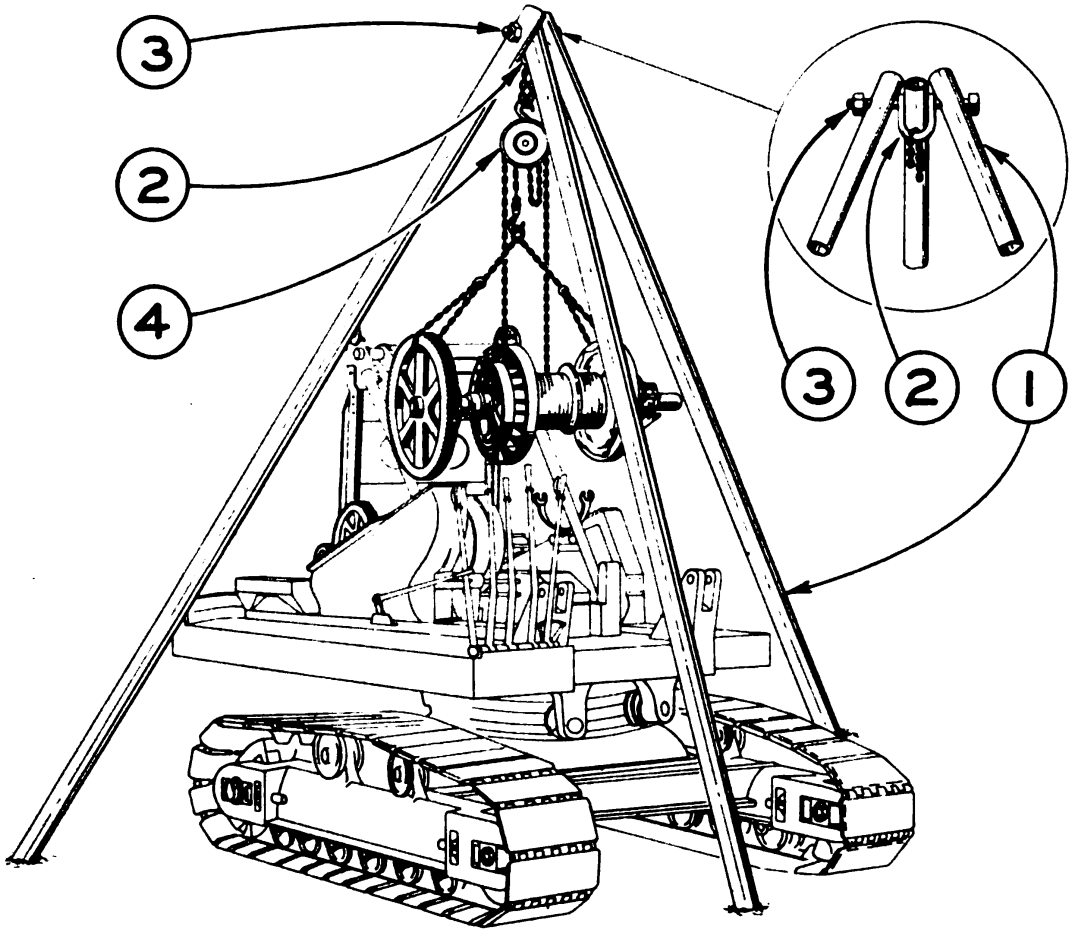


Figure 172

THE RAMP (Figure 173).

When material is not available for the construction of "gin" pole, "A" frame or tripod, it is necessary to lift assemblies or heavy units with jacks, bars and blocks, then roll or skid such assemblies and units to the ground by means of a ramp. For safety, a cable or rope (1) should be securely attached to assemblies and units and snubbed around some part of the machine to control rolling or skidding, and wooden wedges (2) should be driven under timbers as shown to stabilize ramp.

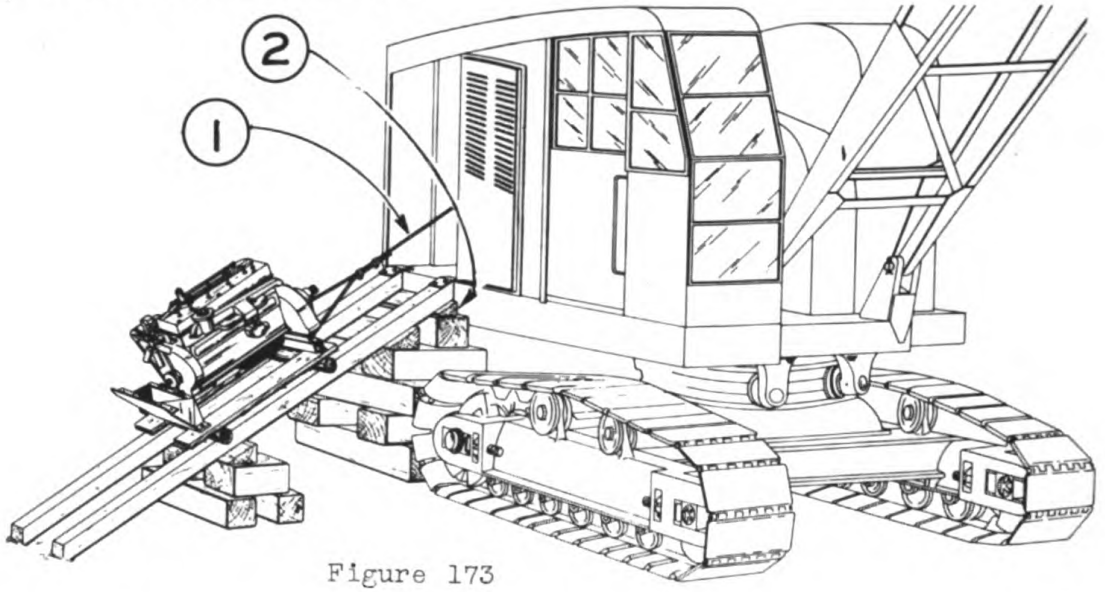


Figure 173

GREASE GUN

With proper care in the use of the grease gun, very little maintenance is required to keep it in efficient operating condition. Since most of the troubles with a grease gun are traceable to foreign particles in the lubricant, repair work consists chiefly of disassembling, cleaning and assembling of the button coupling which has a tendency to filter out the impurities and become 'stopped up'. To insure efficient and trouble-free operation these two simple rules should be followed: 1 - Use only clean grease free from impurities of any kind. 2 - Clean grease fittings before applying the button coupling.

TO DISASSEMBLE: (Figures 174 and 175).

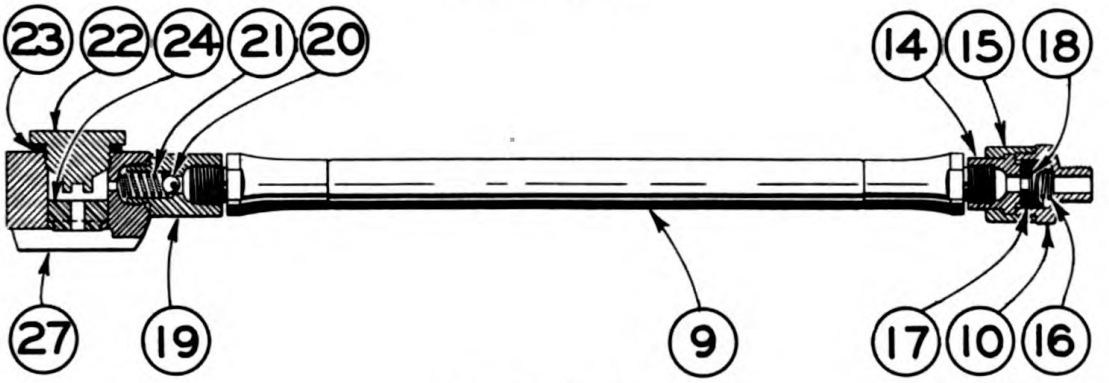
Unscrew cylinder (2) from gun head (3) and remove gasket (25). Remove nut (4) and pull follower rod (5) and latch (28) from cylinder. Remove cup leather assembly (6) and springs (7) and (8) from cylinder. Detach hose assembly (9) from gun head (3) by unscrewing at connection body (10). Punch out rivet (11) after grinding or filing off its head and remove piston (12) and handle (13) from head. Unscrew connection (14) from hose and disassemble by unscrewing hose ring (15) from connection body (10) and removing spring (16), cup leather (17) and flat washer (18). Next remove button coupling by unscrewing adapter (19) from hose and disassemble as follows: Unscrew adapter (19) from button coupling body (27) and remove steel ball (20) and spring (21). Unscrew plug (22) and remove gasket (23) and leather plunger (24).

TO INSPECT:

Clean all parts thoroughly by washing in cleaning fluid and check all metal parts for damage or wear and renew if necessary.

If leather cups of assembly (6) are stiff or worn, renew them. Examine packing (29) by removing packing nut from cup leather assembly and if worn or hard, replace. Examine all gaskets and hose (9) for damage or leaks.

GREASE GUN



.Figure 174

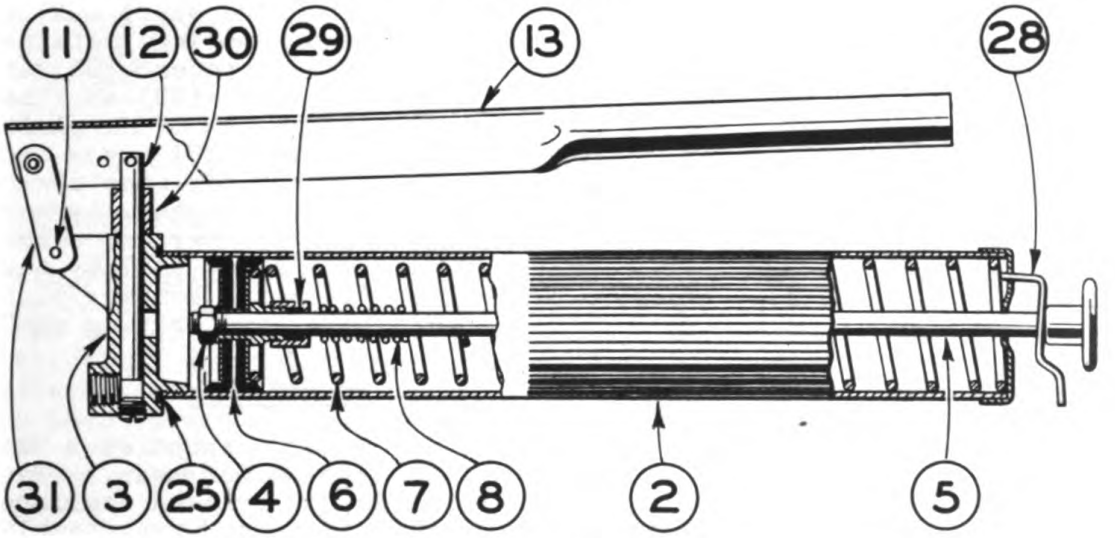


Figure 175

TO REASSEMBLE:

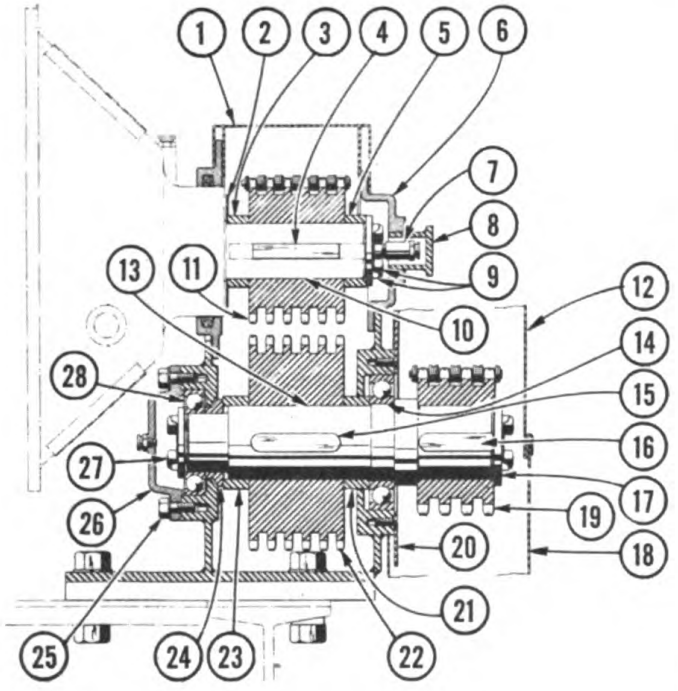
Place latch (28) in position in the end of cylinder (2) and insert follower rod (5), pushing the rod in all the way. Insert spring (7) into cylinder and slide spring (8) on follower rod. Next insert cup leather assembly (6) into cylinder, slipping it over follower rod (5) then attach nut (4). Slip spacer (30) on piston (12) and insert piston into head (3). Line up holes of links (31) with hole in gun head (3); insert rivet and peen. Place gasket in position on gun head (3) and screw cylinder (2) into place. Next assemble button coupling by inserting leather plunger (24) into coupling body (27) and replacing plug (22) with gasket (23) in place. Place ball (20) and spring (21) in position in adapter (19) and screw adapter into button coupling assembly. Assemble connection (14) into hose ring (15), then, after placing spring (16), cup leather (17) and flat washer (18) in position in connection body

(10) as shown in Figure 174, screw connector body into hose ring and tighten. Now mount connector on one end of hose (9) and button coupling on the other end then attach hose assembly (9) to gun head (3).

REDUCTION CASE AND ENGINE SPROCKET

TO DISASSEMBLE:

Remove power transmission chain case cover (12), power transmission chain, reduction case cover and reduction chain as outlined on page (197). Take out bolts in front engine support and rear engine foot and raise engine approximately three inches. Remove grease cap (8), alemite fitting with nipple (7) and grease pipe cover (6). Take out two capscrews in end of engine clutch shaft (10), remove keeper plate (9) and pull off sprocket (11). Remove hose and take out bolts from lower half of case (18) and remove it. Remove capscrews (25) and take off bearing retainer (26). Take off capscrews and lock plate (27), remove flat head capscrews from oil shield (20), then pull or drive shaft out of case removing retainer (24), spacer (23) and sprocket (22) as they become free of the shaft. Bearing (28) may be tapped out of case toward front of engine. Sprocket (19) may be removed from shaft (13) by taking off keeper plate (17) and driving shaft out.



TO INSPECT:

Check sprockets and chains for wear. Wash bearings in cleaning fluid and examine them for cracked balls or chipped races. Wrap them in clean paper until ready to reassemble.

TO REASSEMBLE:

Tap bearing (14) into place on shaft, slip spacer (21) into place and seat key (15). Start shaft through housing slipping on sprocket (22), spacer (23) and retainer (24) in order shown in illustration. Drive shaft lightly until bearing (14) is seated and then fit bearing (28) into housing over shaft. Place keeper plate into position and fasten with lock plate and capscrews. Pack bearing with WB grease. Replace retainer (26) securing it with capscrews (25). Pack bearing (14) with WB grease and replace oil shield (20). Seat key (16) and drive sprocket (19) into place locking it with keeper plate, lock plate and capscrews (17). Replace lower half of case (18) and connect hose. Install oil slinger (2), spac- (3), key (4) and drive sprocket (11) on shaft (10). Slip on spacer '5) and replace keeper plate, fastening it with lock plate and cap- crews. Replace cover (6), grease fitting (7) and cap (8). Re- lace case covers and chains as described on page (197). Refer to ubrication instructions for greasing.

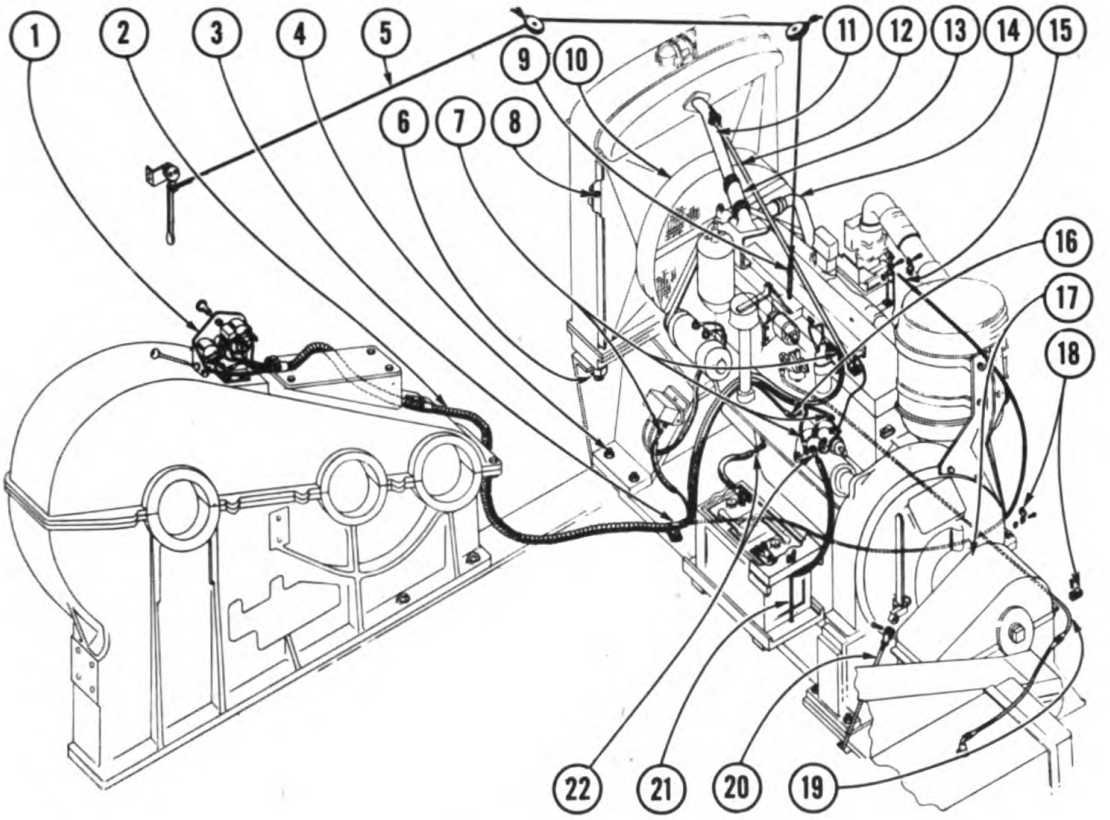


FIGURE 176

TO REMOVE ENGINE:

Drain coolant from radiator and remove brace 12. Loosen radiator hose 13 and slide it up on outlet pipe 11. With pipe wrench unscrew outlet pipe from upper radiator tank and then remove hose connection and inlet pipe 14 from left hand side of engine and radiator base. Remove two nuts 6 from studs at base of radiator and then loosen shroud 10 by removeing stove bolts 8. Pull shroud back away from radiator and lift radiator off, being careful not to lose rubber supports between radiator and engine base. Remove shroud.

Disconnect governor control 5 by unhooking spring 9. Detach throttle control at 15, oil gauge tubing at 16, ignition and starter wires 7 and battery cables 22. Remove clip 3 and pull wires and conduit 2 out from under motor and place them around instrument panel 1. (It is recommended that all wires be tagged or marked in some way for ease in re-assembling.)

Disconnect fuel line 19 at carburetor and remove completely from engine by freeing clips 18. Remove battery and battery case by unscrewing bolts 21 and then take out eight engine base bolts 4. Remove reduction case cover 17 and split chain as outlined on Page (198). Disconnect clutch link 20 and raise engine enough so that two skids (2" x 6" plank will do) can be inserted between engine base and turntable. Skid engine out of cab side door as shown on Page 206.

NOTE: Air cleaner and other engine accessories need not be disturbed for engine removal but if engine is to be disassembled for overhaul it is a good practice to remove them to avoid damage.

Refer to engine section for instruction on these units.

TO REPLACE MOTOR:

Skid engine into cab, clutch end first, and position it so that engine drive sprocket is in line with sprocket in reduction case. Remove skids and connect reduction chain as described on Page 198. Line up holes in engine base with holes in turntable and insert and tighten eight base bolts 4. Replace reduction case cover 17 as outlined on Page 198.

Connect fuel line 19 at fuel tank and carburetor and fasten it with clips 18. Place flexible conduit 2 in position and fasten with clip 3. Replace wires 7 in their respective positions as noted on tags. Connect throttle control 15, governor control 5 and oil gauge tubing 16. Place battery and battery case in position and secure with bolts 21. Connect cables 22. Attach clutch link 20 with pin and secure with cotter.

Place shroud 10 in position over fan and mount radiator, being sure to replace rubber supports between radiator and engine base. Fasten shroud to radiator with stove bolts 8 and screw outlet pipe 11 to upper radiator tank. Slip hose connection 13 into place and fasten with clips. Secure radiator with two nuts 6. Mount inlet pipe and hose connection 14 and install radiator brace 12.

NOTE: If air cleaner or other engine accessories have been removed, replace them, observing instruction for their correct installation as given in engine section. Fill radiator and check oil in engine and reduction case. (Refer to Lubrication Chart Page 67 for instructions). Observe instructions in engine section before starting and also refer to this section for engine operating adjustments.

PARTS SECTION

WARNING

SPARE PARTS can be supplied promptly and accurately only if positively identifed by correct part number and correct part name.

FURNISH THIS INFORMATION ON ALL REQUISITIONS. WITHOUT FAIL, on all requisitions, give name of machine, name of manufacturer, model or size, manufacturer's serial number of each machine and subassemblies attached to machine, and components and accessories for which spare parts are required.

List spare parts for only one make or kind of machine on each requisition.

Requisitions must be double spaced to provide room for office notations when necessary.

WARNING

"When requisitioning parts do not use 'XA' numbers in the Parts Lists. For the crane use manufacturer's parts numbers which can be obtained by referring to the cross-reference which follows the Koehring Parts List. For the light plant use the number which follows the name and description of the part as shown in the Kohler Light Plant Parts List."

INDEX PARTS SECTION

On this page is shown a sample spare parts requisition on QMC Form No. 400 which conforms to the latest revisions. The marginal notes give instructions for preparing a requisition for spare parts for Engineer equipment.

The revised QMC Form 400 has new column headings. Until new forms are available use the present form and type or write in corrections in column headings as shown below.

Under revised heading "Nomenclature" and "Unit" list the article and the unit (ea for each; lb for pound; etc.). Under heading "Maximum or Authorized Level" list the authorized organizational allowances or depot stock levels given in ENG 7 and ENG 8 of the ASF Engineer Supply Catalog (superseding Part III, Corps of Engineers Supply Catalog). The total number on hand for each item is listed under "On Hand". In column headed "Due In" enter the total quantity previously requisitioned but not delivered. Column headed "Required" is to be changed to read "Quantity Desired" and column headed "Approved" is to read "Remarks." For "Initial" and "Replenishment" requisitions, the sum of "Quantity Desired", "Due In", and "On Hand" should equal "Maximum or Authorized Level."

(Additional details on this subject are covered in ENG 1 of the ASF Engineer Supply Catalog which incorporates information formerly contained in Section AA-1, Part III, Engineer Supply Catalog.)

State PERIOD designation by use of one of the following terms:
(1) "INITIAL"—first requisition of authorized allowances.
(2) "REPLENISHMENT"-subsequent requisitions to maintain authorized allowances.
(3) "SPECIAL"—requisitions for necessary repairs not covered by allowances.

Type "SPARE PARTS" in upper right hand corner of requisition.

Address requisitions to Engineer Field Maintenance Office, P. O. Box 1679, Columbus, Ohio (except for spare parts for searchlights and barrage balloons which are addressed to Schenectady, N. Y. or Ogden, Utah ASF depots).

Give complete shipping instructions. Special instructions for packing, marking, routing, etc., should be given at bottom of requisition.

State proper nomenclature of machine, also make, model, machine serial number and U. S. A. registration number.

Prepare a separate requisition for each different machine.

State basis or authority and date delivery is required, immediately below description of machine.

Double space between items.

Group parts required under group headings as shown in manufacturers' parts catalogs (Technical Manuals).

State OCE stock numbers, manufacturers' parts numbers and nomenclature accurately and completely. Do not use abbreviations.

SPARE PARTS

(SAMPLE)
REQUISITION

To: Engineer Field Maintenance Office — No. of Sheets 1 — Sheet No. 1
P.O. Box 1679, Columbus, Ohio
Requisition No. E-743-5-41 — Date May 2, 1944 — Period Replenishment

SHIP TO Engineer Property Officer, Pine Camp, New York.

MARKED FOR: Engineer Supply Officer, 802nd Eng. Battalion, Pine Camp, N.Y.

Requisitioned By: (Show Signature, Rank, Organization, Destination. If different from "ship to" include address)
Robert E. Roe
Robert E. Roe,
Major, C. E.,
Engineer Property Officer.

Approved
For the Commanding Officer:
John E. Doe
John E. Doe,
Col., C. E.,
Executive Officer.

MFG. NO.	NOMENCLATURE AND UNIT	AUTH. or BAS LEVEL	ON HAND	DUE IN	REQUIRED	APPROVED
	PARTS FOR CRANE, CRAWLER, KOEHRING MODEL 304					
	SERIAL NO. U.S.A. REG.NO. W-9871					
	Basis: Repair of Disabled Equipment					
	Delivery is requested by May 17, 1944					
	KOEHRING 304 CRANE GROUP					
	CRAWLERS					
XA 15	Shoe, Crawler	ea. 0	0	0	4	
XA 11	Pin, Shoe	ea. 0	0	0	4	
	TWO SPEED SHAFT					
XA 119	Spacer, Bearing	ea. 0	0	0	1	
XA 120	Bearing	ea. 0	0	0	1	
XA 121	Washer, Thrust	ea. 0	0	0	1	
	BUDA ENGINE GROUP					
	DIESEL K42B, SERIAL NO. 252415					
	CAMSHAFT ASSEMBLY					
XA 2045	Key, Camshaft Gear	ea. 0	0	0	1	
XA 2047	Camshaft	ea. 0	0	0	1	

*Nonexpendable items such as tools must be accounted for, when requisitioned, by a statement that they have been placed on REPORT OF SURVEY or STATEMENT OF CHARGES.

Emergency requisitions sent by telephone, teletype, cablegram, telegraph or radio must be confirmed immediately with requisition marked: "Confirming (state identifying data)."

PREPARATION OF REQUISITIONS

A Sample requisition in the correct form for submission by the Engineer Property Officer is shown on the opposite page.

THIS SHALL BE FOLLOWED IN MAKING OUT REQUISITIONS.

In order to eliminate duplication of work, Property Officers may authorize organizations to prepare requisitions in final form, leaving requisition number space blank for completion by Property Officer.

THE FOLLOWING RULES WILL BE OBSERVED CAREFULLY IN PREPARING REQUISITIONS FOR SPARE PARTS:

a. Prepare a separate requisition for each different machine.

b. Type "SPARE PARTS" in upper right hand corner of requisition form.

c. State PERIOD designation by use of one of the following terms:

   (1) "INITIAL" - first requisition of authorized allowances.

   (2) "REPLENISHMENT" - subsequent requisitions to maintain authorized allowances.

   (3) "SPECIAL" - requisitions for necessary repairs not covered by allowances.

d. Give complete shipping instuctions.

e. State proper nomenclature of machine, and make, model, serial number and registration number.

f. State basis or authority, and date delivery is required, immediately below description of machine.

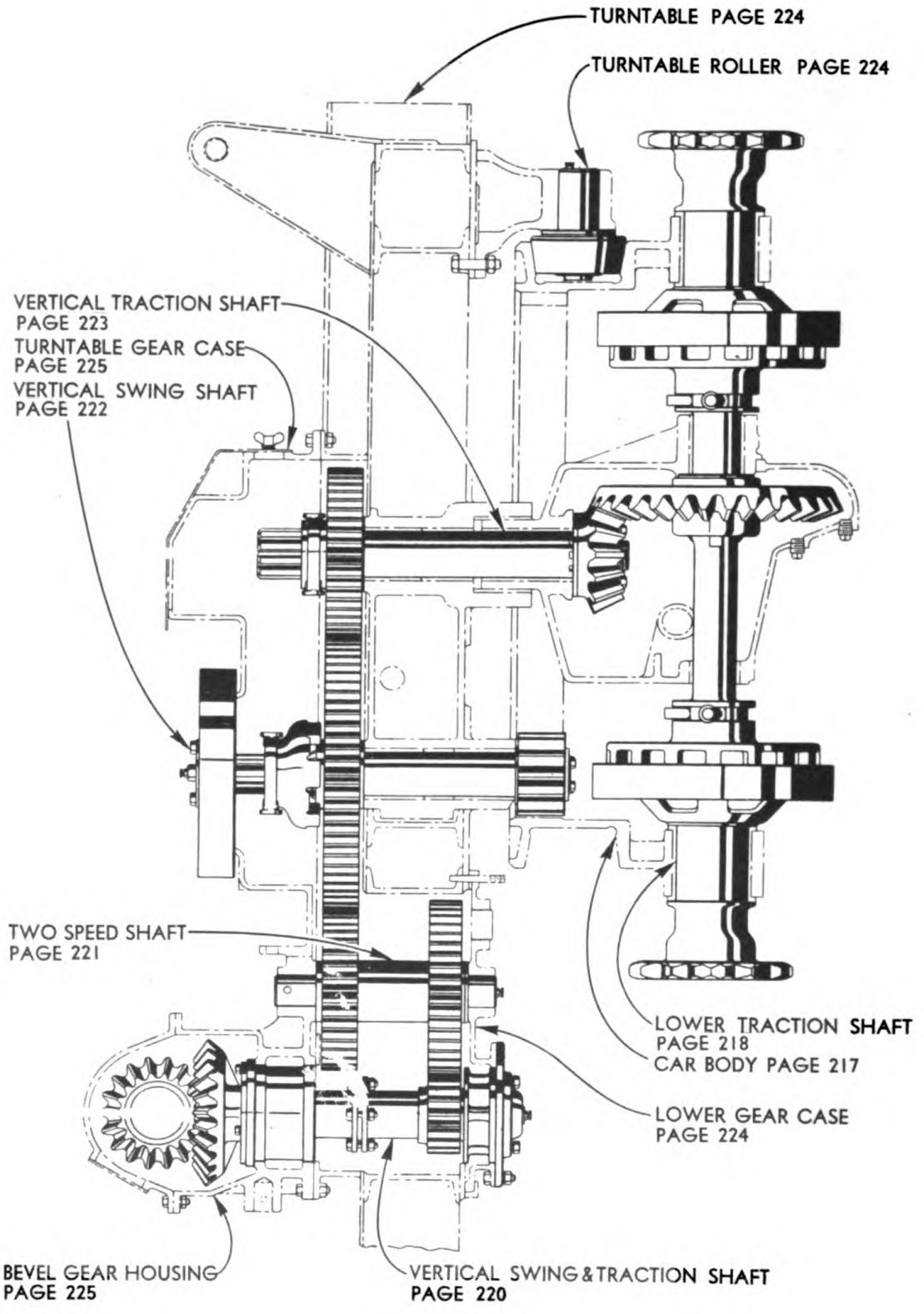
g. Group parts required under group headings as shown in manufacturers' parts catalogs.

h. State manufacturers' parts numbers and nomenclature descriptions accurately and completely. Do not use abbreviations.

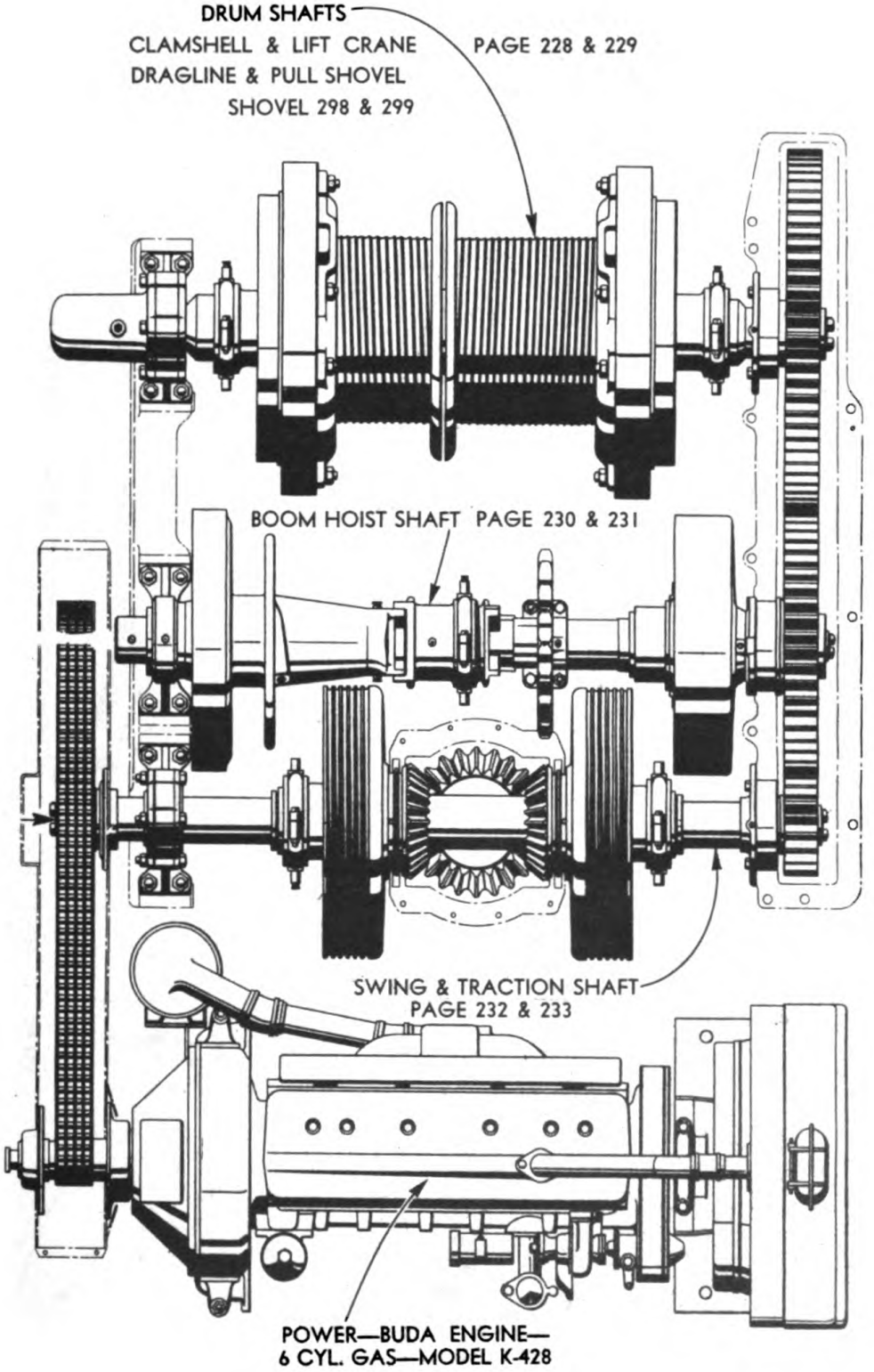
i. Double space between items.

j. Emergency requisitions sent by telephone, telegraph, or radio must always be confirmed immediately with requisition marked: "Confirming (state identifying data)".

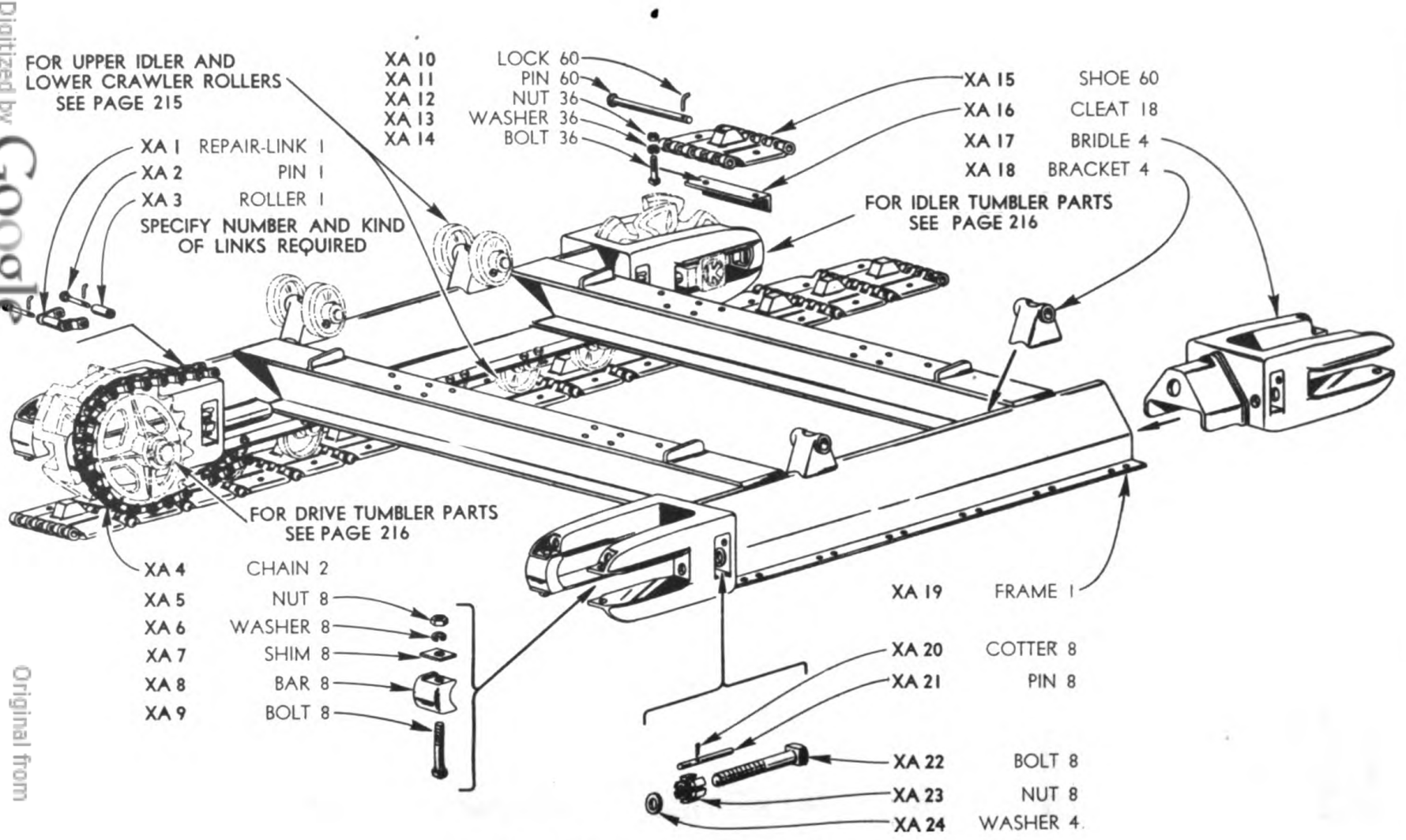
k. Nonexpendable items must be accounted for.



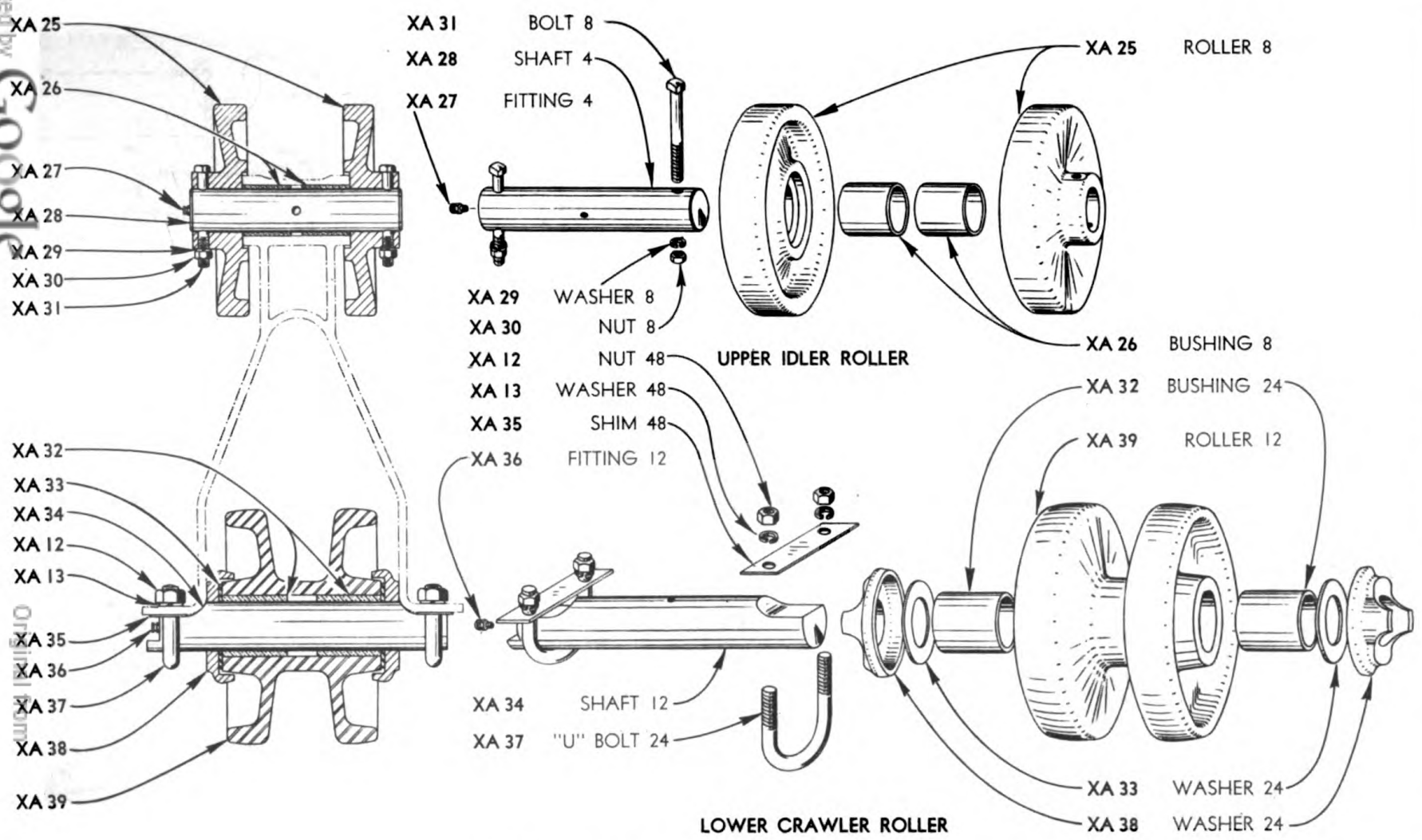
LOWER MACHINERY ASSEMBLY



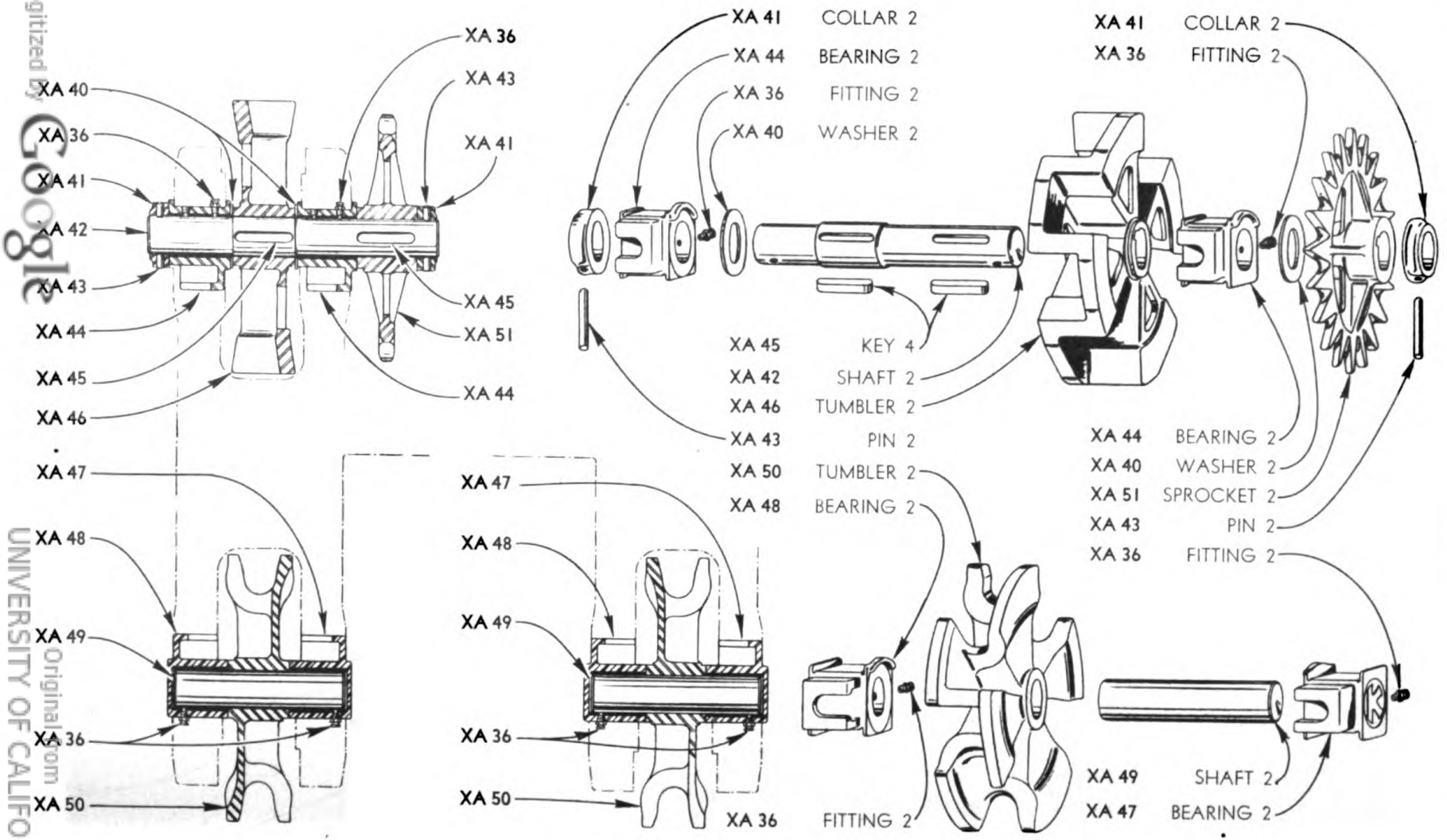
UPPER MACHINERY ASSEMBLY



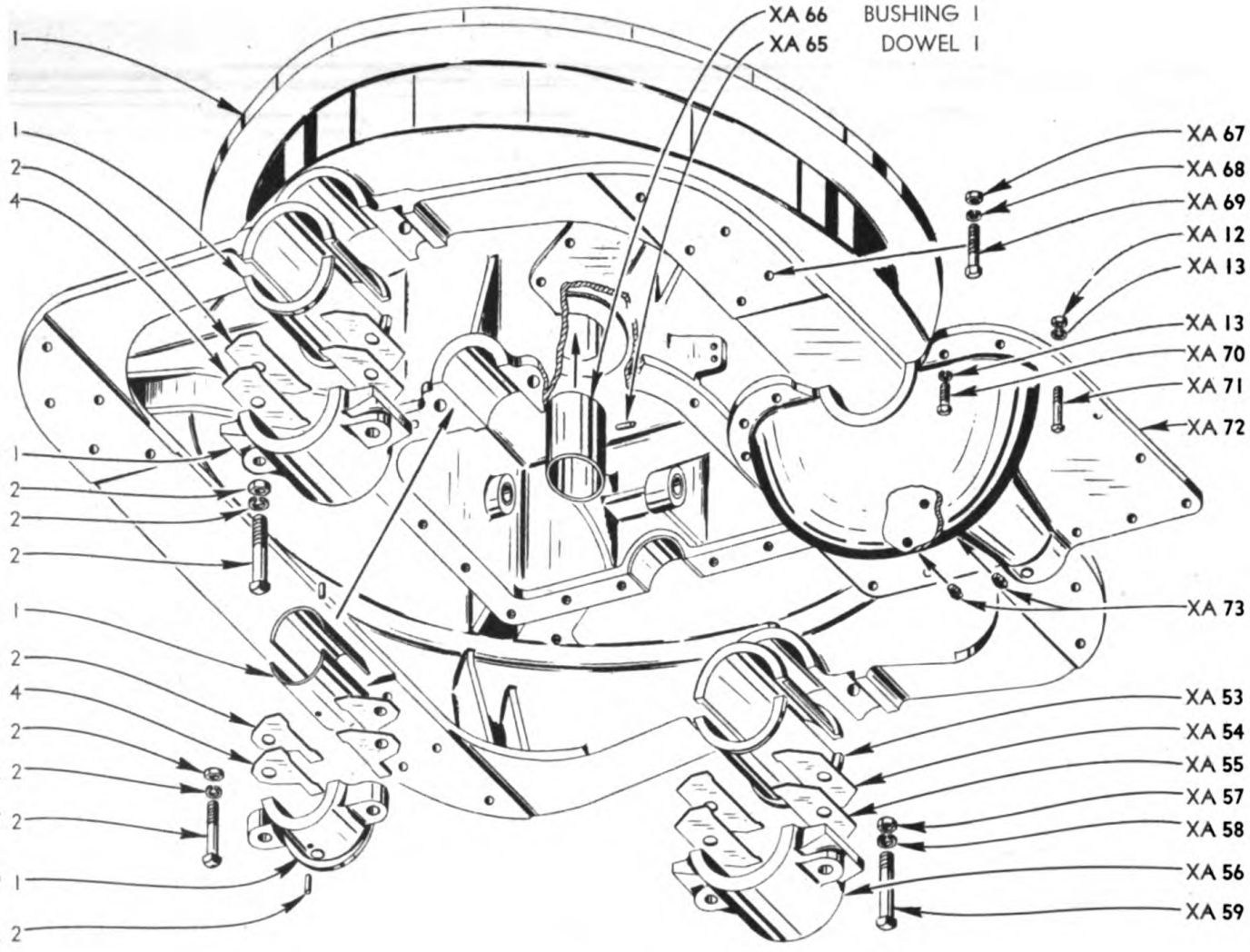
CRAWLER FRAME AND AXLE - DRIVE CHAIN



UPPER IDLER AND LOWER CRAWLER ROLLERS



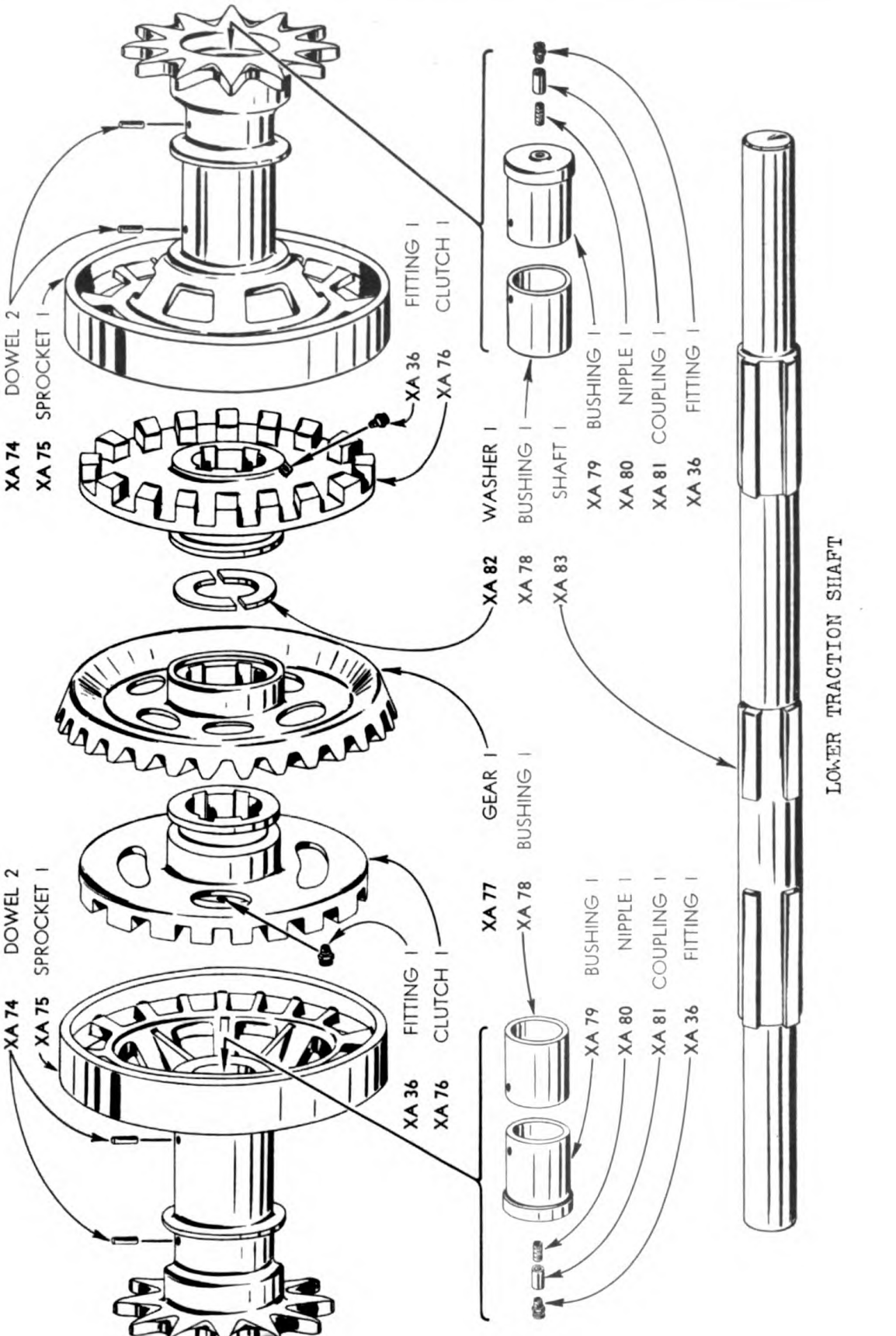
IDLER AND DRIVE TUMBLER SHAFTS

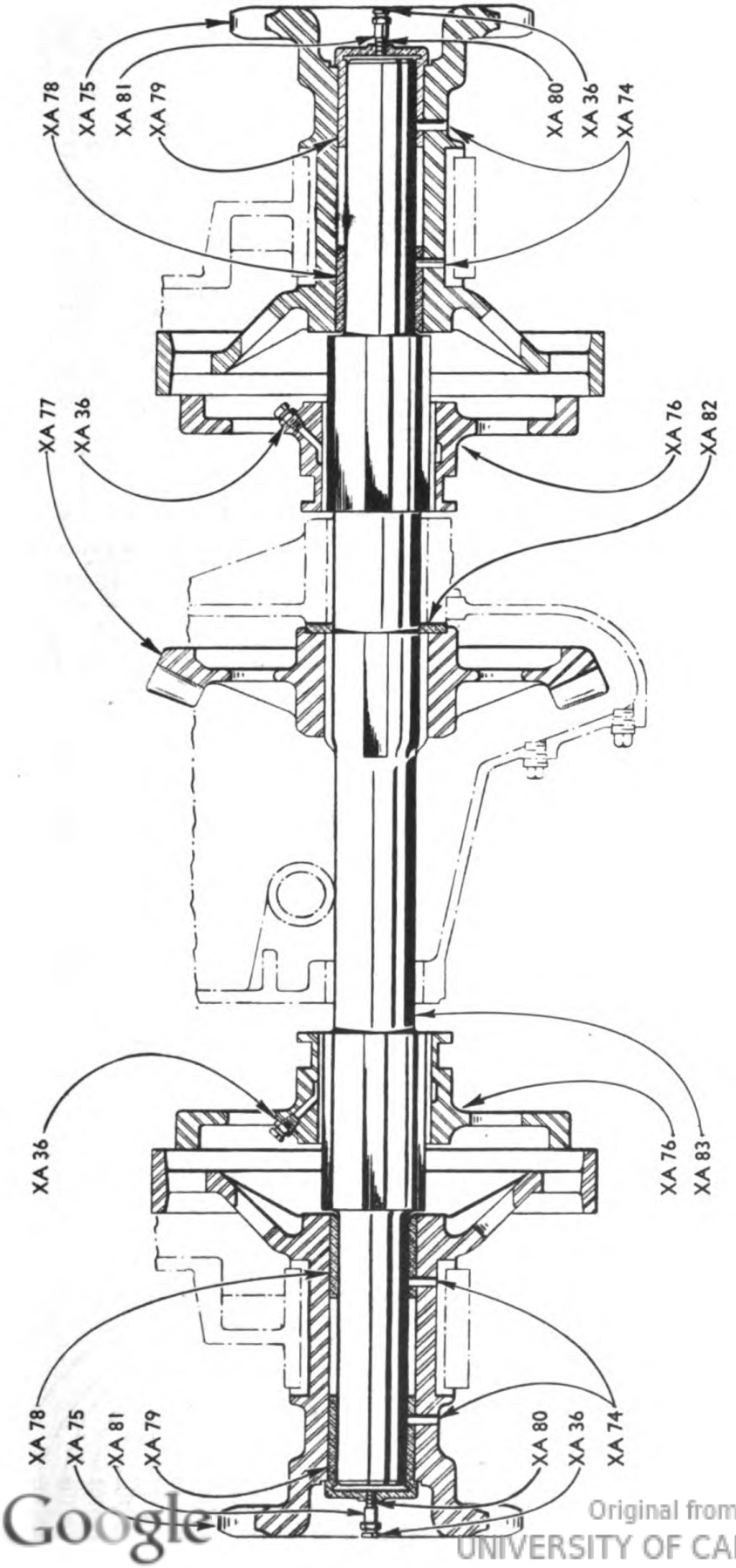


XA 52 CAR BODY 1
XA 53 BUSHING 1
XA 54 SHIM 2
XA 55 SHIM 4
XA 56 CAP 1
XA 57 NUT 2
XA 58 WASHER 2
XA 59 BOLT 2
XA 60 BUSHING 1
XA 61 SHIM 2
XA 62 SHIM 4
XA 57 NUT 2
XA 58 WASHER 2
XA 63 BOLT 2
XA 64 CAP 1
XA 65 DOWEL 2

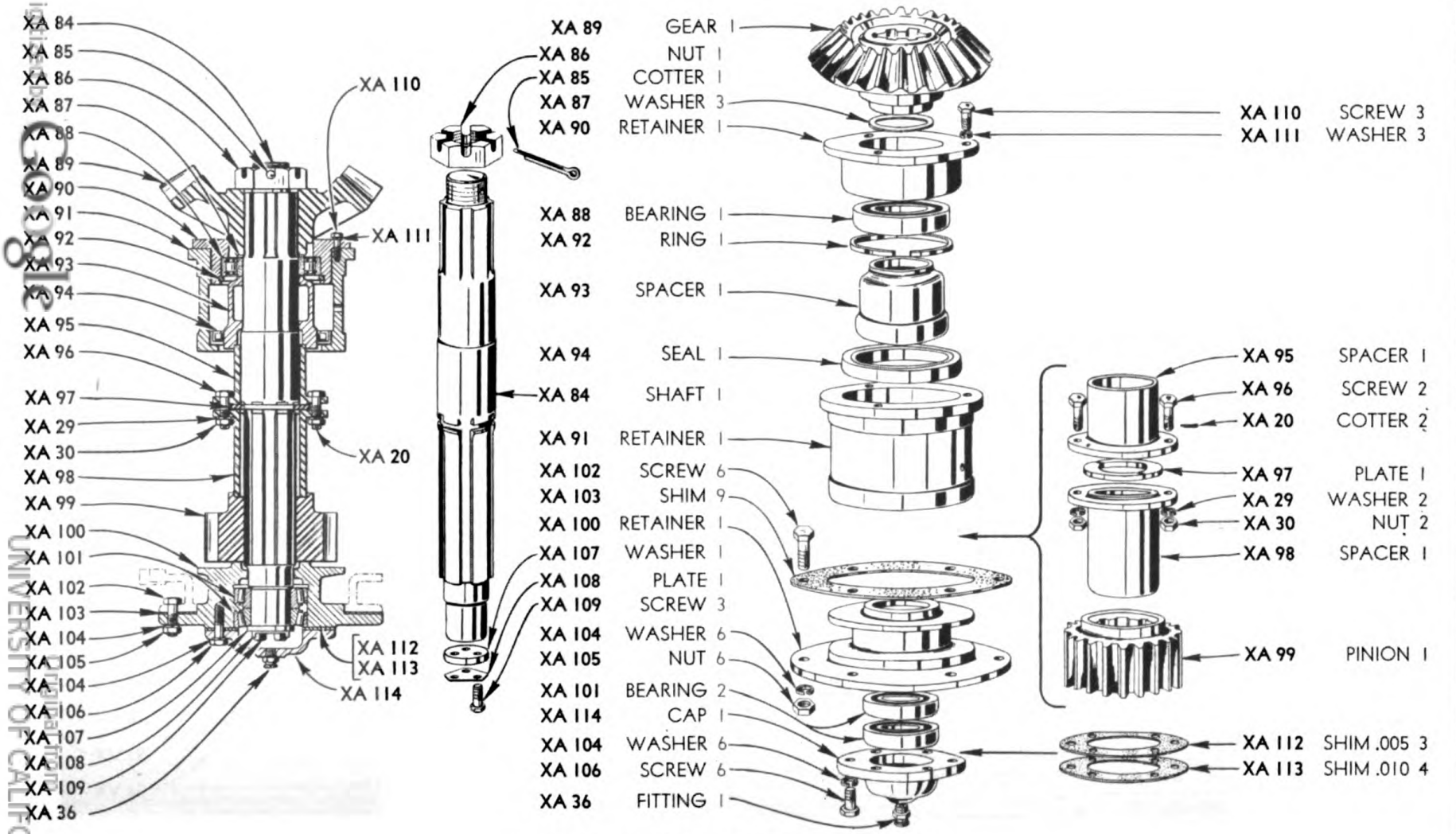
XA 66 BUSHING 1
XA 65 DOWEL 1
XA 67 NUT 20
XA 68 WASHER 20
XA 69 SCREW 20
XA 12 NUT 6
XA 13 WASHER 6
XA 13 WASHER 10
XA 70 SCREW 10
XA 71 BOLT 6
XA 72 COVER 1
XA 73 PLUG 2
XA 53 BUSHING 1
XA 54 SHIM 2
XA 55 SHIM 4
XA 57 NUT 2
XA 58 WASHER 2
XA 56 CAP 1
XA 59 BOLT 2

CARBODY

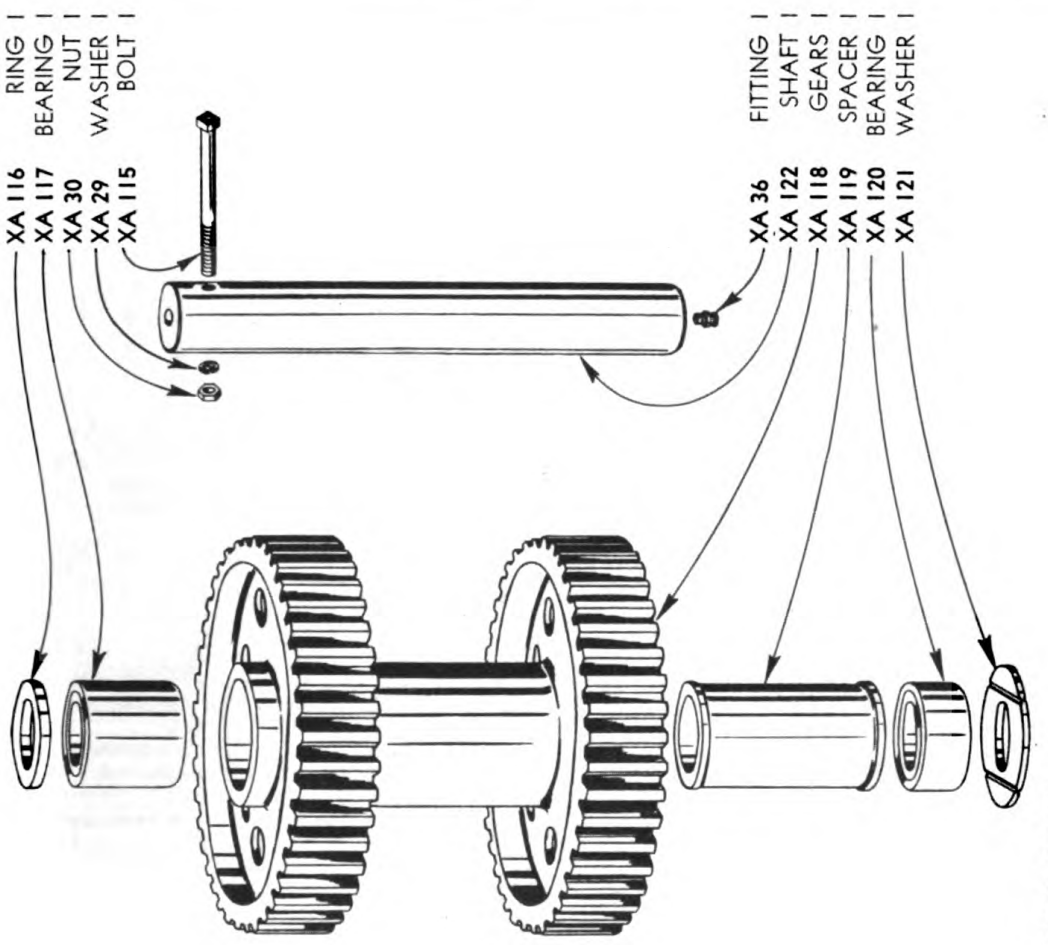




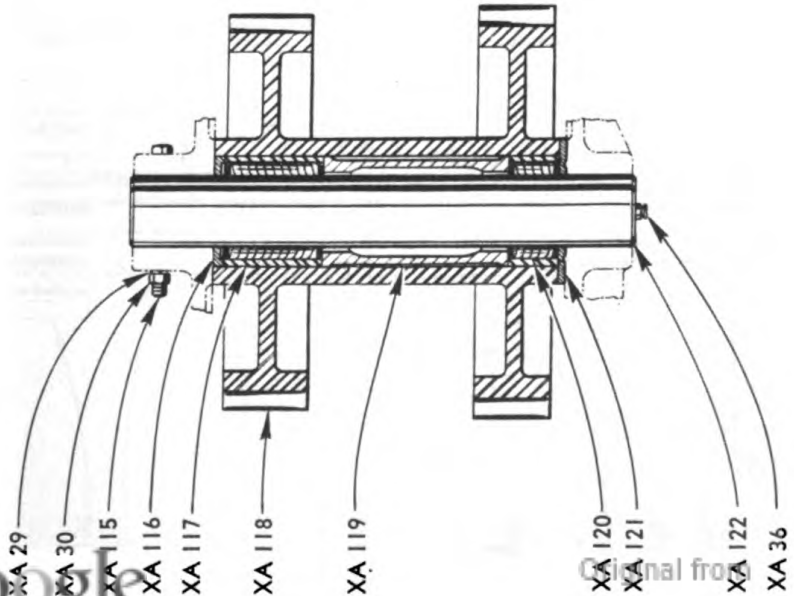
LOWER TRACTION SHAFT
(SECTIONAL VIEW)

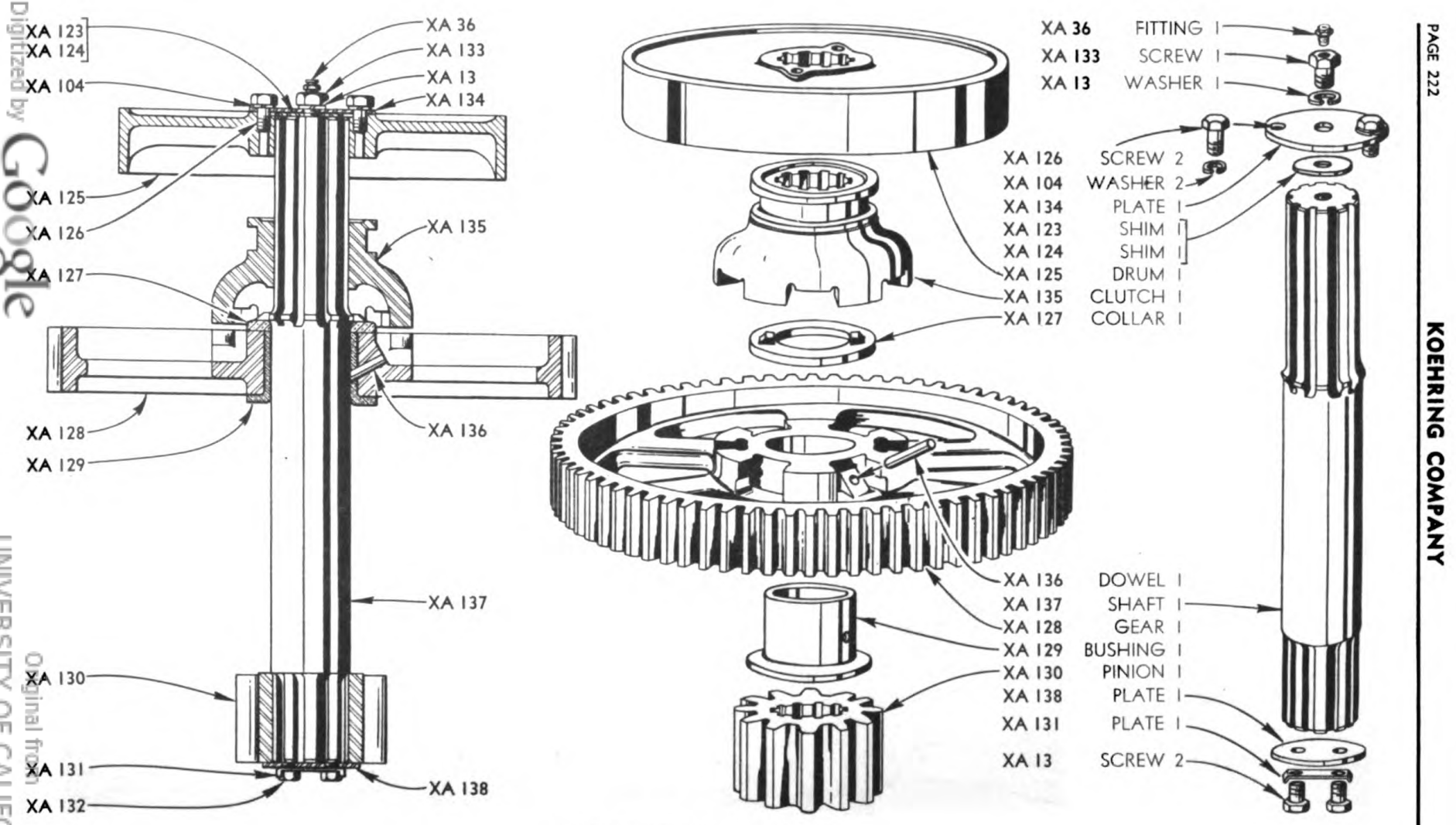


VERTICAL SWING AND TRACTION SHAFT

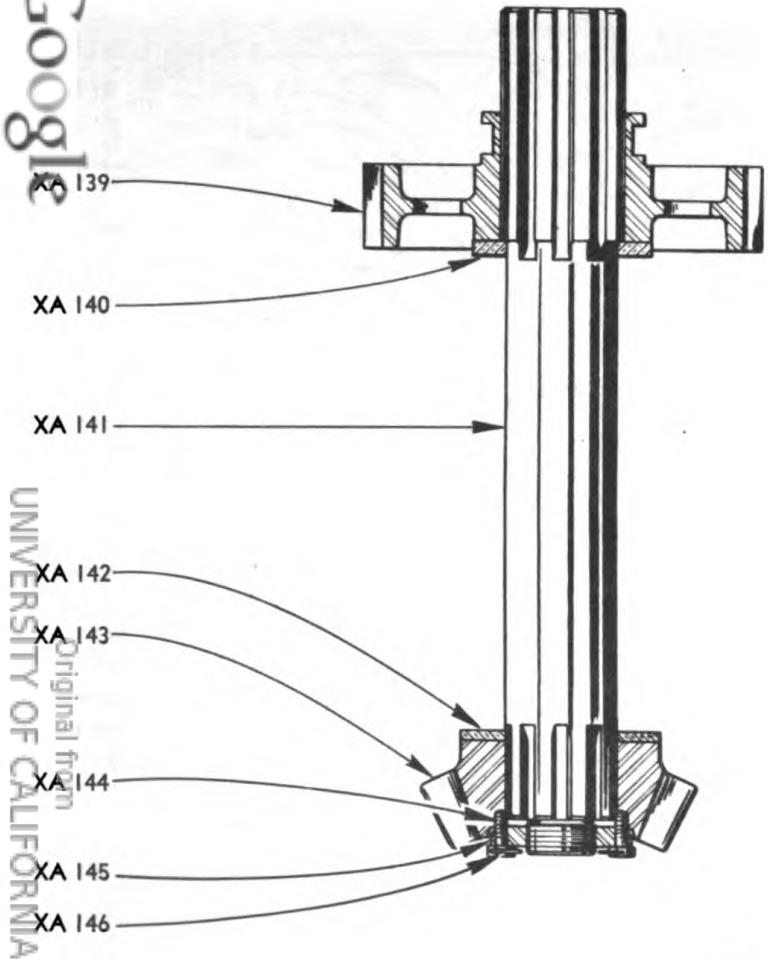


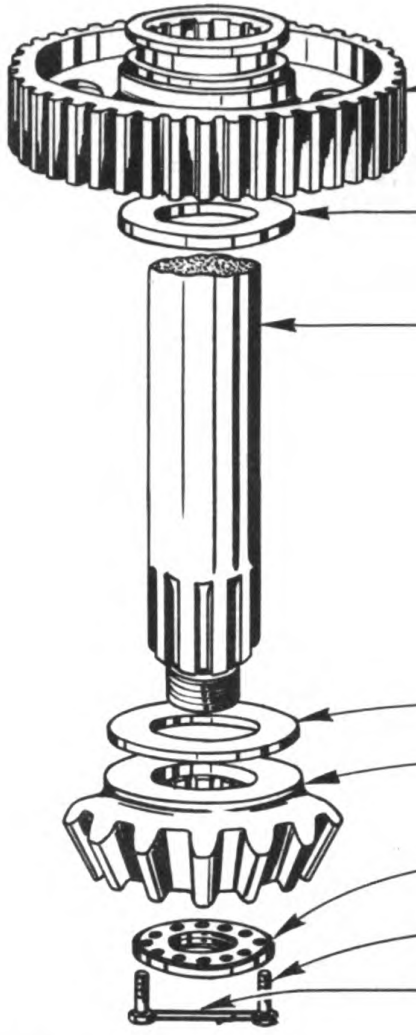
TWO SPEED SHAFT





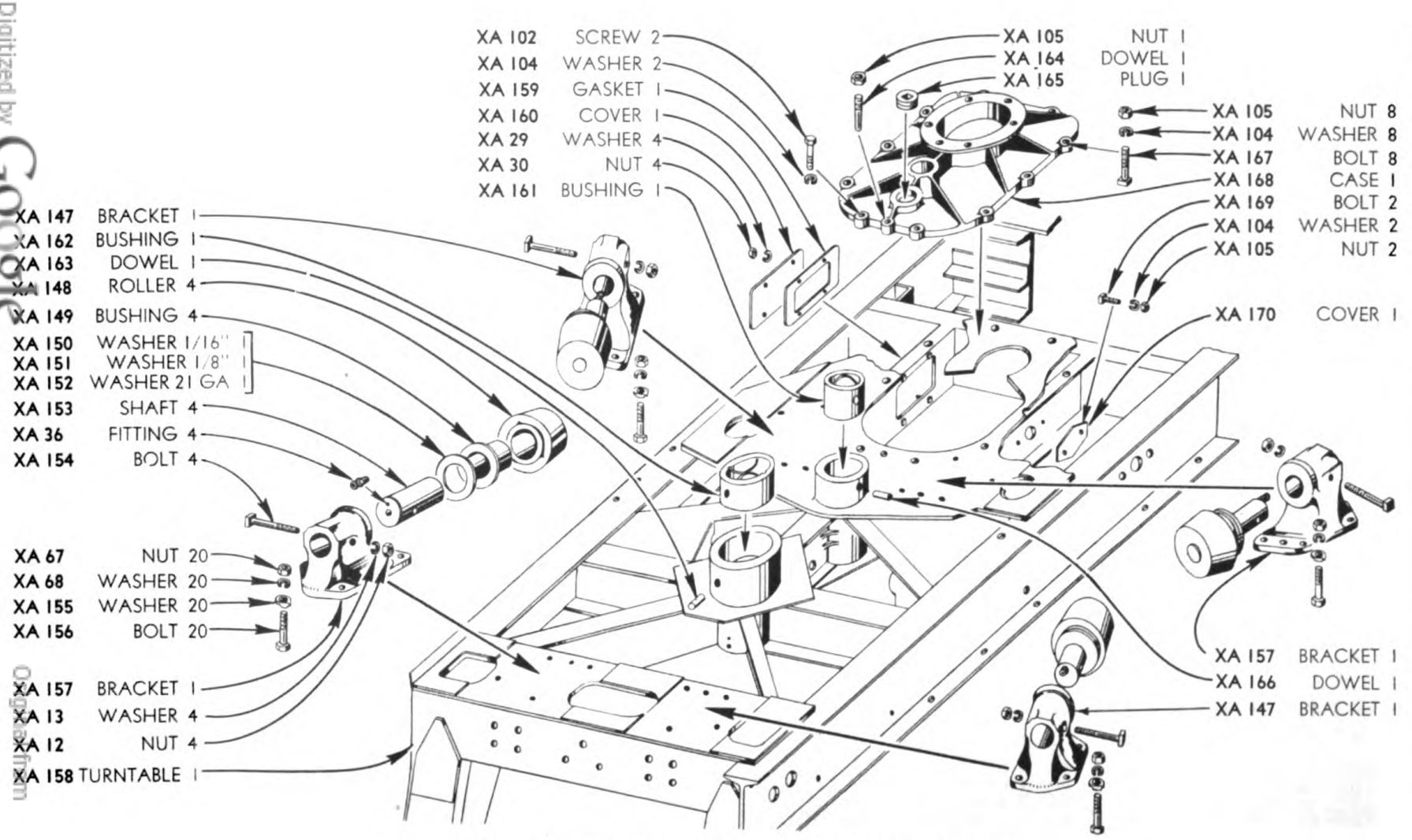
VERTICAL SWING SHAFT



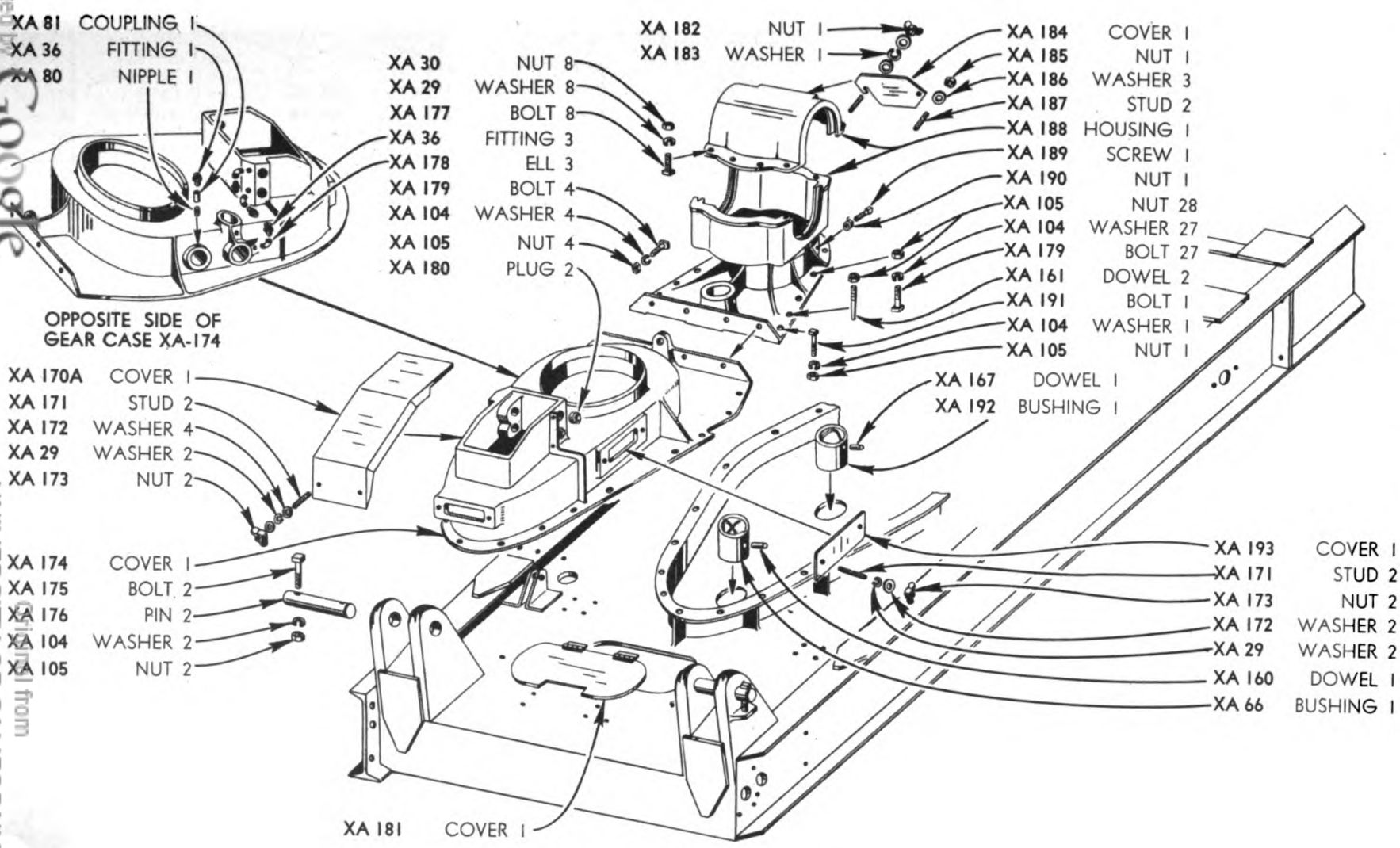


XA 139	GEAR	1
XA 140	WASHER	1
XA 141	SHAFT	1
XA 142	WASHER	1
XA 143	PINION	1
XA 145	NUT	1
XA 144	SCREW	2
XA 146	WIRE	1

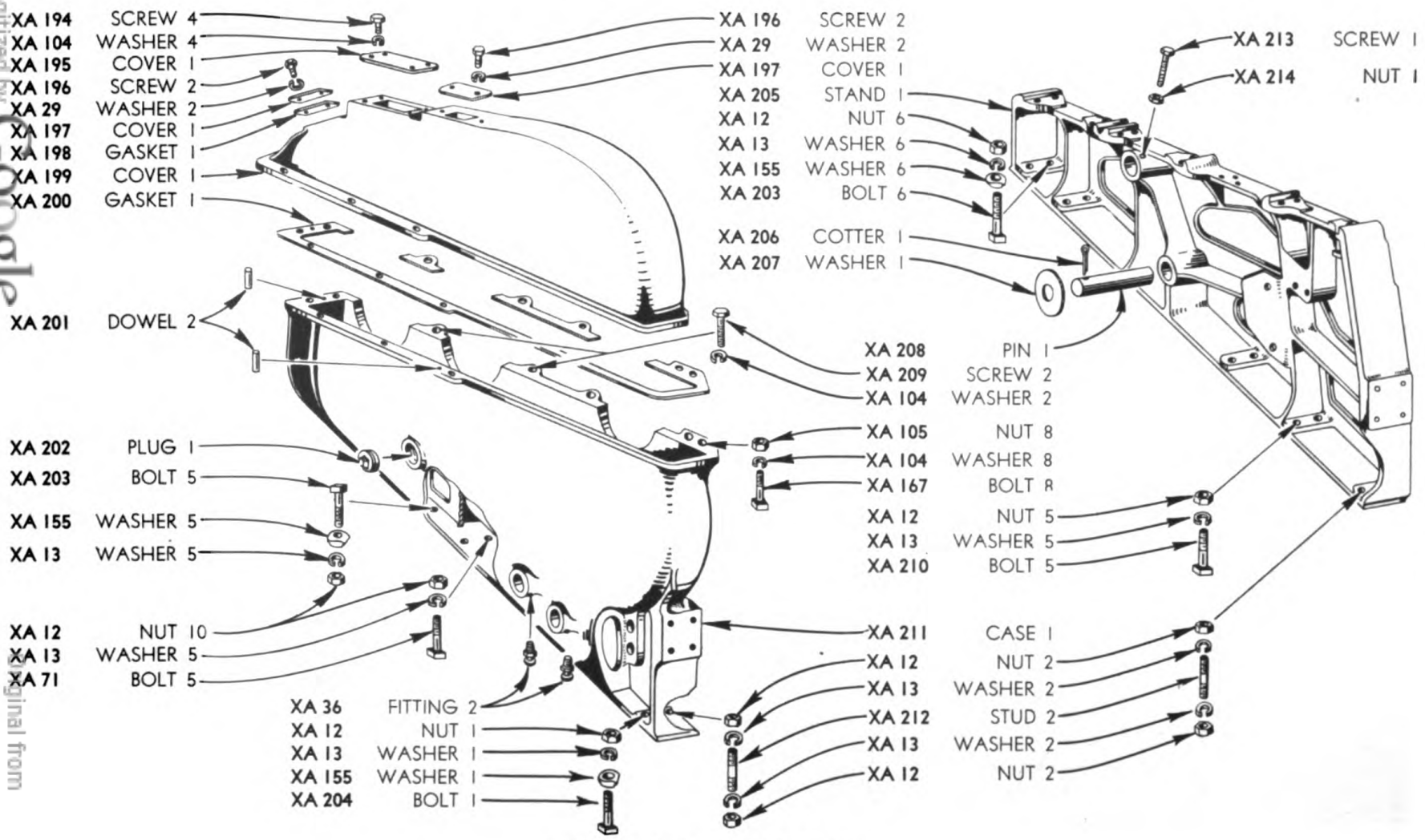
VERTICAL TRACTION SHAFT



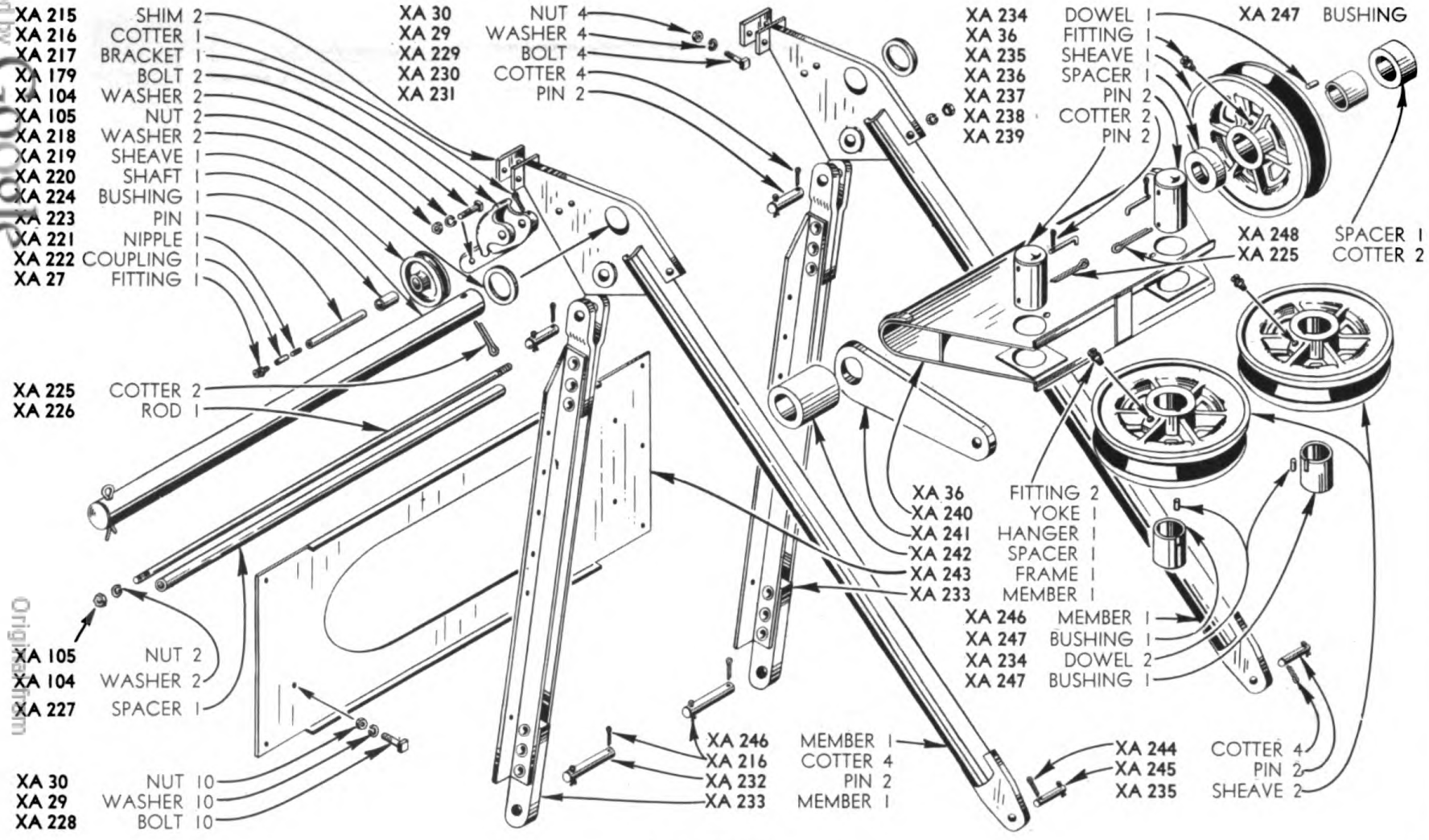
TURN TABLE - LOWER GEAR CASE - TURN TABLE ROLLERS



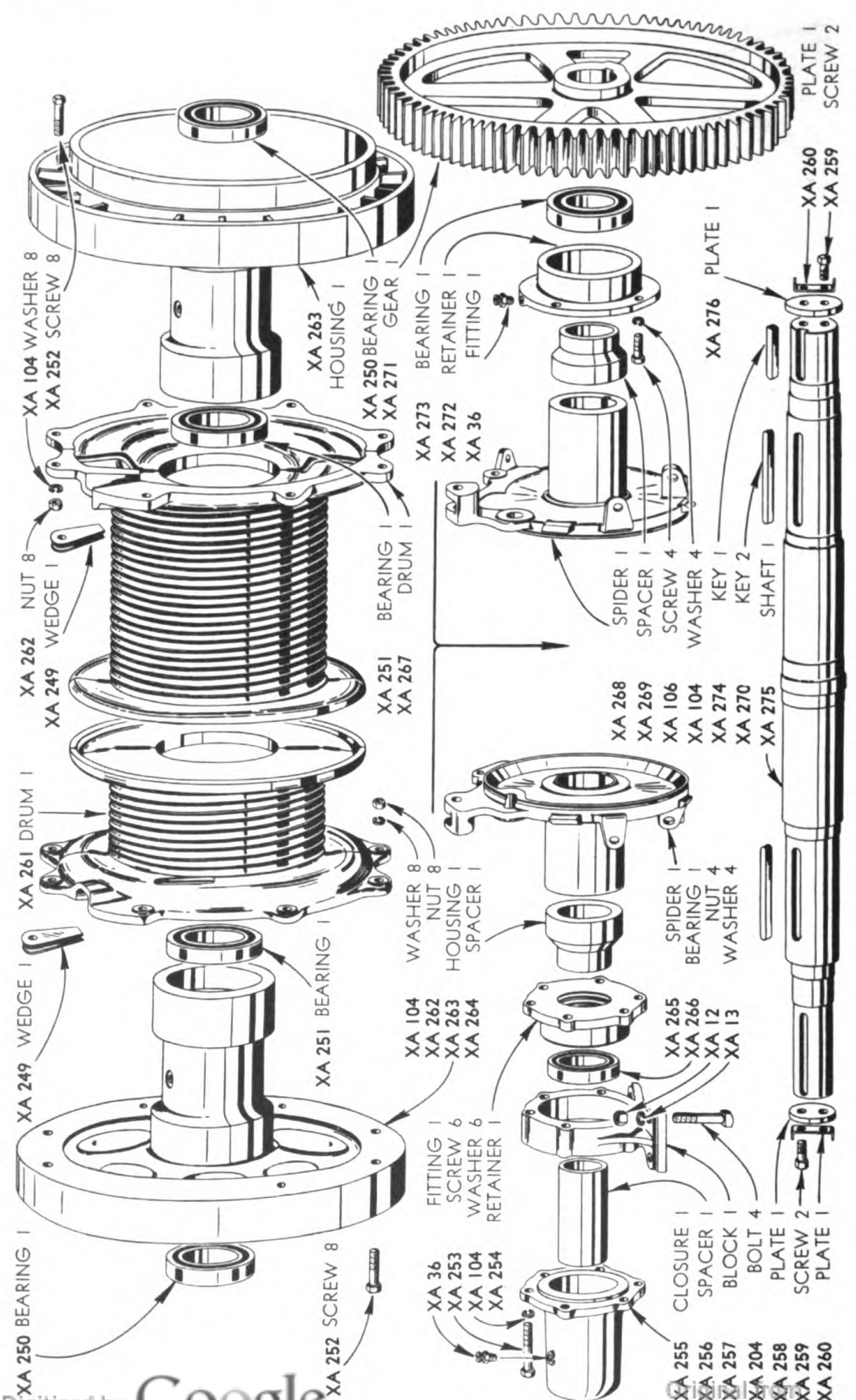
TURNTABLE GEAR CASE - BOOM PIVOT POINT



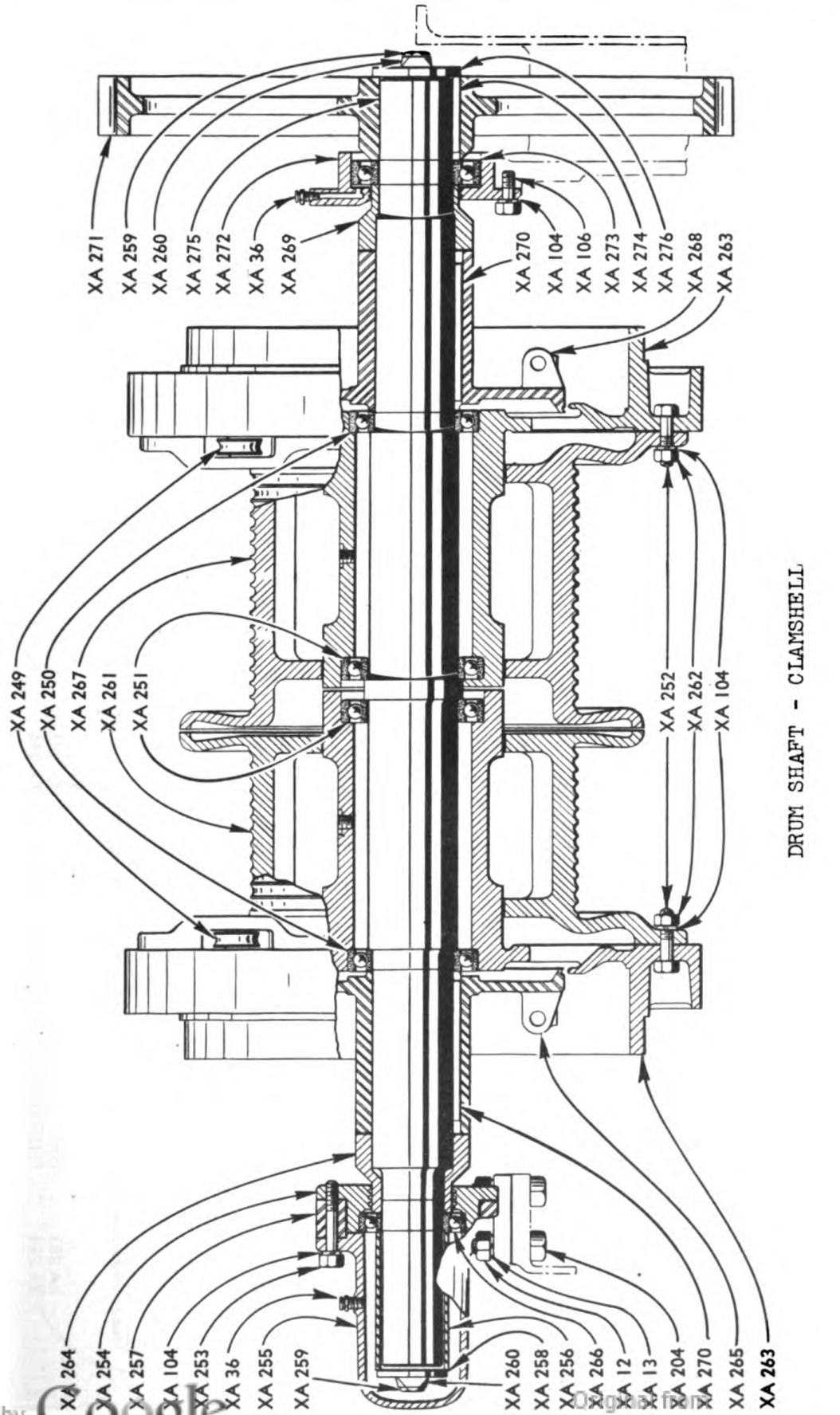
SIDE STAND - GEAR CASE



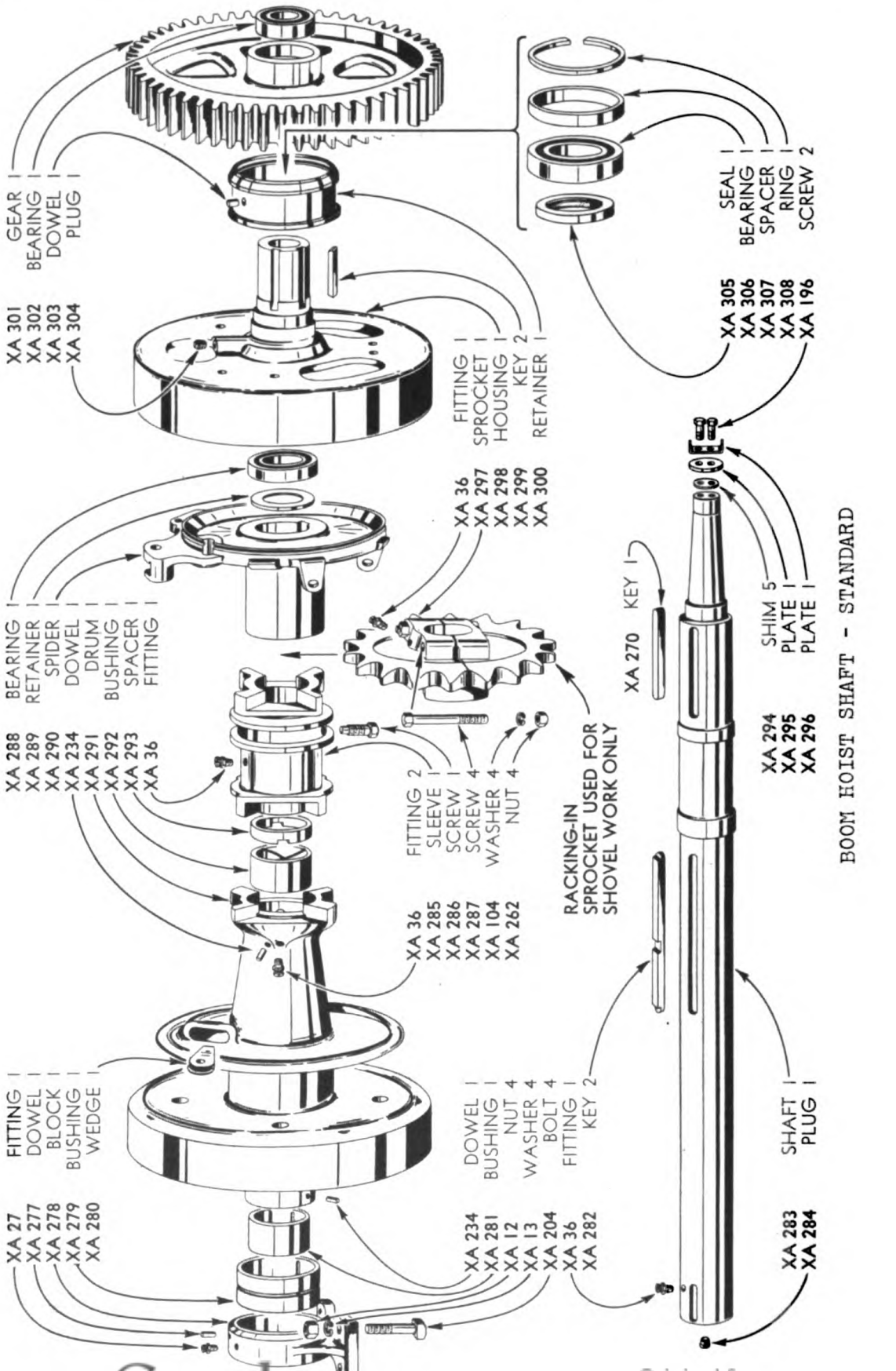
"A" FRAME

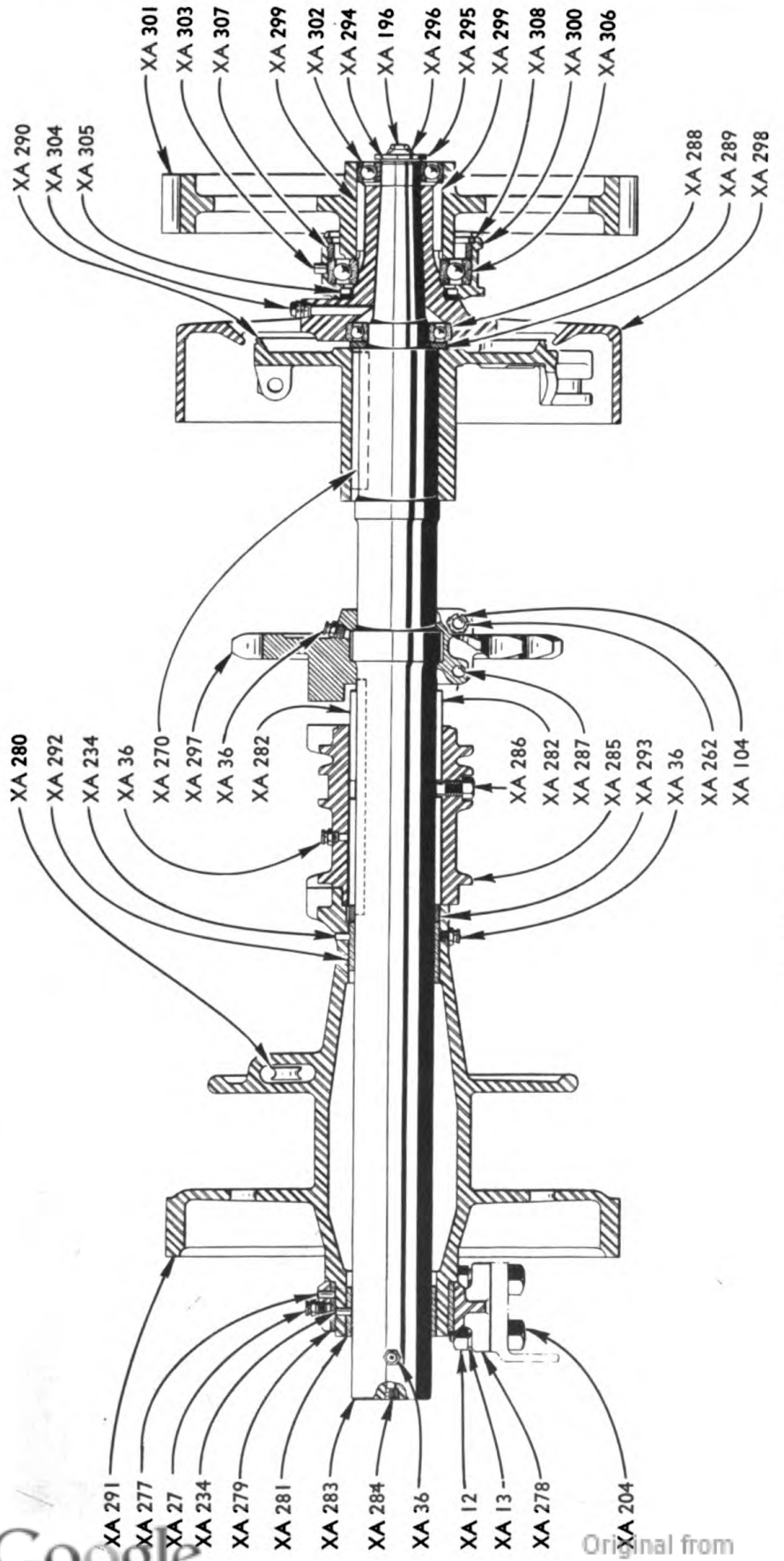


DRUM SHAFT - CLAMSHELL

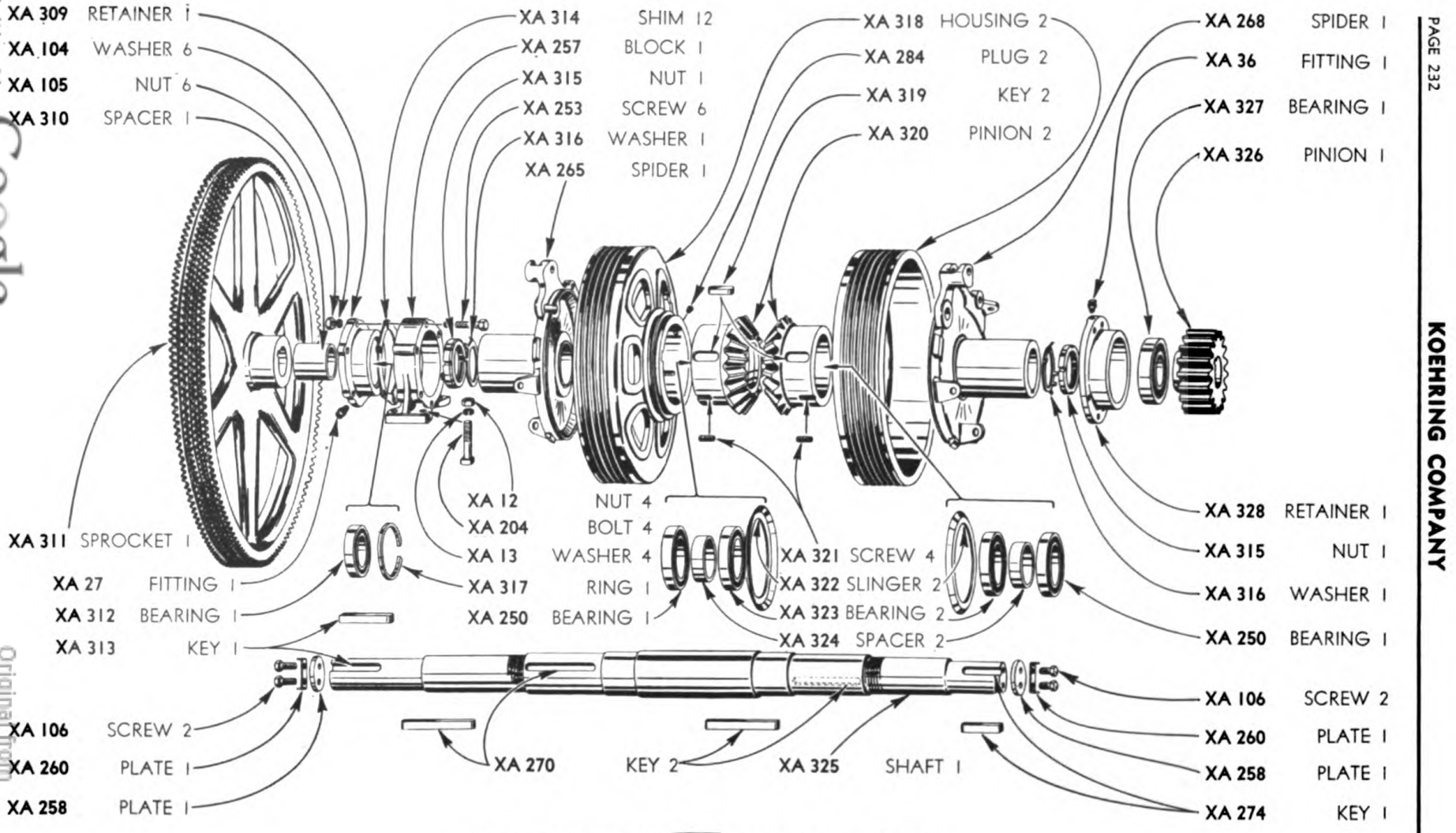


DRUM SHAFT - CLAMSHELL

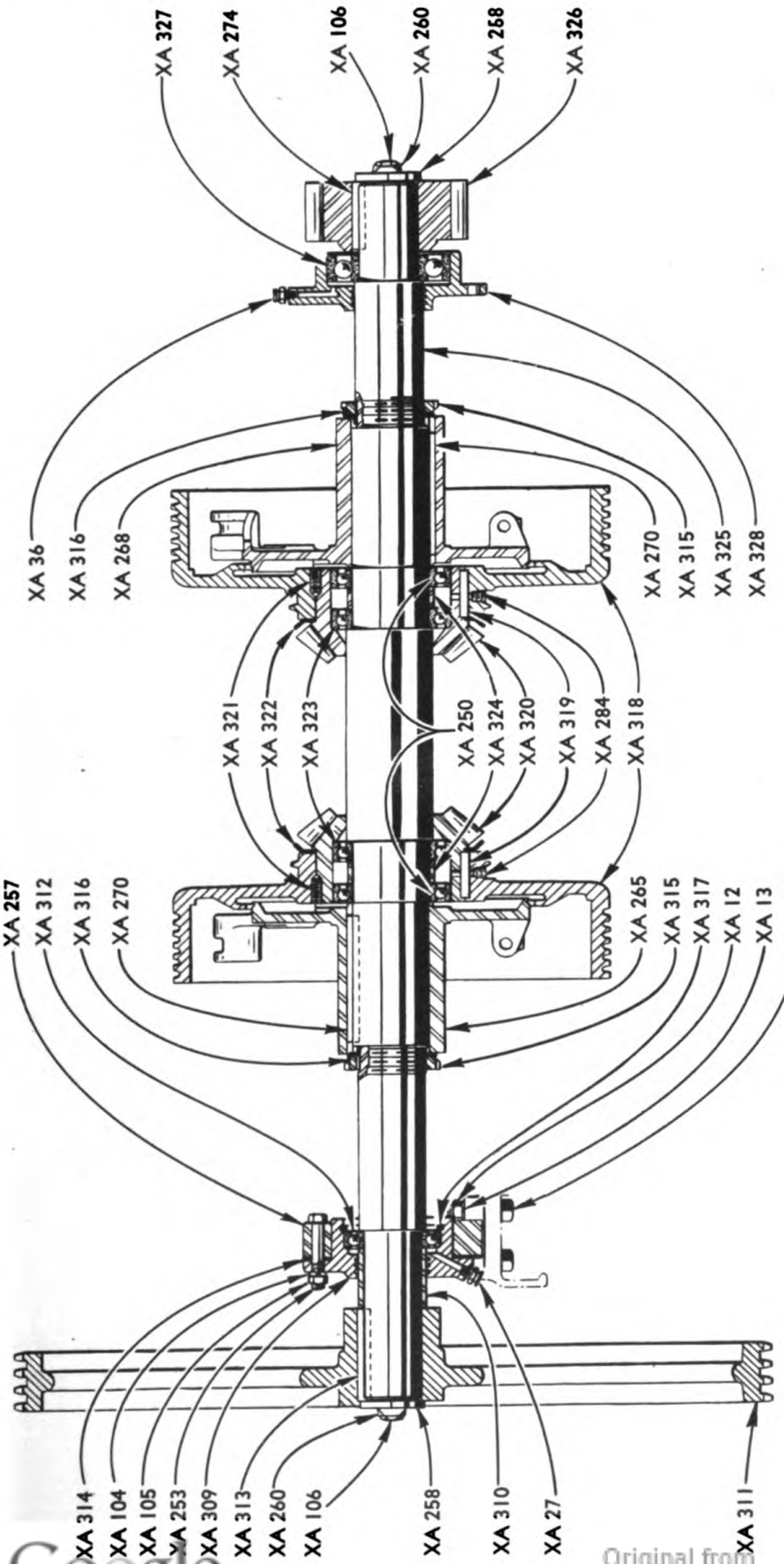




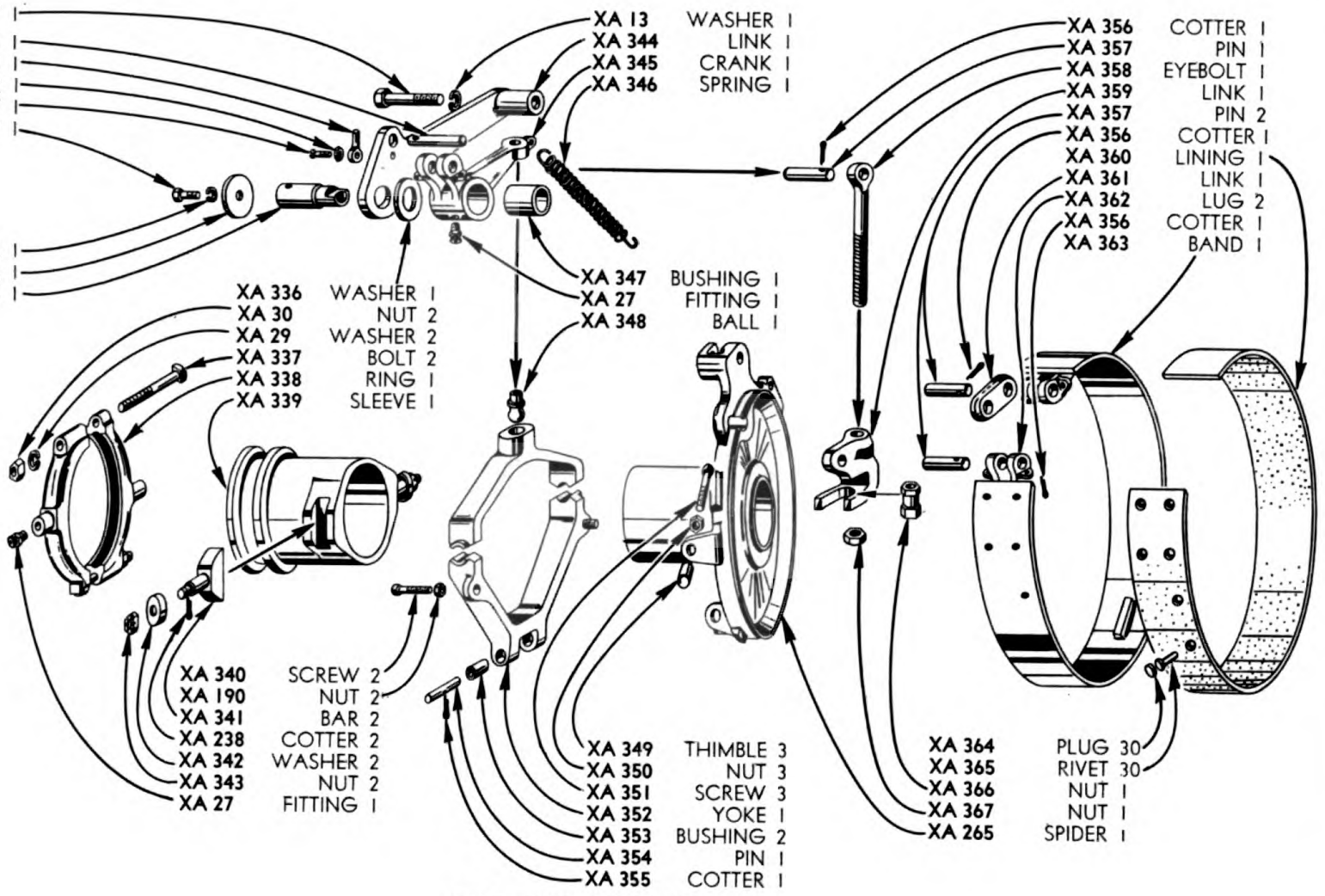
BOOM HOIST SHAFT - STANDARD



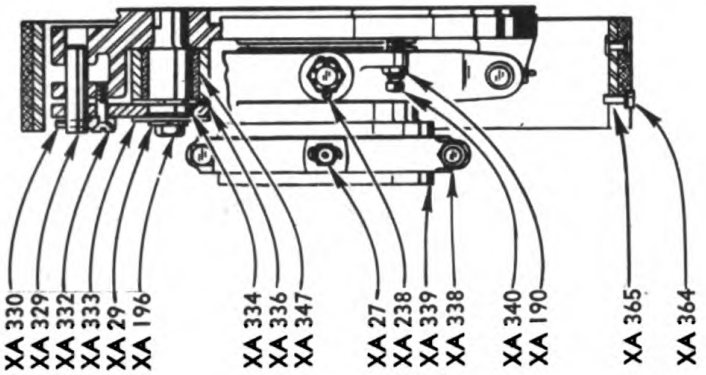
SWING AND TRACTION SHAFT (JACK SHAFT)

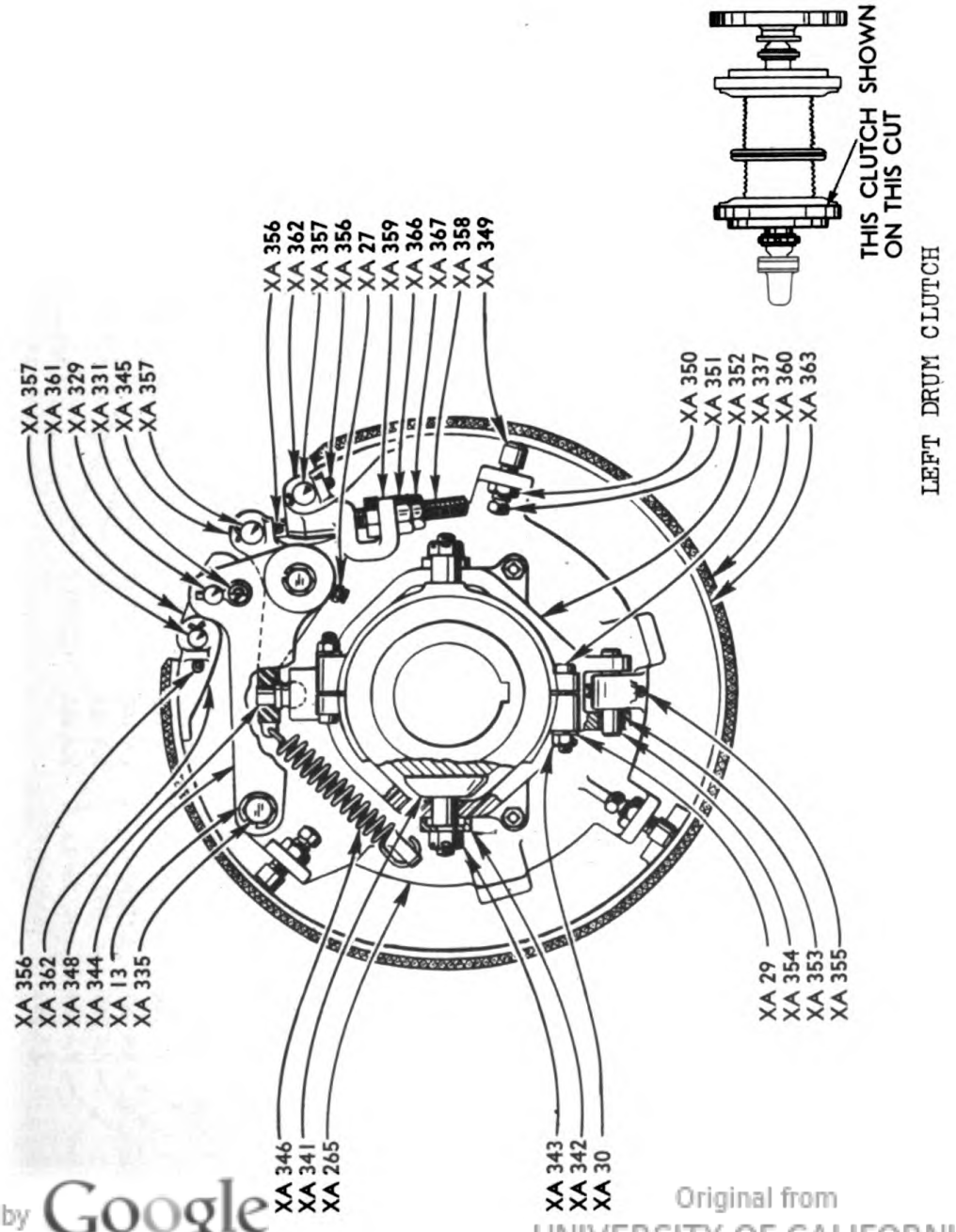


SWING AND TRACTION SHAFT (JACK SHAFT)



LEFT DRUM CLUTCH





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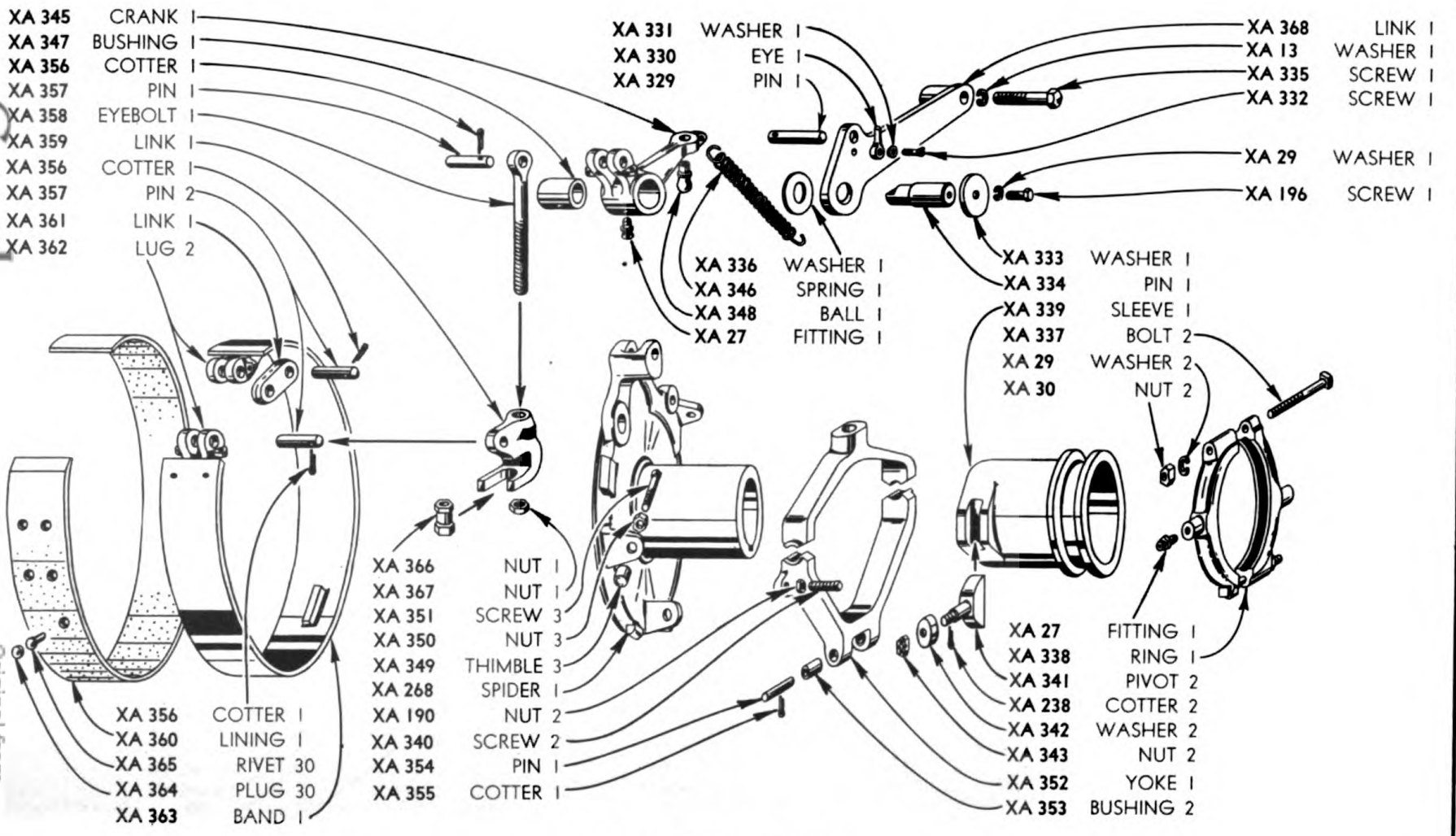

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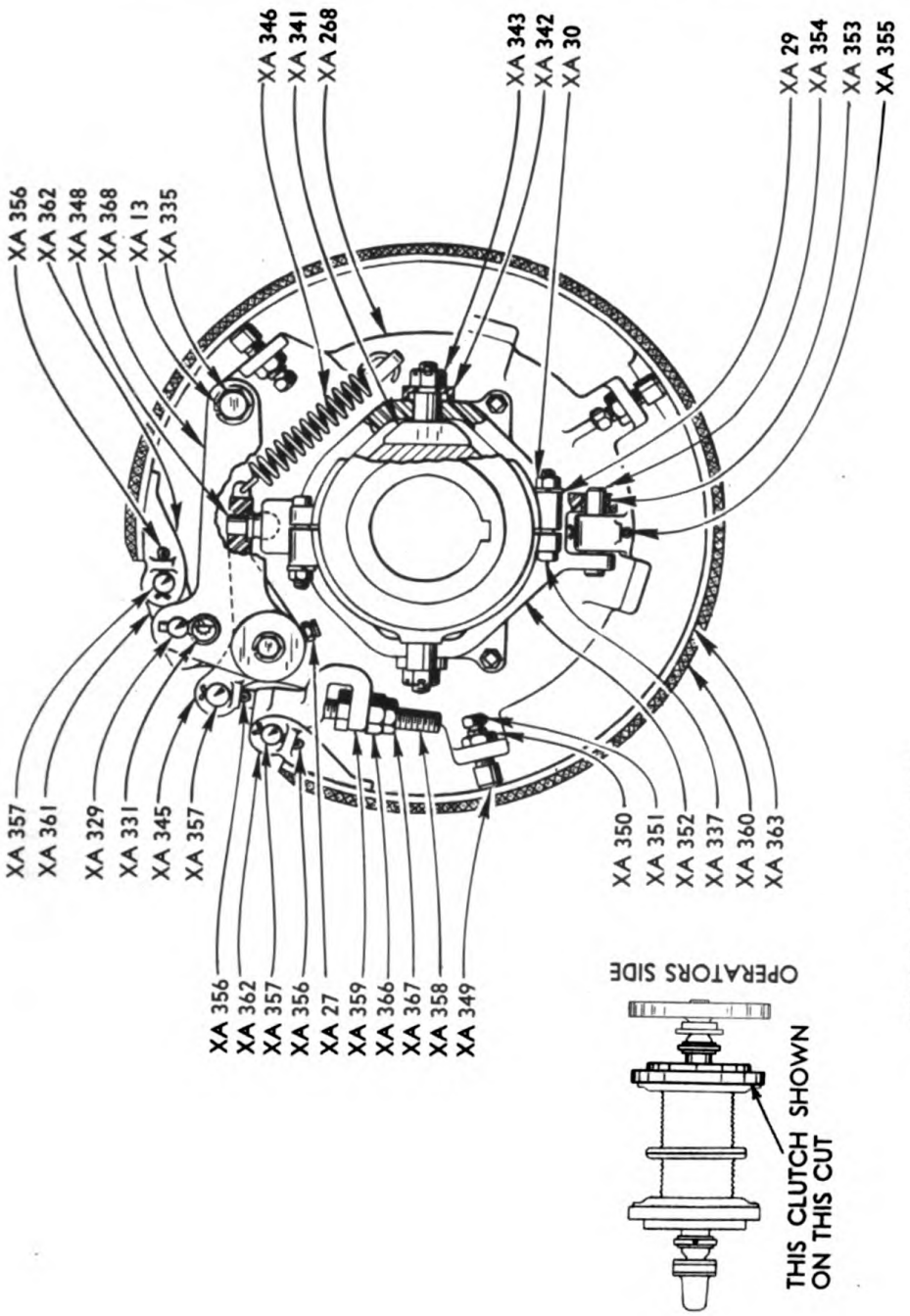
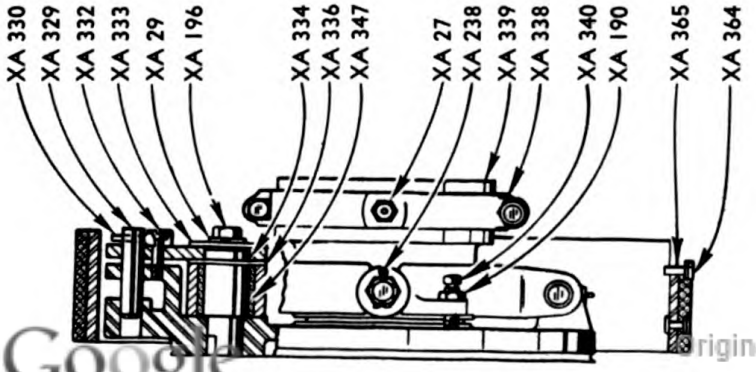
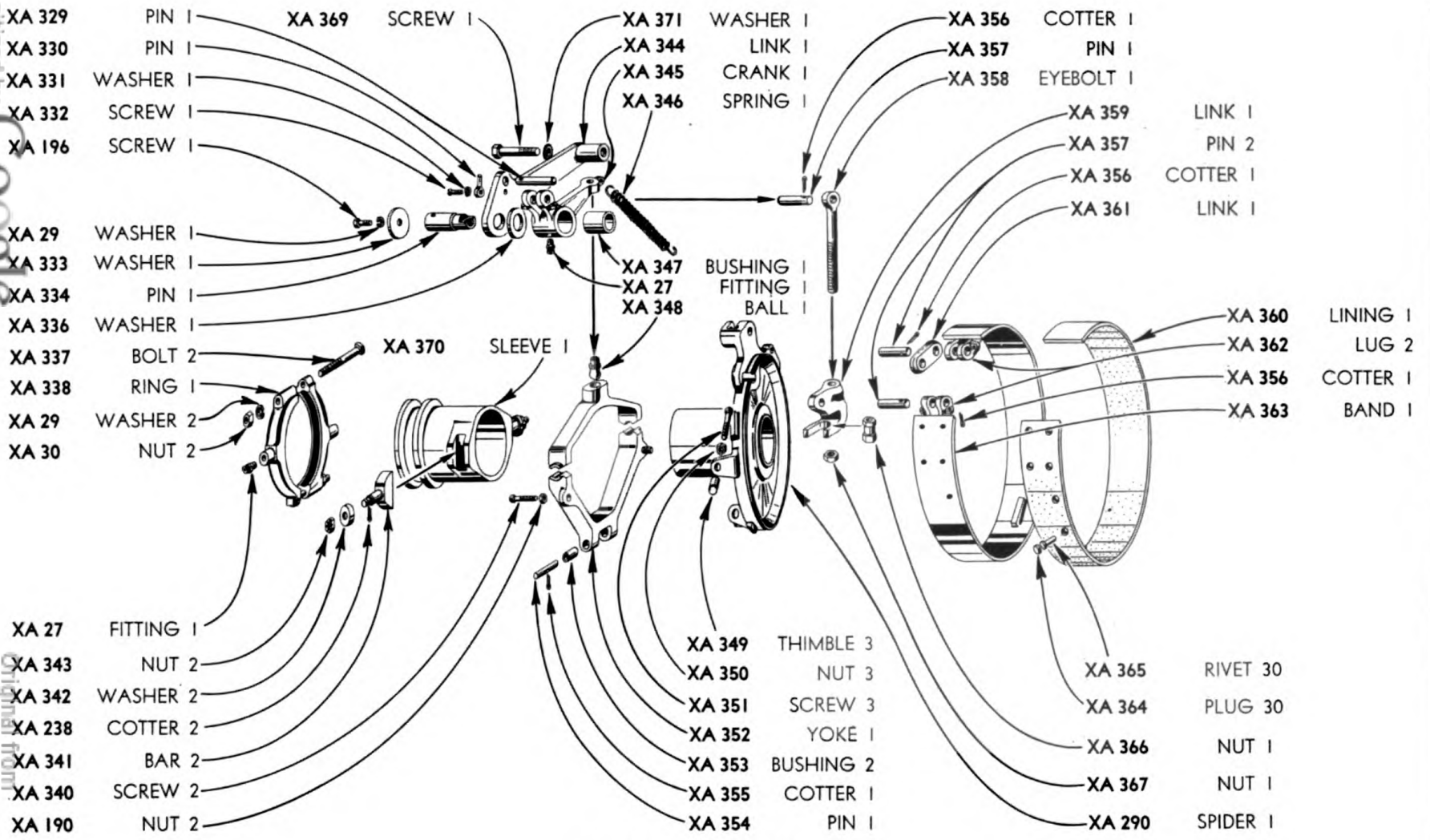
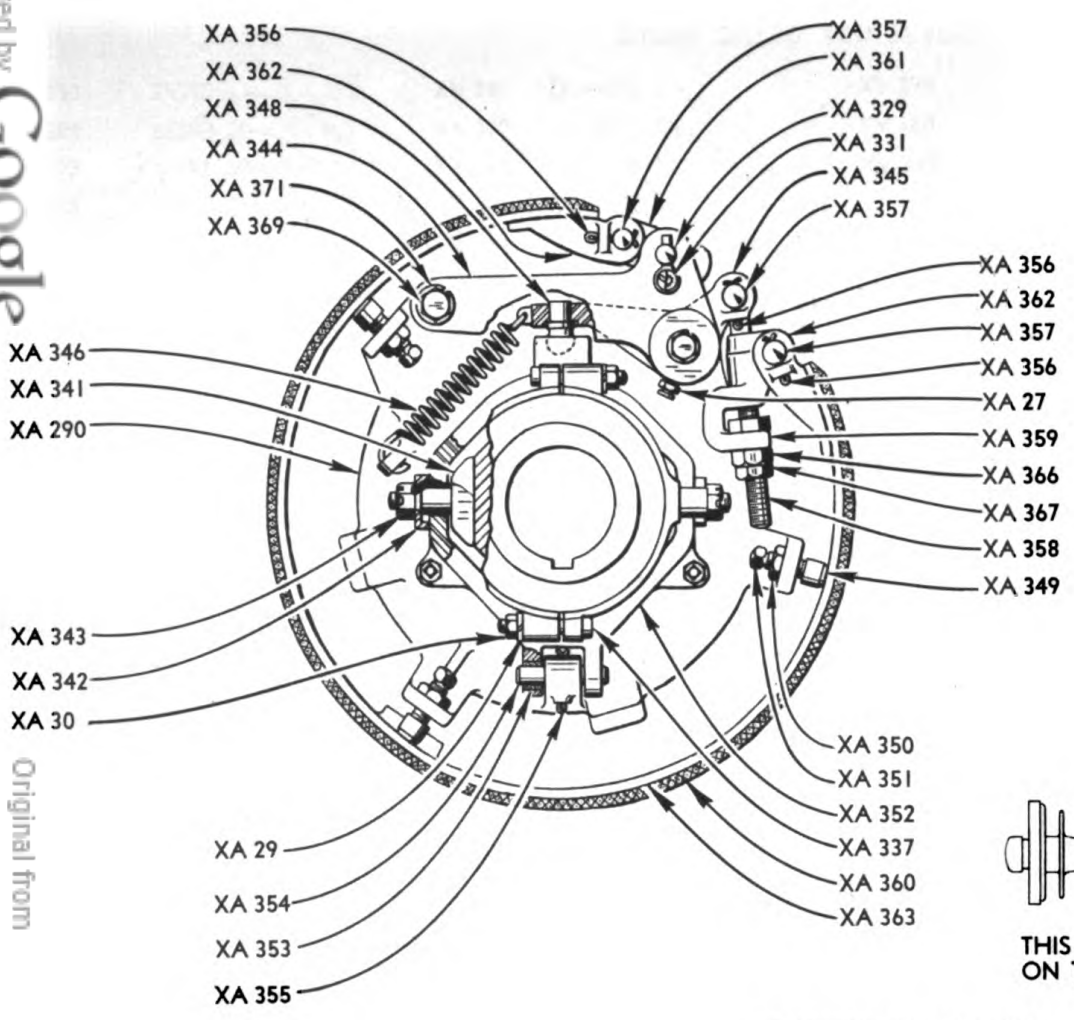


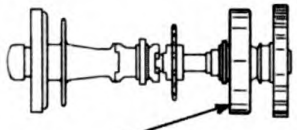
RIGHT DRUM CLUTCH



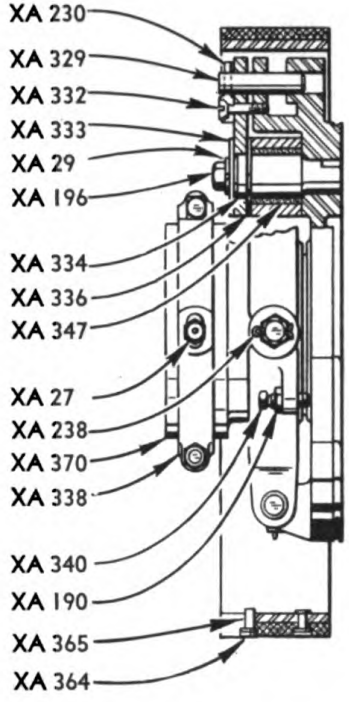


BOOM HOIST CLUTCH

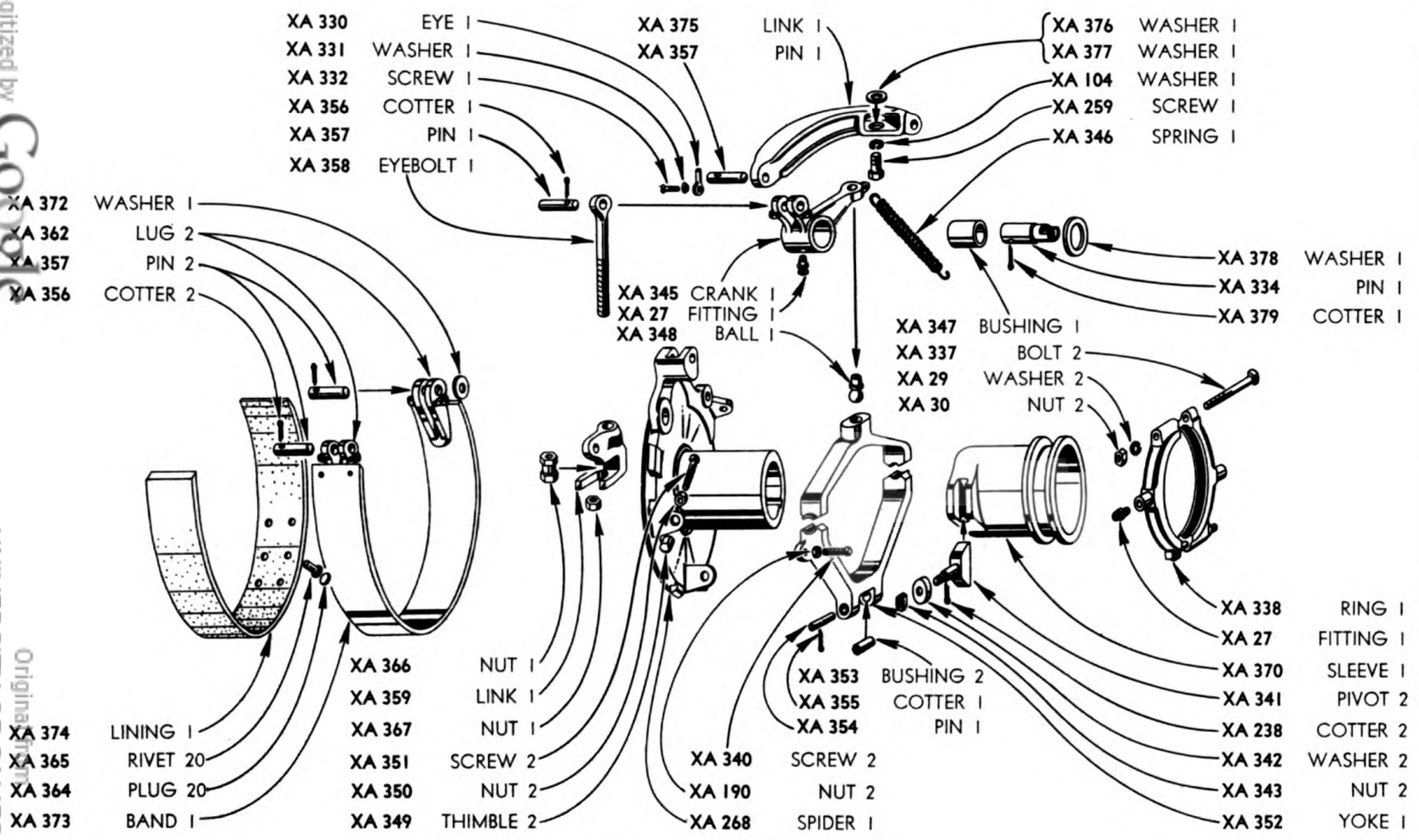




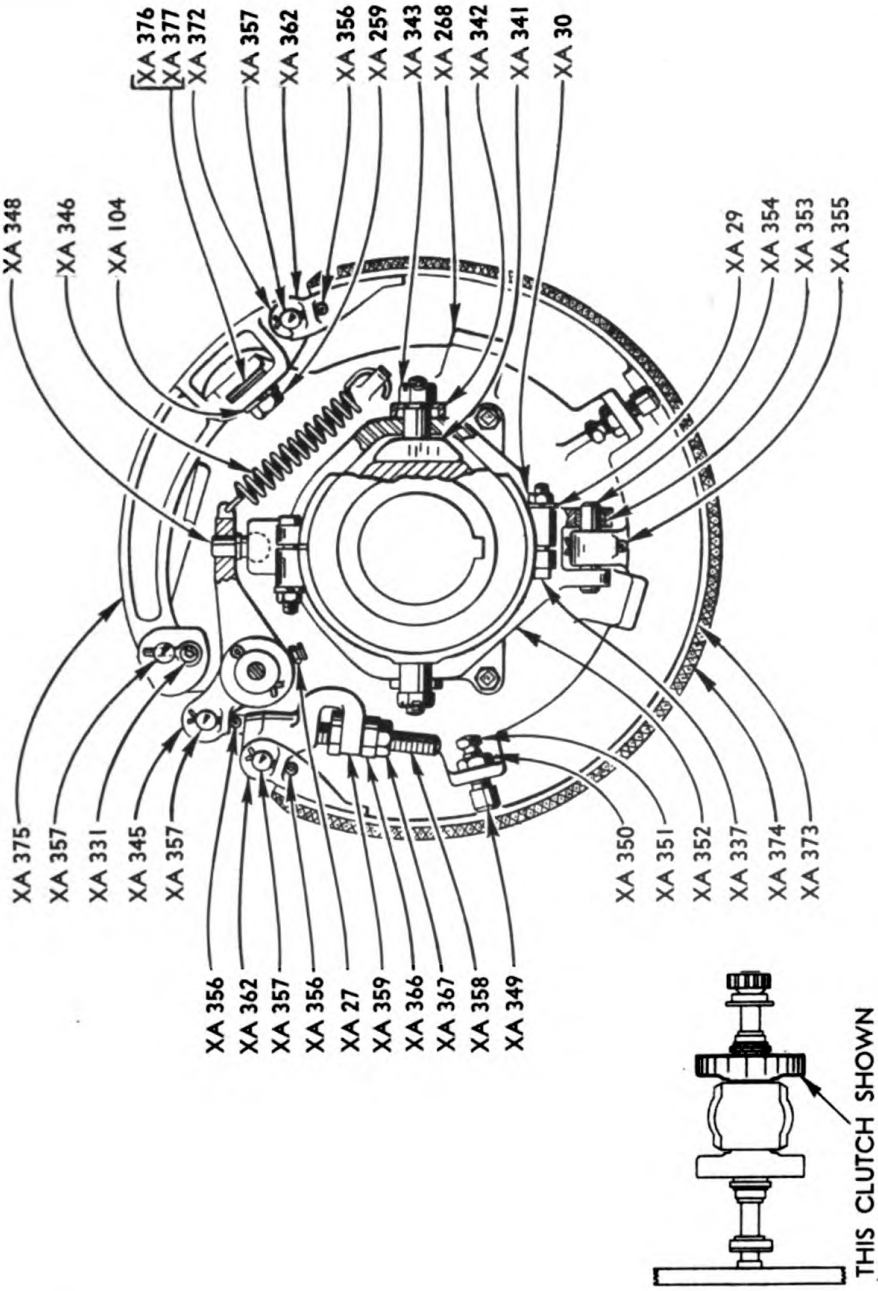
THIS CLUTCH SHOWN ON THIS CUT



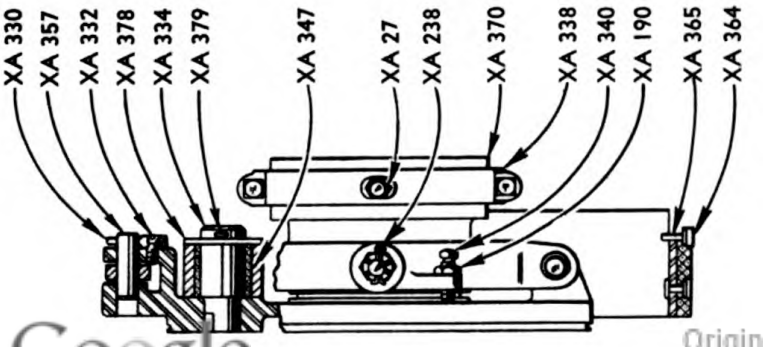
BOOM HOIST CLUTCH

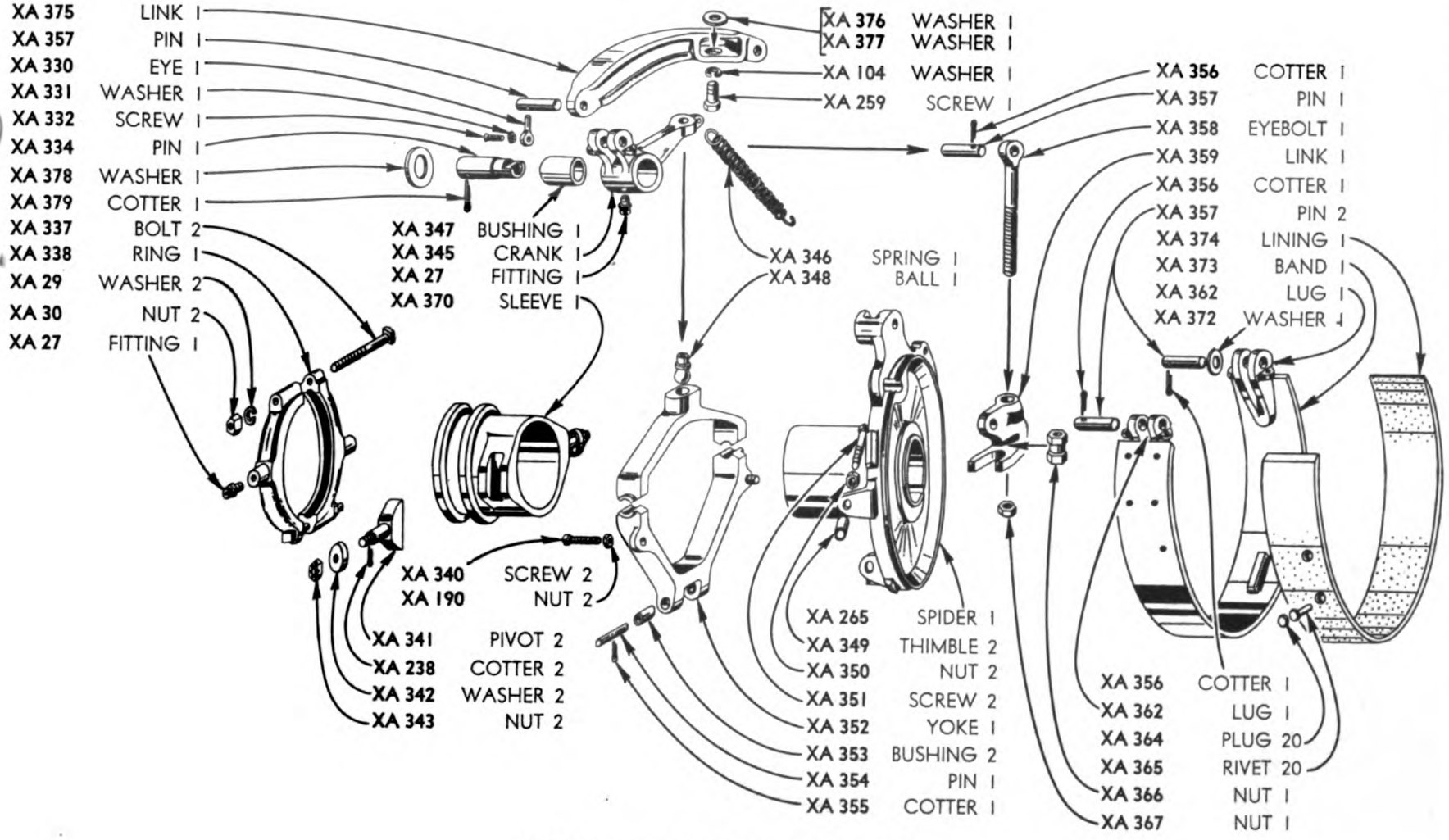


RIGHT SWING AND TRACTION CLUTCH



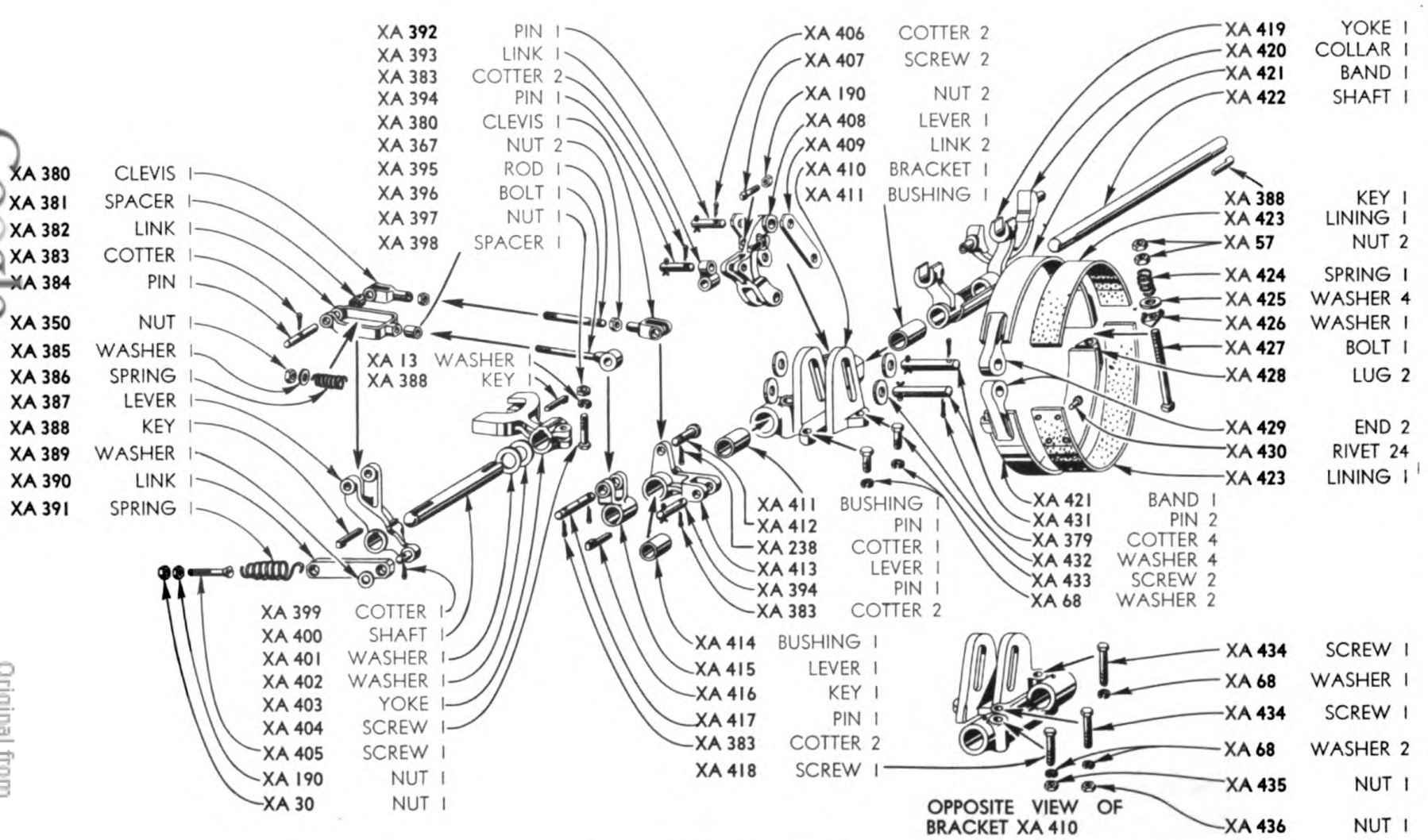
RIGHT SWING AND TRACTION CLUTCH



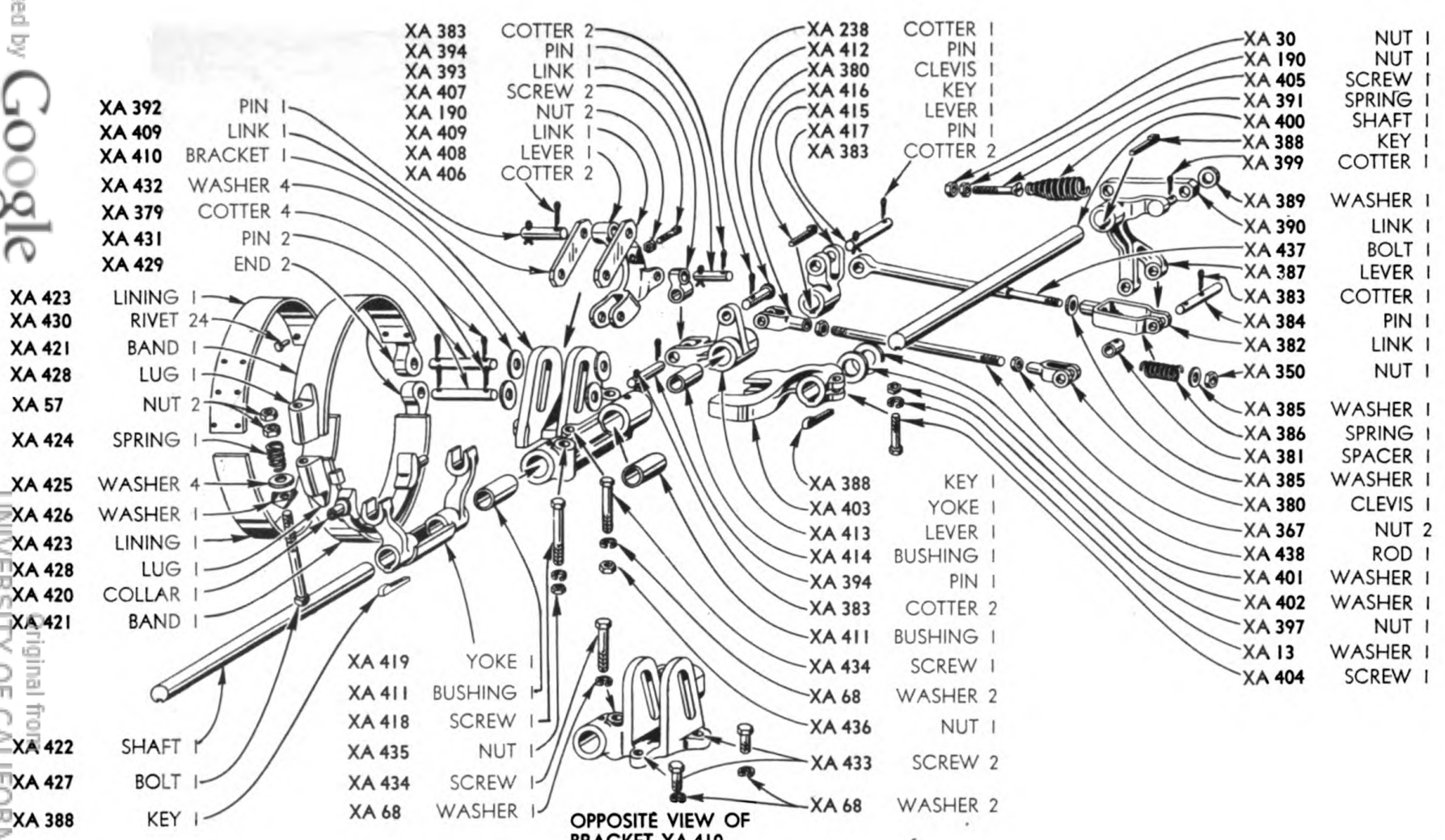


LEFT SWING AND TRACTION CLUTCH

LEFT SWING AND TRACTION CLUTCH

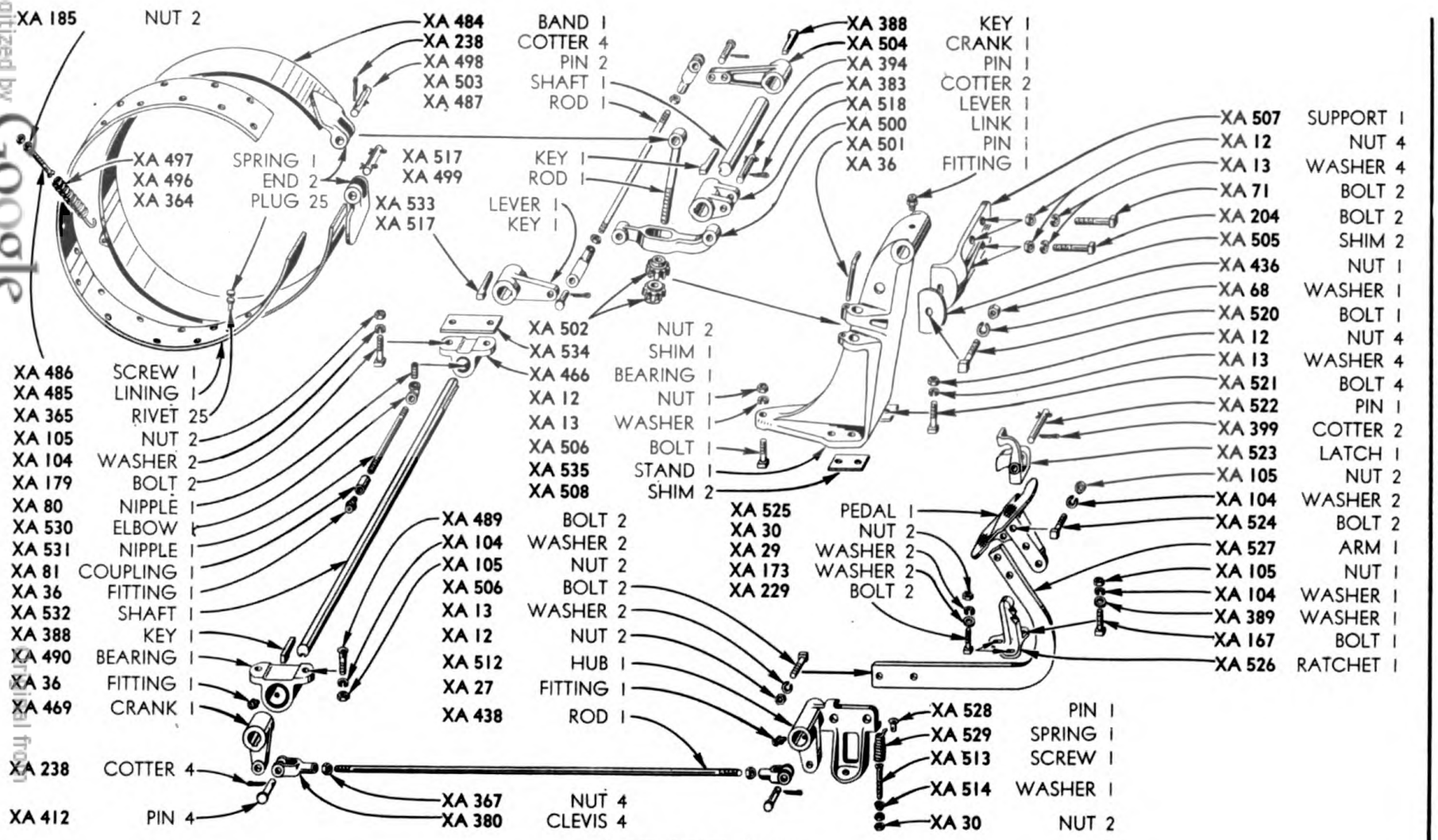


LEFT STEERING BRAKE

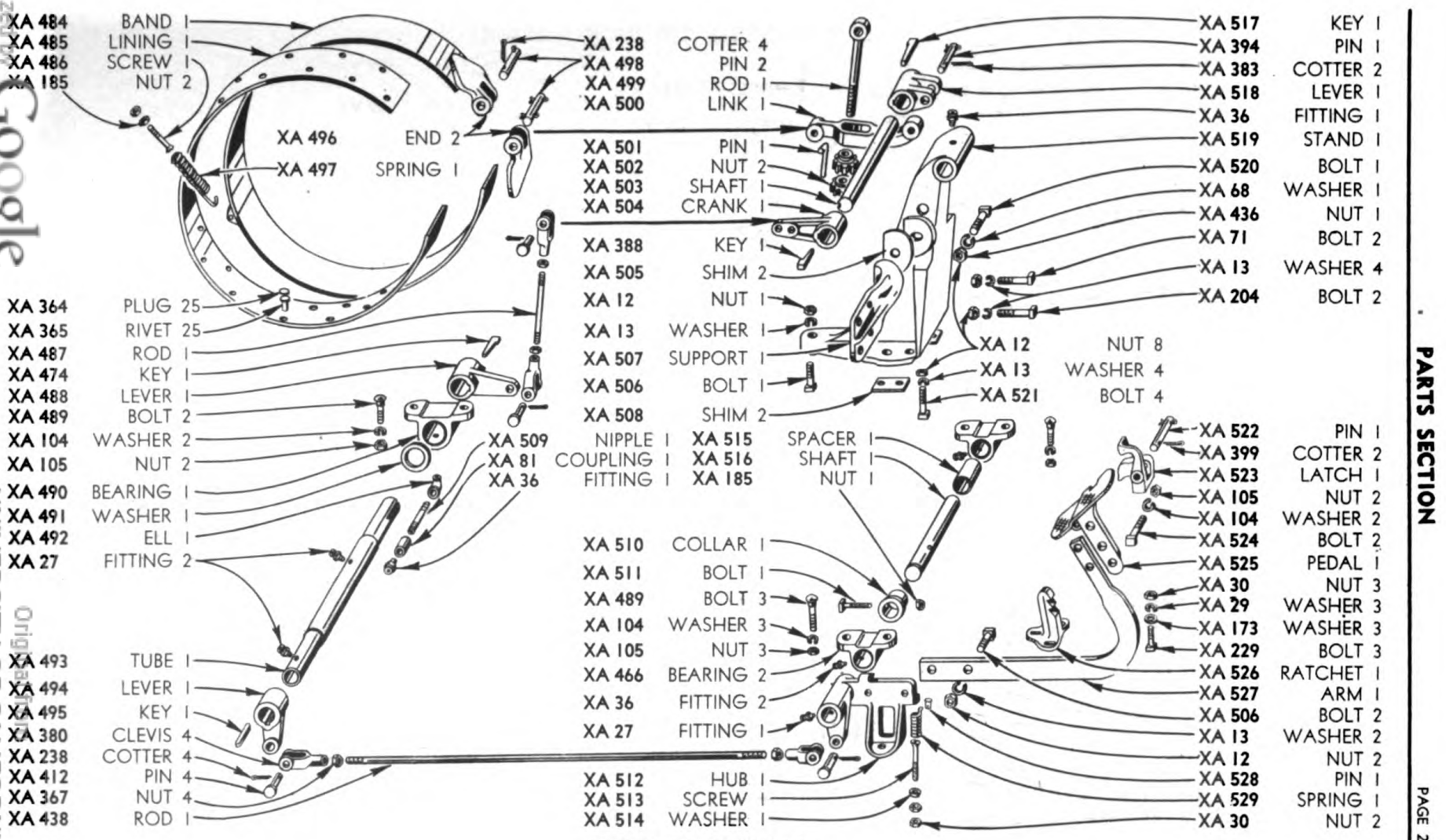


OPPOSITE VIEW OF BRACKET XA 410

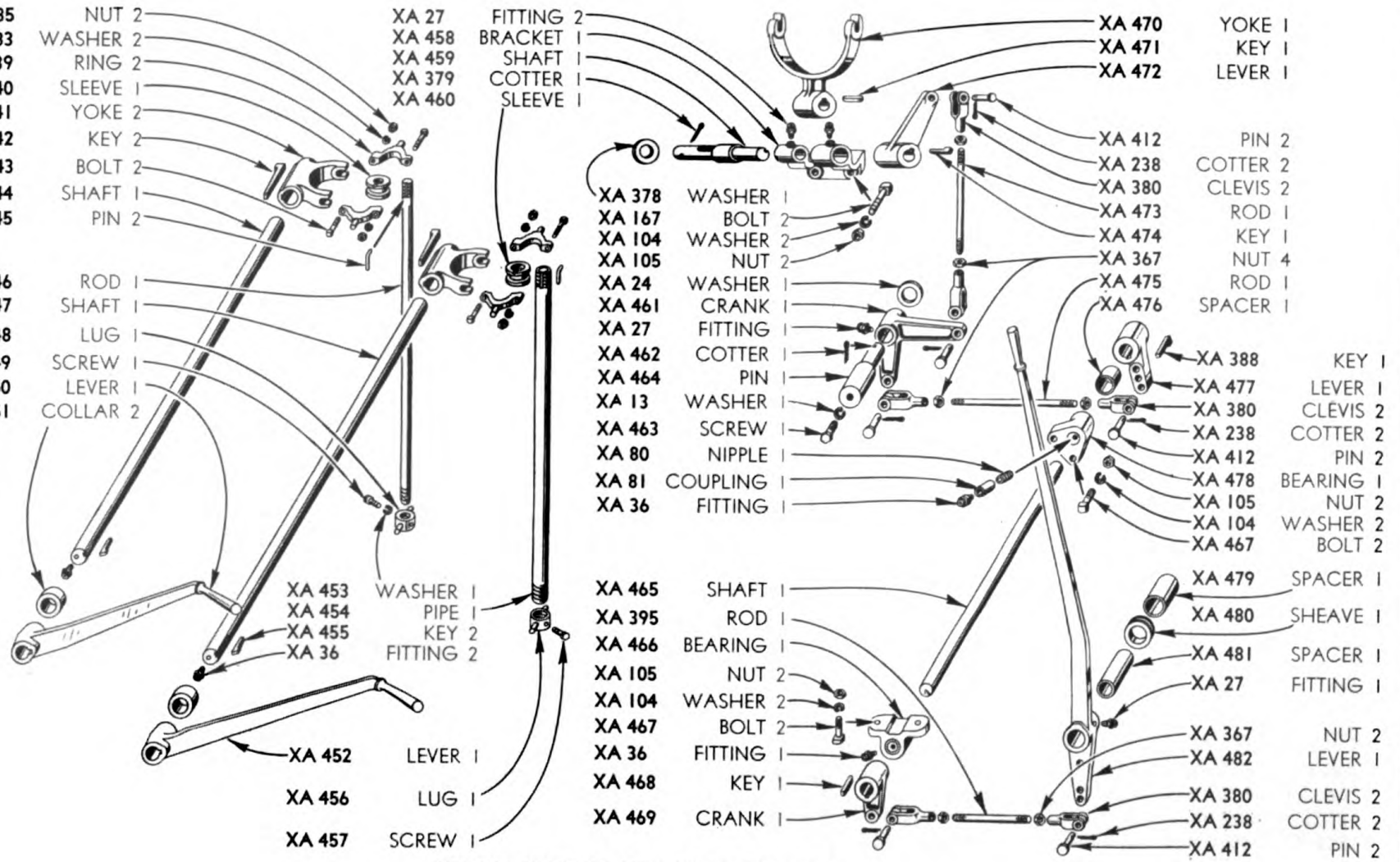
RIGHT STEERING BRAKE



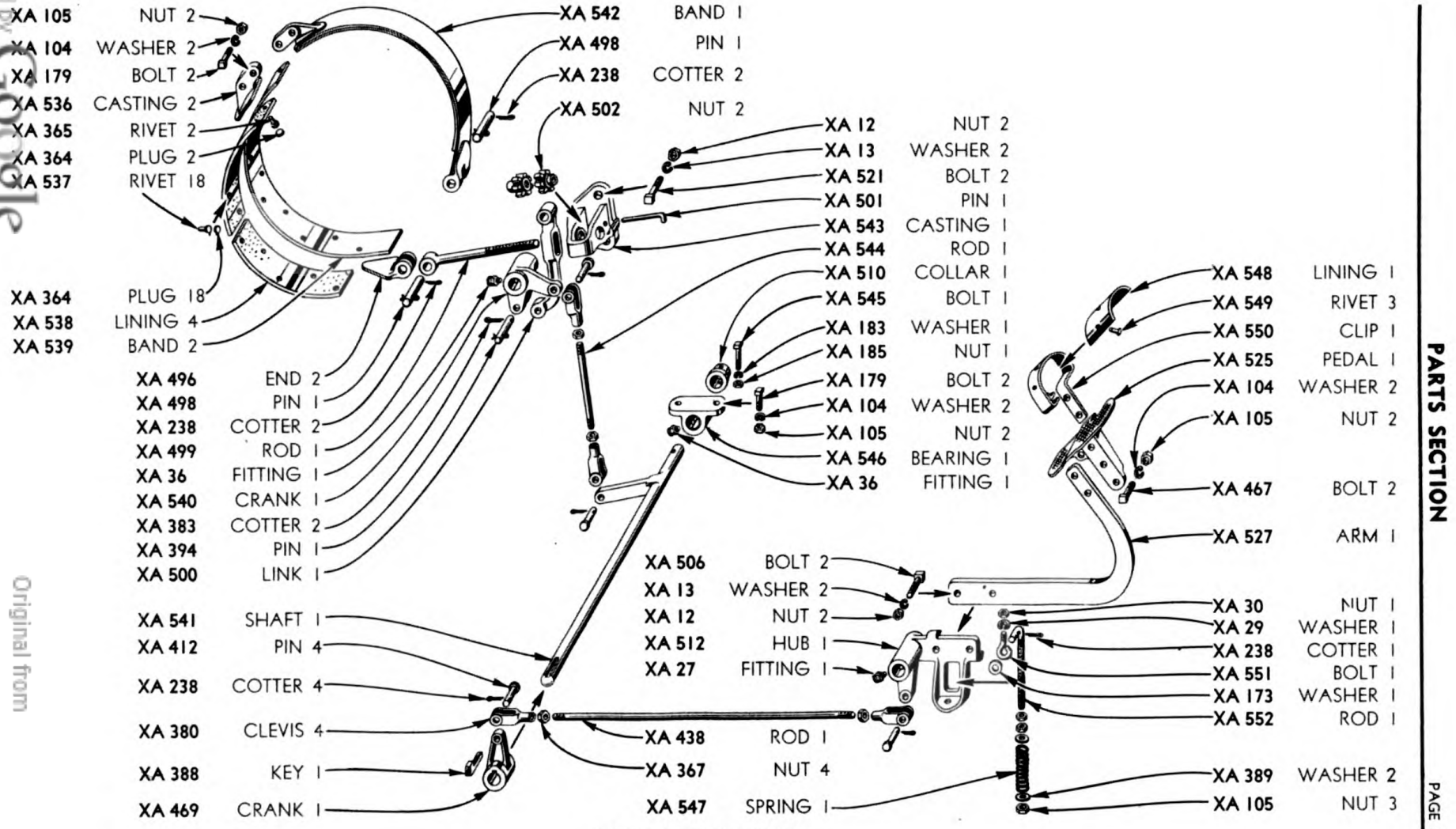
LEFT DRUM BRAKE



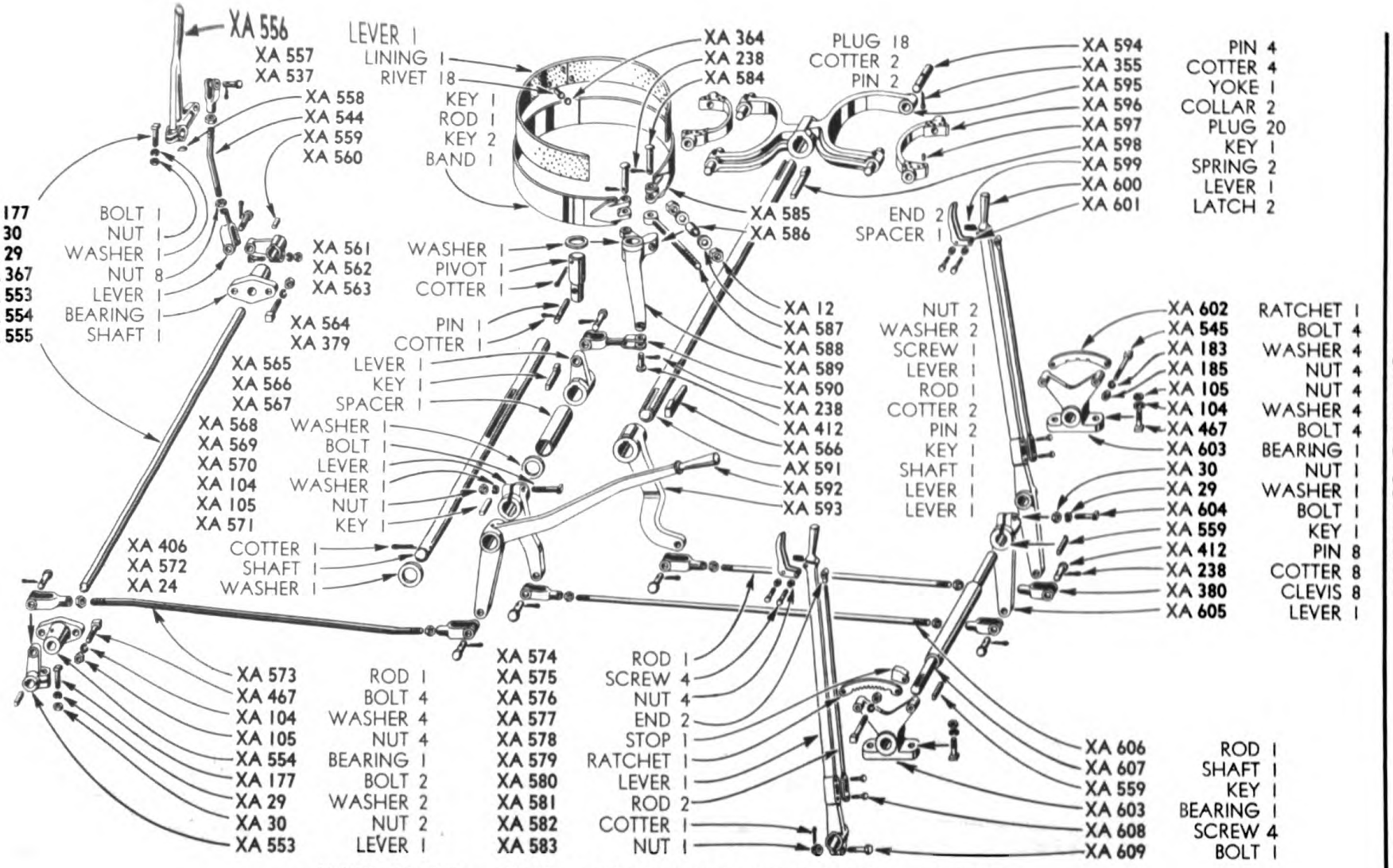
RIGHT DRUM BRAKE



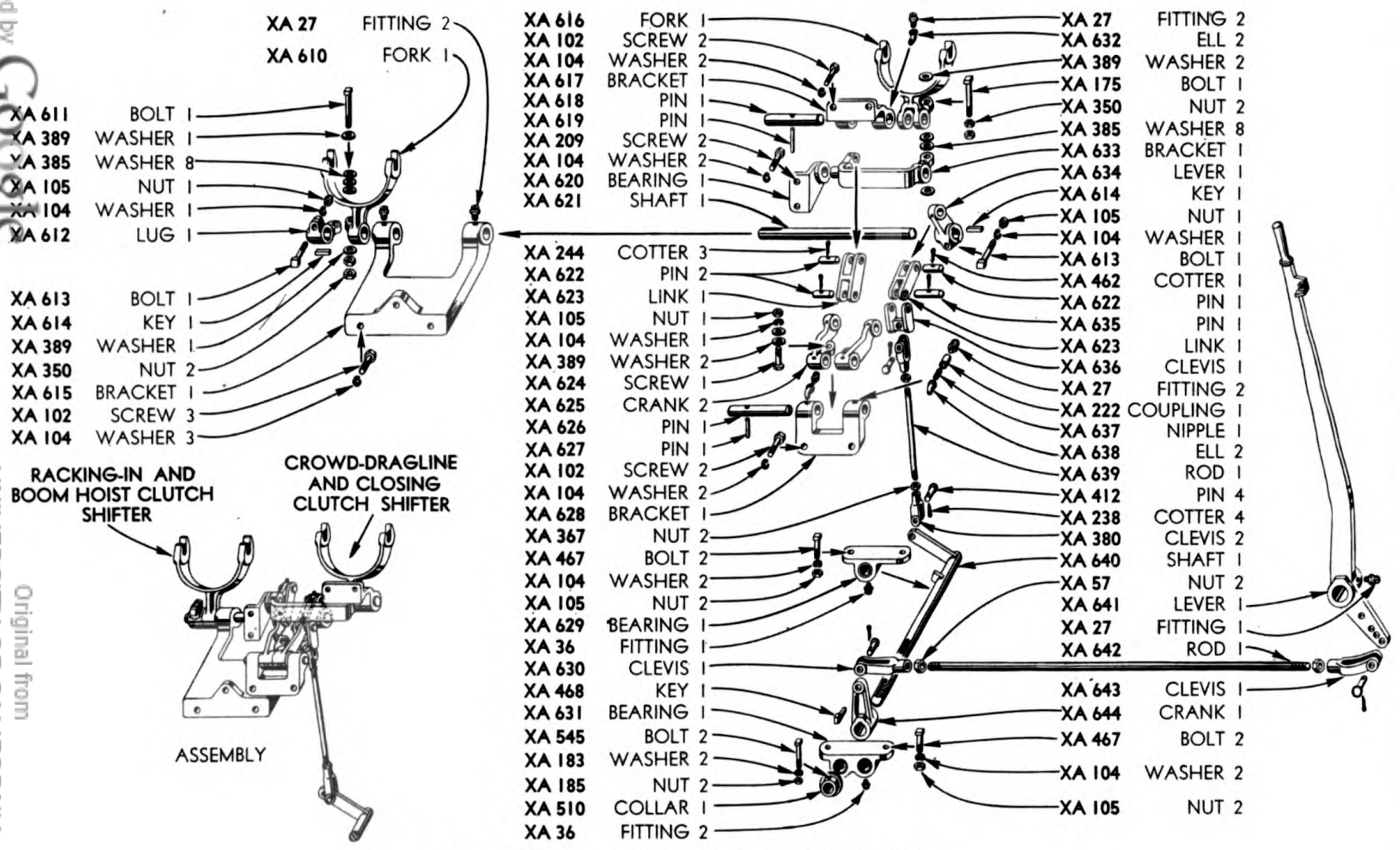
HOIST CLUTCH AND STEERING LEVERS



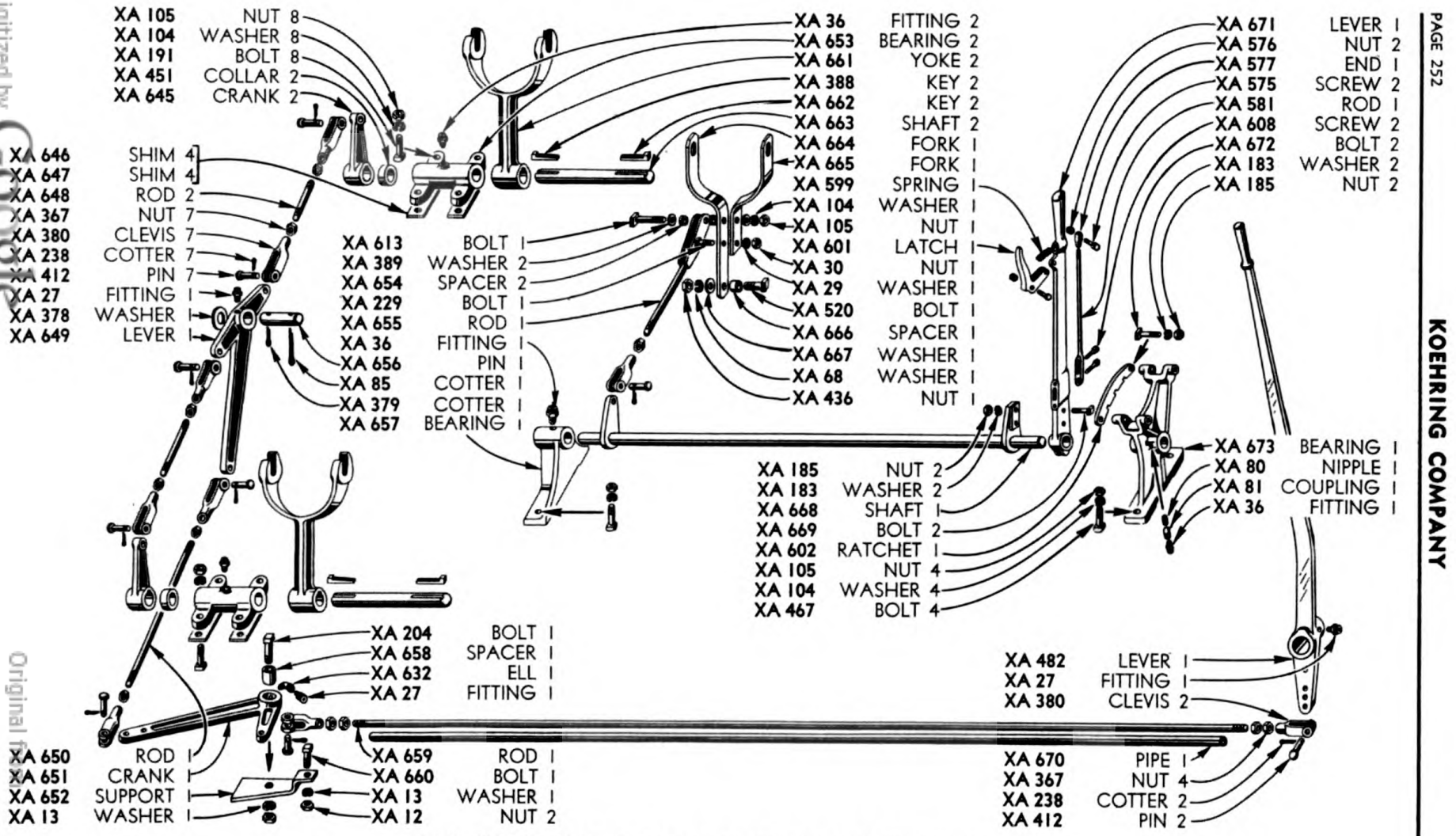
BOOM HOIST BRAKE .



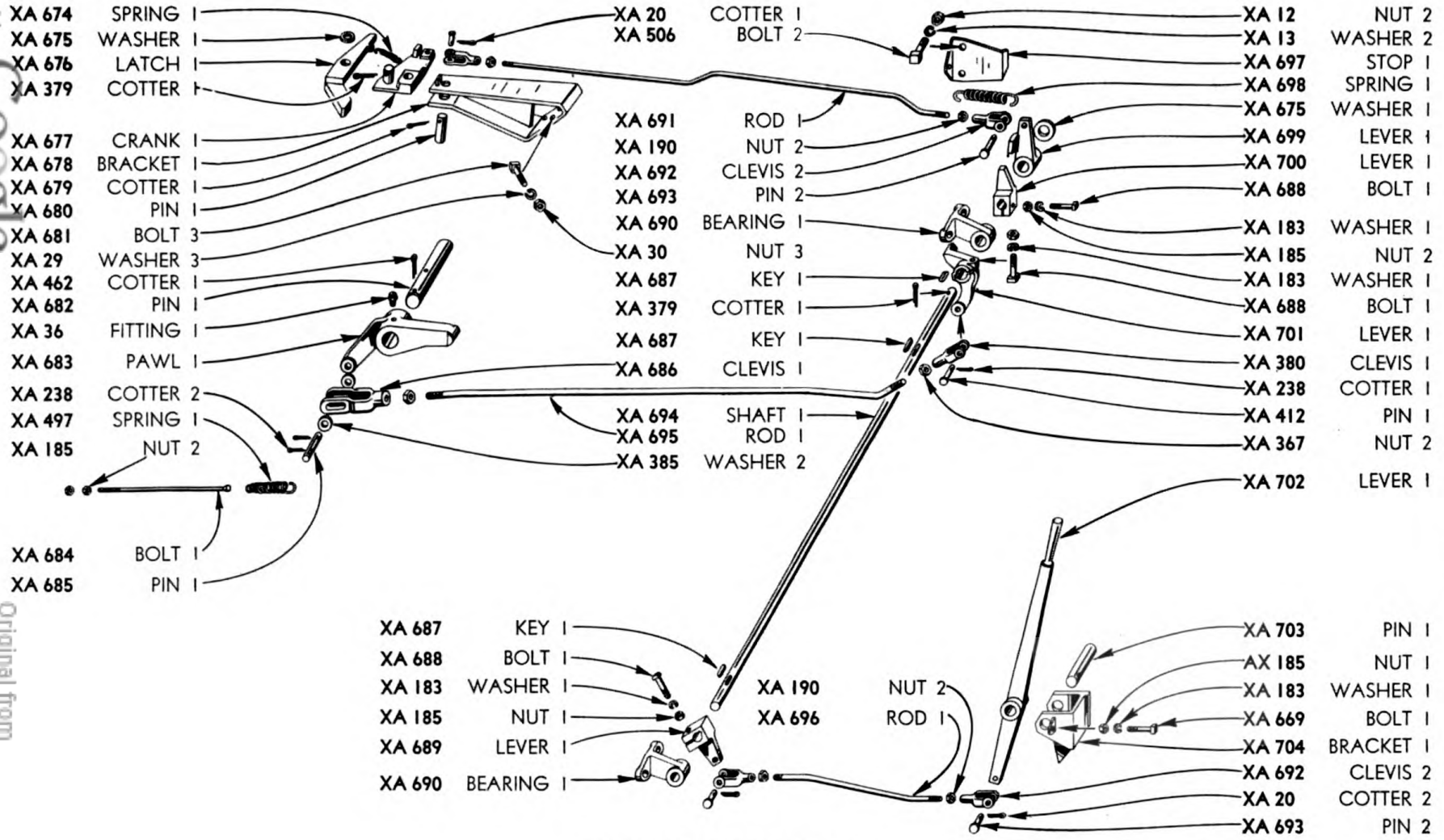
SWING BRAKE - SWING AND TRACTION GEAR SHIFT - ENGINE CLUTCH LEVER



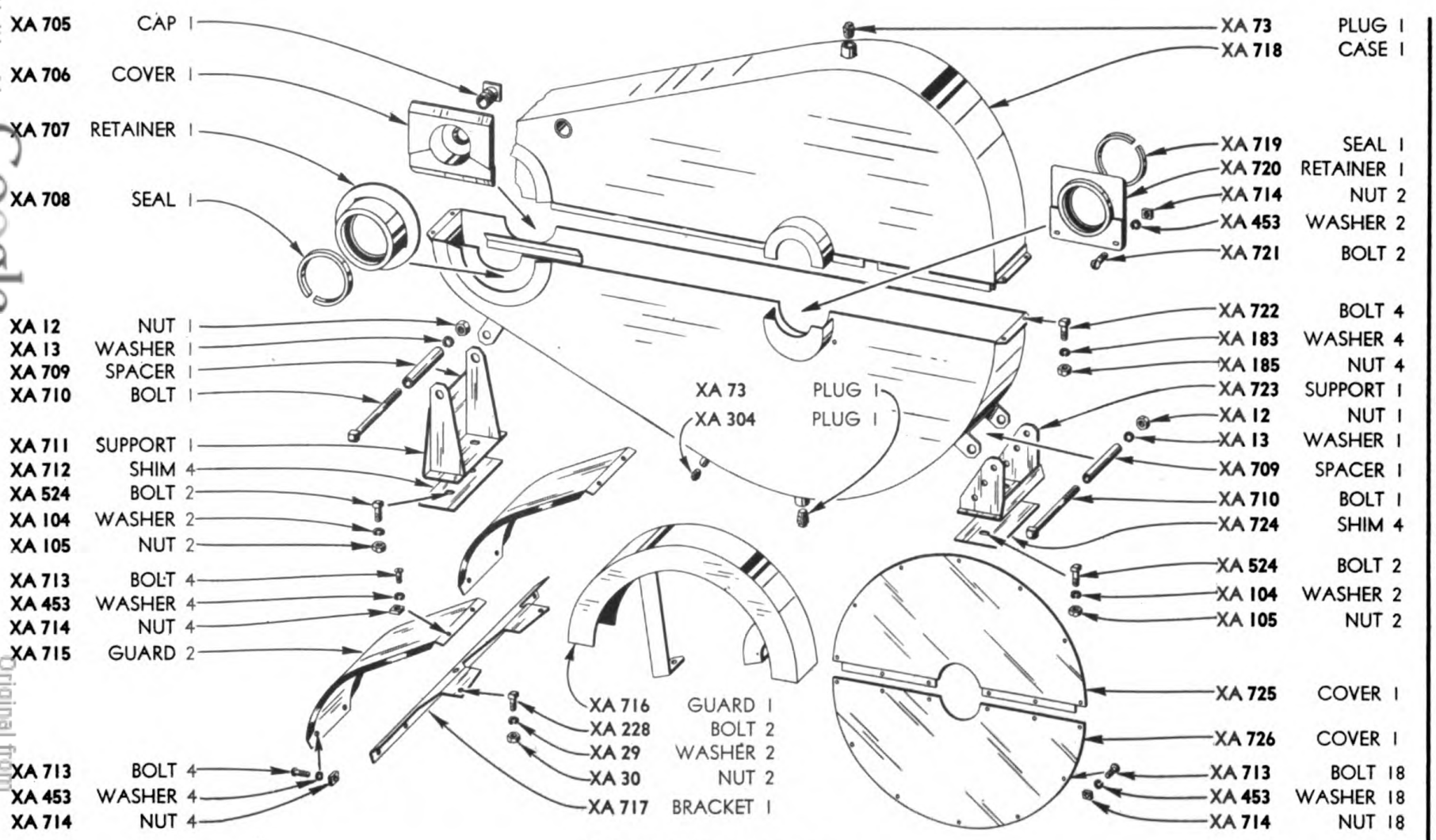
BOOM HOIST - CROWD AND RACKING IN LEVER



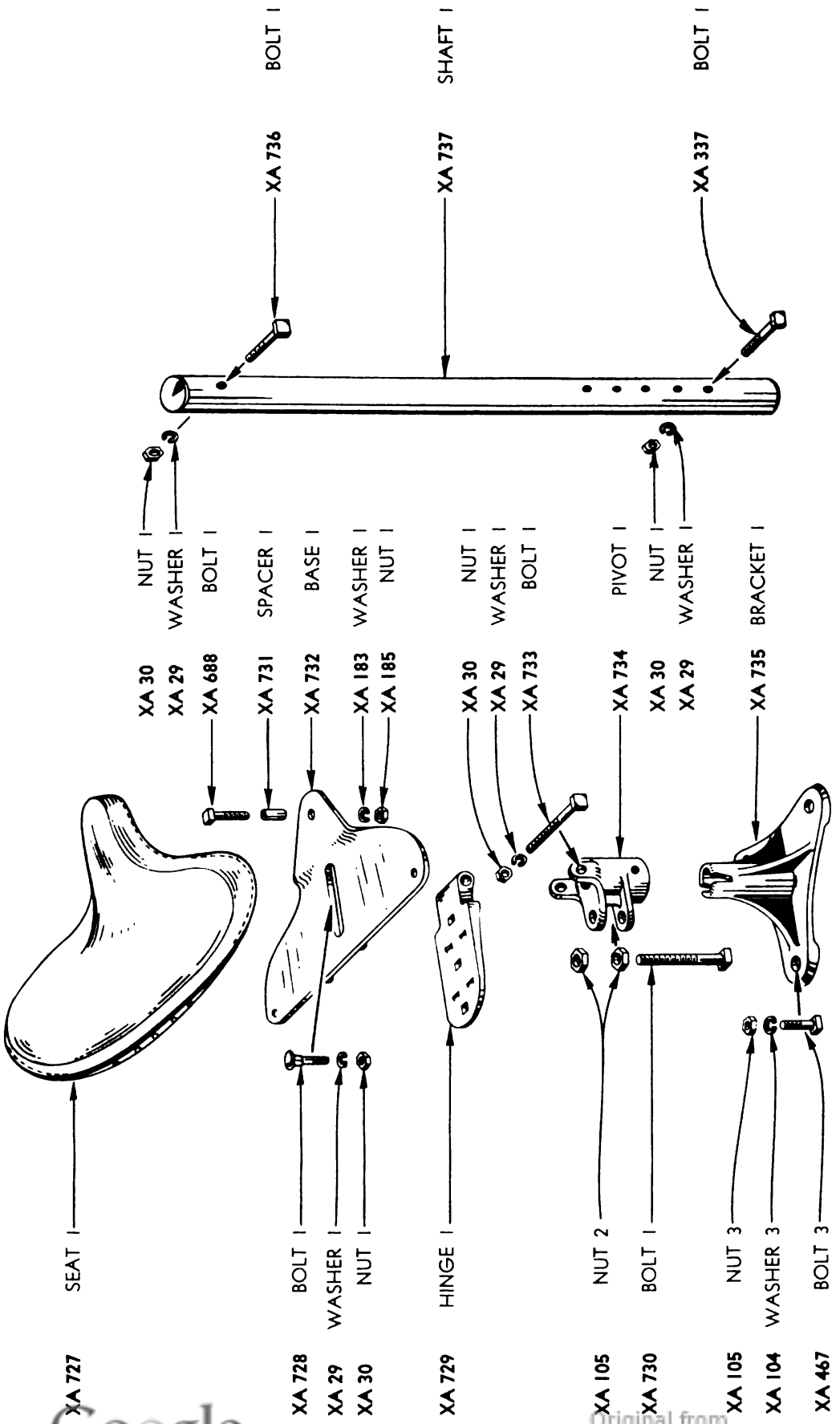
BOOM HOIST JAW CLUTCH AND SWING AND TRACTION CLUTCH LEVER

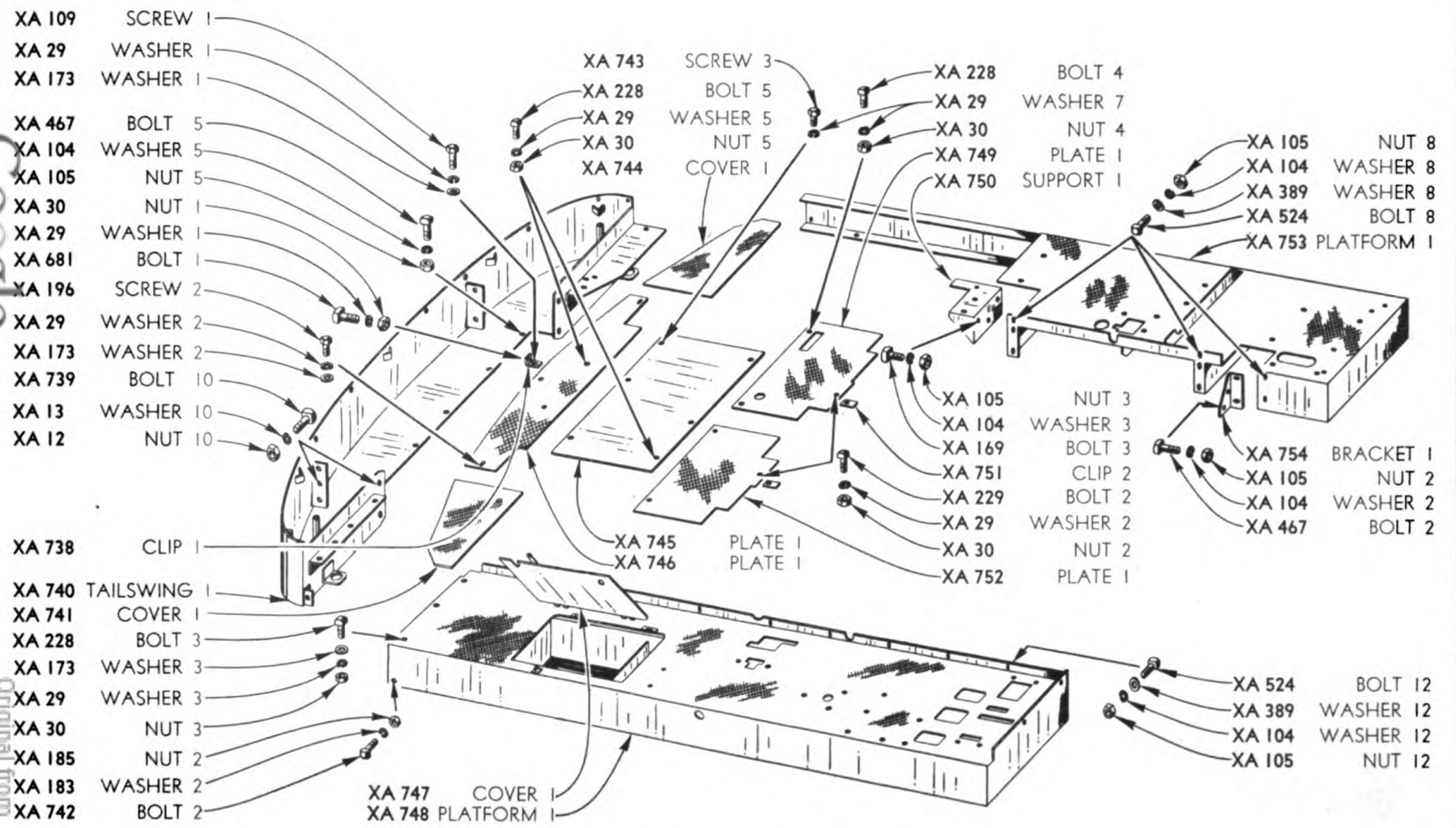


BOOM HOIST PAWL LEVER

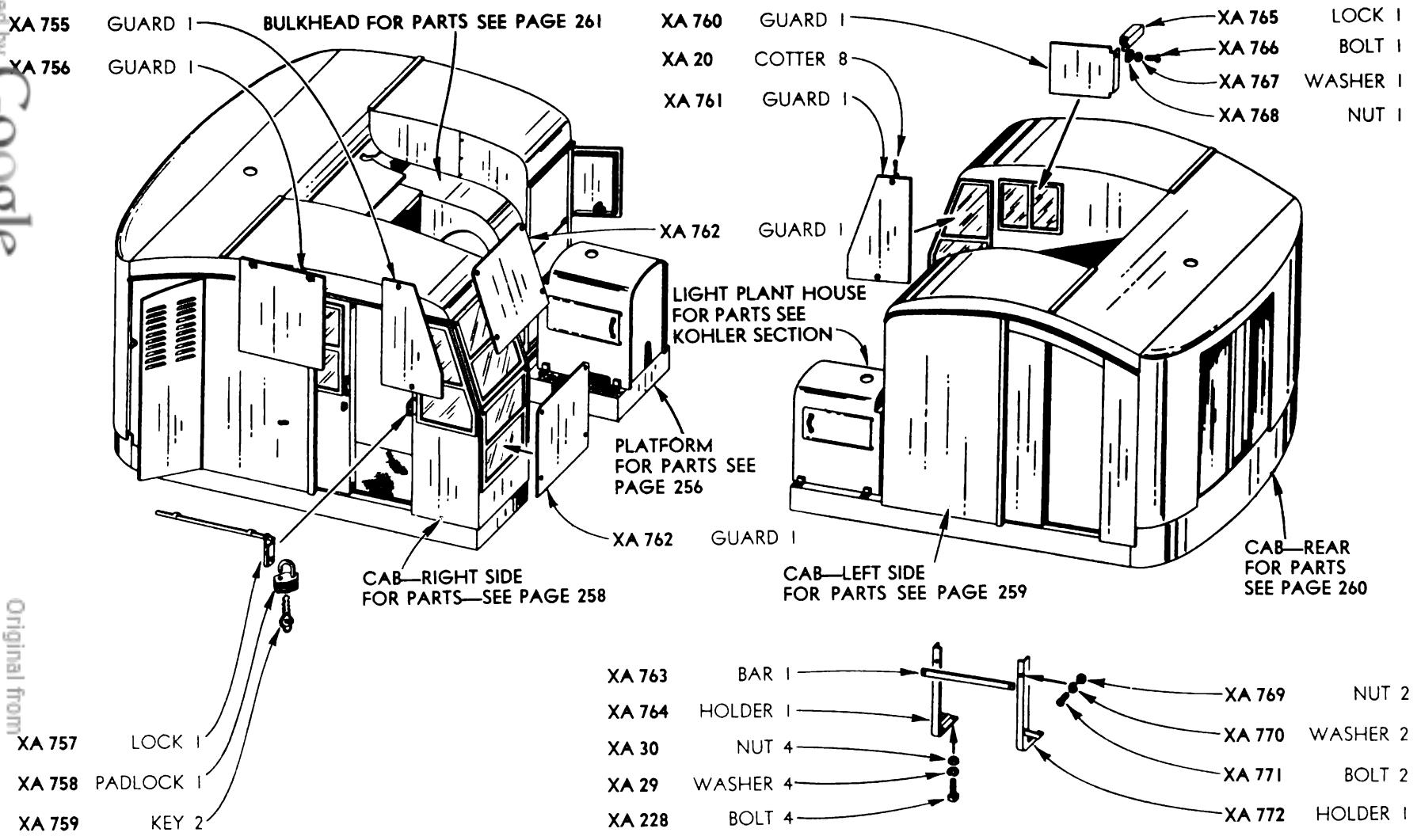


CHAIN CASE - GUARDS

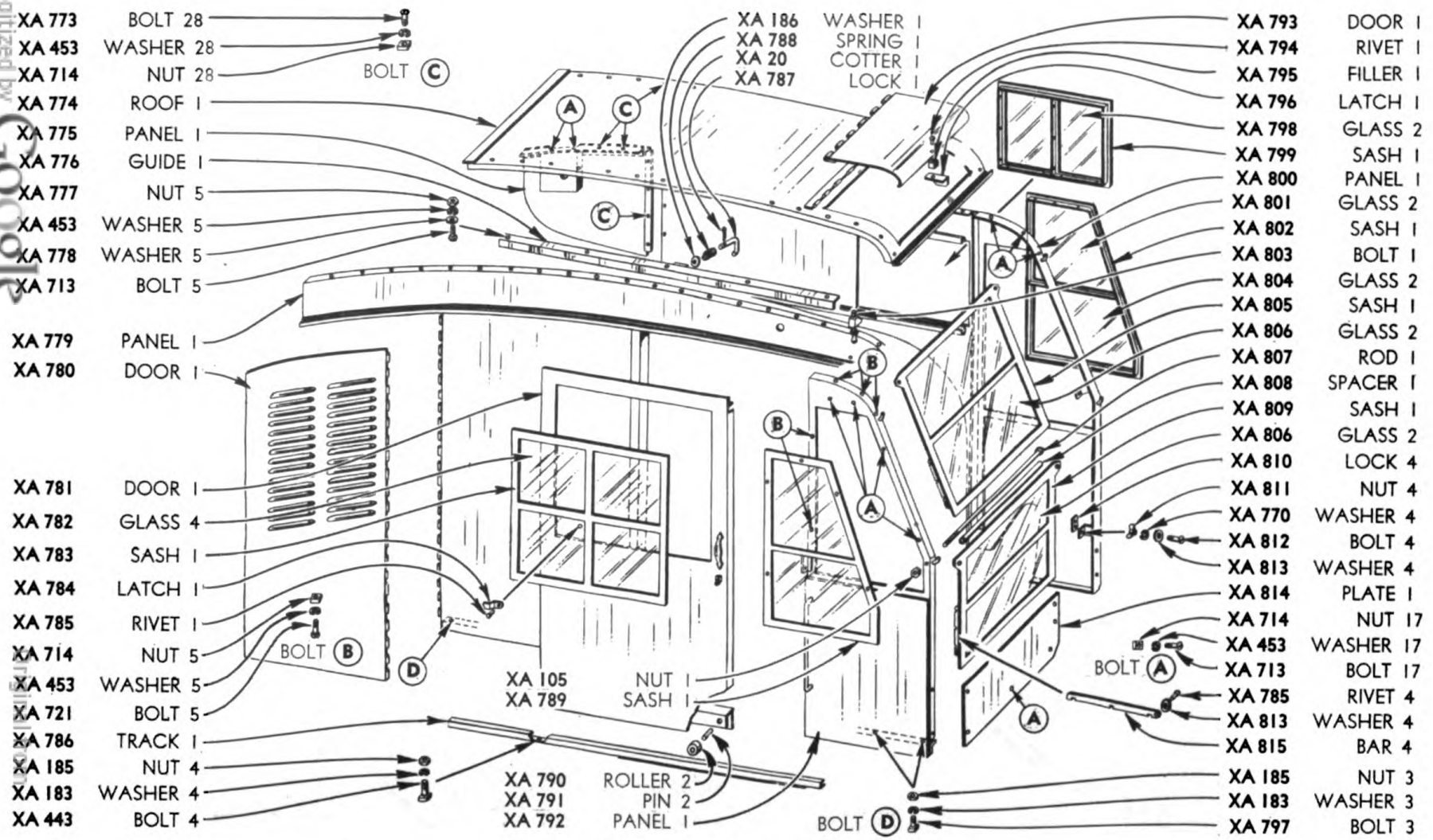




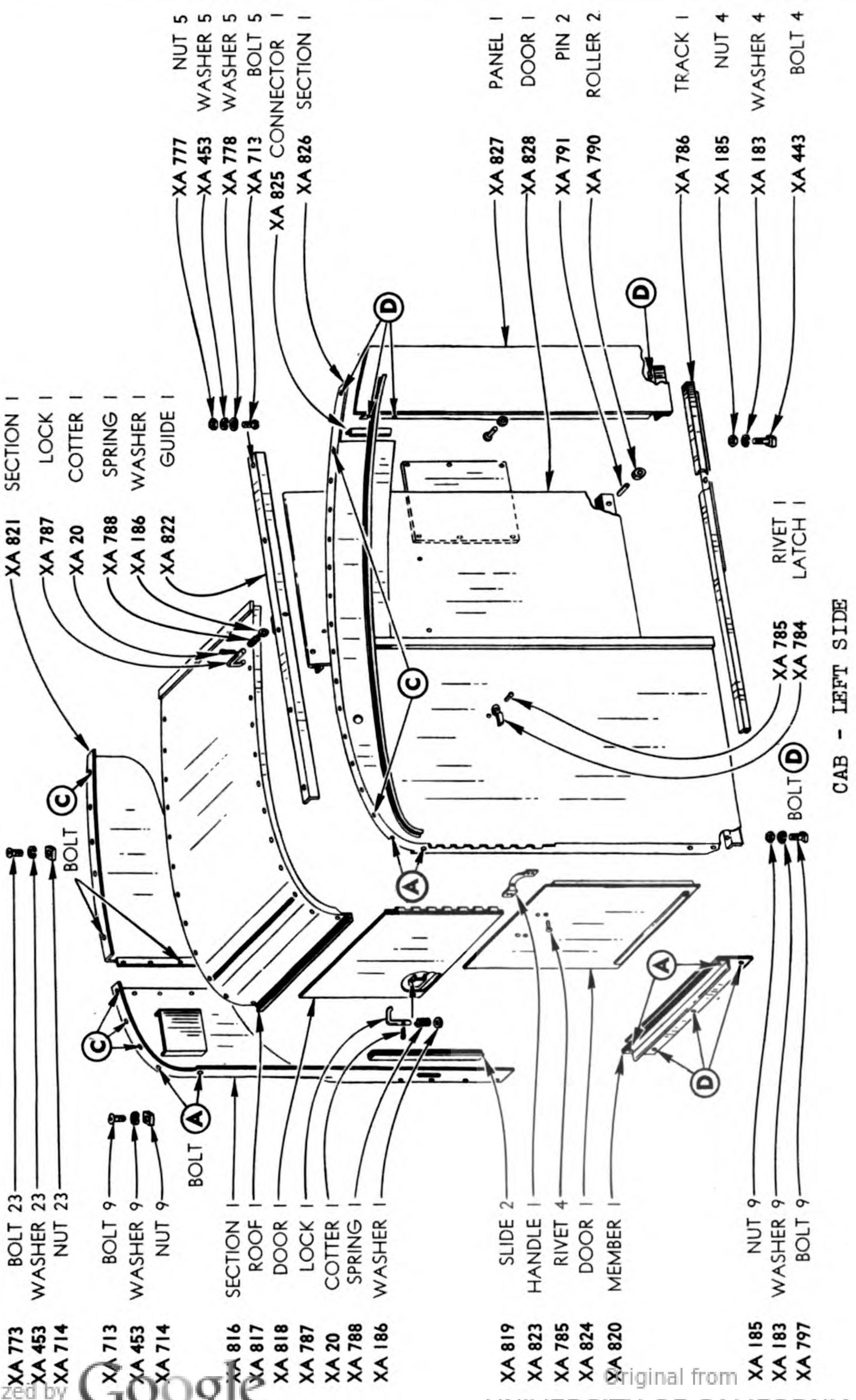
PLATFORM AND TAIL SWING



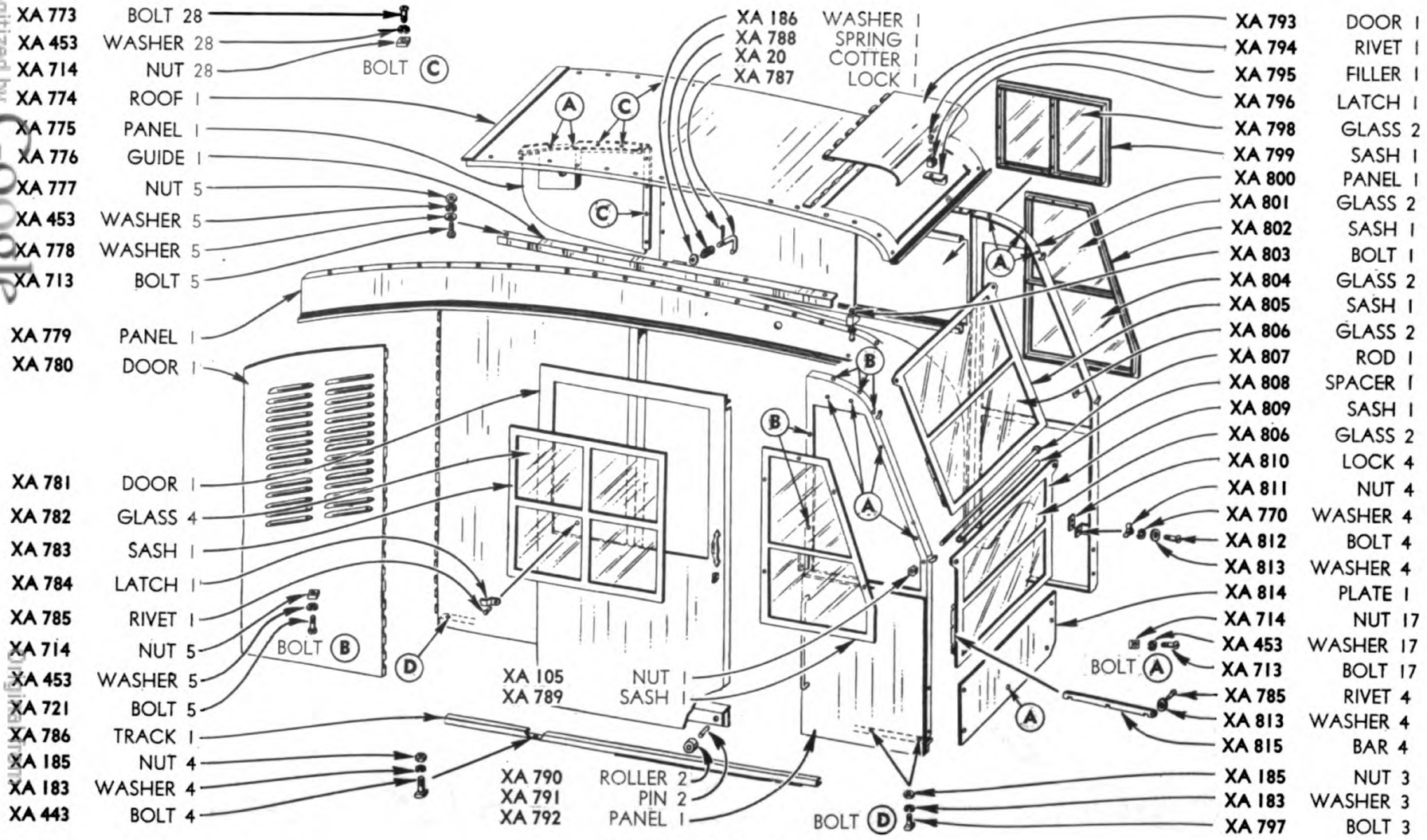
CAB - PLATFORM - BULKHEAD ASSEMBLY - WINDOW GUARD



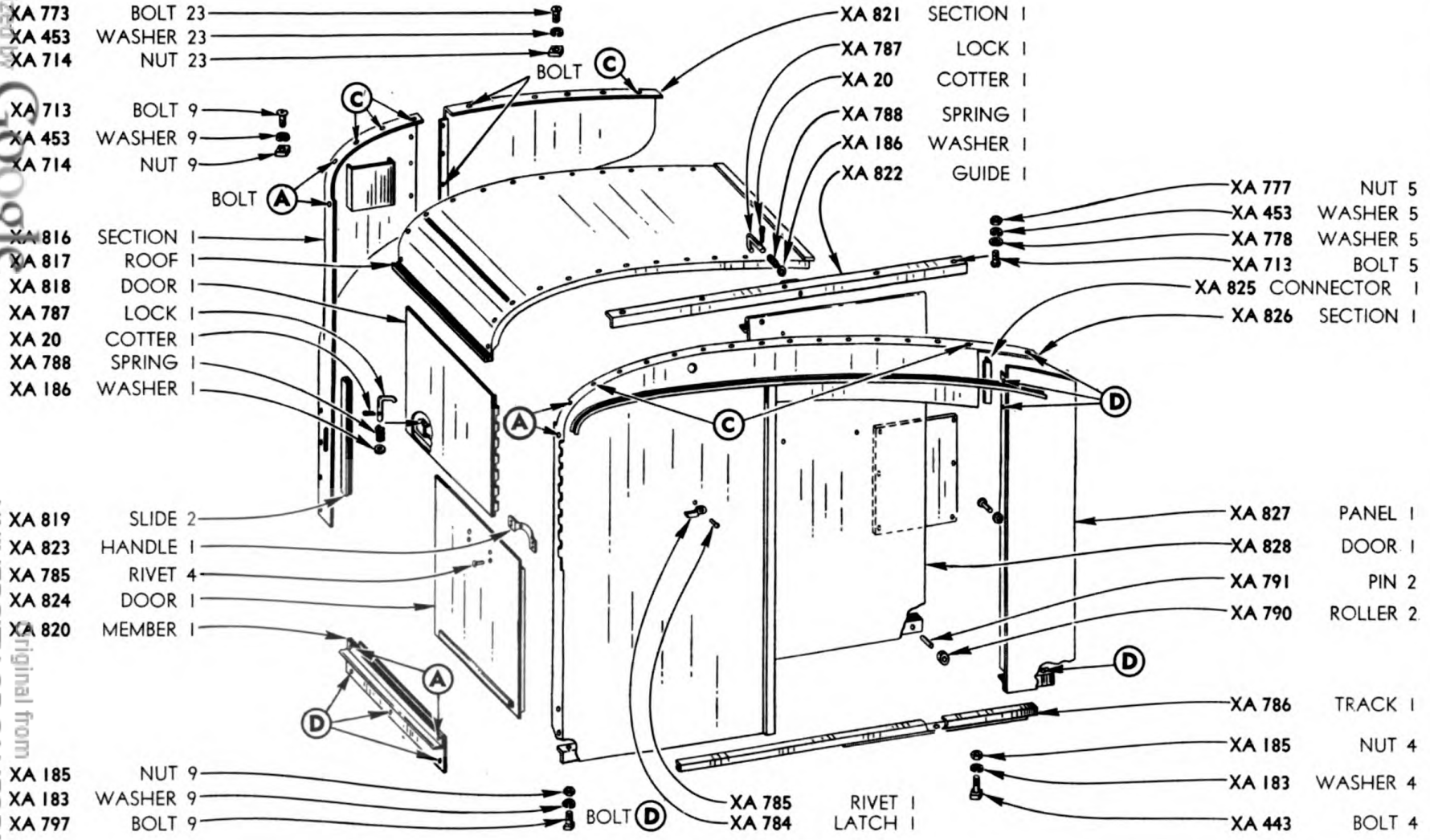
CAB - RIGHT SIDE



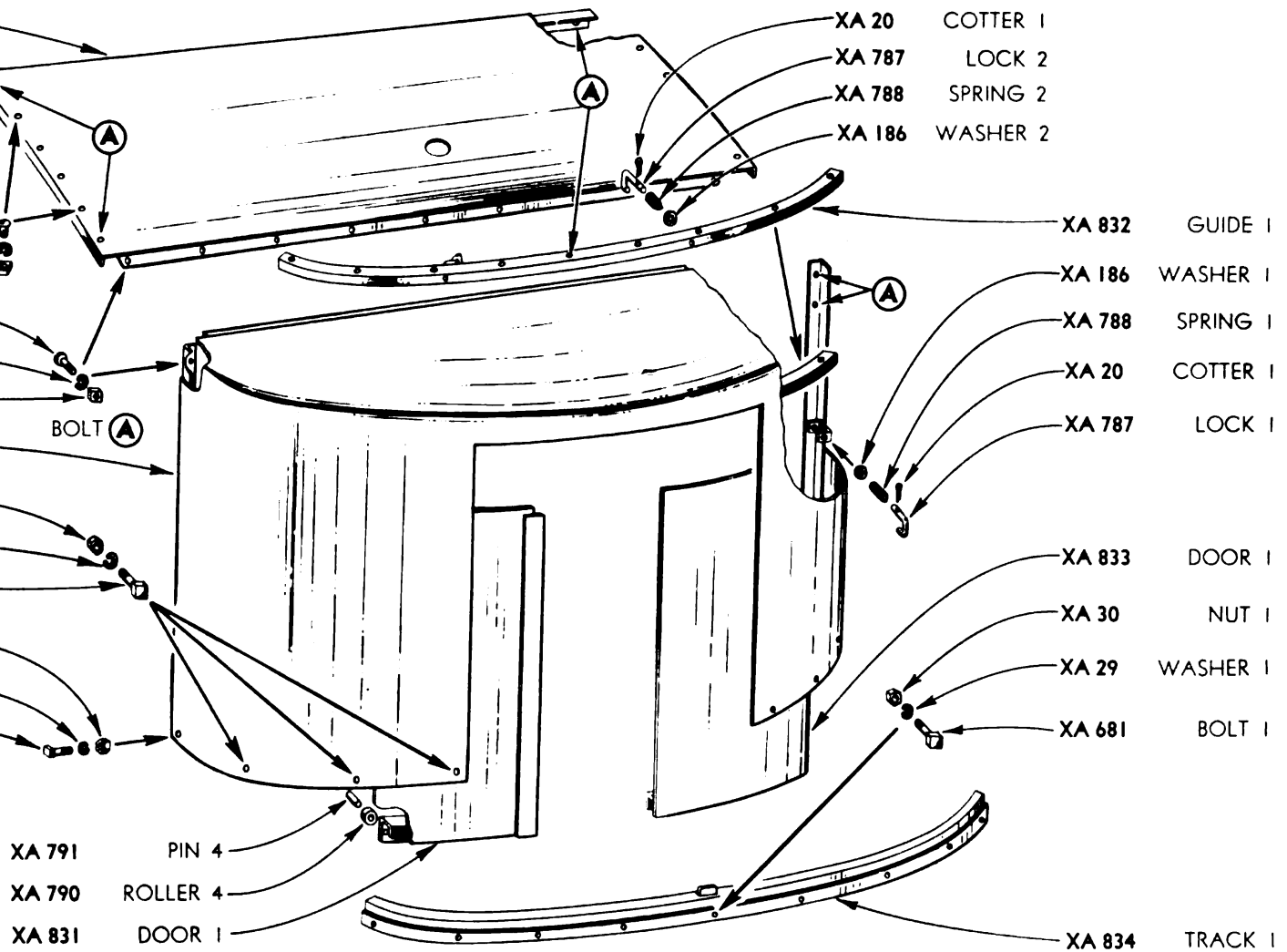
CAB - LEFT SIDE



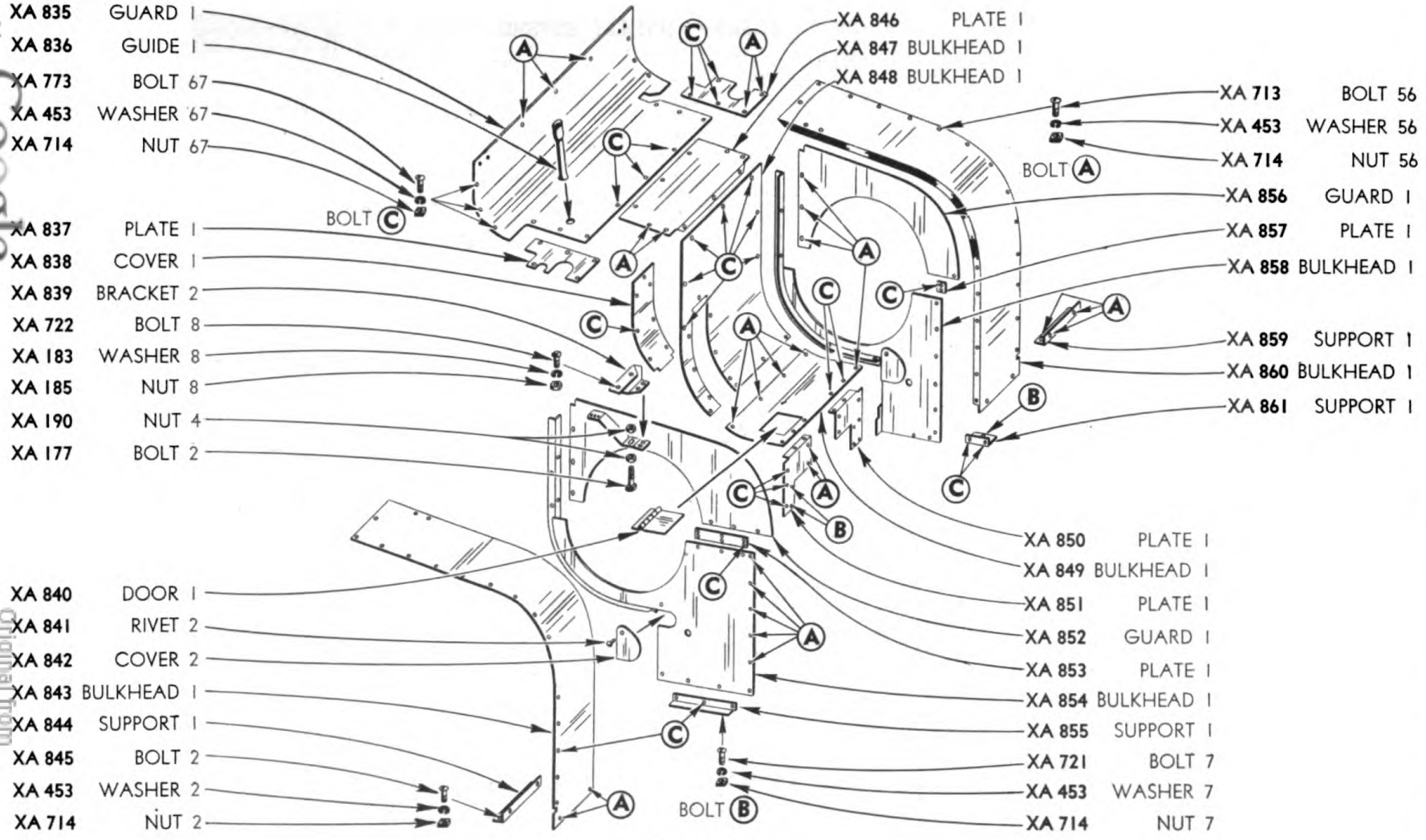
CAB - RIGHT SIDE



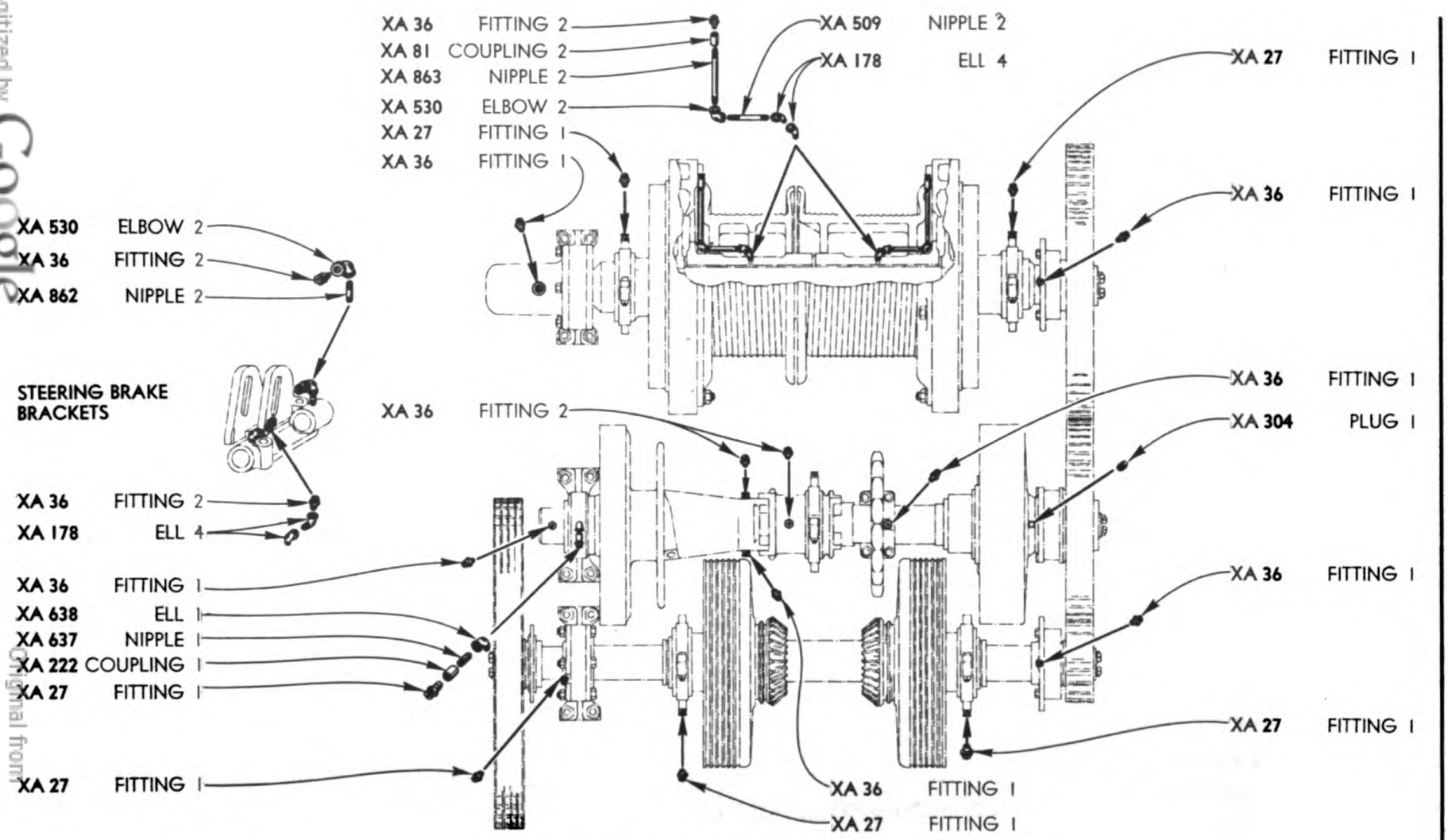
CAB - LEFT SIDE



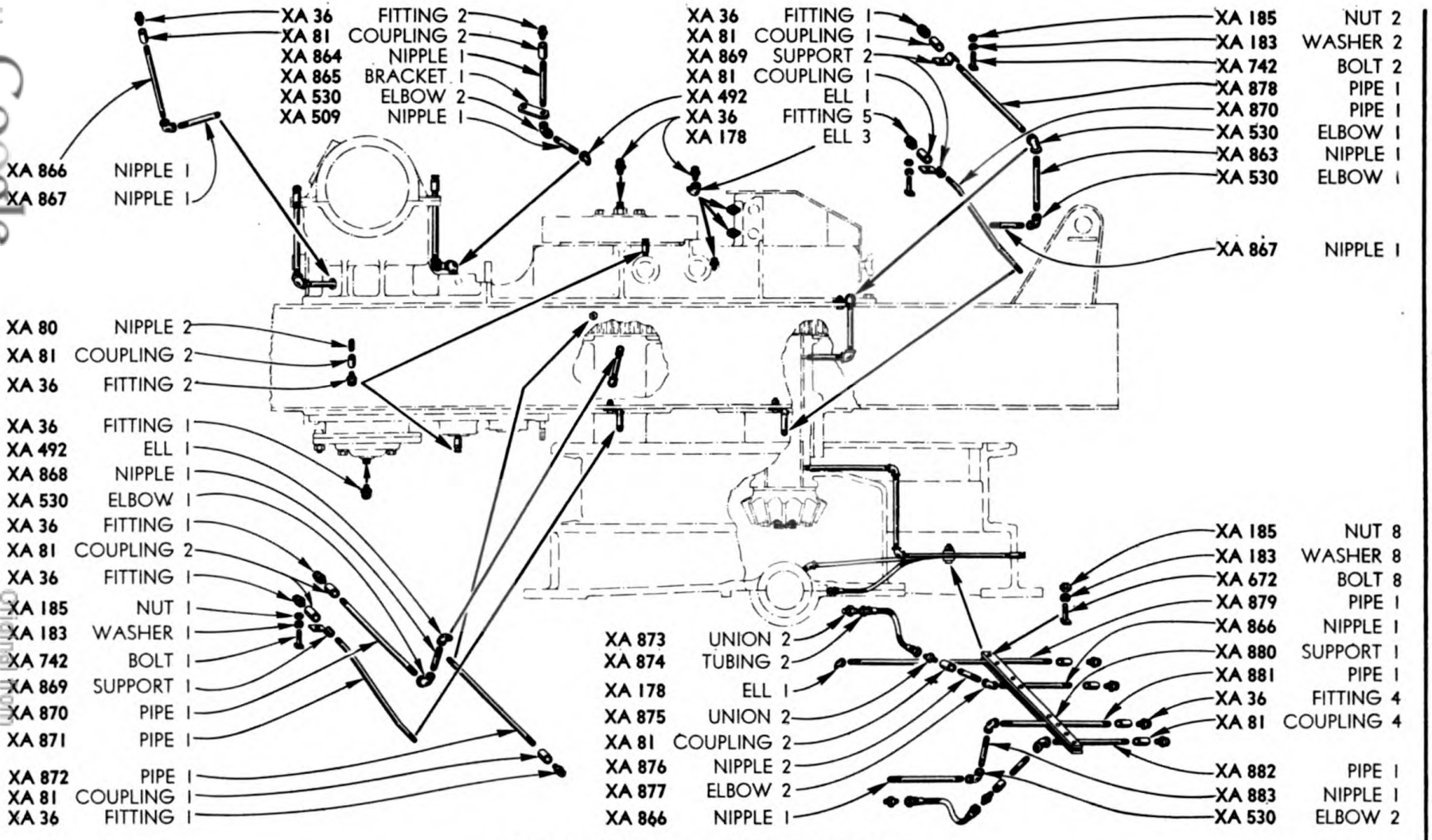
CAB - REAR



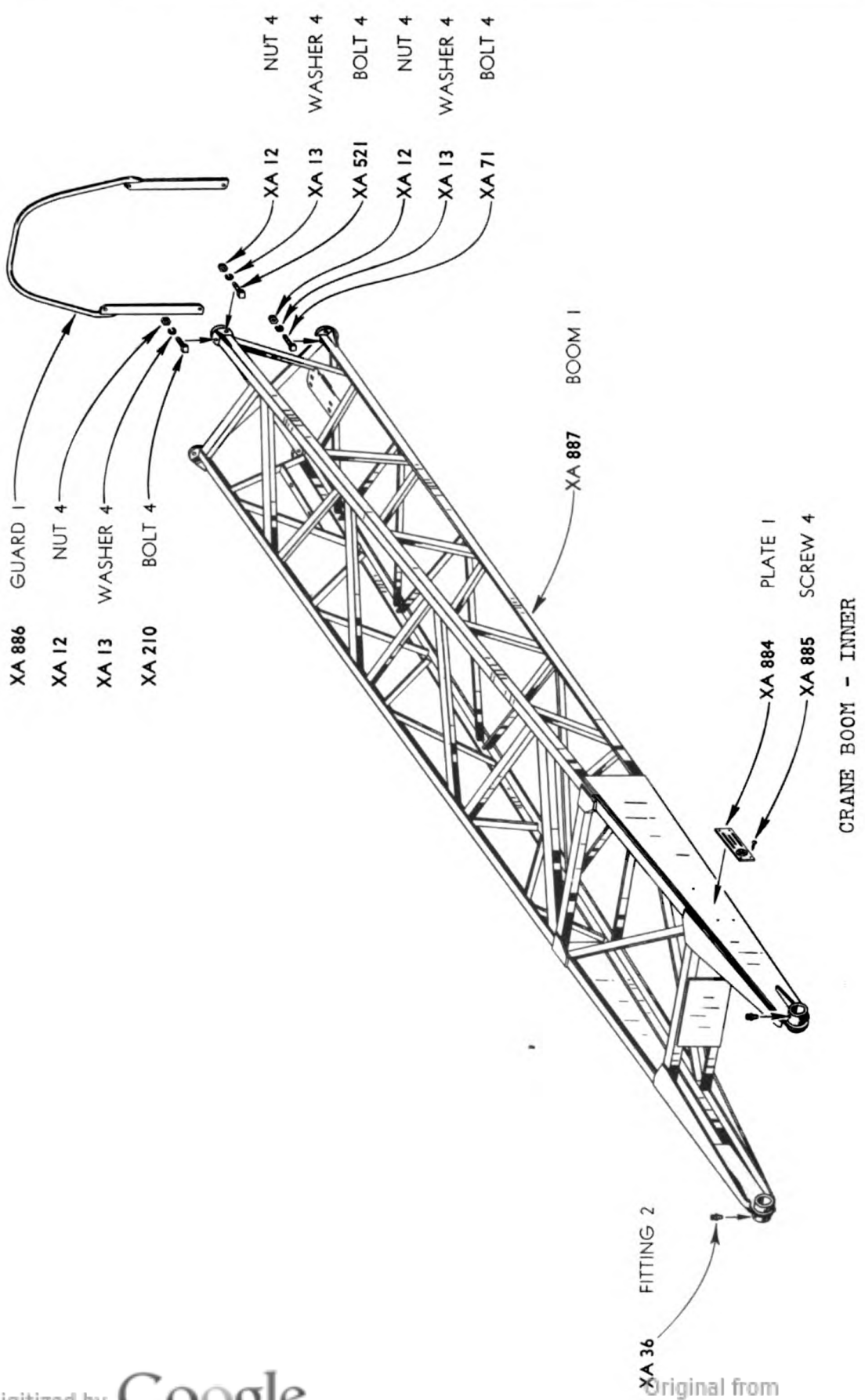
BULKHEAD



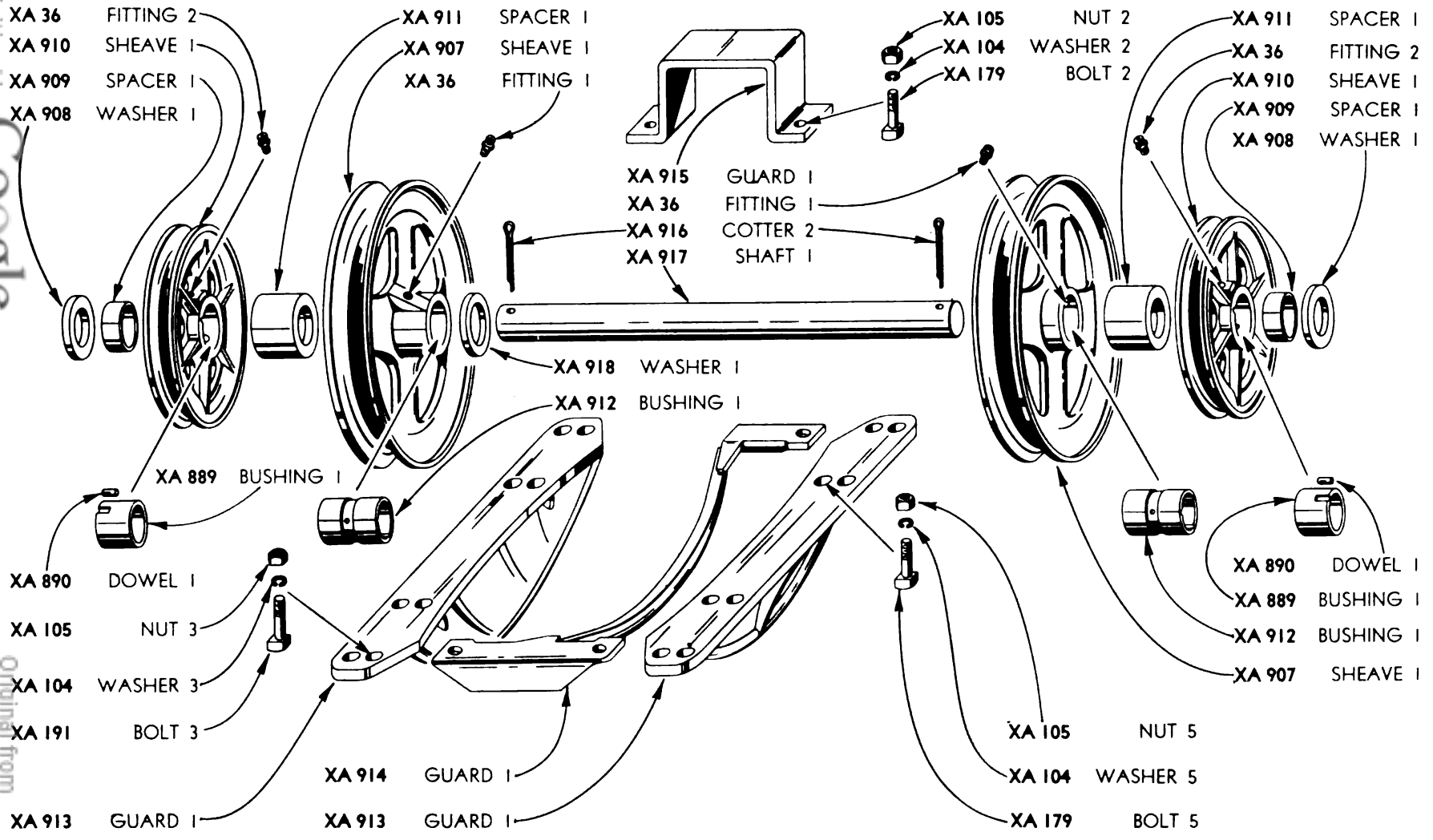
GREASE PIPING - UPPER MACHINERY



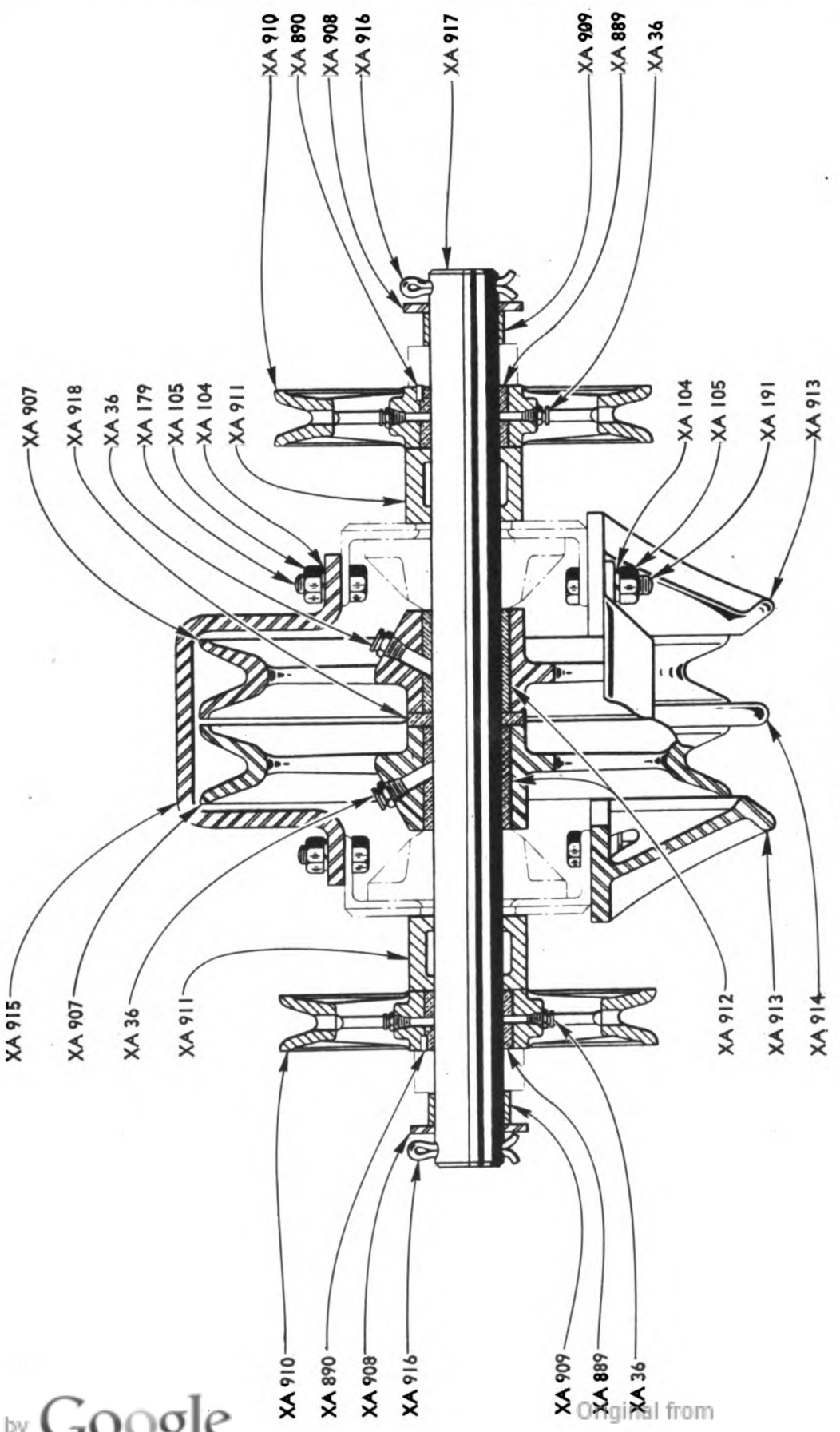
GREASE PIPING - LOWER MACHINERY



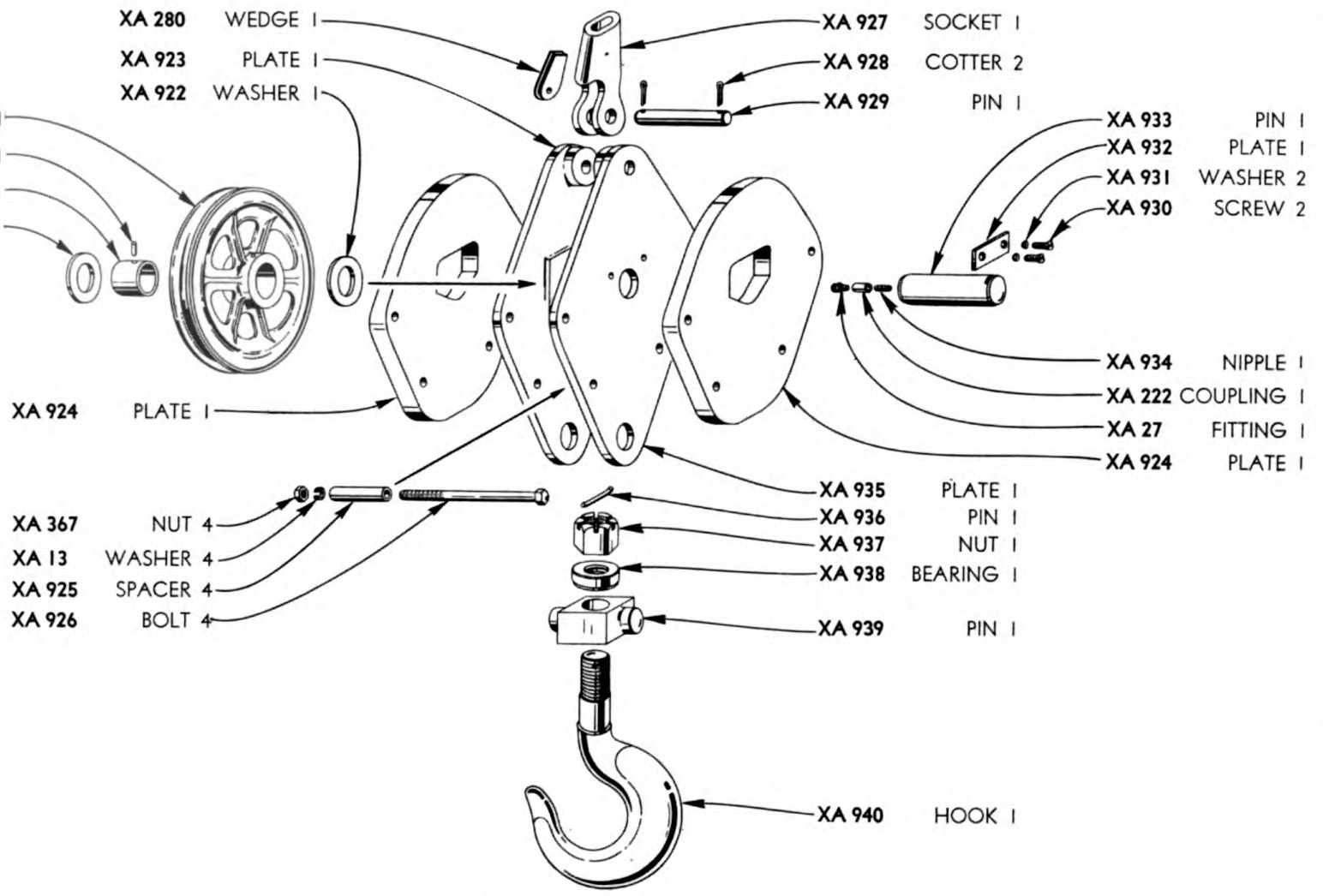
CRANE BOOM - BOOM POINT PARTS



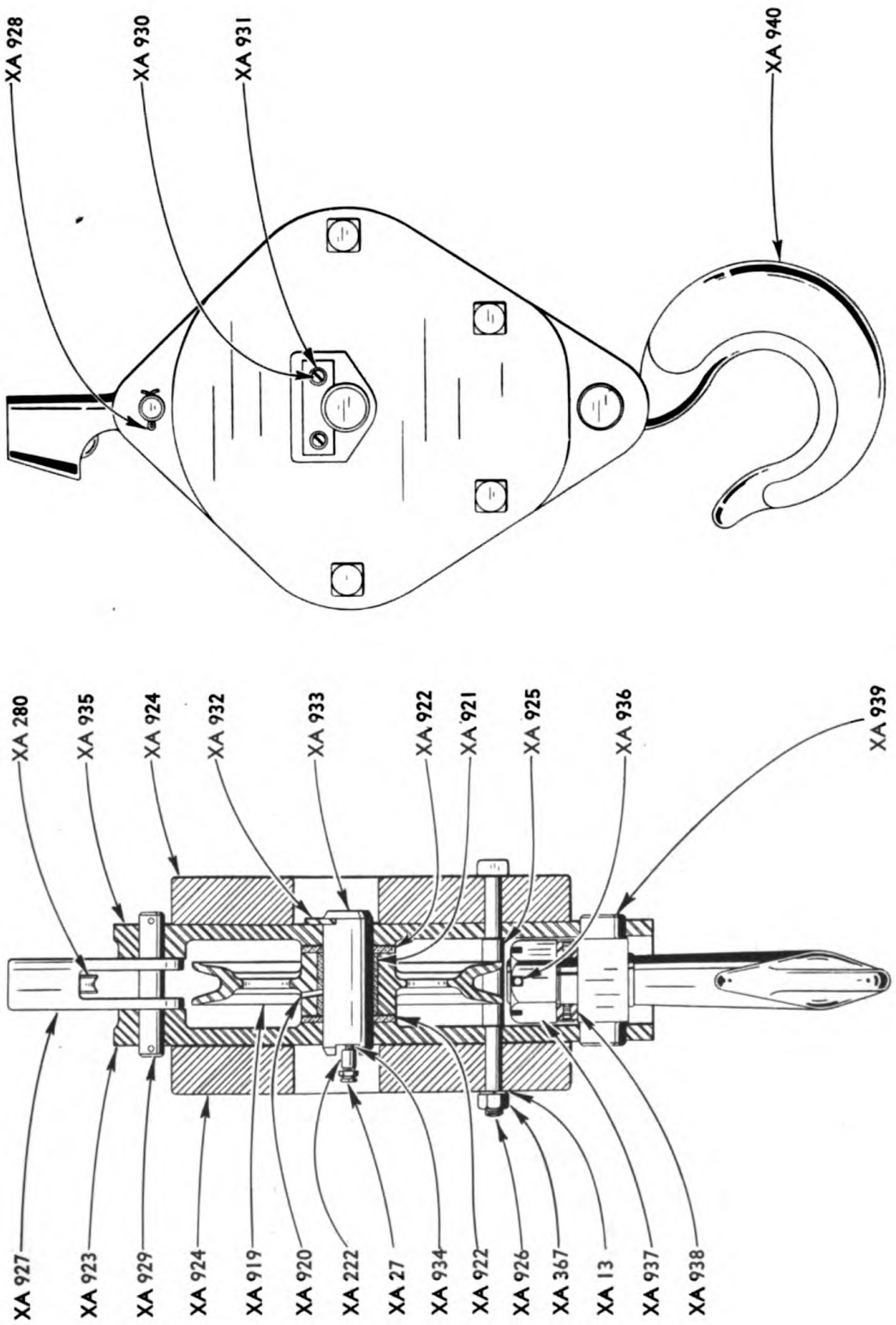
BOOM POINT PARTS



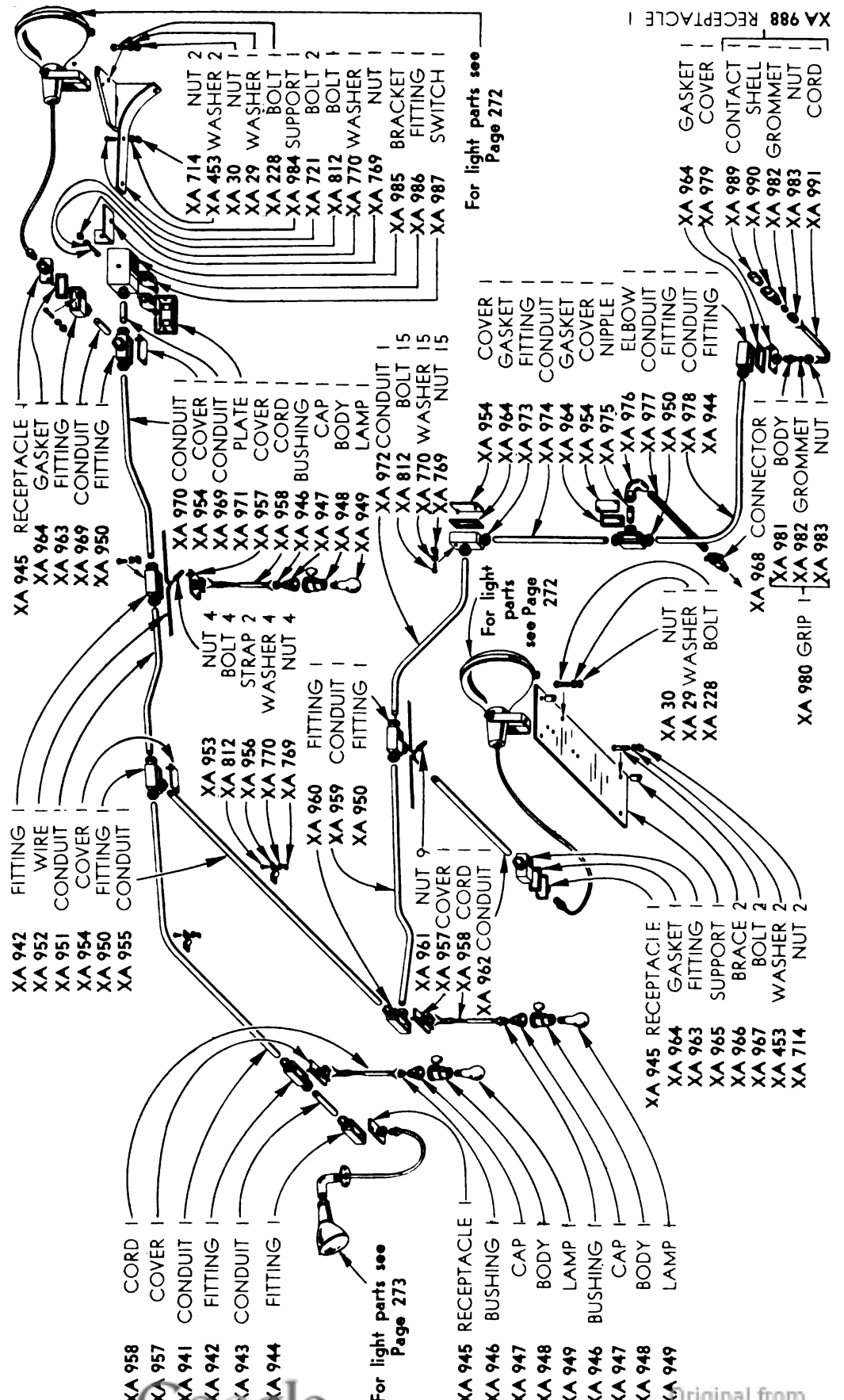
BOOM POINT PARTS



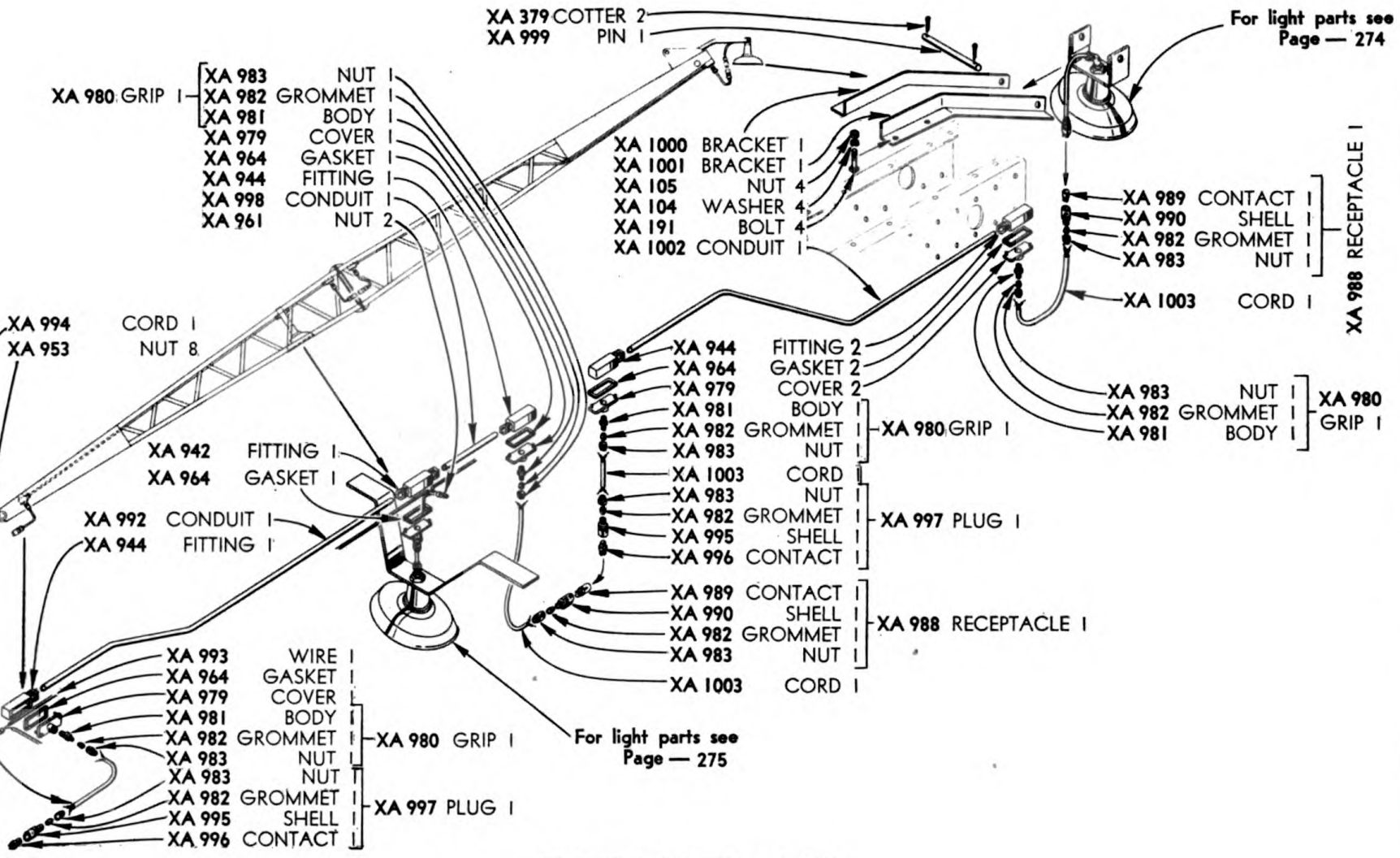
HOOK AND BLOCK



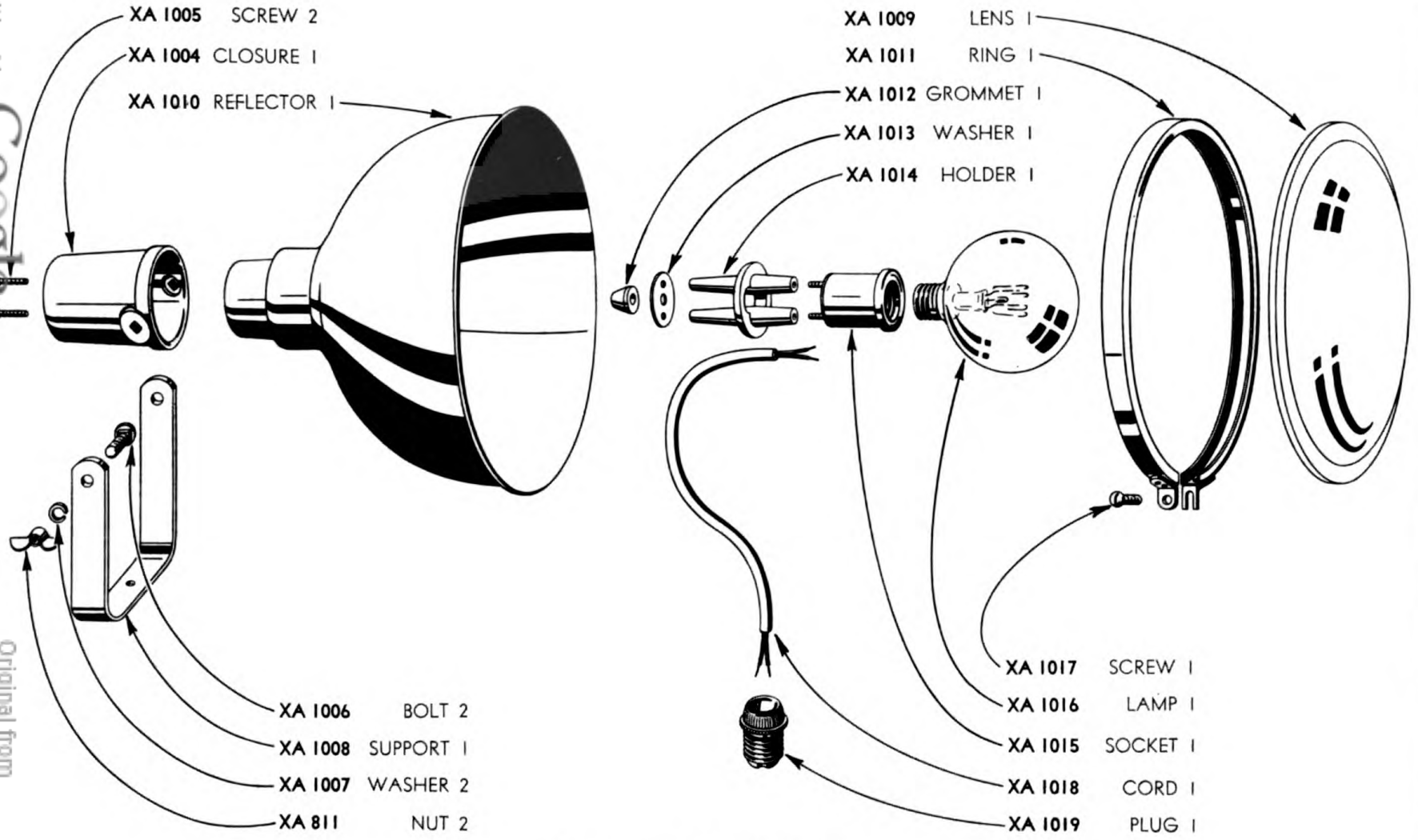
HOOK AND BLOCK



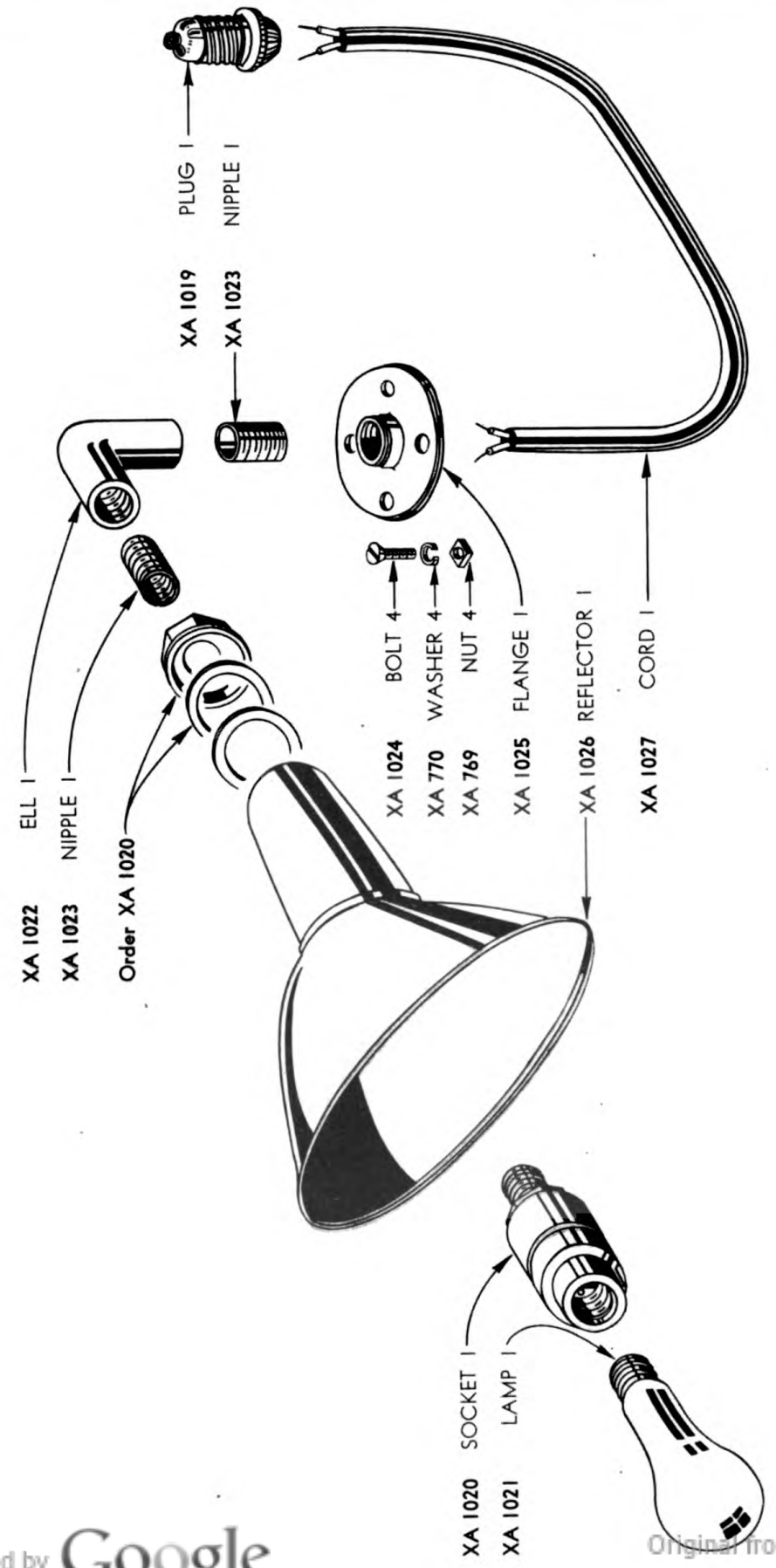
LIGHTING SYSTEM - CAB



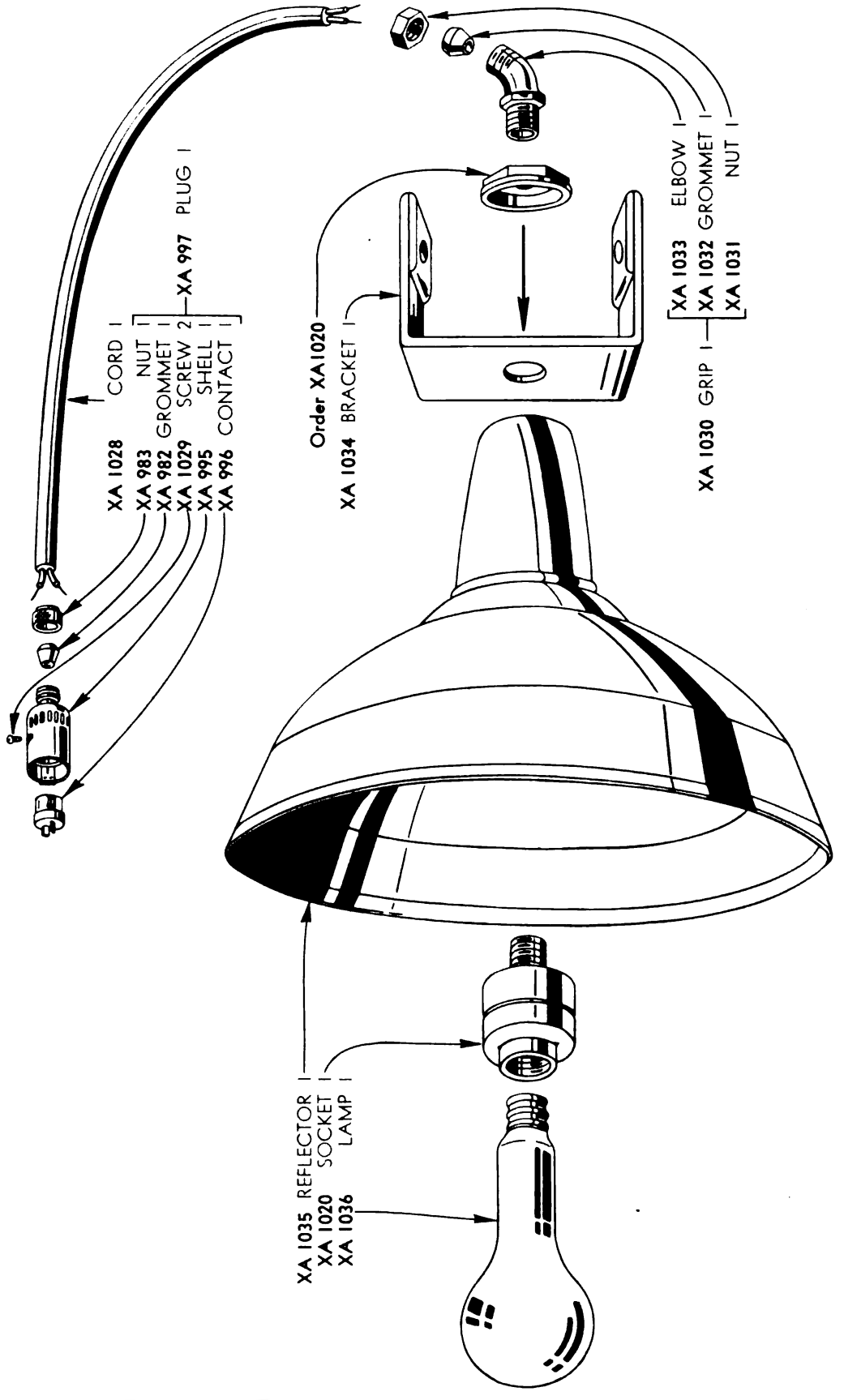
LIGHTING SYSTEM - BOOM



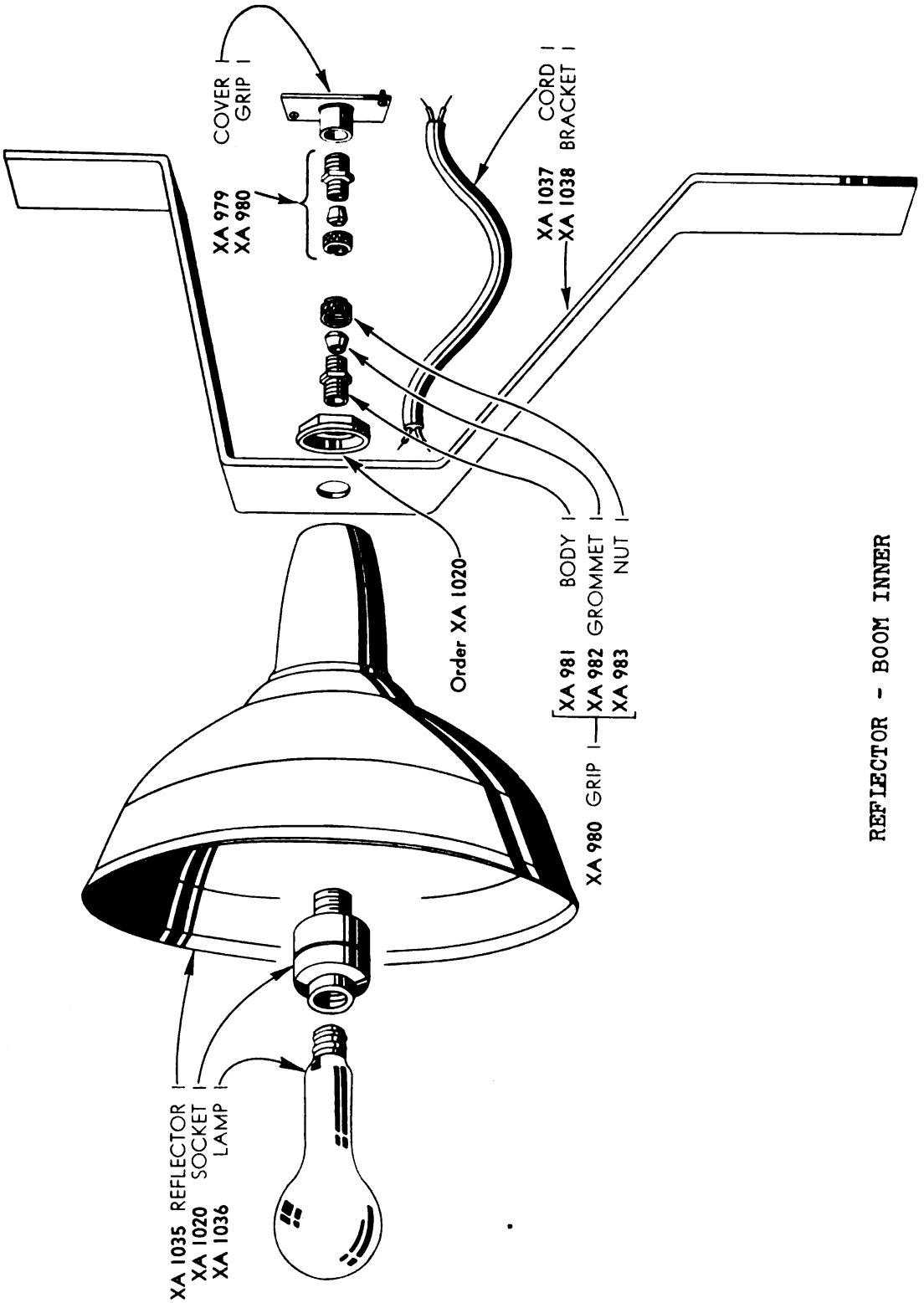
FLOODLIGHTS - CAB FRONT



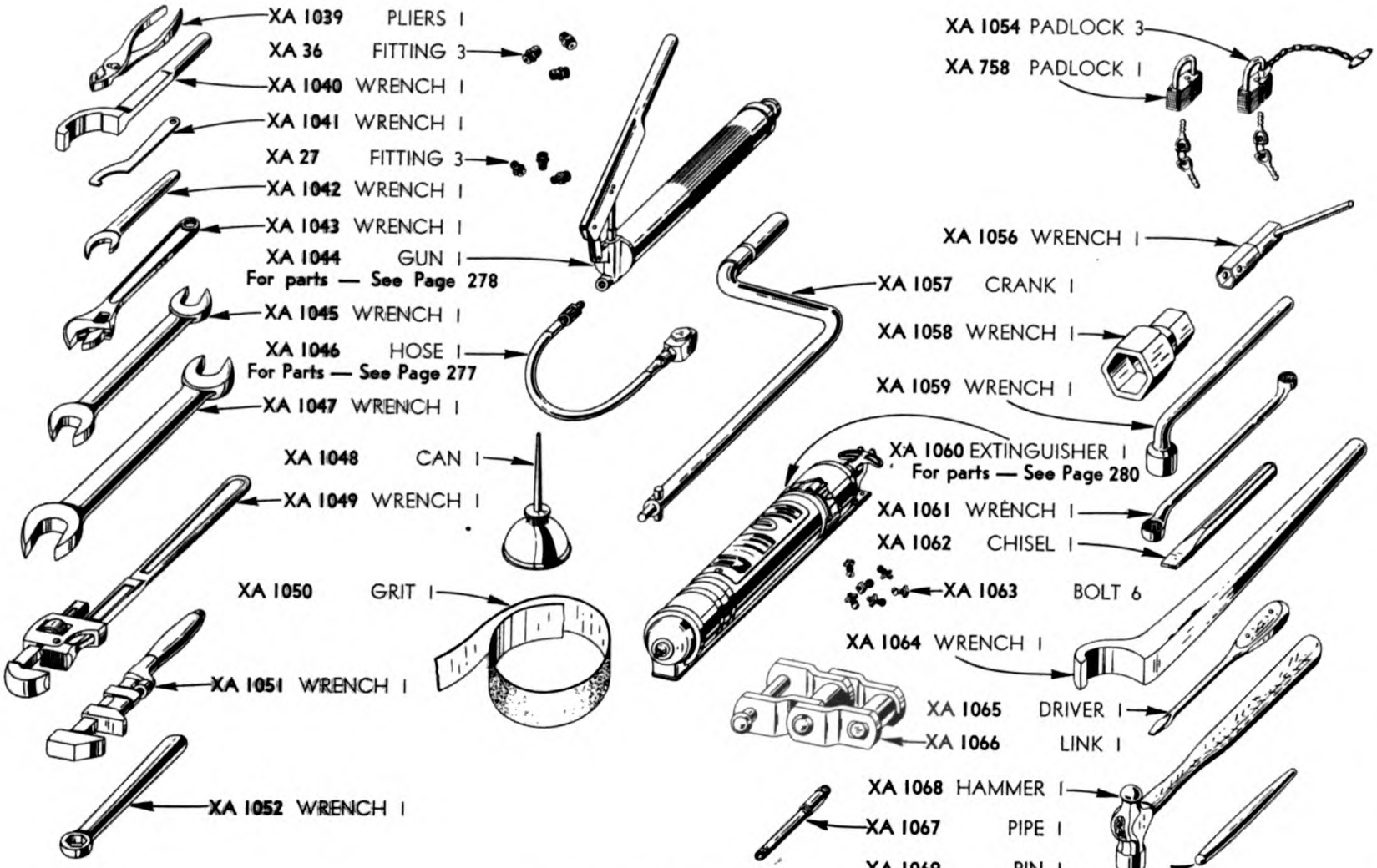
REFLECTOR - CAB REAR



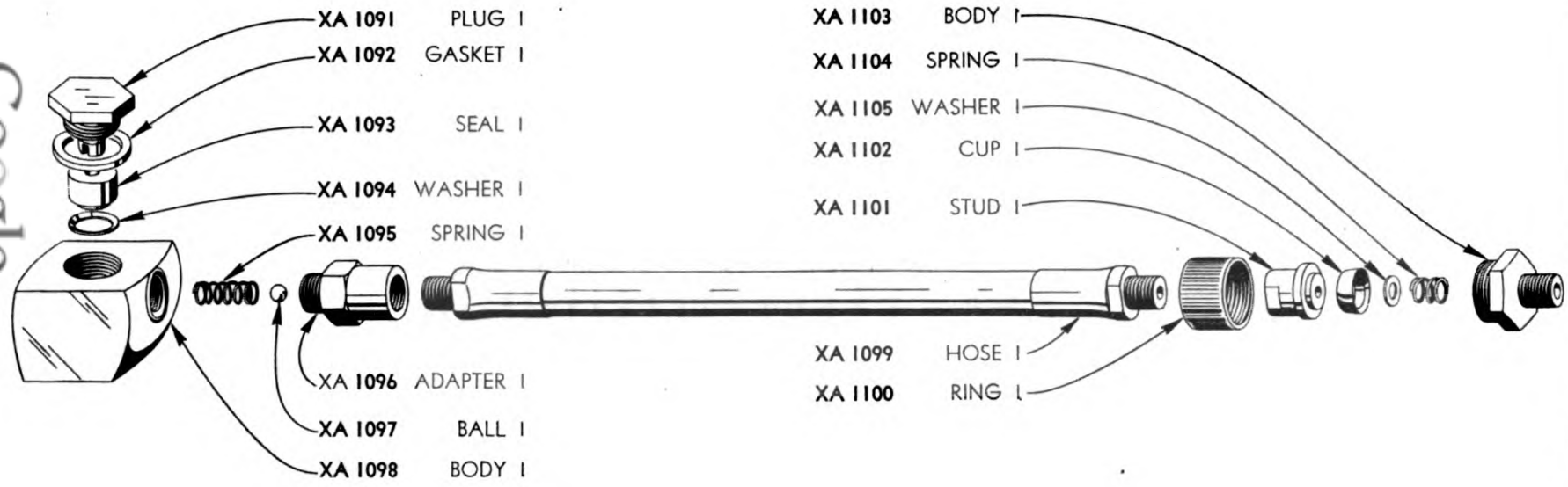
REFLECTOR - BOOM POINT

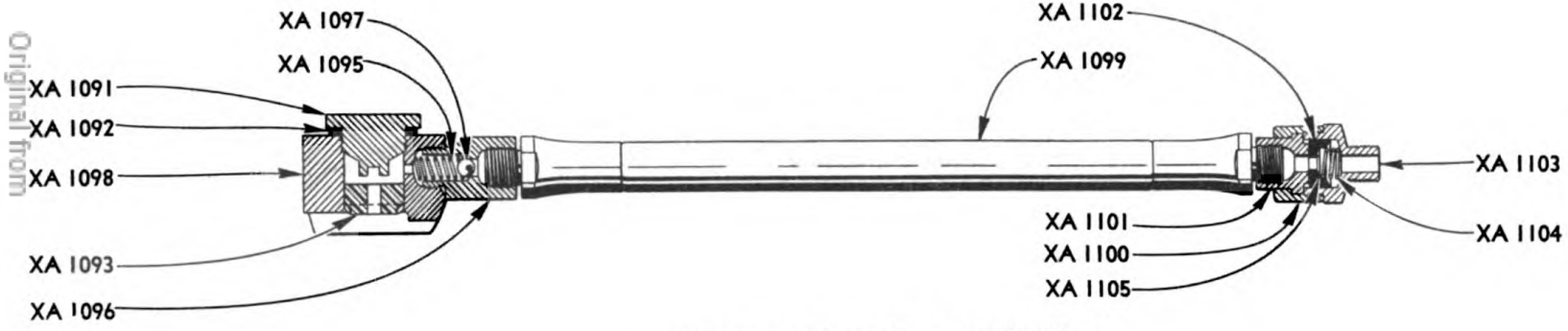


REFLECTOR - BOOM INNER

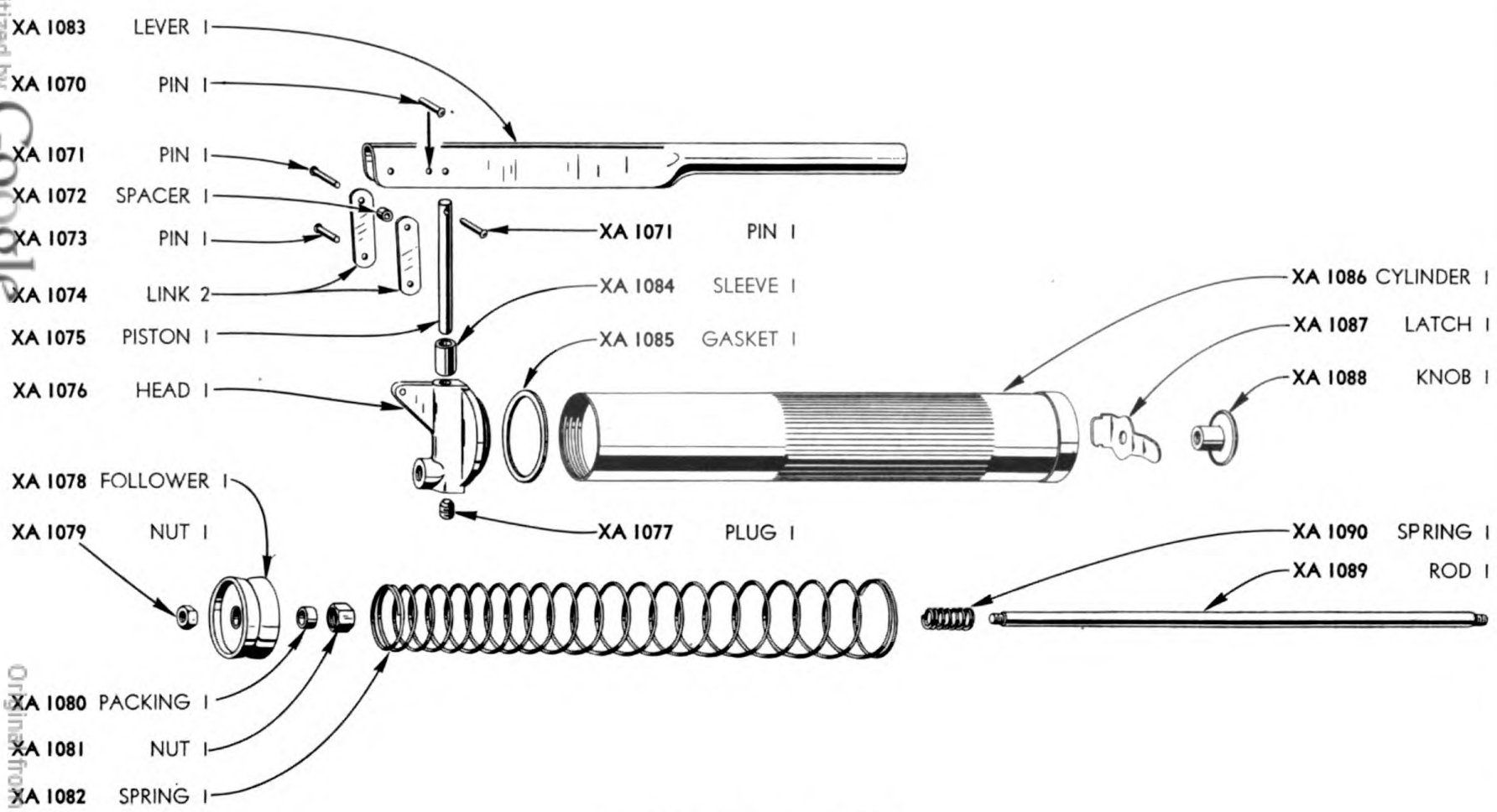


TOOL OPERATING ACCESSORIES

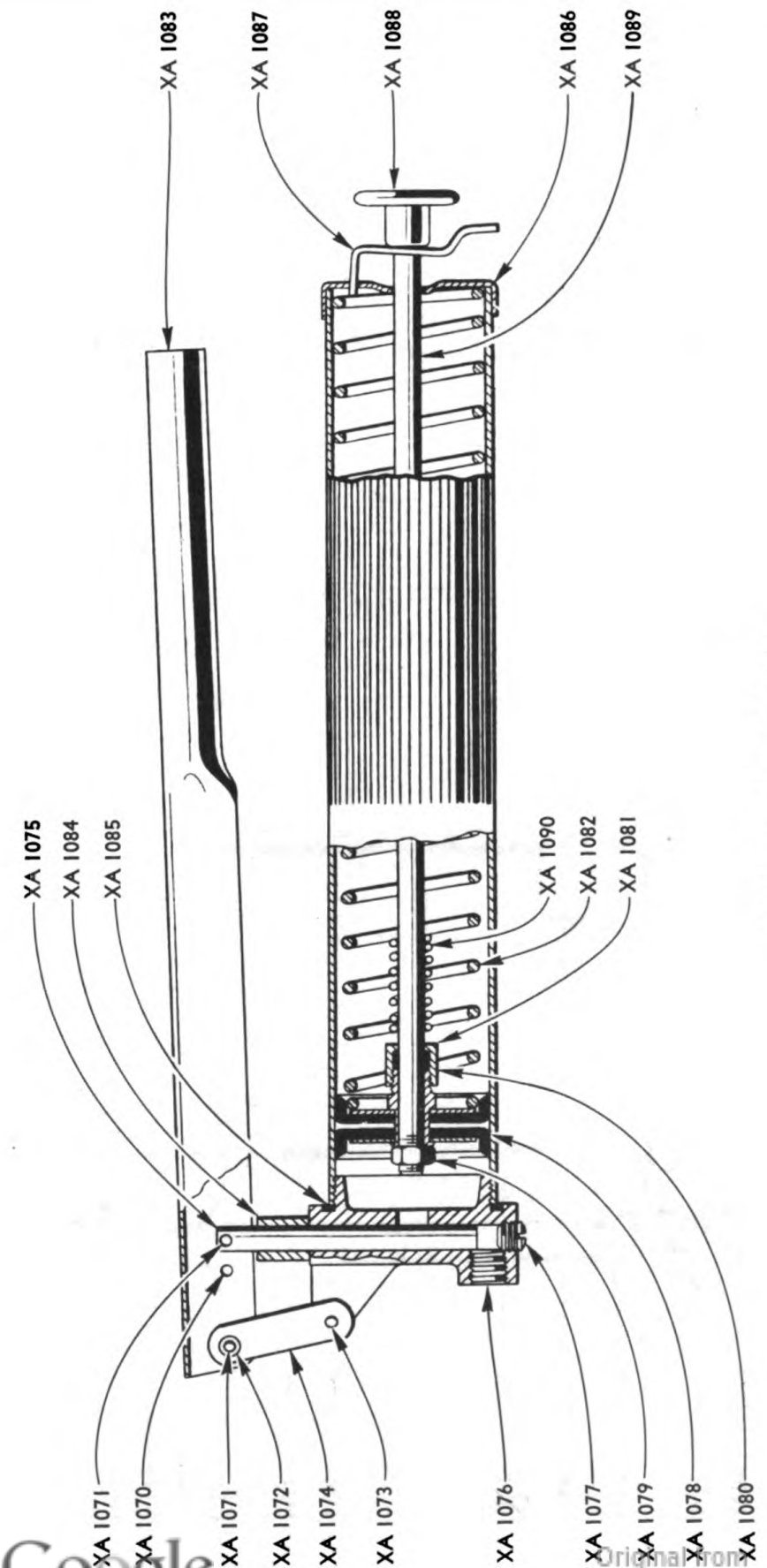




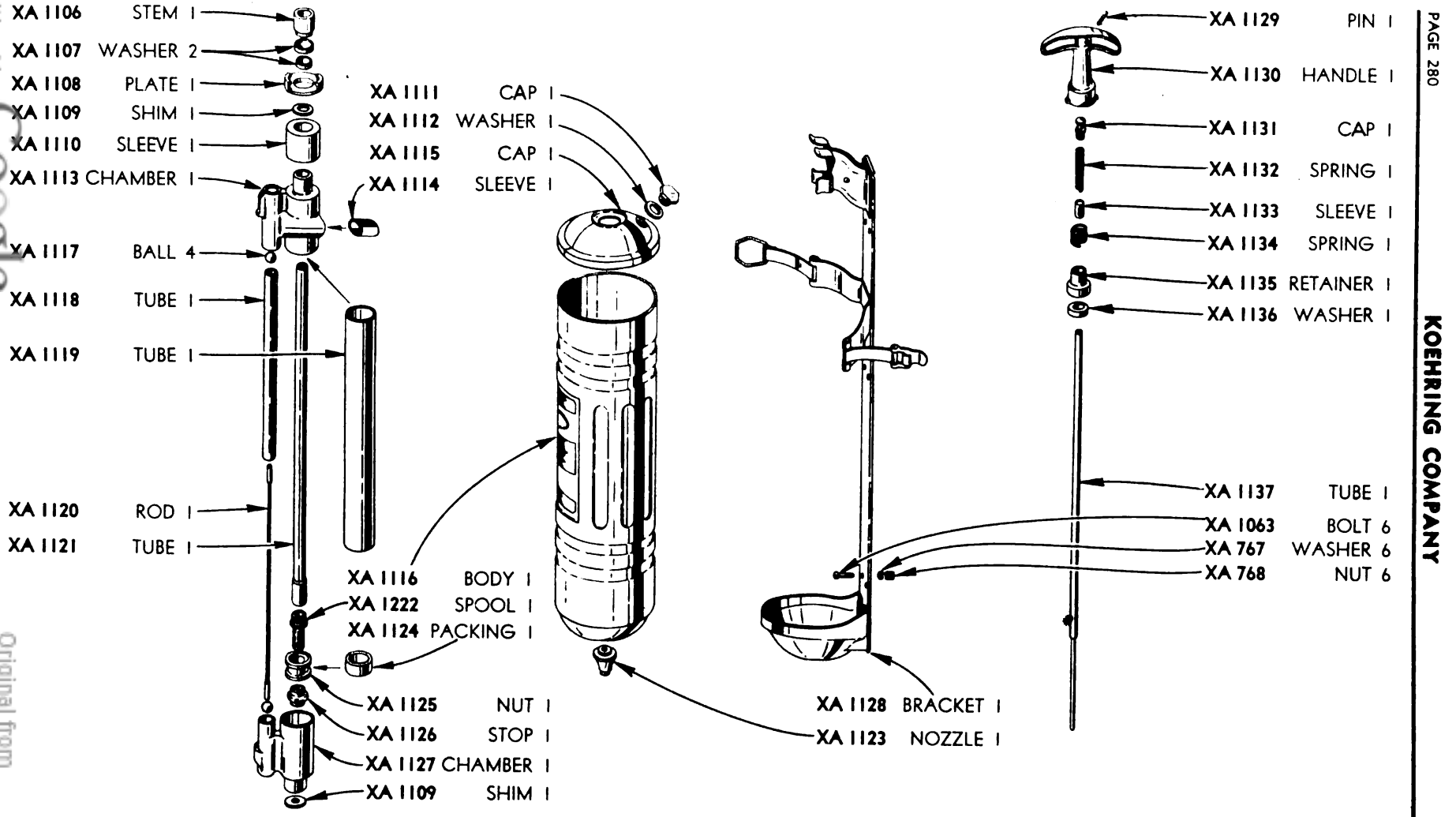
GREASE GUN HOSE - ALEMITE



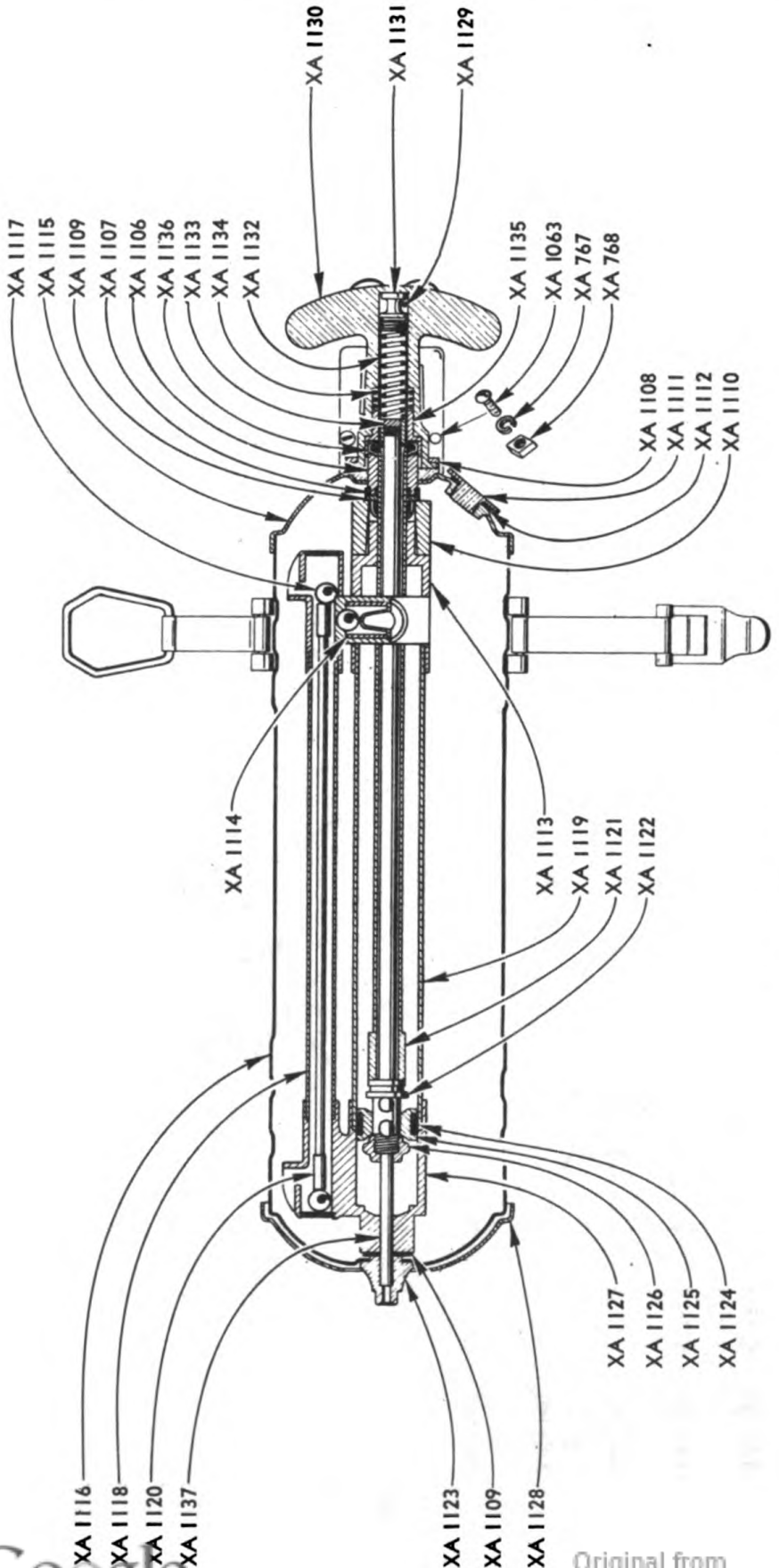
GREASE GUN - ALEMITE



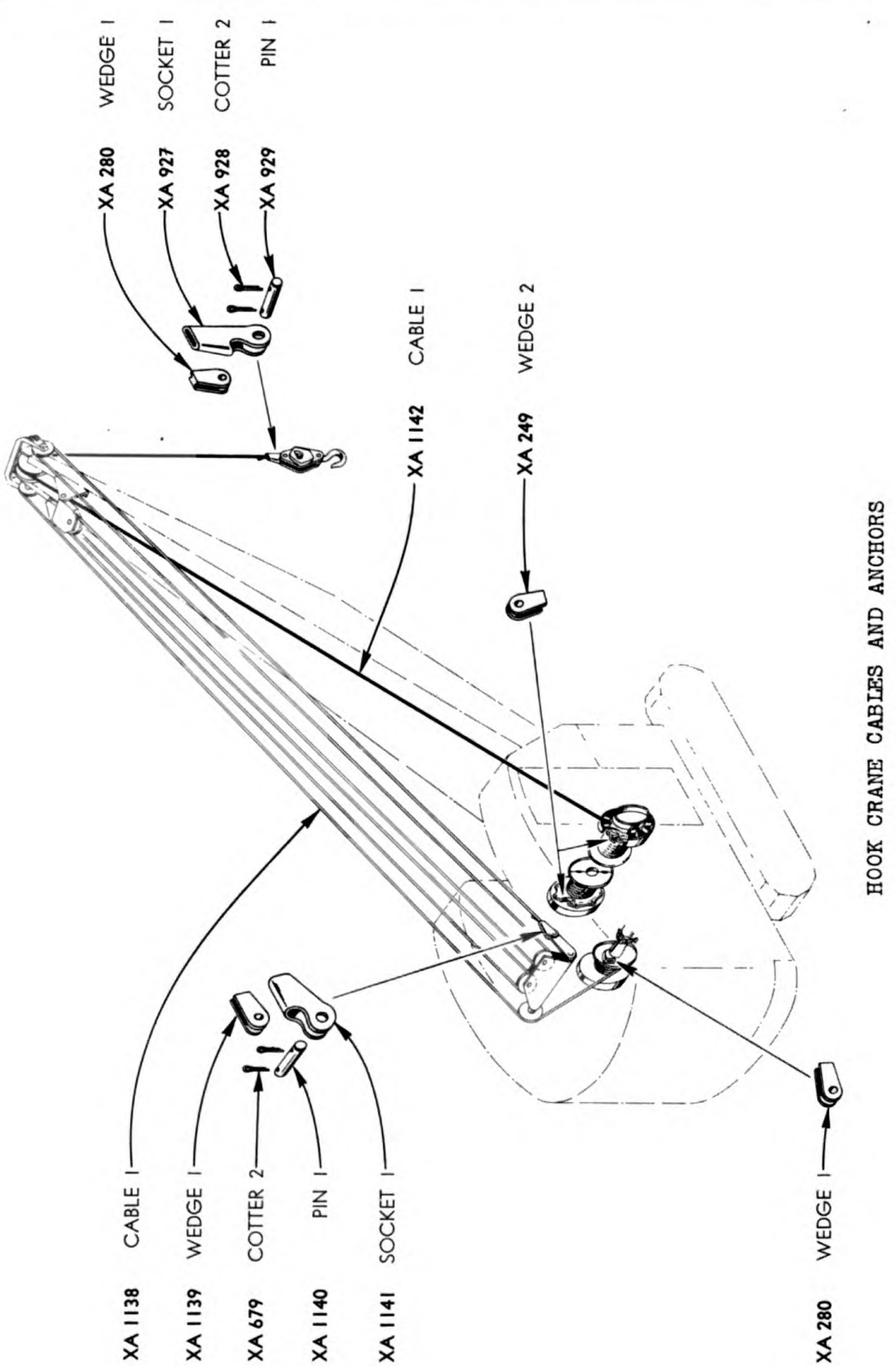
GREASE GUN - ALEMITE



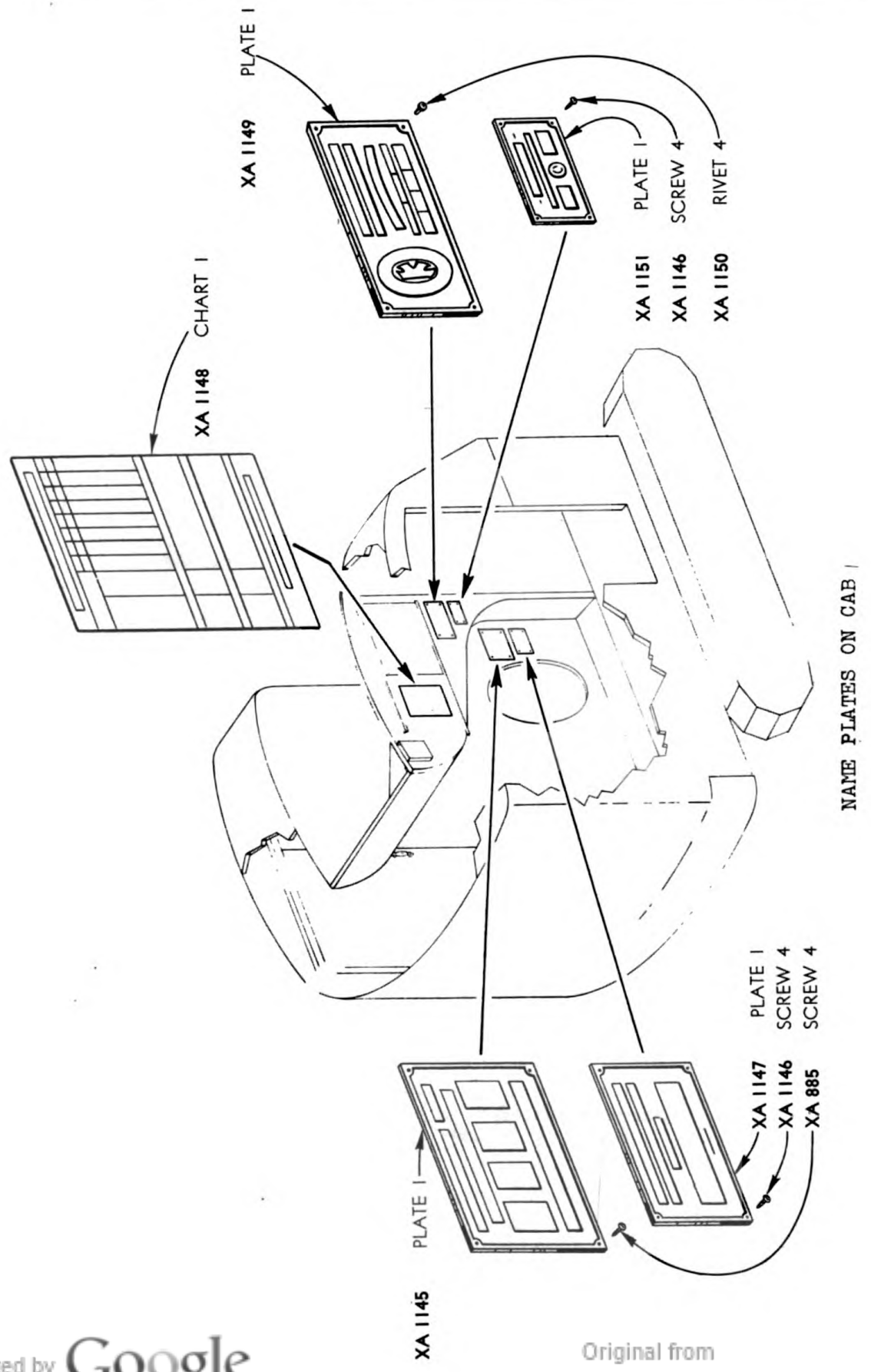
FIRE EXTINGUISHER - PYRENE

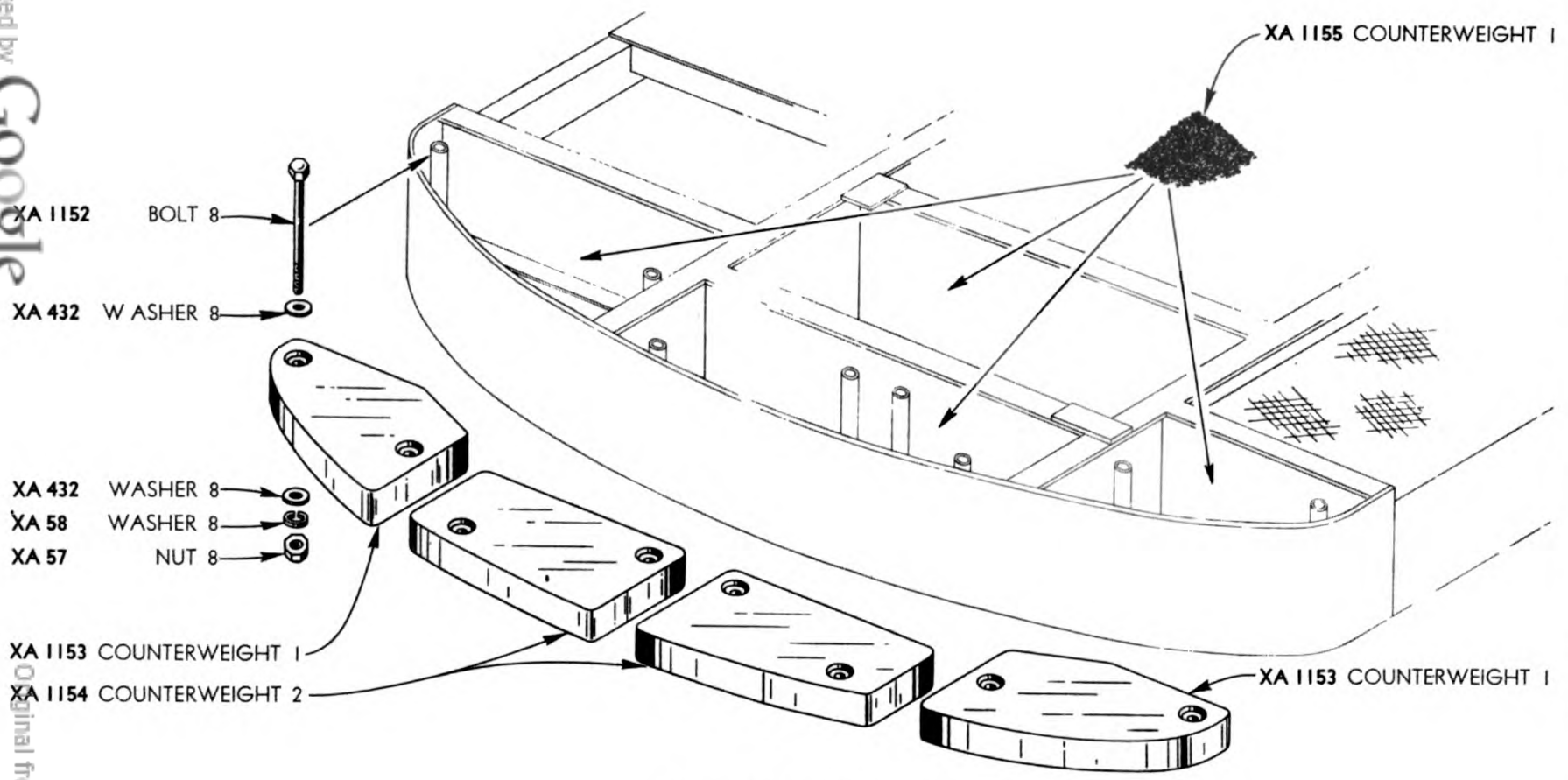


FIRE EXTINGUISHER - PYRENE

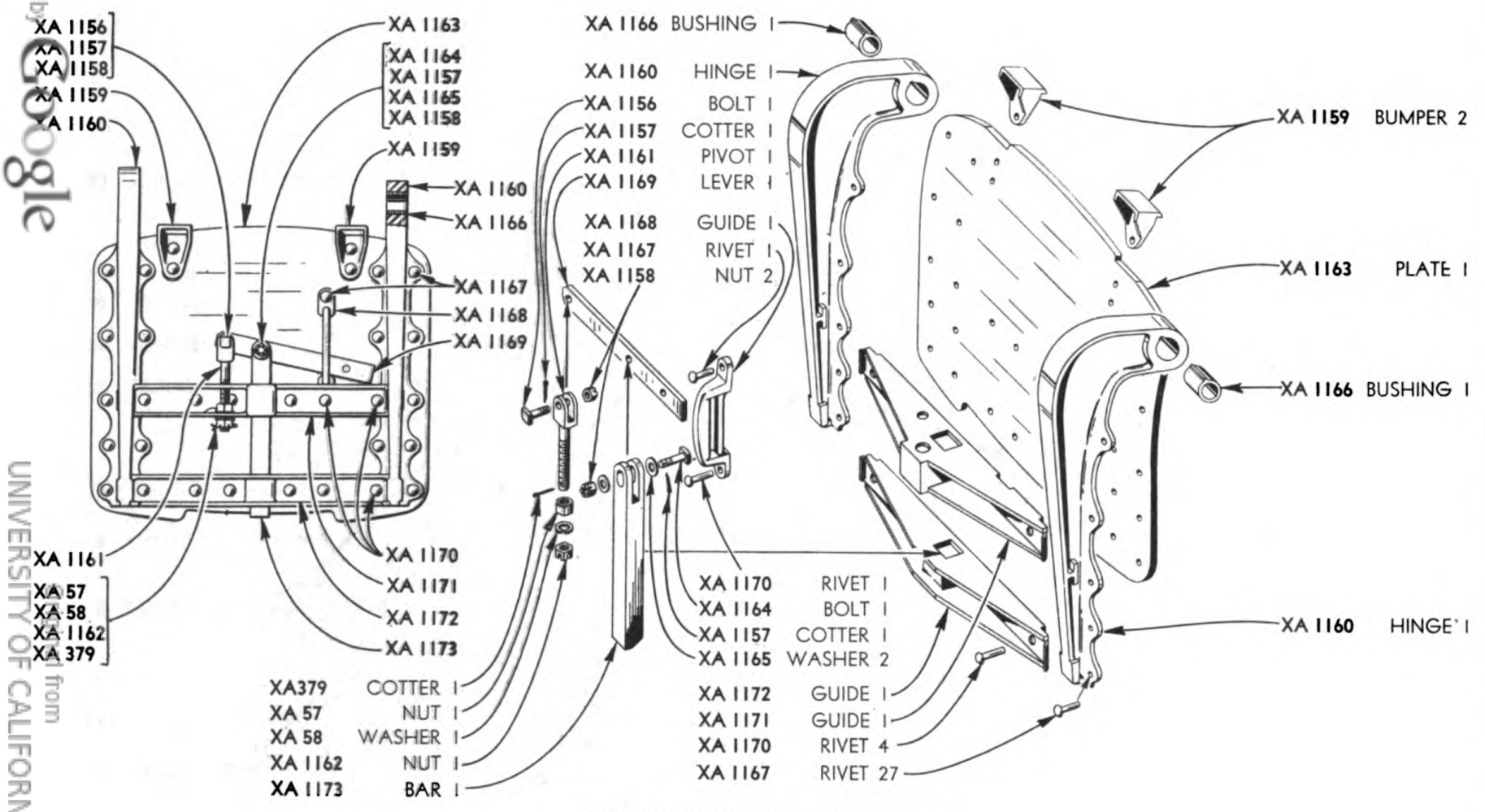


HOOK CRANE CABLES AND ANCHORS

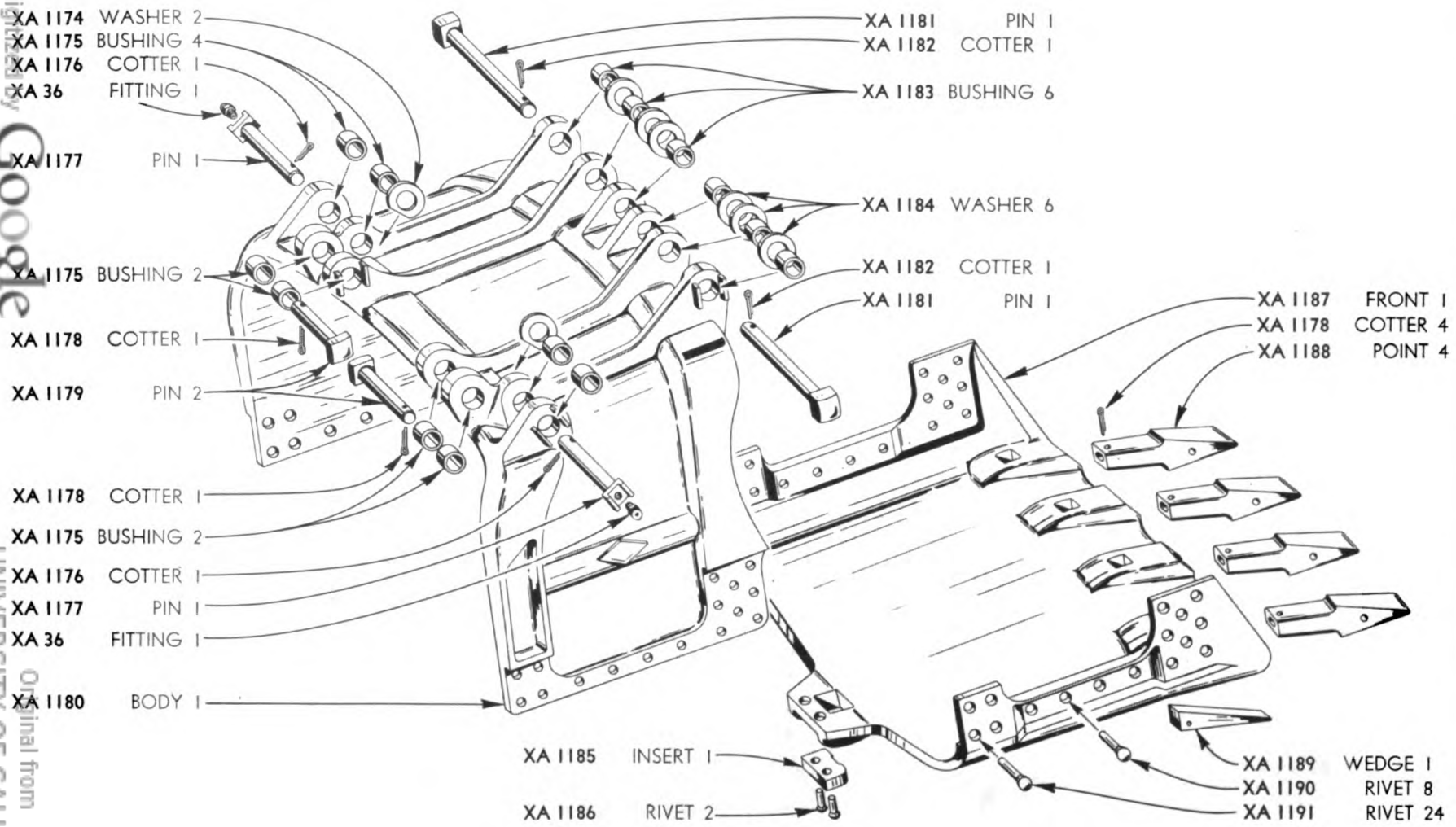




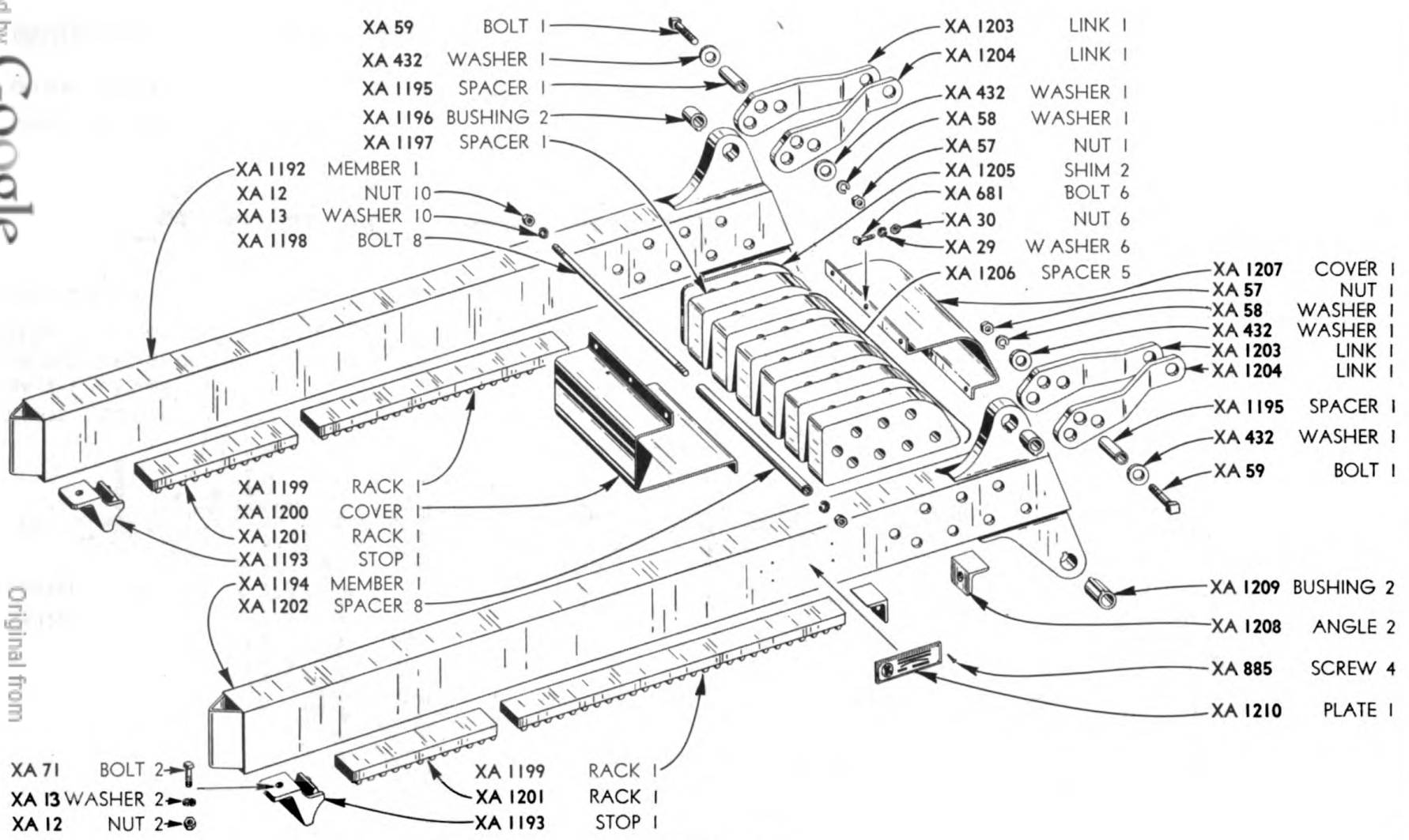
COUNTERWEIGHTS



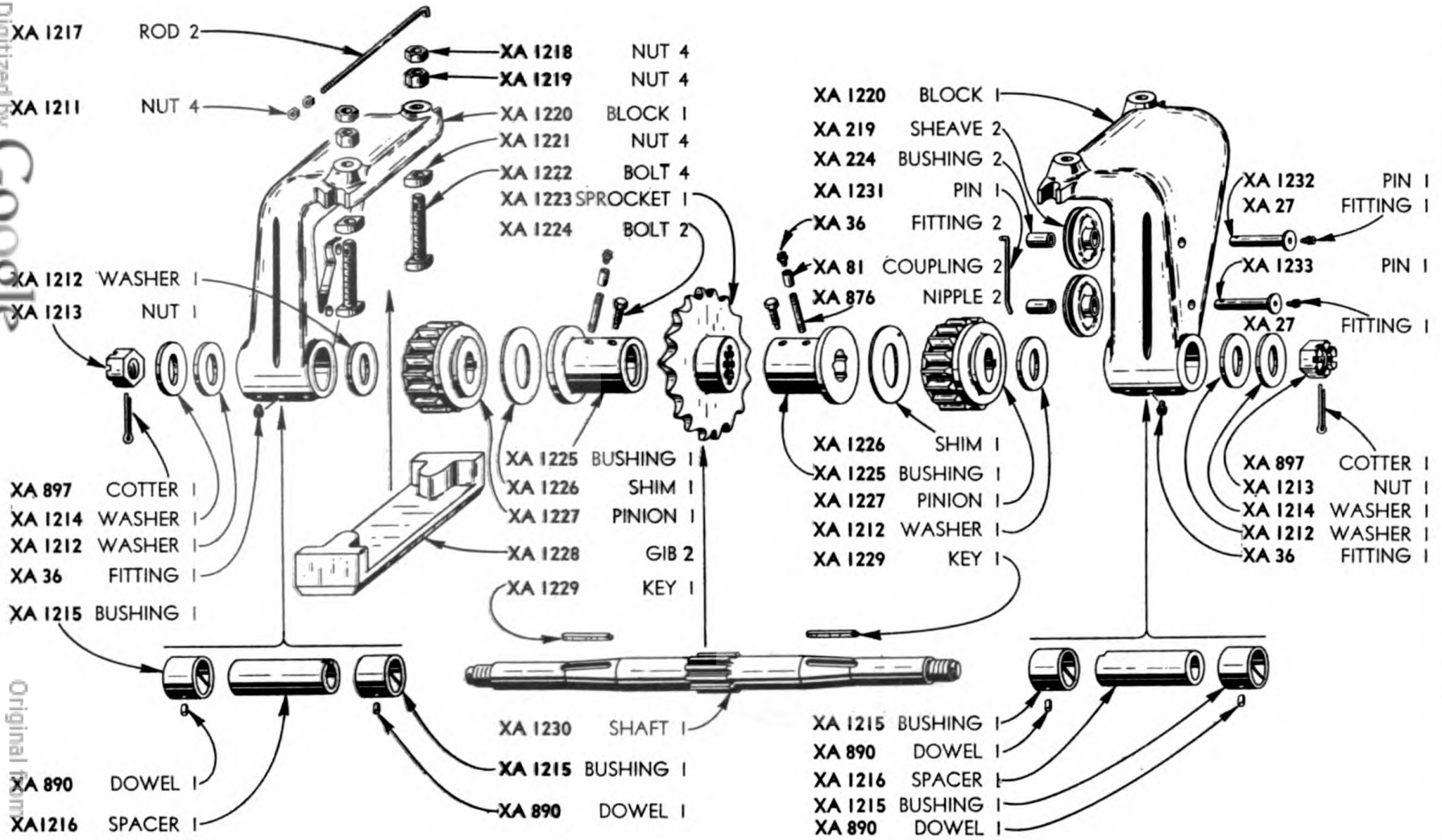
DIPPER DOOR - LATCH PARTS



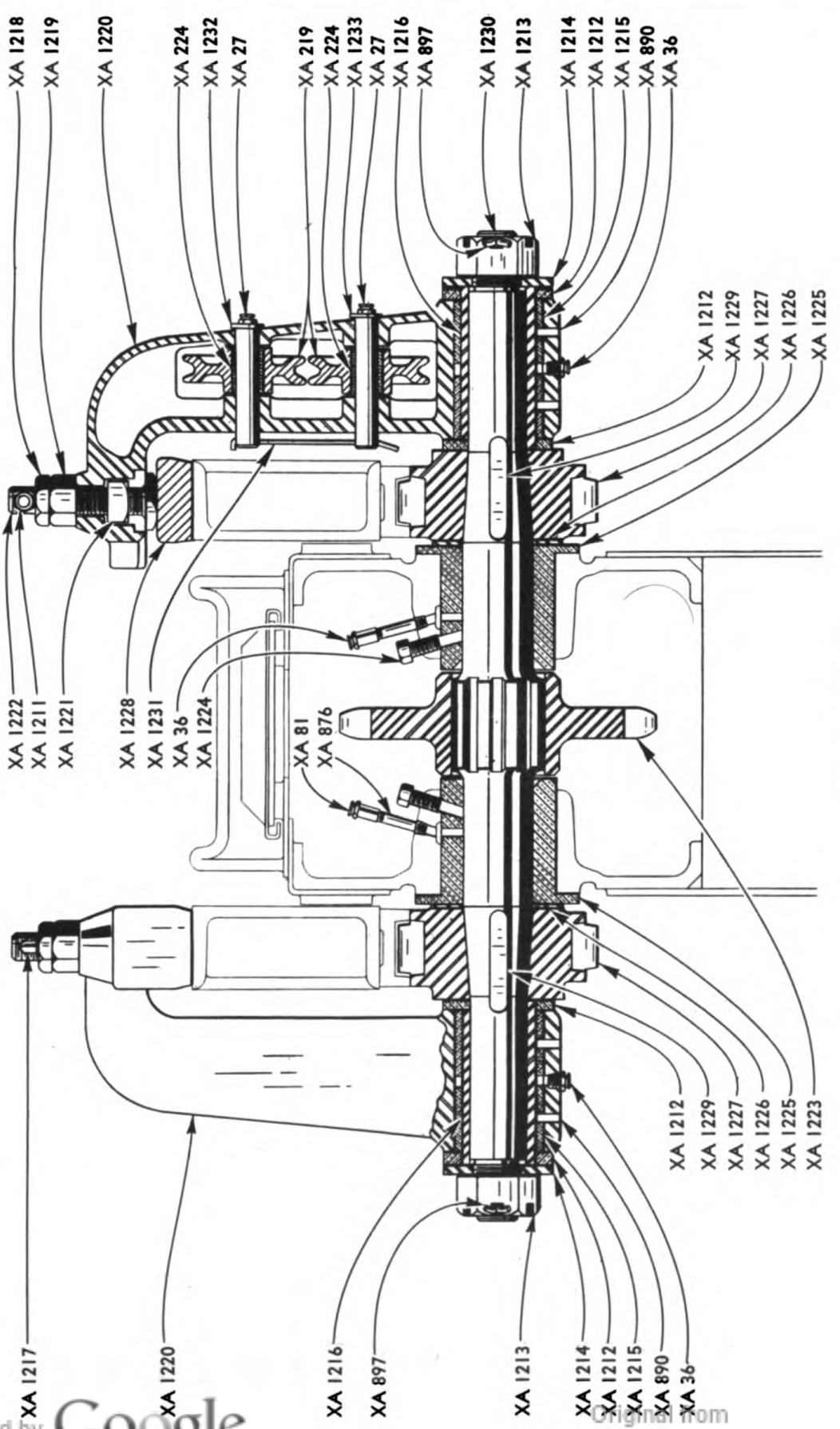
DIPPER BODY - POINTS



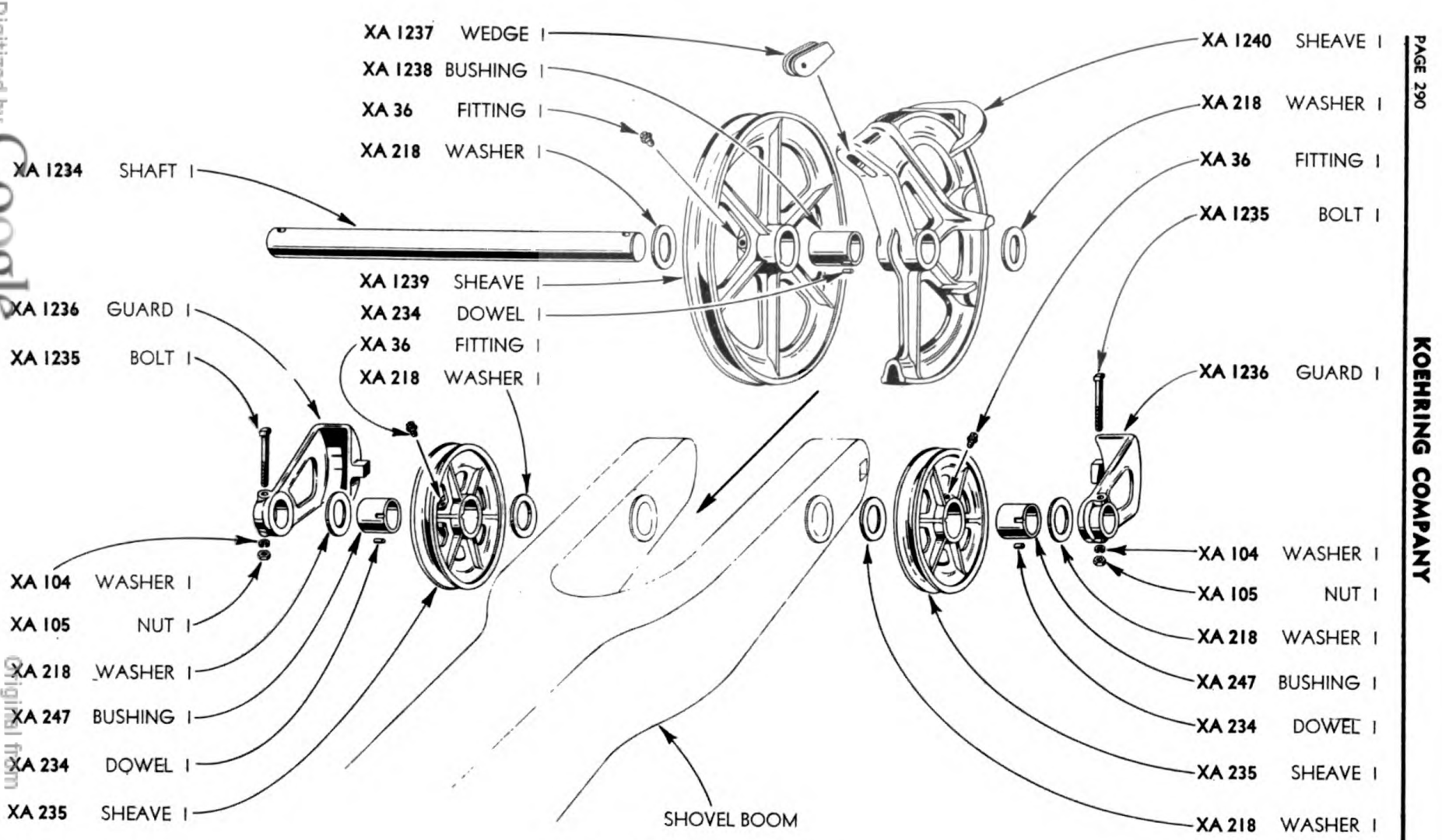
DIPPER STICKS



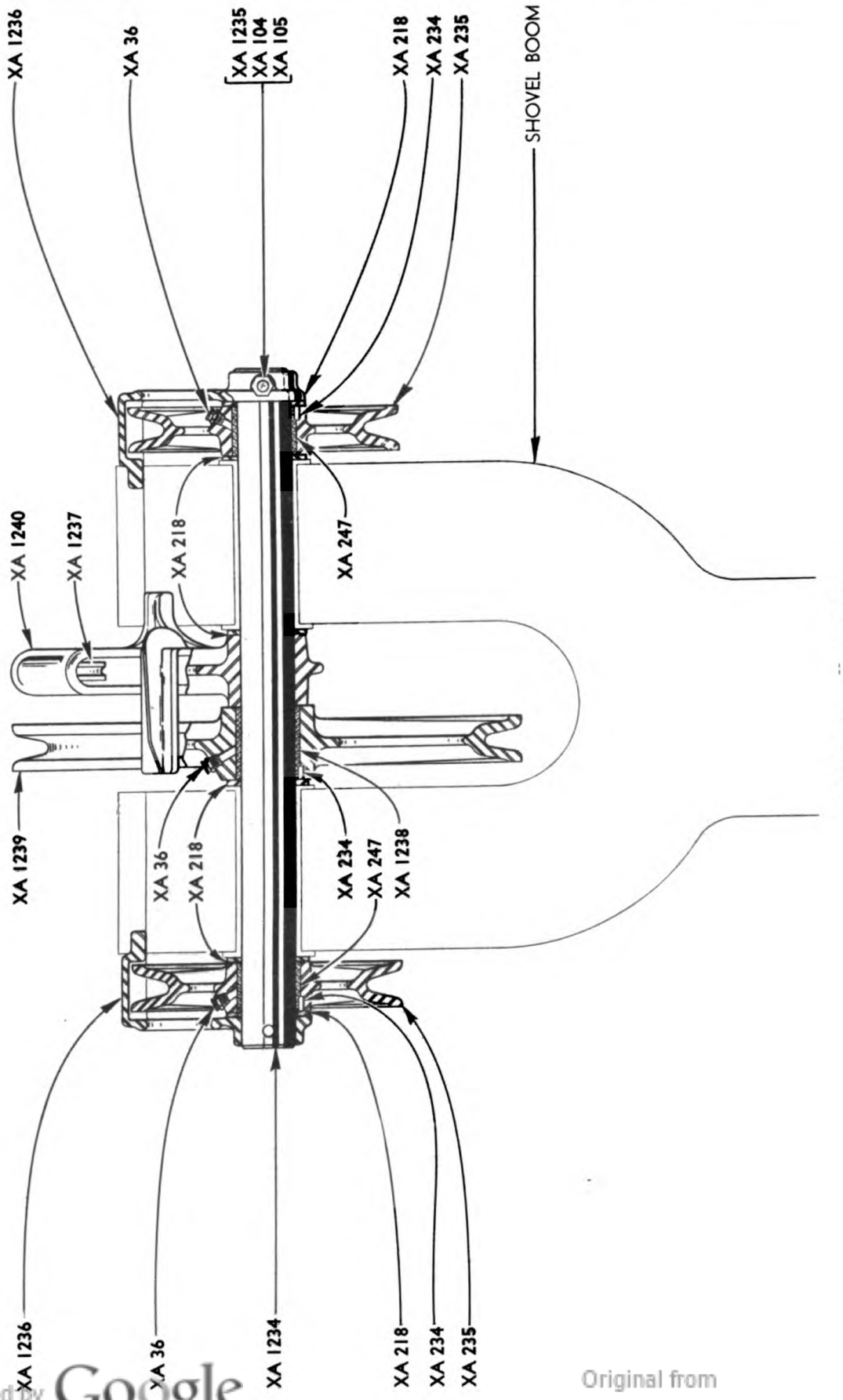
SHIPPER SHAFT



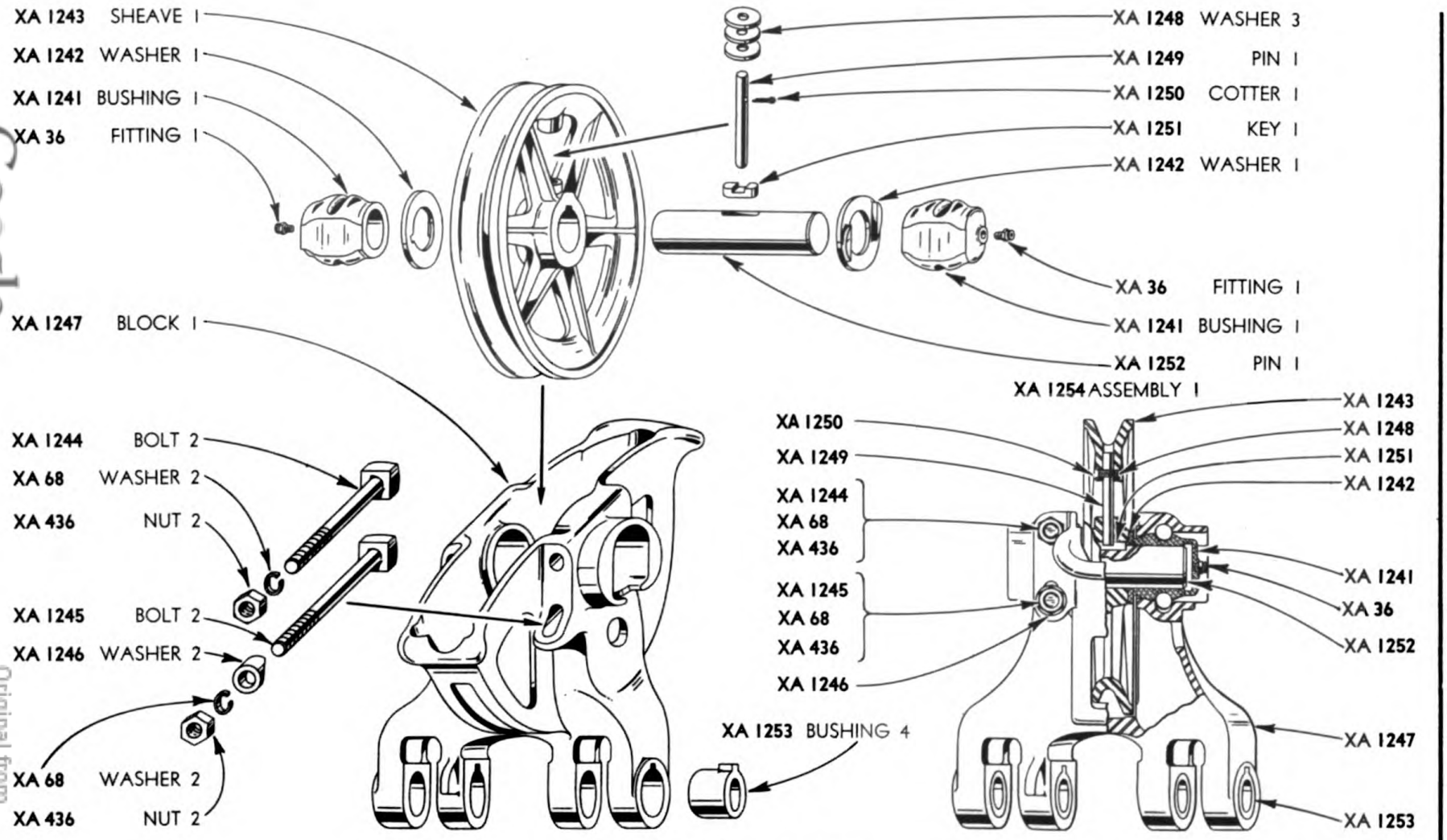
SHIPPER SHAFT



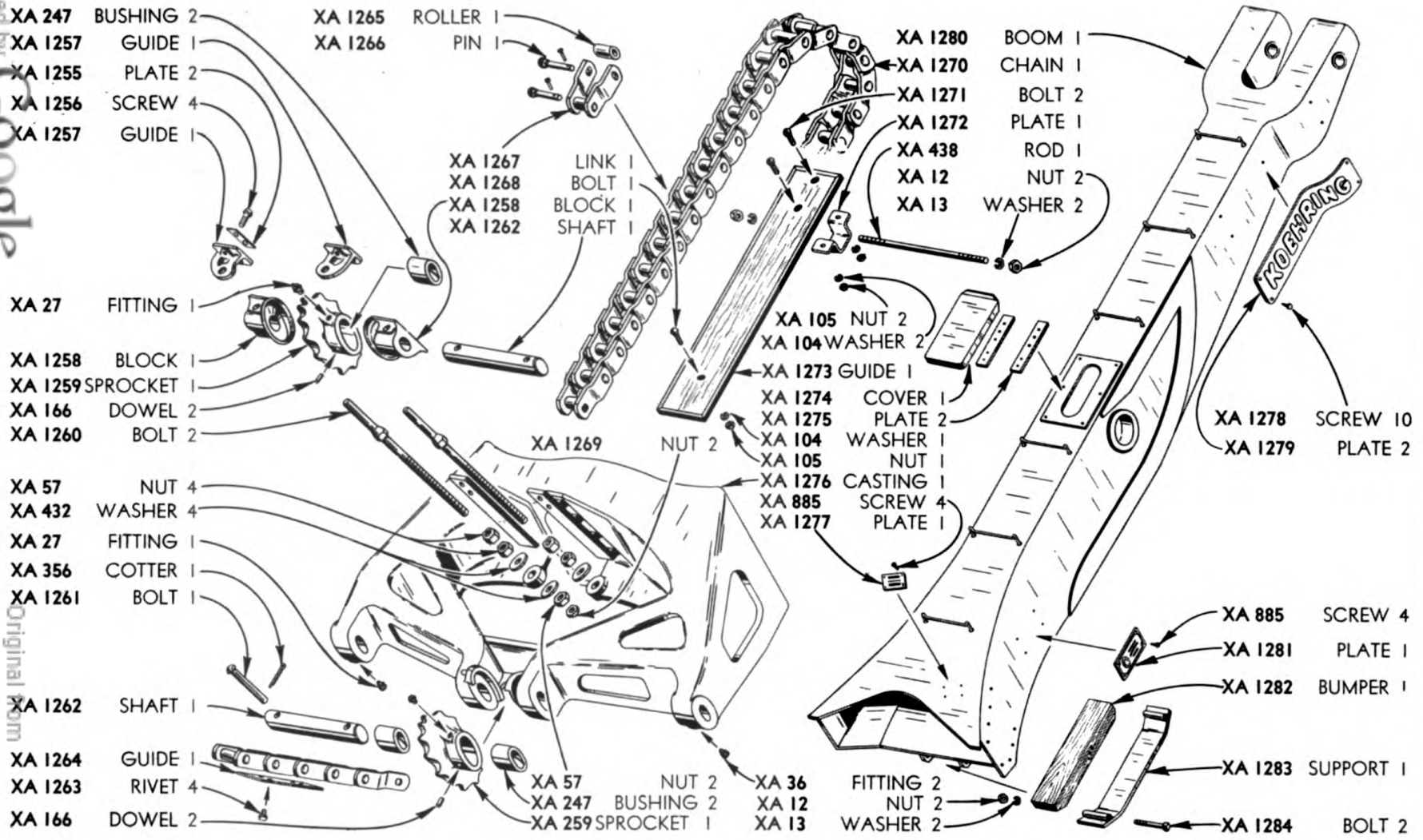
BOOM POINT - SHOVEL



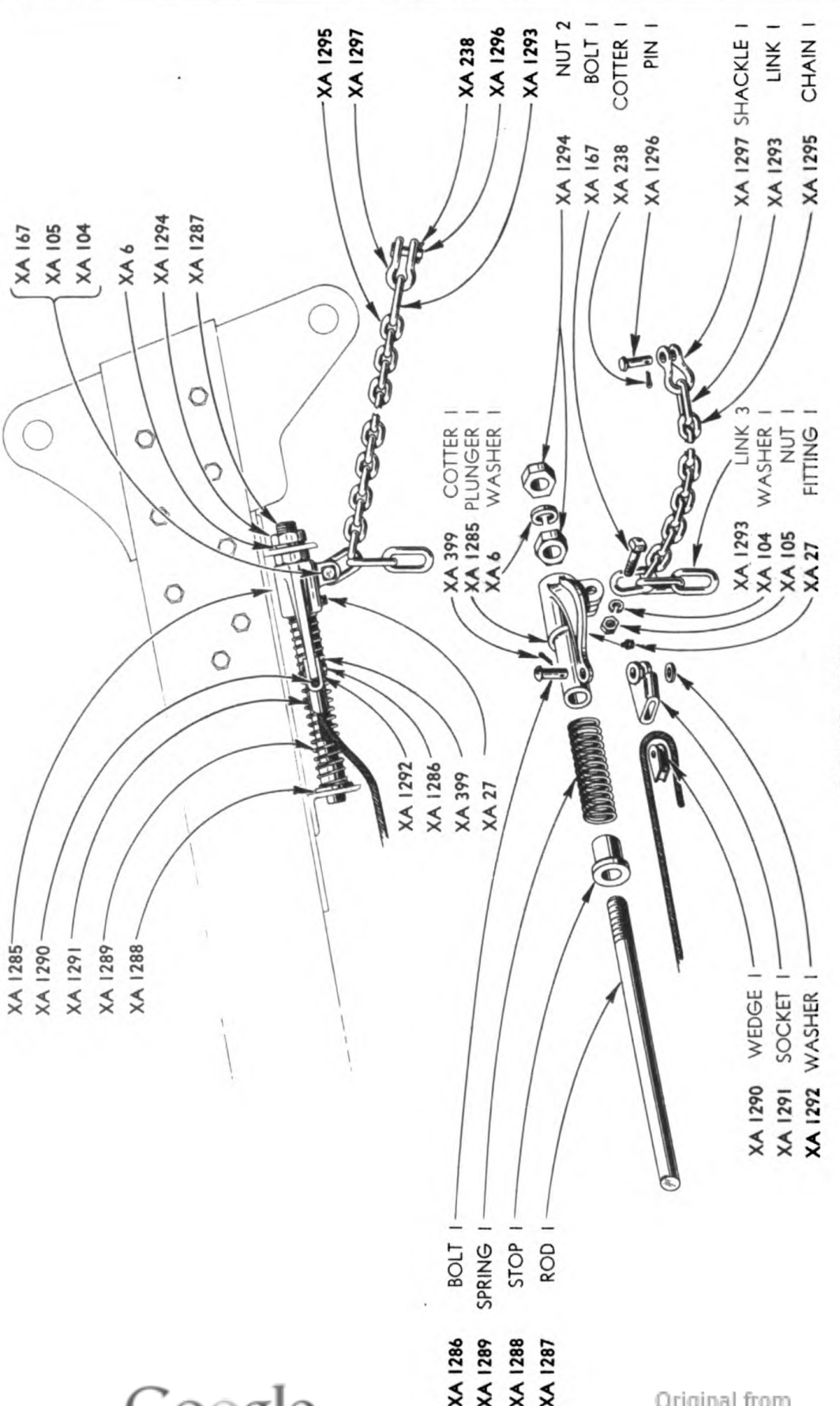
BOOM POINT - SHOVEL



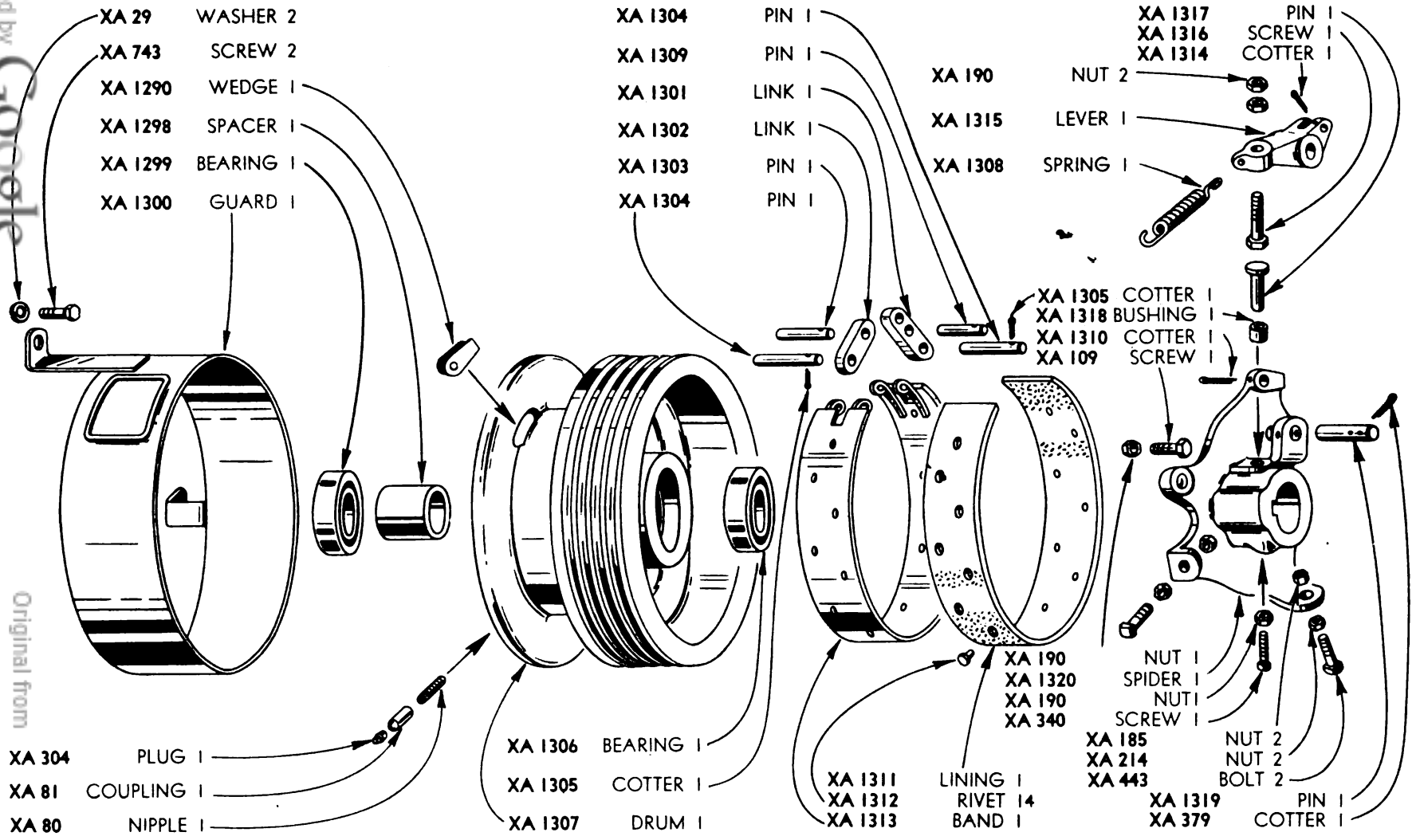
PADLOCK BLOCK - SHOVEL



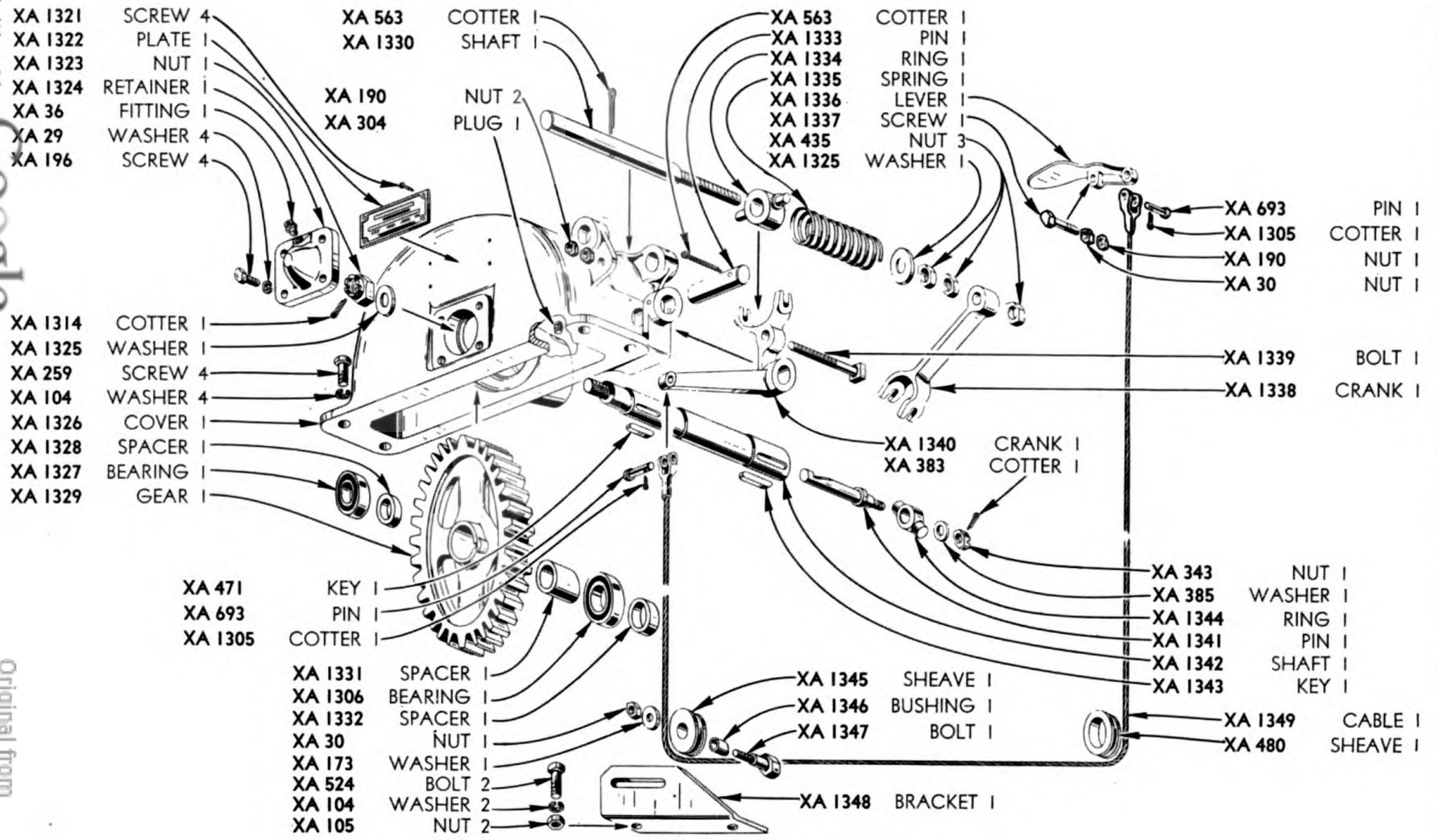
CHAIN GUIDE - SHOVEL BOOM



DIPPER TRIP

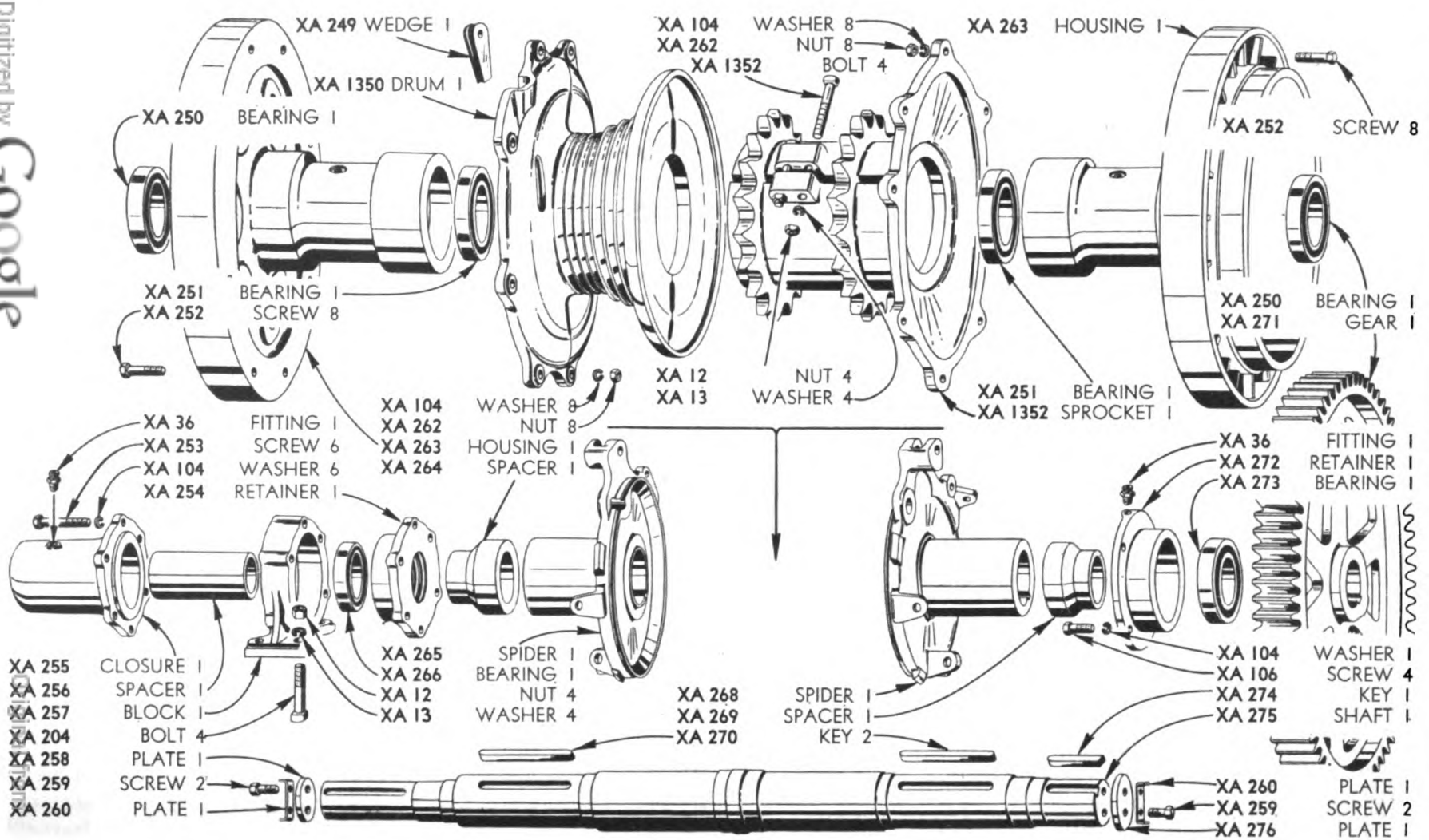


CLUTCH - DIPPER TRIP

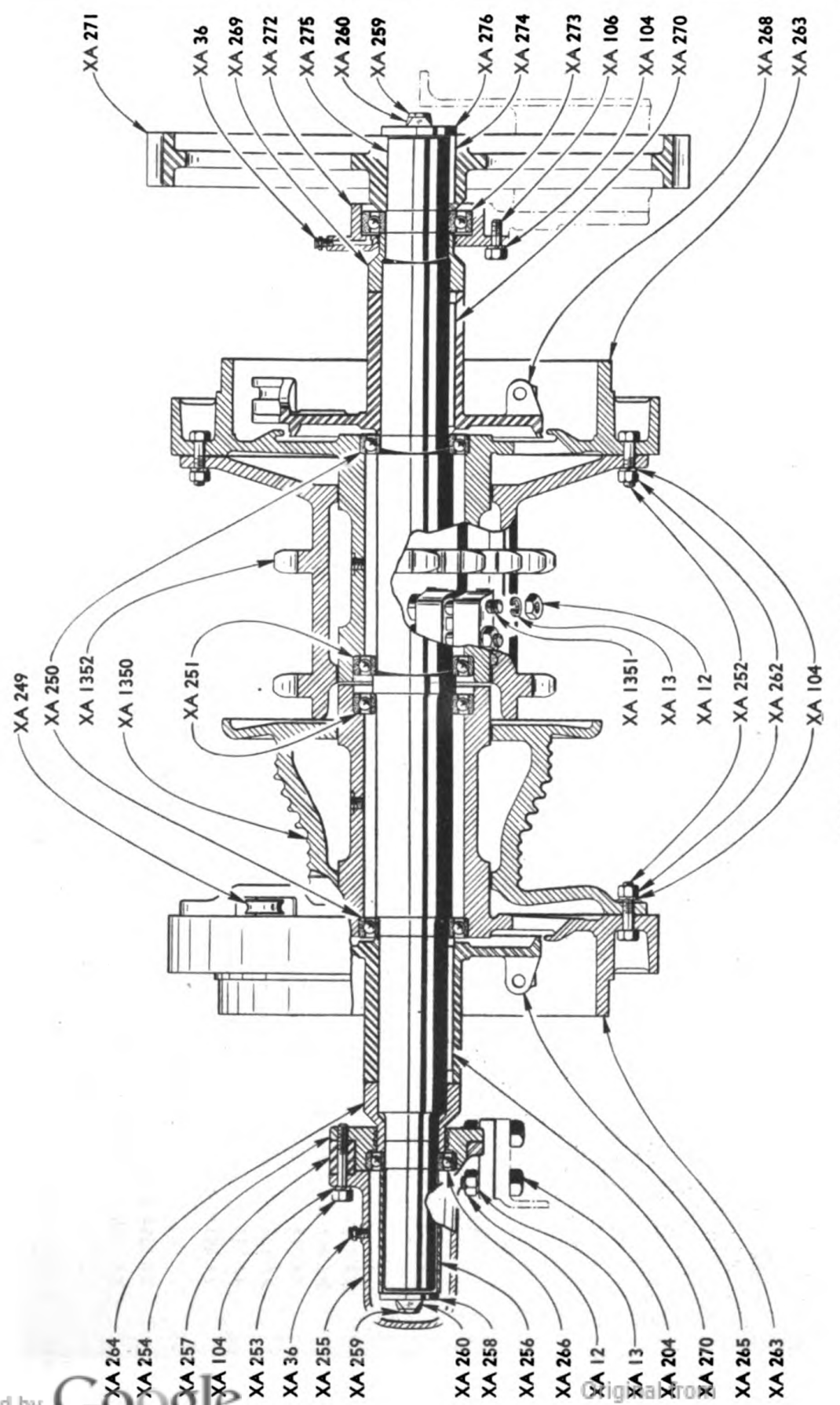


OPERATING MECHANISM - DIPPER TRIP

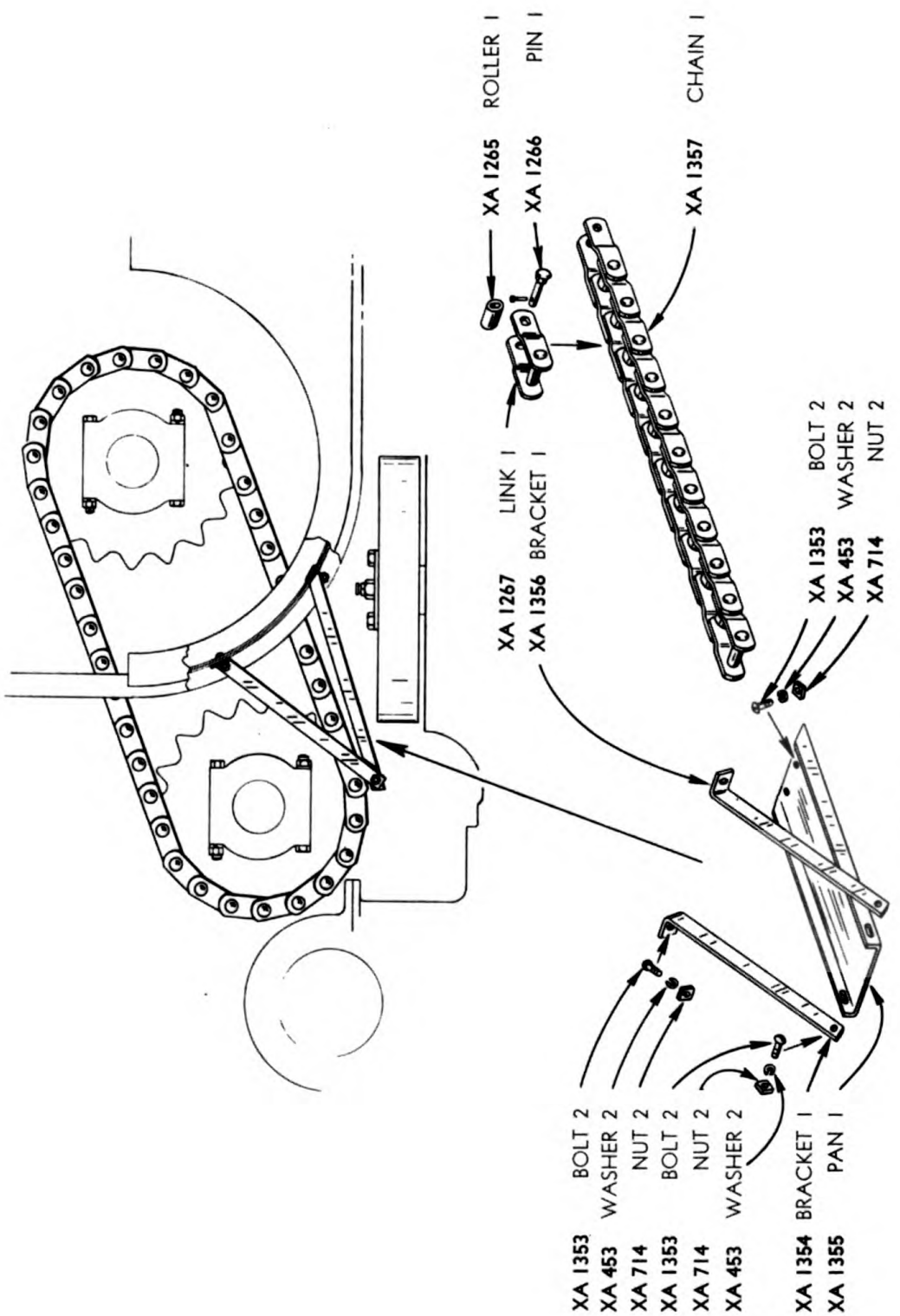
OPERATING MECHANISM - DIPPER TRIP



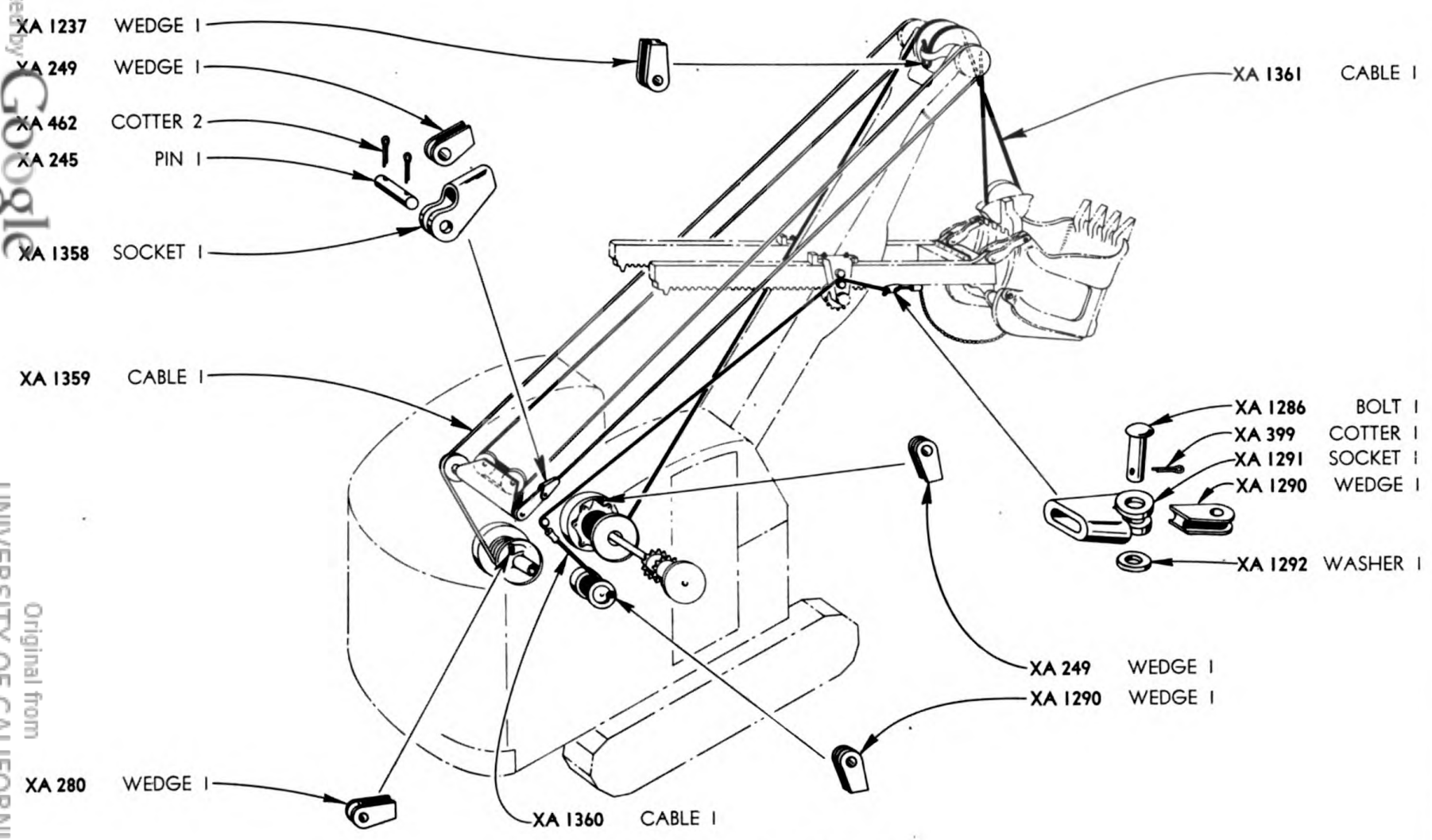
DRUM SHAFT - SHOVEL



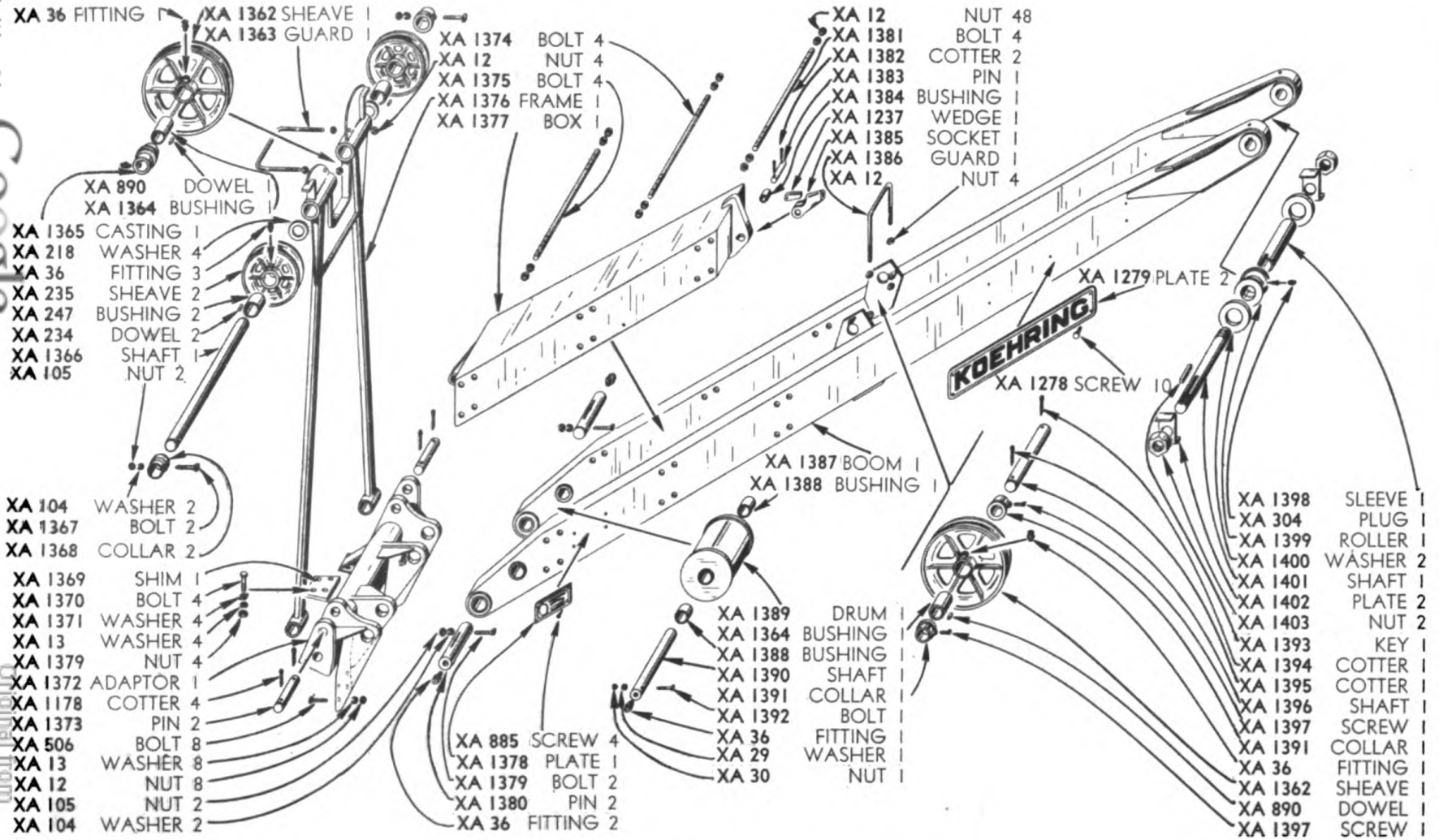
DRUM SHAFT - SHOVEL



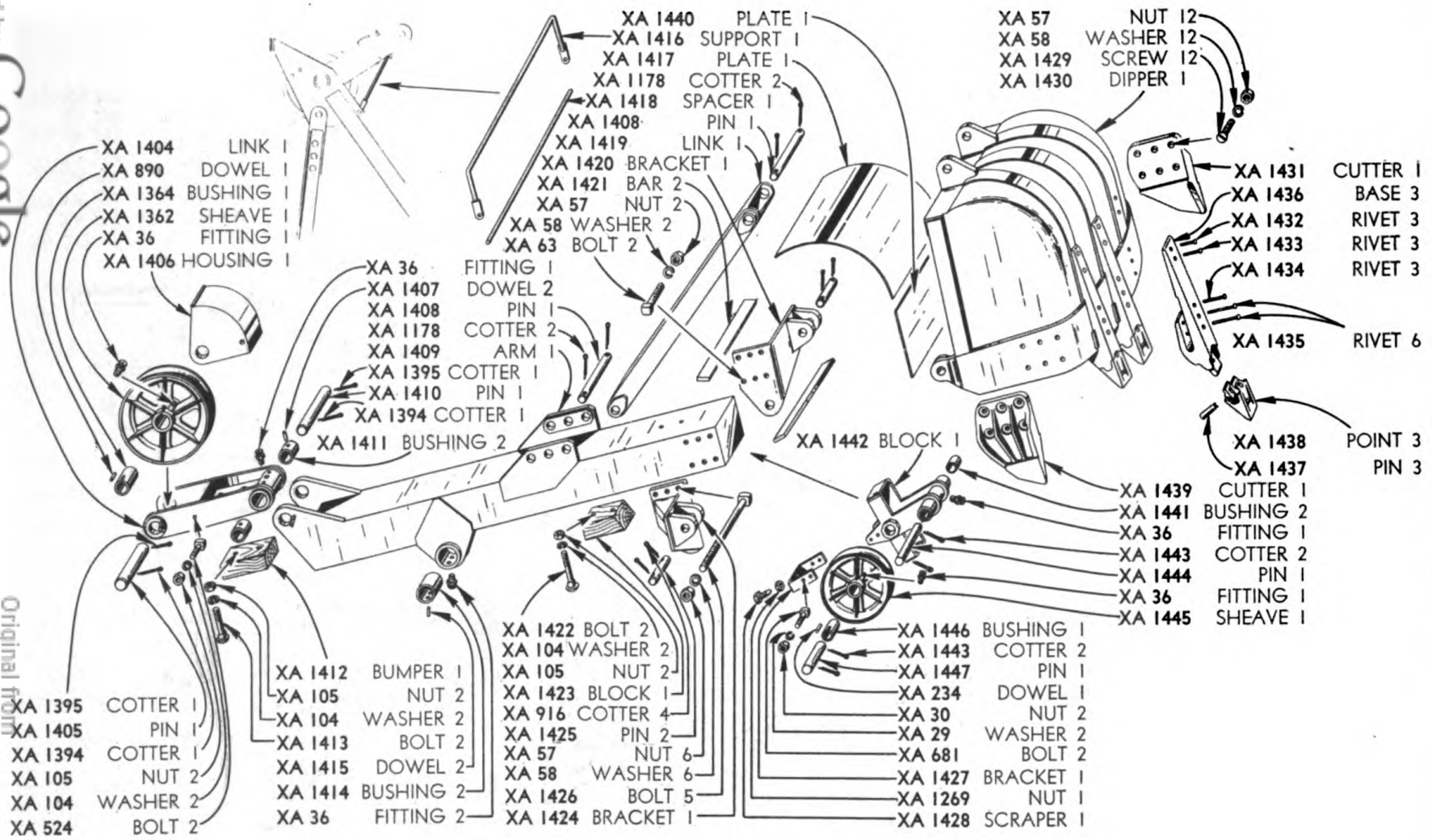
RACK-IN CHAIN - OIL DRIP PAN



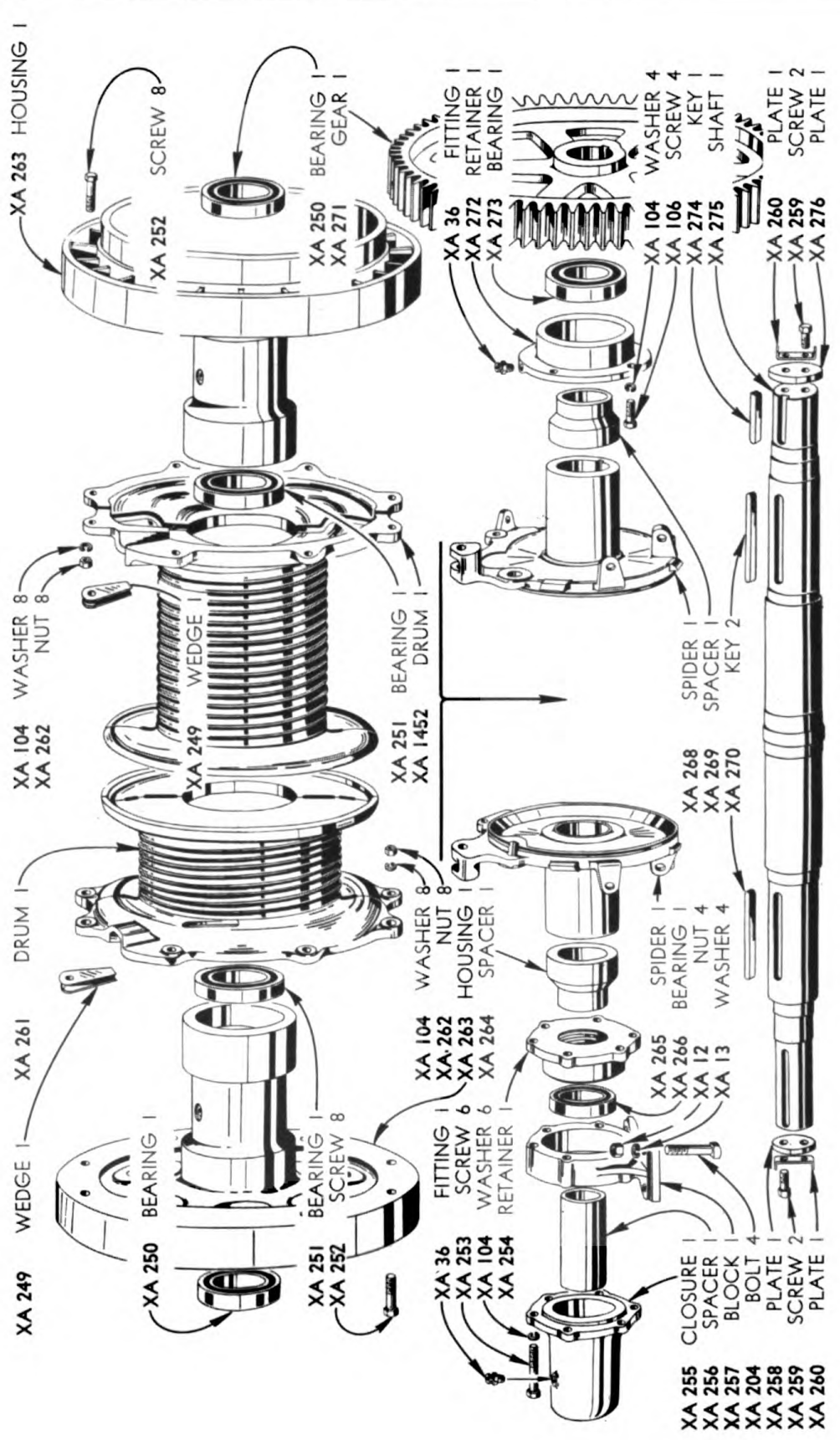
CABLES AND ANCHORS - SHOVEL



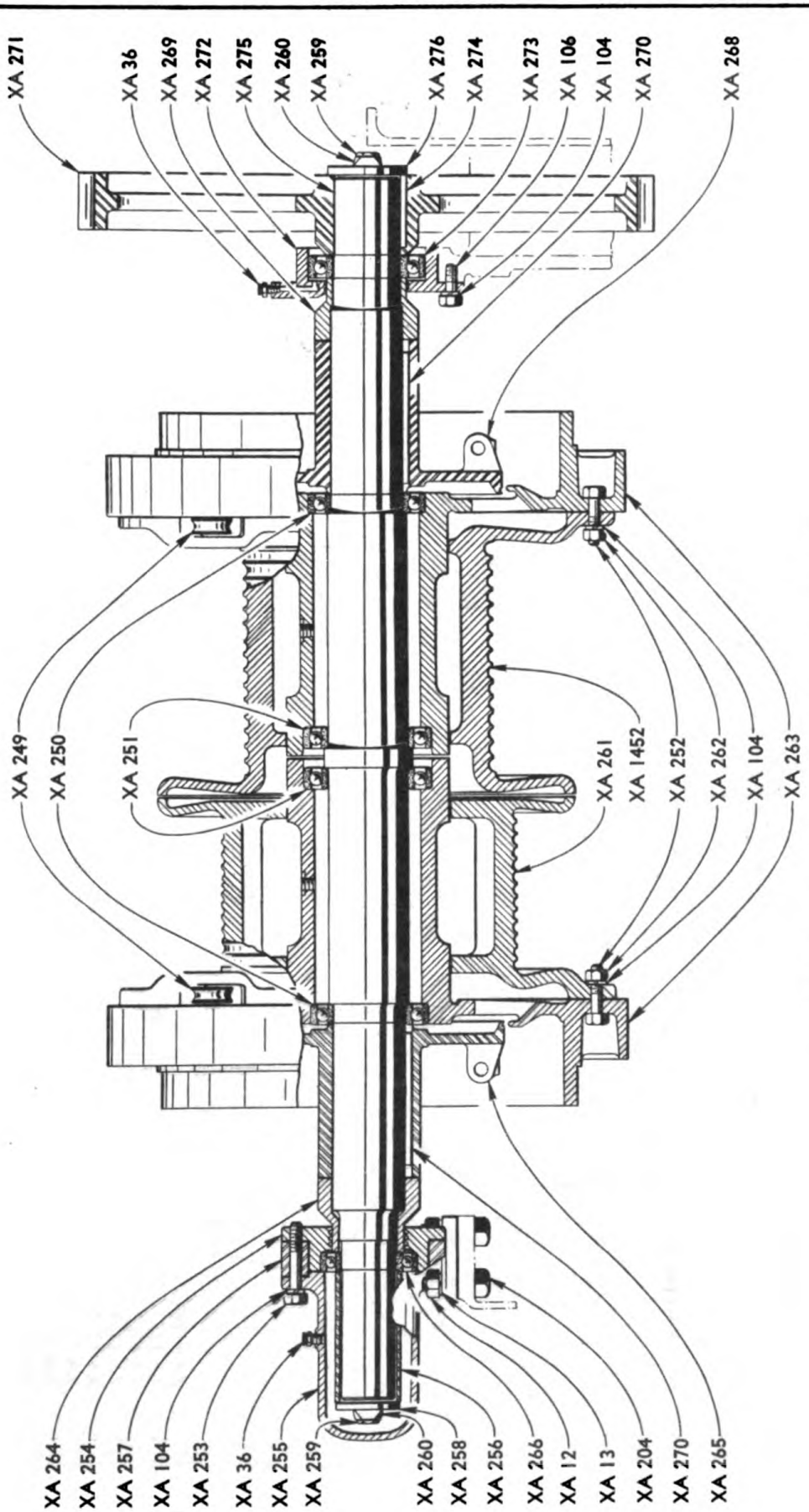
PULL SHOVEL - JIB FRAME AND BOOM



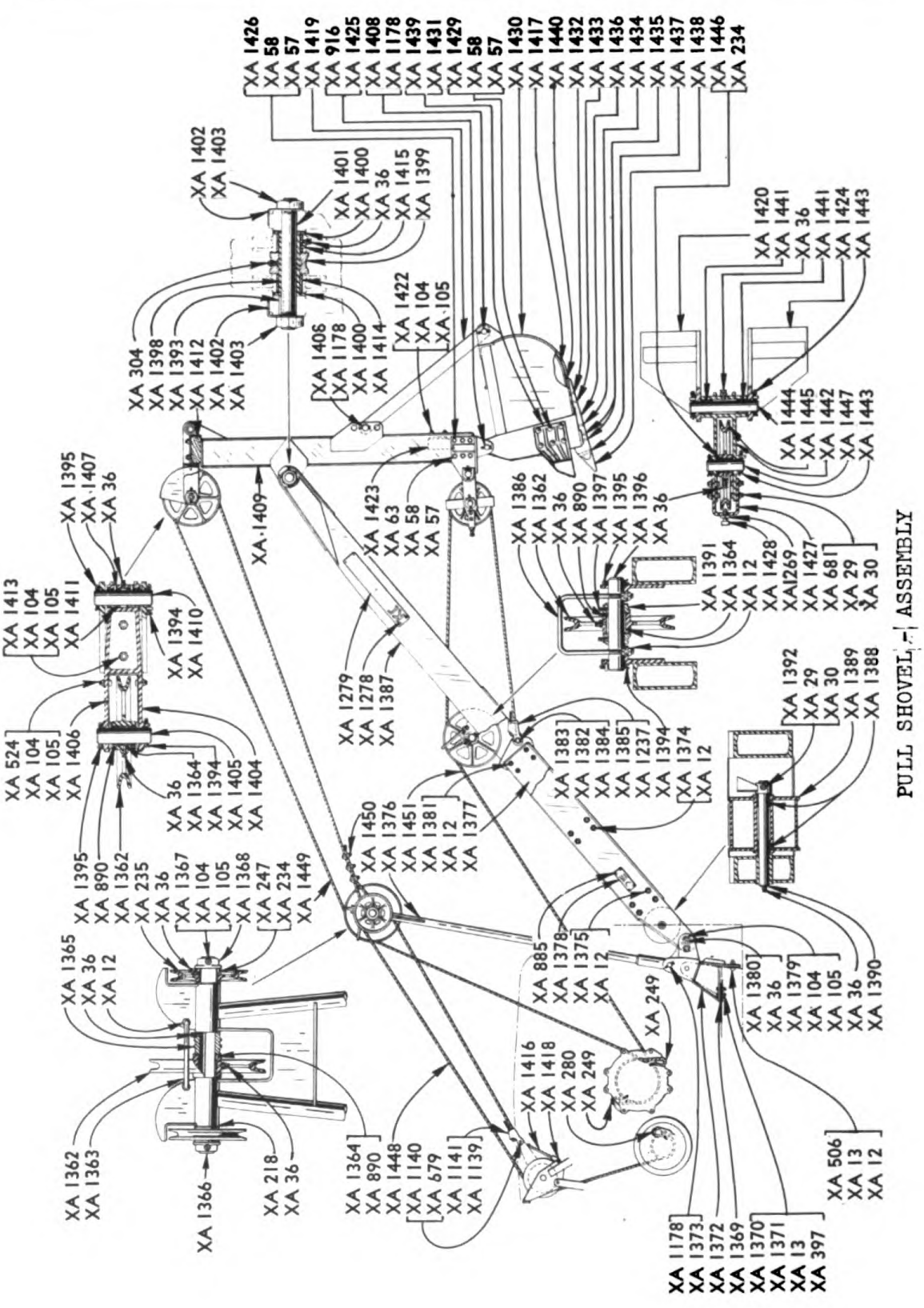
PULL SHOVEL - DIPPER ARM AND DIPPER



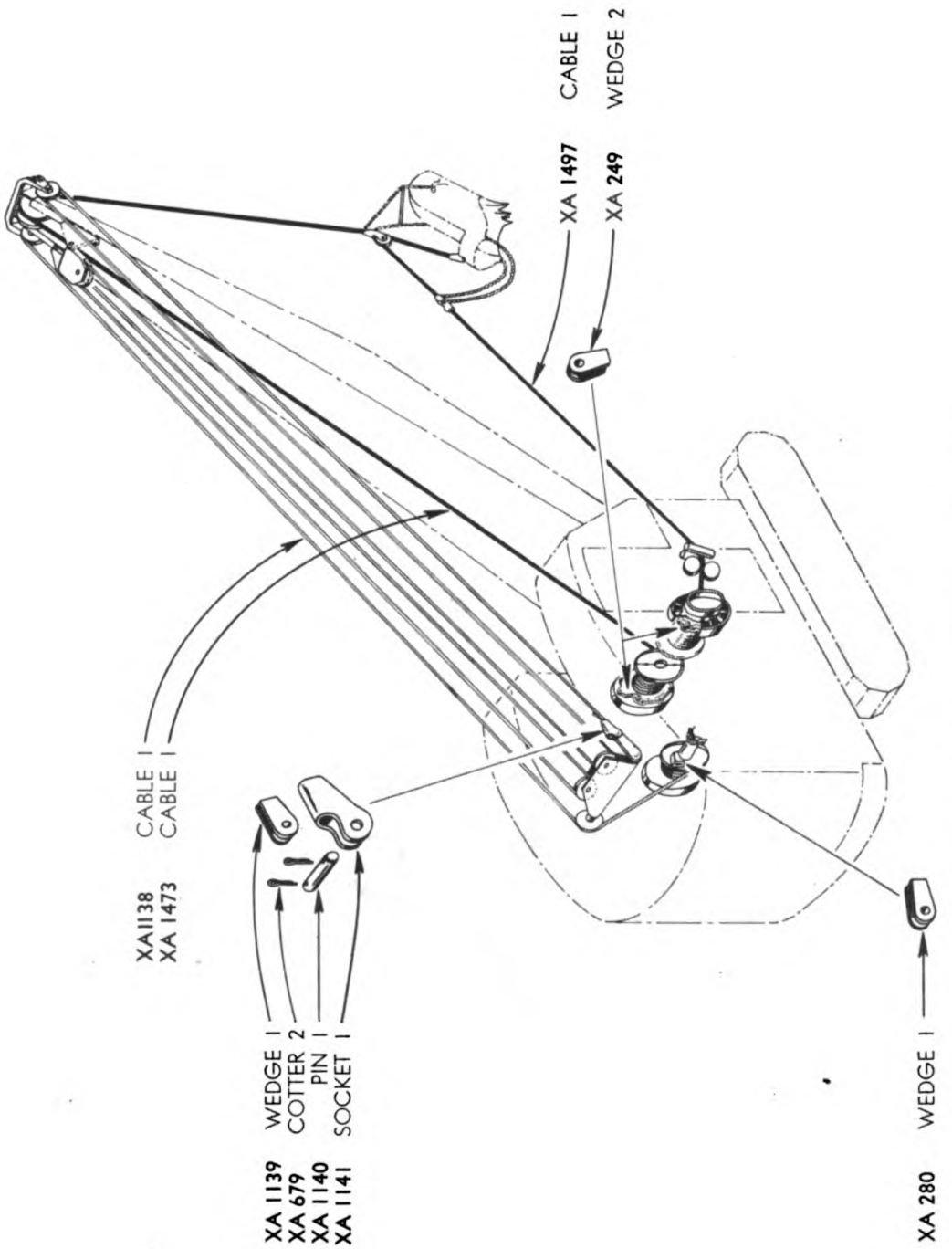
DRUM SHAFT - DRAGLINE AND PULL SHOVEL



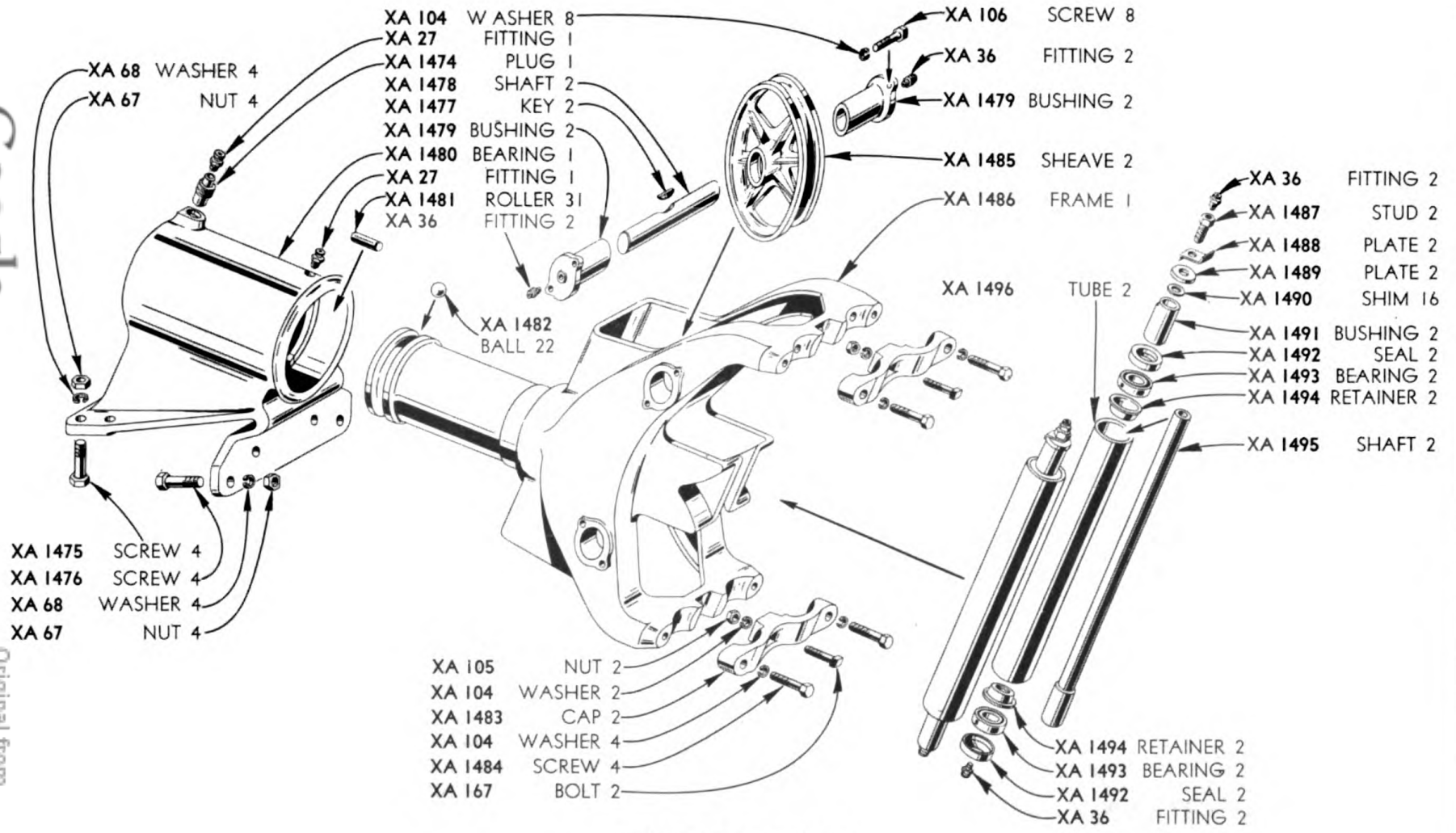
DRUM SHAFT - DRAGLINE AND PULL SHOVEL



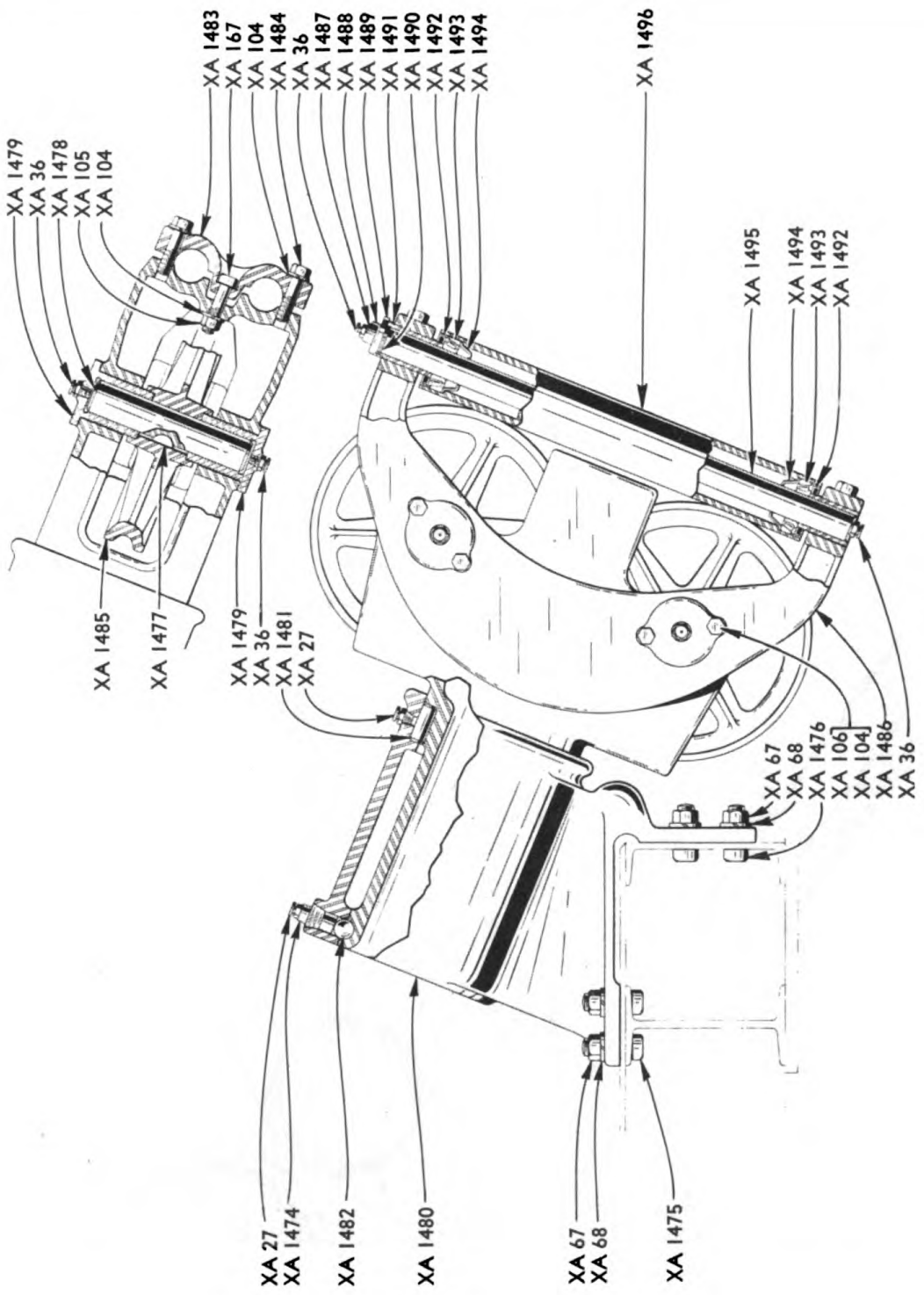
PULL SHOVEL - ASSEMBLY



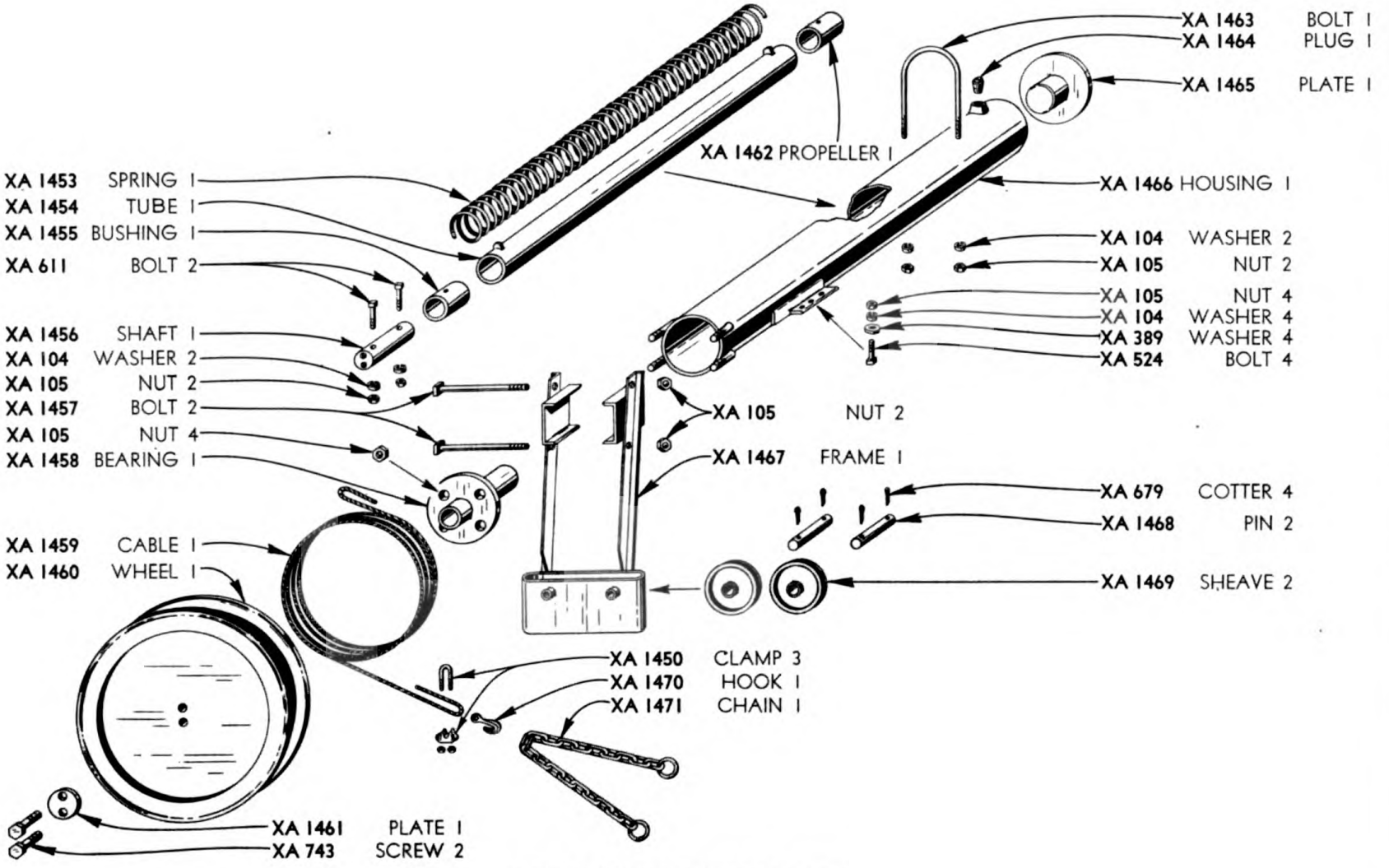
DRAGLINE - CABLE AND ANCHORS



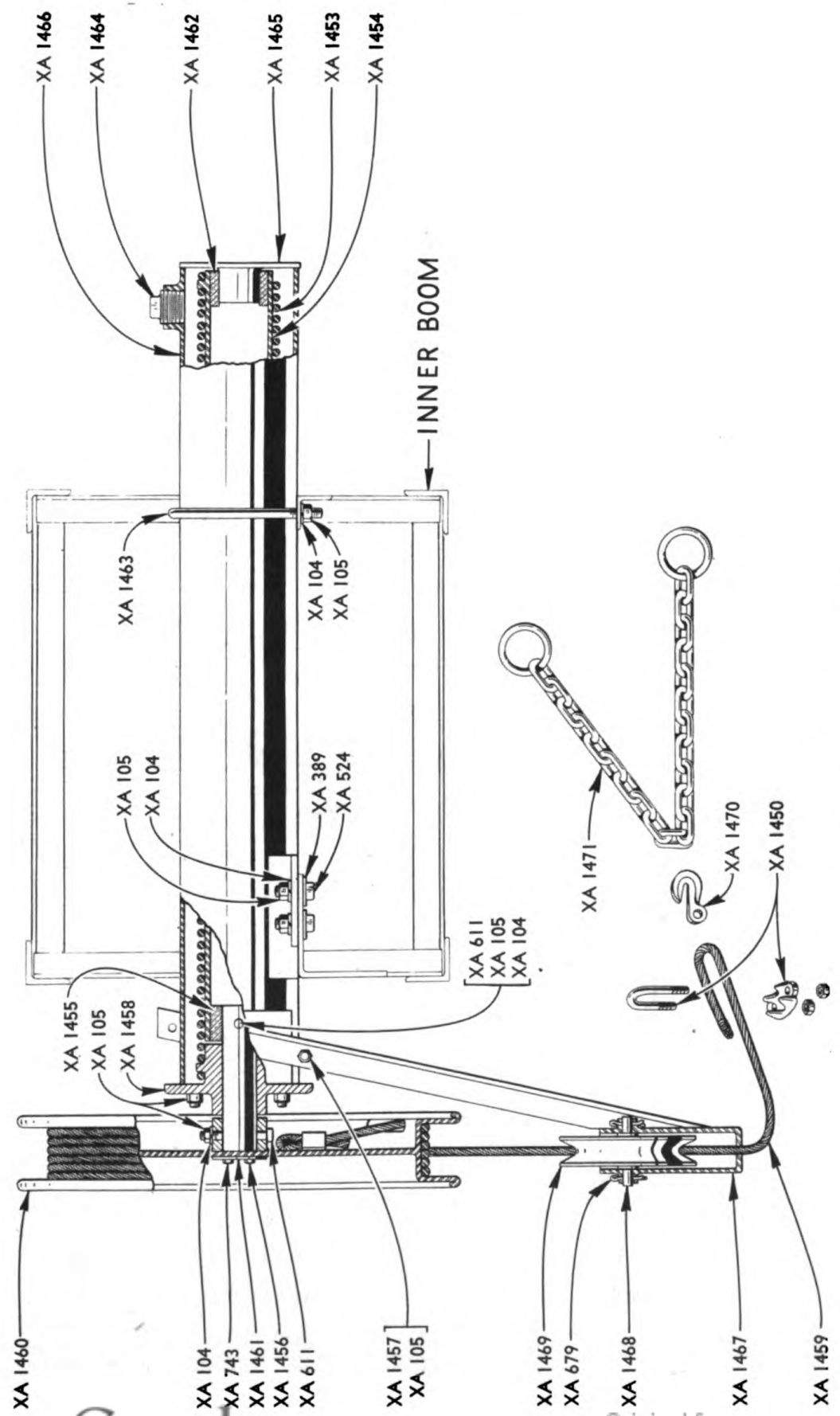
DRAGLINE FAIRLEAD



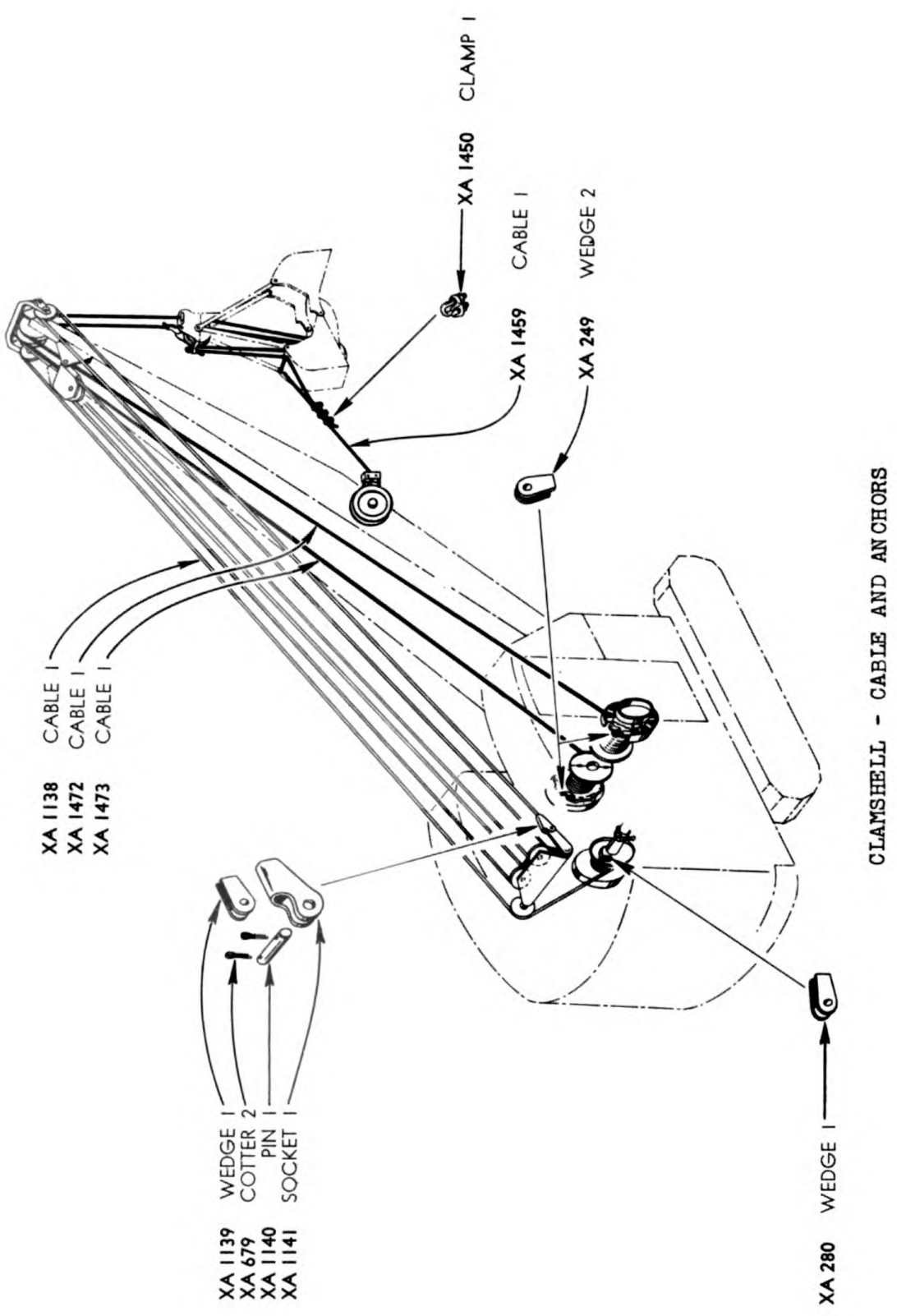
DRAGLINE FAIRLEAD



RUD-O-MATIC TAGLINE UNIT



RUD-O-MATIC TAGLINE UNIT



CLAMSHELL - CABLE AND ANCHORS

304 PARTS SECTION

SYMBOL IDENTIFICATION

A - Alemite (Grease Fittings)

BA - Batavia (Levers)

BR - Bryant (Socket)

CH - Crouse-Hinds (Electrical Fittings)

CR - Crosby (Cable Clamp)

DC - Diamond (Chain)

F - Fafnir (Bearing)

G - Gits (Oil Seal)

GO - Goodrich (Light Reflector)

H - Hyatt (Bearing)

HD - Harley-Davidson (Seat)

JE - Jeffery (Chain)

K - Kondu (Electrical Fittings)

MA - Master Lock Co. (Padlock)

ND - New Departure (Bearing)

P - Perfect (Oil Seal)

PM - Pettibone-Mulliken (Dipper Parts)

PN - Pyle-National (Electrical Fittings)

PR - Pritzlaff Hdwe. (Swivel Pulley)

PY - Pyrene (Fire Extinguisher)

R - Ross Gear & Tool (Friction Disc)

RC - Rollway (Bearing)

RU - Rud-O-Matic (Tagline Unit)

S - Shakeproof (Washers)

T - Timken (Bearing)

WE - Weatherhead (Hose & Fittings)

Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 1	Link, repair JE 1803A	1	3#	$1.40	214
XA 2	Pin, link JE 1803A	1	2 pcs.1#	.50	214
XA 3	Roller, link JE 1803A	1	3 pcs.1#	.35	214
XA 4	Chain, traction drive 52 lks. ea. JE 1803A	2	161#	72.80	214
XA 5	Nut, hexagon-1-1/4" N.C.	8	3/4#	.13	214
XA 6	Washer, lock-1-1/4"	9	6 pcs.1#	.03	
XA 7	Shim, tie bar	8	6 pcs.1#	.12	214
XA 8	Bar, crawler tie	8	8-3/4#	1.80	214
XA 9	Bolt, machine-1-1/4" x 8" N. C.	8	3-1/2#	.60	214
XA 10	Lock, shoe pin	60	16 pcs.1#	.04	214
XA 11	Pin, shoe	60	5-1/4#	.60	214
XA 12	Nut, hexagon-3/4" N. C.	278	5 pcs.1#	.03	
XA 13	Washer, lock-3/4"	244	23 pcs.1#	.01	
XA 14	Bolt, machine-3/4" x 3-3/4" N. C.	36	2 pcs.1#	.12	214
XA 15	Shoe, crawler	60	68#	12.00	214
XA 16	Cleat, shoe	18	6#	1.85	214
XA 17	Casting, bridle (Front and rear)	4	289#	77.50	214
XA 18	Bracket, upper idler roller	4	12#	7.50	214
XA 19	Frame, crawler-w/axles	1	3150#	545.00	214
XA 20	Cotter, 1/8 x 1"	26	**	.10*	
XA 21	Pin, two hole	8	4 pcs.1#	.18	214
XA 22	Bolt, adjusting	8	11#	5.50	214
XA 23	Nut, adjusting	8	3-3/4#	4.80	214
XA 24	Washer, flat	6	4 pcs.1#	.06	
XA 25	Roller, upper idler	8	19-1/2#	7.20	215
XA 26	Bushing, bronze	8	3/4#	.70	215
XA 27	Fitting, "Alemite" A1184	45	23 pcs.1#	.12	
XA 28	Shaft, roller	4	8#	2.70	215
XA 29	Washer, lock-1/2"	128	80 pcs.1#	.60*	
XA 30	Nut, hexagon-1/2" N.C.	114	14 pcs.1#	.01	
XA 31	Bolt, machine-1/2" x 4-1/4" N.C.	8	4 pcs.1#	.06	215
XA 32	Bushing, bronze	24	2#	3.60	215
XA 33	Washer, flat	24	3 pcs.1#	.16	215
XA 34	Shaft, lower roller	12	13#	5.75	215
XA 35	Shim, steel	48	3 pcs.1#	.15	215
XA 36	Fitting, "Alemite" A1186	121	20 pcs.1#	.14	
XA 37	Bolt, "U"	24	1#	.70	215
XA 38	Washer, thrust	24	3#	.90	215
XA 39	Roller, lower crawler-w/bushing	12	61#	23.50	215
XA 40	Washer, flat	4	2 pcs.1#	.90	216
XA 41	Collar, set	4	5#	3.90	216
XA 42	Shaft, drive tumbler	2	61#	29.00	216
XA 43	Pin, collar	4	3/4#	.18	216
XA 44	Bearing, drive tumbler	4	30#	16.00	216
XA 45	Key, round end	4	1#	.55	216
XA 46	Tumbler, drive	2	195#	53.00	216

* Price Per 100 Pcs.
** Over 200 Pcs. Per Lb.

Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 47	Bearing, idler tumbler	2	30#	$16.00	216
XA 48	Bearing, idler tumbler	2	30#	16.00	216
XA 49	Shaft, front idler tumbler	2	40-1/2#	9.00	216
XA 50	Tumbler, idler	2	192#	52.00	216
XA 51	Sprocket, tumbler shat	2	80#	36.00	216
XA 52	Carbody, complete-w/ bearing caps	1	2065#	1002.00	217
XA 53	Bushing, split	2	14-1/4#	14.50	217
XA 54	Shim, bearing	4	4 pcs.1#	.24	217
XA 55	Shim, bearing	8	8 pcs.1#	.18	217
XA 56	Cap, bearing	2	33#	20.00	217
XA 57	Nut, hexagon-1" N.C.	49	2 pcs.1#	.07	
XA 58	Washer, lock-1"	37	15 pcs.1#	.02	
XA 59	Bolt, machine-1" x 5" N. C.	6	1-1/4#	.26	
XA 60	Bushing,inner bearing	1	5-3/4#	6.60	217
XA 61	Shim, inner bearing	2	4 pcs.1#	.24	217
XA 62	Shim, inner bearing	4	8 pcs.1#	.18	217
XA 63	Bolt, machine-1" x 4" N. C.	4	1#	.25	
XA 64	Cap, bearing-inner	1	19#	15.00	217
XA 65	Dowel, 3/8" x 1"	3	29 pcs.1#	.01	217
XA 66	Bushing, center bearing	2	4-1/4#	4.20	217
XA 67	Nut, Hexagon-7/8" N.F.	48	4 pcs.1#	.07	
XA 68	Washer, lock-7/8"	65	20 pcs.1#	.02	
XA 69	Screw,cap-hex. hd. 7/8" x 3¼" N. F.	20	3/4#	.20	217
XA 70	Screw, cap-Hex. Hd. 3/4" x 1-3/4" N.C.	10	3 pcs.1#	.10	217
XA 71	Bolt, machine-3/4" x 3" N.C.	21	2 pcs.1#	.11	
XA 72	Cover, bevel gear case	1	125#	51.00	217
XA 73	Plug, male pipe-Sq. Hd. 3/4"	4	7 pcs.1#	.05	
XA 74	Dowel, Brass-3/8" x 1-1/4"	4	24 pcs.1#	.05	218
XA 75	Sprocket, Drive-with bushings	2	197#	102.00	218
XA 76	Clutch jaw	2	64#	46.00	218
XA 77	Gear, beve	1	138#	51.50	218
XA 78	Bushing, bronze	2	3-1/2#	3.60	218
XA 79	Bushing, bronze	2	5-1/4#	6.60	218
XA 80	Nipple, close-W.I. 1/4"	9	35 pcs.1#	.045	
XA 81	Coupling, Pipe-W.I. 1/4"	27	16 pcs.1#	.10	
XA 82	Washer, thrust	1	2-1/2#	2.70	218
XA 83	Shaft, lower traction	1	203#	168.00	218
XA 84	Shaft, swing and traction bevel gear	1	45#	78.00	220
XA 85	Cotter, 3/8" x 4"	2	9 pcs.1#	.02	
XA 86	Nut T-K-10339	1	2#	3.30	220
XA 87	Washer, flat	3	5 pcs.1#	.10	220
XA 88	Bearing, roller H-A1216TS	1	3 ½#	11.60	220

* Price Per 100 Pcs.
** Over 200 Pcs. Per Lb.

Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 89	Gear, bevel	1	45#	$93.50	220
XA 90	Retainer, bearing	1	12½#	8.40	220
XA 91	Retainer, seal	1	25#	16.50	220
XA 92	Ring, snap	1	3 pcs.1#	1.45	220
XA 93	Spacer, cast iron	1	7¾#	7.25	220
XA 94	Seal, oil G-OS5250	1	1¼#	6.70	220
XA 95	Spacer, bearing	1	5¾#	4.50	220
XA 96	Screw, cap	2	4 pcs.1#	.14	220
XA 97	Plate, lock-split	1	3/4#	5.70	220
XA 98	Spacer, flanged	1	8½#	5.00	220
XA 99	Pinion, low speed	1	25½#	45.00	220
XA 100	Retainer, bearing	1	34#	24.00	220
XA 101	Bearing, roller T-462-453X	2	2¼#	6.50	220
XA 102	Screw, Cap. Hex. Hd. 5/8" x 2" N.C.	15	3 pcs.1#	.07	
XA 103	Shim -.010 x 12½" O.D.	4	4 pcs.1#	.55	220
XA 103A	Shim, .005 x 12½" O.D.	3	5 pcs.1#	.50	
XA 103B	Shim. #22 x 12½" O.D.	2	3/4#	.75	
XA 104	Washer, lock - 5/8"	277	44 pcs.1#	.01	
XA 105	Nut, hex.hd.-5/8" N.C.	216	9 pcs.1#	.022	
XA 106	Screw, cap-hex.hd. 5/8" x 1 1/2" N.C.	22	5 pcs.1#	.07	
XA 107	Washer, retainer	1	2 pcs.1#	2.15	220
XA 108	Plate, lock	1	8 pcs.1#	.40	220
XA 109	Screw, cap-hex.hd. ½" x 1¼" N.C.	5	9 pcs.1#	.03	
XA 110	Screw, cap-hex.hd. 3/8" x 1 1/4" N.C.	3	16 pcs.1#	.02	220
XA 111	Washer, lock-3/8"	3	200 pcs.1#	.50*	220
XA 112	Shim, steel-.005 thick	3	16 pcs.1#	.40	220
XA 113	Shim, steel-.010 thick	3	8 pcs.1#	.45	220
XA 114	Cap, bearing retainer	1	6#	3.30	220
XA 115	Bolt, machine-½" x 5½" N. C.	1	3 pcs.1#	.07	221
XA 116	Ring, seal	1	3/4#	2.10	221
XA 117	Bearing, roller H-CD211	1	5¼#	9.35	221
XA 118	Gears, double	1	154#	115.00	221
XA 119	Spacer, bearing	1	6 1/4#	4.50	221
XA 120	Bearing, roller H-CW211	1	2 3/4#	4.80	221
XA 121	Washer, Flat	1	1 1/4#	4.80	221
XA 122	Shaft, two speed	1	28#	24.00	221
XA 123	Shim, washer-1/8" thick	1	4 pcs.1#	.06	222
XA 124	Shim, washer-3/16" thick	1	3 pcs.1#	.07	222
XA 125	Drum, brake	1	59#	30.00	222
XA 126	Screw, special cap	2	5 pcs.1#	.35	222
XA 127	Collar, thrust	1	3#	2.80	222
XA 128	Gear, Swing shaft-w/ bushing	1	132#	110.00	222
XA 129	Bushing, flanged	1	4-1/4#	19.00	222
XA 130	Pinion, swing	1	22-1/2#	52.00	222
XA 131	Plate, lock	1	8 pcs.1#	.24	222
XA 132	Screw, cap	2	5 pcs.1#	.40	222
XA 133	Screw, special cap	1	3 pcs.1#	.70	222

* Price Per 100 Pcs.
** Over 200 Pcs. Per Lb.

Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 134	Plate, retaining	1	1-1/4#	$ 1.20	222
XA 135	Clutch, swing jaw	1	31#	27.00	222
XA 136	Dowel, bronze-1/2" x 2-3/8"	1	7 pcs.1#	.05	222
XA 137	Shaft, swing	1	82#	75.00	222
XA 138	Plate, retaining	1	1#	.80	222
XA 139	Gear, traction	1	63#	65.00	223
XA 140	Washer, thrust	1	3-1/4#	4.50	223
XA 141	Shaft, vertical traction	1	85#	102.00	223
XA 142	Washer, thrust	1	3#	3.84	223
XA 143	Pinion, bevel	1	30#	40.00	223
XA 144	Screw, cap	2	5 pcs.1#	.25	223
XA 145	Nut, lock	1	2-1/2#	6.60	223
XA 146	Wire, soft lock-1/16" x 20'-0"	1	5 pcs.1#	.02	223
XA 147	Bracket, roller	2	62#	32.50	224
XA 148	Roller, turntable with bushing	4	36#	33.50	224
XA 149	Bushing, bronze	4	7-3/4#	9.60	224
XA 150	Washer, flat-1/16"x6" O.D.	1	3 pcs.1#	.18	224
XA 151	Washer, flat-1/8" x 6" O.D.	1	3/4#	.20	224
XA 152	Washer, flat-21 Ga. x 6" O.D.	1	5 pcs.1#	.24	224
XA 153	Shaft, Turntable roller	4	22#	12.00	224
XA 154	Bolt, machine-3/4" x 6-1/2" N.C.	4	1#	.14	224
XA 155	Washer, bevel	32	4 pcs.1#	.22	224
XA 156	Bolt, special	20	1#	.50	224
XA 157	Bracket, roller	2	62#	32.50	224
XA 158	Turntable, welded	1	3128#	1170.00	224
XA 159	Gasket, hand hole cover	1	4 pcs.1#	.65	224
XA 160	Cover, hand hole	2	4-1/4#	.55	
XA 161	Bushing, bronze-"Lower"	2	4-1/2#	17.00	
XA 162	Bushing, bronze-"Lower"	1	9#	7.80	224
XA 163	Dowel, "Bronze"-3/8" x 1-3/4"	1	14 pcs.1#	.05	224
XA 164	Dowel,tapered	1	2 pcs.1#	.40	224
XA 165	Plug, pipe-Ctsk. Head Cast Iron 2-1/2"	1	1/2#	.55	
XA 166	Dowel, bronze-3/8" x 1-1/2"	5	19 pcs.1#	.05	
XA 167	Bolt, Machine-5/8" x 2-1/2" N.C.	23	3 pcs.1#	.07	
XA 168	Case, Lower gear	1	74#	74.50	224
XA 169	Bolt, Machine-5/8" x 1-1/4" N. C.	5	5 pcs.1#	.07	
XA 170	Cover, plate	1	1-1/2#	.45	224
XA 170A	Cover, inspection	1	5-1/2#	2.10	225
XA 171	Stud, cover-1/2" x 1-3/4" N. C.	4	10 pcs.1#	.10	225
XA 172	Washer, plain-1/2"	6	26 pcs.1#	.50*	225
XA 173	Nut, wing-1/2" N.C.	17	10 pcs.1#	.06	
XA 174	Cover,Turntable gear case	1	225#	85.00	225

* Price Per 100 Pcs.
** Over 200 Pcs. Per Lb.

Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 175	Bolt, machine-5/8" x 3-3/4" N. C.	3	2 pcs.1#	$ .09	
XA 176	Pin, boom pivot	2	8-1/2#	2.30	225
XA 177	Bolt, machine-1/2" x 2" N. C.	13	6 pcs.1#	.04	
XA 178	Ell, street-1/4"-45°	12	12 pcs.1#	.18	
XA 179	Bolt, mach.-5/8"x2" N. C.	46	3 pcs.1#	.07	
XA 180	Plug, pipe-Male, sq. hd. 1-1/4"	2	3 pcs.1#	.09	225
XA 181	Cover, w/3" hinge-Butts	1	11#	3.50	225
XA 182	Nut, wing-3/8" N.C.	1	16 pcs.1#	.03	225
XA 183	Washer, lock-3/8"	72	200 pcs.1#	.50*	
XA 184	Cover, inspection	1	2#	1.00	225
XA 185	Nut, Hexagon-3/8" N.C.	73	32 pcs.1#	.30*	
XA 186	Washer, flat-3/8" U. S. Std.	9	66 pcs.1#	.20*	
XA 187	Stud, 3/8" x 1-1/2" N. C.	2	22 pcs.1#	.07	225
XA 188	Housing, Jack Shaft bevel gear (with cover)	1	205#	118.00	225
XA 189	Screw, Set-Dog Point Sq.Hd. 1/2" x 2-1/2" N. C.	1	4 pcs.1#	.07	225
XA 190	Nut, Hex. Half-1/2" N. C.	32	30 pcs.1#	.016	
XA 191	Bolt, machine-5/8"x 2-1/4" N. C.	16	4 pcs.1#	.07	
XA 192	Bushing, bronze-upper	1	5#	6.00	225
XA 193	Cover, hand hole	1	1-3/4#	.30	225
XA 194	Screw, cap-hex.hd. 5/8" x 1" N. C.	4	5 pcs.1#	.06	226
XA 195	Cover, dipper trip	1	3-1/2#	.65	226
XA 196	Screw, cap-hex.hd. 1/2" x 1" N. C.	15	8 pcs.1#	.03	
XA 197	Cover, inspection hole	2	1-1/2#	.30	226
XA 198	Gasket,inspection cover	1	2 pcs.1#	.30	226
XA 199	Cover, gear case	1	347#	95.00	226
XA 200	Gasket,	1	1#	1.15	226
XA 200A	Gasket	1	4 pcs.1#	.30	226
XA 200B	Gasket	1	16 pcs.1#	.18	226
XA 201	Dowel, 3/8" x 1-1/2" C.R.S.	2	22 pcs.1#	.01	226
XA 202	Plug, pipe-Male W.I. sq. Hd. 1-1/2"	1	2 pcs.1#	.12	226
XA 203	Bolt, Machine-3/4" x 3-1/4" N.C.	11	2 pcs.1"	.11	226
XA 204	Bolt, machine-3/4" x 3-1/2" N. C.	18	2 pcs.1#	.15	
XA 205	Stand, side (with pin)	1	275#	160.00	226
XA 206	Cotter, 3/16" x 2-1/2"	1	54 pcs.1#	.40*	226
XA 207	Washer, flat 2447-13	1	5 pcs.1#	.06	226
XA 208	Pin, boom hoist brake	1	4#	1.60	226
XA 209	Screw, cap-hex.hd. 5/8" x 1-3/4" N.C.	4	4 pcs.1#	.07	

* Price Per 100 Pcs.
** Over 200 Pcs. Per Lb.

Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 210	Bolt, machine-3/4" x 2-3/4" N. C.	9	2 pcs.1#	$ .11	
XA 211	Case, gear Not sold separately-Includes Part No. XA 197	1	945#	324.00	226
XA 212	Stud, 3/4" x 4 1/4" C724-5	2	2 pcs.1#	.35	226
XA 213	Screw, cap-hex. head 3/8" x 1-3/4" N.C.	1	14 pcs.1#	.03	226
XA 214	Nut, hexagon half-3/8" N. C.	3	60 pcs.1#	.01	
XA 215	Shim, steel	2	3 pcs.1#	.15	227
XA 216	Cotter, 5/16" x 2-1/2"	5	18 pcs.1#	.01	227
XA 217	Bracket, sheave	1	5#	4.80	227
XA 218	Washer, flat	12	2 pcs.1#	.24	
XA 219	Sheave, Cable-with bushing	3	4-1/2#	3.60	
XA 220	Shaft, "A" frame	1	91#	13.50	227
XA 221	Nipple, close-1/8"	1	50 pcs.1#	.045	227
XA 222	Coupling, pipe-1/8"	4	20 pcs.1#	.10	
XA 223	Pin, sheave	1	3/4#	.90	227
XA 224	Bushing, bronze	3	3 pcs.1#	.55	
XA 225	Cotter, 1/2" x 4-1/2"	4	4 pcs.1#	.06	227
XA 226	Rod, reach	1	4#	1.00	227
XA 227	Spacer, pipe	1	4#	1.00	227
XA 228	Bolt, machine-1/" x 1-1/4" N. C.	32	9 pcs.1#	.04	
XA 229	Bolt, machine-1/2" x 1-1/2" N. C.	18	8 pcs.1#	.04	
XA 230	Cotter, 3/8" x 2"	4	15 pcs.1#	.014	227
XA 231	Pin, hinge	2	1-1/4#	.75	227
XA 232	Pin, Anchor	2	2#	1.15	227
XA 233	Member, tension	2	77#	26.00	227
XA 234	Dowel, brass-3/8" x 3/4"	11	34 pcs.1#	.05	
XA 235	Sheave, suspension	7	44#	21.50	
XA 236	Spacer, pipe	1	1-3/4#	1.75	227
XA 237	Pin, yoke	2	10-3/4#	2.90	227
XA 238	Cotter, 3/16" x 1-1/4"	69	105 pcs.1#	.10*	
XA 239	Pin, lock	2	3 pcs.1#	.55	227
XA 240	Yoke, "A" Frame-	1	85#	36.00	227
XA 241	Hanger, Dead End	1	16-3/4#	4.60	227
XA 242	Spacer, pipe	1	10#	2.40	227
XA 243	Frame, support	1	28#	5.40	227
XA 244	Cotter, 1/4" x 2-1/4"	7	36 pcs.1#	.80*	
XA 245	Pin, hinge	2	1-1/4#	.60	227
XA 246	Member, compression	2	105#	30.00	227
XA 247	Bushing, bronze	11	2-1/4#	2.40	
XA 248	Spacer, pipe	1	3-1/2#	1.95	227
XA 249	Wedge, drum	2	1#	.60	228
XA 250	Bearing, ball F-120WD-2N	4	5#	19.25	
XA 251	Bearing, ball F-122WD-2N	2	7#	26.50	228
XA 252	Screw, cap-Hex.Hd. 5/8"x2-1/2" N. F.	16	3 pcs.1#	.08	228
XA 253	Screw, Cap-Hex.Hd. 5/8" x 3-1/2" N. C.	12	3 pcs.1#	.10	

* Price Per 100 Pcs.
** Over 200 Pcs. Per Lb.

Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 254	Retainer, bearing	1	13-3/4#	$19.50	228
XA 255	Closure, shaft	1	22#	9.25	228
XA 256	Spacer, pipe	1	4-1/4#	1.70	228
XA 257	Block, pillow	2	22-1/2#	23.50	
XA 258	Plate, retainer	3	1#	.35	
XA 259	Screw, Cap-Hex. Hd. 5/8" x 1-1/4" N. C.	10	5 pcs.1#	.06	
XA 260	Plate, lock	4	16 pcs.1#	.18	
XA 261	Drum, hoist	1	247#	66.00	228
XA 262	Nut, Hexagon-5/8" N.F.	20	9 pcs.1#	.03	
XA 263	Housing, clutch-21"	2	295#	138.00	228
XA 264	Spacer, cast iron	1	8-1/2#	9.50	228
XA 265	Spider, clutch	4	60#	51.50	
XA 266	Bearing, ball F-215W	1	3#	8.20	228
XA 267	Drum, closing	1	300#	78.00	228
XA 268	Spider, Clutch	4	60#	51.50	
XA 269	Spacer, cast iron	1	7-3/4#	9.30	228
XA 270	Key, straight	3	1#	.50	
XA 271	Gear, drum drive	1	175#	126.0C	228
XA 272	Retainer, bearing	1	16#	14.50	228
XA 273	Bearing, ball F-218WD	1	5-3/4#	14.50	228
XA 274	Key, straight	2	2 pcs.1#	.65	
XA 275	Shaft, drum	1	218#	156.00	228
XA 276	Plate, retainer	1	2#	.90	228
XA 277	Dowel, brass-3/8"x7/8"	1	31 pcs.1#	.05	230
XA 278	Block,pillow-with bushing	1	21 1/2#	24.50	230
XA 279	Bushing, bronze	1	3 1/2#	3.75	230
XA 280	Wedge, socket	2	1 #	.65	
XA 281	Bushing, bronze-outer	1	2 1/2#	7.20	230
XA 282	Key, straight	2	1 3/4#	1.30	230
XA 283	Shaft, boom hoist	1	206#	145.00	230
XA 284	Plug, pipe-Ctsk.Hd.$\frac{1}{4}$"	3	45 pcs.1#	.07	
XA 285	Sleeve, shifter	1	47 1/2#	33.50	230
XA 286	Screw, lock	1	3 pcs.1#	.60	230
XA 287	Screw, cap-Hex.Hd. 5/8" x 6 3/4" N.F.	4	3/4#	.20	230
XA 288	Bearing, ball-N.D. 7215	1	3#	8.50	230
XA 289	Retainer, ring	1	3/4#	3.30	230
XA 290	Spider, clutch	2	59#	72.00	
XA 291	Drum, boom hoist-with bushing	1	225#	125.00	230
XA 292	Bushing, bronze-inner	1	2 1/2#	7.20	230
XA 293	Spacer, pipe	1	225#	3.60	230
XA 294	Shim, #28 Ga.	5	80 pcs.1#	.30	230
XA 295	Plate, retainer	1	4 pcs.1#	.40	230
XA 296	Plate, lock	1	21 pcs.1#	.24	230
XA 297	Sprocket, racking-in	1	66#	42.00	230
XA 298	Housing, clutch	1	104#	98.00	230
XA 299	Key, straight	2	3 pcs.1#	.30	230
XA 300	Retainer, bearing	1	8 1/2#	21.00	230
XA 301	Gear, boom hoist	1	117#	87.00	230
XA 302	Bearing, Ball-N.D. 7310	1	2 1/2#	6.70	230
XA 303	Dowel, steel - 1/2" x 5/8"	1	28 pcs.1#	.05	230
XA 304	Plug, pipe-Sq.Hd. 1/4"	5	33 pcs.1#	.04	

* Price Per 100 Pcs.
** Over 200 Pcs. Per Lb.

Part No.	Name and Description Of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 305	Seal, oil P-575412	1	3/4#	$3.55	230
XA 306	Bearing, ball F-220W	1	8 1/4#	19.50	230
XA 307	Spacer, pipe	1	1 1/4#	3.75	230
XA 308	Ring, snap	1	3 pcs.1#	1.10	230
XA 309	Retainer, bearing	1	15 1/2#	15.00	232
XA 310	Spacer, pipe	1	2 3/4#	3.25	232
XA 311	Sprocket, drive	1	239#	135.00	232
XA 312	Bearing, ball F-215WD	1	3#	8.20	232
XA 313	Key, straight	1	3/4#	.50	232
XA 314	Shims, .020 thick	3	12 pcs.1#	.35	232
XA 314A	Shims, .005 thick	9	48 pcs.1#	.20	232
XA 315	Nut, lock F-N19	2	1 1/2#	2.55	232
XA 316	Washer, lock F-W19	2	6 pcs.1#	.25	232
XA 317	Ring, snap	1	4 pcs.1#	.90	232
XA 318	Housing, clutch	2			232
Note:	Not sold separately- Includes Parts XA 318 to XA 322 Inclusive	2	167#	170.00	232
XA 319	Key, straight	2	3 pcs.1#	.55	232
XA 320	Pinion, bevel	2	29#	82.00	232
XA 321	Screw, headless socket set 1/2" x 1" N.C.	4	20 pcs.1#	.11	232
XA 322	Slinger, oil	2	2 pcs.1#	1.45	232
XA 323	Bearing, ball F-120W-2	2	5#	18.60	232
XA 324	Spacer, pipe	2	1 1/4#	1.65	232
XA 325	Shaft, jack- with #19 Fafnir nuts 40SA179B	1	207#	165.00	232
XA 326	Pinion, drive	1	37#	42.00	232
XA 327	Bearing, ball F-315 WD	1	8#	18.00	232
XA 328	Retainer, bearing	1	17 3/4#	15.00	232
XA 329	Pin, crank	3	2 pcs.1#	.35	
XA 330	Pin, eye	5	16 pcs.1#	.30	
XA 331	Washer, lock-type #15 S-1520	5	32 pcs.1#	.05	
XA 332	Screw, flat head-3/8" x 1" N. C.	5	20 pcs.1#	.05	
XA 333	Washer, retainer	3	4 pcs.1#	.06	
XA 334	Pin, shoulder	5	1#	2.00	
XA 335	Screw, cap-Hex. Head 3/4" x 3 1/2" N.C.	2	2 pcs.1#	.15	
XA 336	Washer, S.A.E.-3/4" Special	3	9 pcs.1#	.01	
XA 337	Bolt, machine-1/2" x 3" N. C.	10	5 pcs.1#	.06	
XA 338	Ring, shifter-2 halves	6	6 1/2#	5.70	
XA 339	Sleeve, shifter	2	18 1/4#	12.00	
XA 340	Screw, square head set-1/2"x1-1/2" N.C. cup point	11	8 pcs.1#	.05	
XA 341	Bar, pivot	10	1#	4.50	
XA 342	Washer, cup	10	6 pcs.1#	.40	
XA 343	Nut, hex. slotted 5/8" N. C.	11	15 pcs.1#	.03	
XA 344	Link, reinforcing	2	4 1/2#	3.60	

* Price Per 100 Pcs.
** Over 200 Pcs. Per Lb.

Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 345	Crank, operating with bushing	5	4 1/2#	$10.00	
XA 346	Spring, tension	5	4 pcs.1#	.50	
XA 347	Bushing, bronze	5	3/4#	.80	
XA 348	End, ball	5	4 pcs.1#	1.20	
XA 349	Thimble, adjusting	13	10 pcs.1#	.18	
XA 350	Nut, Hex. Half-5/8" N.C.	19	18 pcs.1#	.02	
XA 351	Screw, Sq. Head Set 5/8" x 2 1/4" Cup point	13	4 pcs.1#	.09	
XA 352	Yoke, toggle-w/bushing	5	12#	18.00	
XA 353	Bushing, bronze	7	8 pcs.1#	.24	
XA 354	Pin, pivot	5	2 pcs.1#	.35	
XA 355	Cotter, 3/16" x 2 1/4"	9	60 pcs.1#	.40*	
XA 356	Cotter, 1/4" x 1 1/2"	14	50 pcs.1#	.50*	
XA 357	Pin, crank and band	17	3 pcs.1#	.30	
XA 358	Eyebolt, adjusting	5	1#	3.00	
XA 359	Link, adjusting	5	2#	4.50	
XA 360	Lining, brake- J.M.#900	3	5 1/2#	10.00	
XA 361	Link, band end	3	3/4#	.90	
XA 362	Lug, clutch band	10	1#	1.50	
XA 363	Band, clutch-with lugs	3	28#	18.00	
XA 364	Plug, rivet-9/16" x 3/16"	218	**	.02	
XA 365	Rivet, brass-1/4" x 5/8" 250	182	100 pcs.1#	.01	
XA 366	Nut, adjusting	5	3 pcs.1#	1.10	
XA 367	Nut, Hex. Half-3/4" N. C.	49	10 pcs.1#	.04	
XA 368	Link, reinforcing	1	4 1/2#	3.60	236
XA 369	Screw, cap-special	1	2 pcs.1#	.45	238
XA 370	Sleeve, shifter	3	14 1/2#	11.00	
XA 371	Washer, Type S-1132	1	160 pcs.1#	.02	238
XA 372	Washer, flat	2	20 pcs.1#	.02	
XA 373	Band, brake with lining and lugs	2	22 3/4#	30.00	
XA 374	Lining, brake-J.M. 200	2	4 1/2#	9.00	
XA 375	Link, dead end	2	3 pcs.1#	3.60	
XA 376	Washer, flat-#28 Ga.	2	176 pcs.1#	.02	
XA 377	Washer, flat-#16 Ga.	1	64 pcs.1#	.03	240
XA 378	Washer, flat	5	8 pcs.1#	.12	
XA 379	Cotter, 1/4" x 2"	19	38 pcs.1#	.60*	
XA 380	Clevis, reach rod	38	1#	1.00	
XA 381	Spacer, pipe	2	8 pcs.1#	.45	
XA 382	Link, toggle	2	1 1/4#	6.00	
XA 383	Cotter, 3/16" x 1-1/2"	21	104 pcs.1#	.20*	
XA 384	Pin, clevis and link	2	2 pcs.1#	.45	
XA 385	Washer, flat-5/8" S.A.E.	22	13 pcs.1#	.60*	
XA 386	Spring, compression	2	1#	.55	
XA 387	Lever, traction shifter	2	6 3/4#	8.00	
XA 388	Key, gib-3/8" x 3/8" x 2"	13	9 pcs.1#	.11	
XA 389	Washer, flat-5/8" St'd.	37	13 pcs.1#	.60*	
XA 390	Link, connector	3	1 1/2#	.65	
XA 391	Spring, tension	1	1 1/2#	1.10	244

* Price Per 100 Pcs.
** Over 200 Pcs. Per Lb.

Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 392	Pin, lever	2	3/4#	$ .35	
XA 393	Link, connecting	2	4 pcs.1#	1.50	
XA 394	Pin, pivot	7	2 pcs.1#	.24	
XA 395	Rod, reach	2	2 pcs.1#	.55	
XA 396	Bolt, eye	1	1#	4.00	244
XA 397	Nut, Hexagon-3/4" N.F.	6	5 pcs.1#	.05	
XA 398	Spacer, pipe	1	4 pcs.1#	.30	244
XA 399	Cotter, 3/16" x 1"	7	114 pcs.1#	.10*	
XA 400	Shaft, traction shifter	2	5 3/4#	2.10	
XA 401	Washer, flat	2	8 pcs.1#	.10	
XA 402	Washer, flat	4	4 pcs.1#	.06	
XA 403	Yoke, center steering	2	7 1/4#	9.50	
XA 404	Screw, cap-hex.hd. 3/4" x 2 3/4" N.F.	2	2 pcs.1#	.12	
XA 405	Screw, cap-flat head 1/2" x 4" N.C.	2	4 pcs.1#	.24	
XA 406	Cotter, 5/16" x 2"	5	22 pcs.1#	.01	
XA 407	Screw, set-square head cup point 1/2" x 2" N.C.	4	6 pcs.1#	.06	
XA 408	Lever, brake locking	3	6 1/4#	5.25	
XA 409	Link, connection	4	1 3/4#	1.15	
XA 410	Bracket, steering brake	2	25#	27.00	
XA 411	Bushing, bronze	4	3/4#	1.15	
XA 412	Pin, clevis	40	4 pcs.1#	.14	
XA 413	Lever, brake with bushing	2	5 1/4#	8.50	
XA 414	Bushing, bronze	2	1 /2#	1.75	
XA 415	Lever, shifter	2	2-3/4#	5.50	
XA 416	Key, gib-3/8"x3/8"x1½"	2	11 pcs.1#	.11	
XA 417	Pin, lever	2	4 pcs.1#	.35	
XA 418	Screw, cap-Hex. Head 7/8" x 5" N. C.	2	3/4#	.28	
XA 419	Yoke, steering clutch	2	8 1/2#	6.60	
XA 420	Collar, shifter	2	3 1/2#	5.40	
XA 421	Band, steering brake with lining and ends	4	12#	13.00	
XA 422	Shaft, shifter	2	9 3/4#	2.50	
XA 423	Lining, brake #11-7680 J.M.	4	1 3/4#	4.00	
XA 424	Spring, tension	2	4 pcs.1#	.30	
XA 425	Washer, flat	8	8 pcs.1#	.04	
XA 426	Washer, lock	2	3 pcs.1#	.55	
XA 427	Bolt, machine-special	2	2 3/4#	.75	
XA 428	Lug, brake band	4	1 3/4#	1.00	
XA 429	End, brake band	4	2 1/2#	2.15	
XA 430	Rivet, brass-1/4" x 3/4"	48	113 pcs.1#	.01	
XA 431	Pin, band end	4	1 1/2#	.75	
XA 432	Washer, flat - 1"	32	5 pcs.1#	.03	
XA 433	Screw, cap-Hex. Head 7/8" x 1 3/4" N. C.	4	3/4#	.17	
XA 434	Screw, cap-Hex. Head 7/8" x 4" N. C.	4	1#	.23	
XA 435	Nut, Hex. Half-7/8"N.C.	5	7 pcs.1#	.07	
XA 436	Nut, Hexagon-7/8" N.C.	9	4 pcs.1#	.05*	
XA 437	Bolt, eye	1	3 1/2#	4.75	245
XA 438	Rod, reach	4	2 1/4#	.50	

* Price Per 100 Pcs.
** Over 200 Pcs. Per Lb.

Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 439	Ring, shifter (2 halves)	2	1 1/4#	$5.05	248
XA 440	Sleeve, upper shifter	1	1#	6.00	248
XA 441	Yoke, lower center steering	2	4 1/2#	7.20	248
XA 442	Key, gib-3/8" x 3/8" x 3-1/2"	2	6 pcs.1#	.13	248
XA 443	Bolt, machine-3/8" x 1-1/2" N. C.	12	13 pcs.1#	.03	
XA 444	Shaft, upper	1	15 1/2#	4.20	248
XA 445	Pin, lock	2	48 pcs.1#	.35	248
XA 446	Rod, steering-inner	1	10 3/4#	2.60	248
XA 447	Shaft, lower	1	15#	4.25	248
XA 448	Lug, lower shifter	1	1#	3.95	248
XA 449	Screw, cap-Hex. Head 5/16" x 1" N. C.	1	28 pcs.1#	.01	248
XA 450	Lever, upper traction	1	8#	6.55	248
XA 451	Collar, pipe	4	3 pcs.1#	1.00	
XA 452	Lever, lower traction	1	8 1/2#	7.00	248
XA 453	Washer, lock-5/16"	284	**	.30*	
XA 454	Pipe, steering-outer	1	9 1/4#	2.60	248
XA 455	Key, gib - 3/8" x 3/8" x 1 3/4"	2	10 pcs.1#	.11	248
XA 456	Lug, lower shifter	1	1#	3.95	248
XA 457	Screw, cap-Hex.Head 5/16" x 3/4" N. C.	1	30 pcs.1#	.01	248
XA 458	Bracket, bearing	1	8#	8.75	248
XA 459	Shaft, clutch yoke pivot	1	5#	6.00	248
XA 460	Sleeve, upper shifter	1	1 1/4#	5.70	248
XA 461	Crank, bell	1	5#	4.00	248
XA 462	Cotter, 1/4" x 2-1/2"	3	32 pcs.1#	.02	
XA 463	Screw, cap-hex.head 3/4" x 2" N.C.	1	2 pcs.1#	.11	248
XA 464	Pin, bell crank	1	5 3/4#	3.75	248
XA 465	Shaft, lever	1	37 1/2#	7.25	248
XA 466	Bearing, Babbitted	4	3 1/4#	1.35	248
XA 467	Bolt, machine-5/8" x 1 3/4" N. C.	30	4 pcs.1#	.07	
XA 468	Key, taper	2	16 pcs.1#	.10	
XA 469	Crank, operating	3	3 3/4#	5.00	
XA 470	Yoke, clutch	1	9 1/2#	10.00	248
XA 471	Key, straight	2	16 pcs.1#	.15	
XA 472	Lever, operating	1	5 1/2#	4.80	248
XA 473	Rod, reach	1	2 3/4#	.75	248
XA 474	Key, gib-3/8" x 3/8" x 2-1/4"	2	8 pcs.1#	.11	
XA 475	Rod, reach	1	5#	.95	248
XA 476	Spacer, pipe	1	3 pcs.1#	.30	248
XA 477	Lever, Operating	1	3 1/4#	5.75	248
XA 478	Bearing, flanged	1	3 1/2#	3.90	248
XA 479	Spacer, pipe	1	1#	.55	248
XA 480	Sheave, cable	2	2 pcs.1#	.60	
XA 481	Spacer, pipe	1	1 1/4#	.35	248
XA 482	Lever, Hand	2	15#	9.35	
XA 484	Band, Brake with lining and Ends	2	24#	29.00	
XA 485	Lining, band	2	3 pcs.1#	9.30	

* Price Per 100 Pcs.

** Over 200 Pcs. Per Lb.

Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 486	Screw, cap-Flat Head 3/8" x 4" N. C.	2	8 pcs.1#	$ .20	
XA 487	Rod, reach	2	2 1/4#	.60	
XA 488	Lever, operating	1	6 1/4#	7.30	247
XA 489	Bolt, carriage-5/8"x2"	7	3 pcs.1#	.08	
XA 490	Bearing, Babbitted	2	5#	1.60	
XA 491	Washer, flat	1	3 pcs.1#	.75	247
XA 492	Ell, street-1/4"x90°	3	11 pcs.1#	.14	
XA 493	Tube, brake operating	1	24 1/2#	18.00	247
XA 494	Lever, operating	1	4 3/4#	7.75	247
XA 495	Key, feather	1	8 pcs.1#	.15	247
XA 496	End, brake band	6	1#	1.45	
XA 497	Spring, tension	3	2 pcs.1#	.70	
XA 498	Pin, band end	6	2 pcs.1#	.50	
XA 499	Rod, brake adjusting	3	3 1/4#	1.80	
XA 500	Link, brake	4	4 1/2#	3.50	
XA 501	Pin, lock	2	5 pcs.1#	.25	
XA 502	Nut, adjusting lock	6	3/4#	1.85	
XA 503	Shaft, operating	2	4#	2.15	
XA 504	Crank, operating	2	3#	4.00	
XA 505	Shim, support	4	5 pcs.1#	.10	
XA 506	Bolt, machine-3/4" x 2" N. C.	18	2 pcs.1#	.10	
XA 507	Support, brake stand	2	10#	7.75	
XA 508	Shim, brake stand	4	6 pcs.1#	.12	
XA 509	Nipple, 1/4" x 4"	4	7 pcs.1#	.07	
XA 510	Collar, set 53-396	3	1#	1.20	
XA 511	Bolt, Machine-3/8" x 3" N. C.	1	9 pcs.1#	.04	247
XA 512	Hub, brake pedal	3	10#	6.75	
XA 513	Screw, Cap-Flat Head 1/2" x 4-1/2" N.C.	2	4 pcs.1#	.32	
XA 514	Washer, cup	2	16 pcs.1#	.05	
XA 515	Spacer, pipe	1	2 pcs.1#	.24	247
XA 516	Shaft, foot lever	1	9#	1.90	247
XA 517	Key, Gib-3/8" x 3/8" x 2-1/2"	3	8 pcs.1#	.11	
XA 518	Lever, operating	2	4-1/4#	3.90	
XA 519	Stand, brake	1	51#	34.50	247
XA 520	Bolt, machine-7/8" x 2-1/2" N. C.	3	3/4#	.17	
XA 521	Bolt, Machine-3/4" x 2-1/2" N. C.	14	2 pcs.1#	.11	
XA 522	Pin, latch	2	3 pcs.1#	.40	
XA 523	Latch, brake	2	2-1/4#	1.75	
XA 524	Bolt, machine-5/8" x 1-1/2" N.C.	42	5 pcs.1#	.07	
XA 525	Pedal, Brake	3	5 3/4#	3.25	
XA 526	Ratchet, latch	2	3#	1.75	
XA 527	Arm, brake pedal	3	9-1/2#	3.55	
XA 528	Pin, button head	2	5 pcs.1#	.12	
XA 529	Spring, brake pedal	2	1 1/4#	.85	
XA 530	Elbow, 1/4"-90°	12	9 pcs.1#	.12	
XA 531	Nipple, 1/4" x 8"	1	4 pcs.1#	.20	246
XA 532	Shaft, brake operating	1	34 1/4#	5.75	246
XA 533	Lever, operating	1	5 1/4#	5.45	246

* Price Per 100 Pcs.
** Over 200 Pcs. Per Lb.

Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 534	Shim, bearing	1	1#	$ .30	246
XA 535	Stand, brake	1	52#	37.50	246
XA 536	Casting, splice	2	1 3/4#	2.60	249
XA 537	Rivet, flat head-1/4" x 1/2" brass 250	36	80 pcs.1#	.01	
XA 538	Lining, block	5	1 1/4#	3.60	
XA 539	Band, brake Order XA 542	2			249
XA 540	Crank, bell	1	5 1/4#	8.65	249
XA 541	Shaft, lever	1	35#	13.00	249
XA 542	Band, brake with lining, ends and splice casting. (two halves)	1	23#	50.50	249
XA 543	Casting, anchor	1	11 1/2#	10.50	249
XA 544	Rod, reach	2	1 3/4#	.70	
XA 545	Bolt, machine 3/8" x 2 3/4" N. C.	7	10 pcs.1#	.03	
XA 546	Bearing, solid	1	3 1/4#	1.30	249
XA 547	Spring, foot brake	1	3/4#	.60	249
XA 548	Lining, clip	1	3 pcs.1#	.25	249
XA 549	Rivet, countersunk head 1/4" x 5/8" copper	3	100 pcs.1#	.01	
XA 550	Clip, brake pedal	1	1 3/4#	6.85	249
XA 551	Bolt, eye	1	3 pcs.1#	.55	249
XA 552	Rod, foot brake spring	1	1#	1.10	249
XA 553	Lever, operating	2	1 3/4#	3.70	250
XA 554	Bearing, lever shaft	2	3#	1.60	250
XA 555	Shaft, clutch lever	1	13 1/2#	3.15	250
XA 556	Lever, engine clutch	1	3 1/2#	8.40	250
XA 557	Lining, brake band	1	3#	5.10	250
XA 558	Key, Woodruff 808	1	40 pcs.1#	.03	250
XA 559	Key, straight	4	32 pcs.1#	.05	250
XA 560	Band, brake with lining and ends	1	15#	23.00	250
XA 561	Washer, flat	1	4 pcs.1#	.50	250
XA 562	Pivot, lever	1	4#	3.25	250
XA 563	Cotter, 1/4" x 3"	3	27 pcs.1#	.02	
XA 564	Pin, lock	1	6 pcs.1#	.30	250
XA 565	Lever, operating	1	3#	4.45	250
XA 566	Key, gib 7/16" x 7/16" x 2"	2	6 pcs.1#	.15	250
XA 567	Spacer, pipe	1	1 1/4#	.50	250
XA 568	Washer, flat 1-5/8"	1	2 pcs.1#	.05	
XA 569	Bolt, machine 5/8" x 3-1/4" N. C.	1	3 pcs.1#	.08	250
XA 570	Lever, operating	1	7 1/4#	5.75	250
XA 571	Key, straight	1	16 pcs.1#	.15	250
XA 572	Shaft, swing brake	1	18 1/2#	5.00	250
XA 573	Rod, reach	1	5#	1.90	250
XA 574	Rod, reach	1	6#	1.45	250
XA 575	Screw, latch	6	80 pcs.1#	.09	
XA 576	Nut, latch screw BA-X-05	6	**	.02	
XA 577	End, rod BA-X-06-4	3	13 pcs.1#	.50	
XA 578	Stop, lever	1	16 pcs.1#	1.00	250

* Price Per 100 Pcs.

** Over 200 Pcs. Per Lb.

Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 579	Ratchet, notched	1	2 pcs.1#	$1.50	250
XA 580	Lever, hand	1	7 3/4#	9.35	250
XA 581	Rod, pawl BA-X-07C-36B	3	2 pcs.1#	1.15	
XA 582	Cotter BA-X-09	1	**	.01	250
XA 583	Nut, castle BA-X-20	1	40 pcs.1#	.02	250
XA 584	Pin, band	2	3 pcs.1#	.20	250
XA 585	End, band	2	1#	1.00	250
XA 586	Spacer, pipe	1	5 pcs.1#	.25	250
XA 587	Washer, flat	2	5 pcs.1#	.02	250
XA 588	Screw, take-up	1	1 1/4#	3.30	250
XA 589	Lever, brake band	1	6#	7.25	250
XA 590	Rod, reach	1	3/4#	2.15	250
XA 591	Shaft, lever	1	24#	4.85	250
XA 592	Lever, hand	1	11#	8.75	250
XA 593	Lever, operating	1	10 3/4#	7.35	250
XA 594	Pin, shift collar	4	3 pcs.1#	.25	250
XA 595	Yoke, gear shift	1	20 1/2#	14.50	250
XA 596	Collar, gear shift with graphite plugs	2	2#	7.50	250
XA 597	Plug, Dixon's graphite	20	**	.05	250
XA 598	Key, gib-7/16" x 7/16" x 2 1/2"	1	5 pcs.1#	.16	250
XA 599	Spring, latch BA-X-03	3	80 pcs.1#	.12	
XA 600	Lever, hand	1	9#	11.00	250
XA 601	Latch, grip BA-X-02	3	5 pcs.1#	.35	
XA 602	Ratchet, blank BA-X14-4B	2	3 pcs.1#	.60	
XA 603	Bearing, lever shaft	2	6 3/4#	3.60	250
XA 604	Bolt, machine 1/2" x 2-1/4" N. C.	1	6 pcs.1#	.05	
XA 605	Lever, swing brake	1	4#	7.00	250
XA 606	Rod, reach	1	6 3/4#	.85	250
XA 607	Shaft, lever	1	14 3/4#	7.00	250
XA 608	Screw, pawl BA-X-08	6	48 pcs.1#	.15	
XA 609	Bolt, clamp BA-X-55	1	16 pcs.1#	.07	250
XA 610	Fork, shifter	1	8 1/2#	10.00	251
XA 611	Bolt, machine 5/8" x 4" N. C.	3	2 pcs.1#	.09	
XA 612	Lug, adjusting	1	3 1/4#	5.50	251
XA 613	Bolt, machine 5/8" x 3" N. C.	3	3 pcs.1#	.08	
XA 614	Key, straight	2	5 pcs.1#	.15	251
XA 615	Bracket, lever bearing	1	35#	17.00	251
XA 616	Fork, shifter	1	9 1/4#	9.90	251
XA 617	Bracket, shifter fork	1	6 3/4#	7.80	251
XA 618	Pin, one hole	1	3#	2.10	251
XA 619	Pin, lock 5/16" x 3 1/2"	1	12 pcs.1#	.01	251
XA 620	Bearing, bracket.	1	3 1/2#	2.40	251
XA 621	Shaft, clutch operating	1	8 1/2#	2.90	251
XA 622	Pin, one hole	3	2 pcs.1#	.30	251
XA 623	Link, clutch operating	2	3/4#	3.30	251
XA 624	Screw, cap-Hex. Head 5/8" x 3 1/4" N.C.	1	3 pcs.1#	.10	251
XA 625	Crank, adjusting-Half	2	4#	5.70	251
XA 626	Pin, one hole	1	2 3/4#	2.30	251
XA 627	Pin, lock	1	8 pcs.1#	.02	251

* Price Per 100 Pcs.
** Over 200 Pcs. Per Lb.

Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 628	Bracket, bearing	1	8 1/2#	$10.00	251
XA 629	Bearing, solid	1	3 3/4#	.90	251
XA 630	Clevis, reach rod	1	1 3/4#	2.30	251
XA 631	Bearing, double	1	5 1/2#	1.75	251
XA 632	Ell, street 1/8" x 45°	3	22 pcs.1#	.18	
XA 633	Bracket, adjusting	1	12 3/4#	12.50	251
XA 634	Lever, operating	1	2 3/4#	3.00	251
XA 635	Pin, one hole	1	3/4#	1.10	251
XA 636	Clevis, special	1	2#	3.00	251
XA 637	Nipple, 1/8" x 1 1/2"	2	35 pcs.1#	.05	
XA 638	Ell, street-1/8" x 90°	3	22 pcs.1#	.14	
XA 639	Rod, reach	1	1 3/4#	.55	251
XA 640	Shaft, lever	1	14 1/2#	10.50	251
XA 641	Lever, hand	1	15 1/2#	15.00	251
XA 642	Rod, reach	1	12#	1.85	251
XA 643	Clevis, offset	1	1 1/2#	2.80	251
XA 644	Crank, operating	1	2 3/4#	4.25	251
XA 645	Crank, operating	2	3#	4.20	252
XA 646	Shim, 1/8" thick	4	2 pcs.1#	.17	252
XA 647	Shim, #16 gauge	4	4 pcs.1#	.15	252
XA 648	Rod, reach	2	3/4#	.65	252
XA 649	Lever, equalizer	1	7#	5.35	252
XA 650	Rod, reach	1	3#	.85	252
XA 651	Crank, bell	1	5 3/4#	6.75	252
XA 652	Support, bell crank	1	3 1/4#	1.45	252
XA 653	Bearing, shifter yoke	2	9 3/4#	3.25	252
XA 654	Spacer, pipe	2	3 pcs.1#	.04	252
XA 655	Rod, connecting	1	4 1/2#	3.90	252
XA 656	Pin, pivot	1	1 3/4#	1.20	252
XA 657	Bearing, lever shaft	1	9 1/2#	4.85	252
XA 658	Spacer, pipe	1	2 pcs.1#	.45	252
XA 659	Rod, reach	1	10#	1.90	252
XA 660	Bolt, machine 3/4" x 2-1/4" N. C.	7	2 pcs.1#	.10	
XA 661	Yoke, clutch	2	14#	8.70	252
XA 662	Key, gib 3/8" x 3/8" x 3"	2	7 pcs.1#	.12	252
XA 663	Shaft, lever	2	5 3/4#	2.40	252
XA 664	Fork, shifter-half	1	3 3/4#	3.00	252
XA 665	Fork, shifter-half	1	3#	3.00	252
XA 666	Spacer, pipe	1	1 1/4#	.35	252
XA 667	Washer, flat 7/8" S.A.E.	1	6 pcs.1#	.02	252
XA 668	Shaft, lever	1	2 1/2#	10.00	252
XA 669	Bolt, machine 3/8" x 2" N. C.	3	12 pcs.1#	.03	
XA 670	Pipe, reinforcing 3/4" x 72"	1	6 3/4#	1.85	252
XA 671	Lever, hand	1	5 1/2#	9.60	252
XA 672	Bolt, machine 3/8" x 1 3/4" N. C.	10	14 pcs.1#	.03	
XA 673	Bearing, lever shaft	1	15 1/2#	5.75	252
XA 674	Spring, tension	1	48 pcs.1#	.10	253
XA 675	Washer, flat	2	16 pcs.1#	.03	253
XA 676	Latch, engagement	1	3 1/2#	3.60	253
XA 677	Crank, bell-with pin	1	2#	3.60	253
XA 678	Bracket, bell crank	1	9#	5.00	253

* Price Per 100 Pcs.
** Over 200 Pcs. Per Lb.

Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 679	Cotter, 3/16" x 2"	7	66 pcs.1#	$ .30*	
XA 680	Pin, pivot	1	2 pcs.1#	.40	253
XA 681	Bolt, machine 1/2" x 1-3/4" N. C.	13	7 pcs.1#	.04	
XA 682	Pin, pawl pivot	1	4 1/2#	1.30	253
XA 683	Pawl, boom hoist	1	8#	8.35	253
XA 684	Bolt, spring	1	2 pcs.1#	.80	253
XA 685	Pin, clevis	1	4 pcs.1#	.45	253
XA 686	Clevis, reach rod	1	2#	2.10	253
XA 687	Key, straight	3	32 pcs.1#	.12	253
XA 688	Bolt, machine 3/8" x 2-1/4" N. C.	4	11 pcs.1#	.03	
XA 689	Lever, operating	1	1 3/4#	3.60	253
XA 690	Bearing, lever shaft	2	2 1/2#	2.40	253
XA 691	Rod, reach	1	2 1/4#	1.00	253
XA 692	Clevis, reach rod	4	3 pcs.1#	.55	253
XA 693	Pin, clevis	6	8 pcs.1#	.08	
XA 694	Shaft, pawl operating	1	13 1/4#	3.75	253
XA 695	Rod, reach	1	6#	2.15	253
XA 696	Rod, reach	1	1#	.75	253
XA 697	Stop, lever	1	5 pcs.1#	.75	253
XA 698	Spring, tension	1	3 pcs.1#	.90	253
XA 699	Lever, engagement	1	2#	2.45	253
XA 700	Lever, engagement	1	1 1/2#	2.45	253
XA 701	Lever, operating	1	2 1/4#	6.75	253
XA 702	Lever, hand	1	6 1/2#	4.75	253
XA 703	Pin, pivot	1	1 1/4#	.60	253
XA 704	Bracket, hand lever	1	4#	2.90	253
XA 705	Cap, grease pipe	1	3/4#	1.00	254
XA 706	Cover, clutch shaft	1	6 1/2#	2.45	254
XA 707	Retainer, felt seal	1	8 1/2#	1.90	254
XA 708	Seal, felt-medium hard 1/2" x 1/2" x 17-3/4"	1	53 pcs.1#	.30	254
XA 709	Spacer, pipe	2	2 pcs.1#	.17	254
XA 710	Bolt, machine-3/4" x 7" N. C.	2	1#	.15	254
XA 711	Support, chain case (rear)	1	10#	5.75	254
XA 712	Shim, support	4	2 pcs.1#	.25	254
XA 713	Bolt, stove-round head 5/16" x 3/4" N. C.	155	28 pcs.1#	.02	
XA 714	Nut, square 5/16" N.C.	297	45 pcs.1#	.90*	
XA 715	Guard, swing and traction clutch	2	4#	.90	254
XA 716	Guard, boom hoist brake	1	12#	9.60	254
XA 717	Bracket, clutch guard	1	4#	2.15	254
XA 718	Case, chain-upper and lower	1	125#	55.00	254
XA 719	Seal, felt-5" I.D. x 3/8" thick x 5-3/4" O. D.	1	80 pcs.1#	.60	254
XA 720	Retainer, felt seal	1	5 1/2#	3.00	254
XA 721	Bolt, stove-round head 5/16" x 1" N. C.	16	25 pcs.1#	.02	
XA 722	Bolt, machine-3/8" x 3/4" N. C.	12	22 pcs.1#	.03	

* Price Per 100 Pcs.
** Over 200 Pcs. Per Lb.

Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 723	Support, chain case (front)	1	6 1/2#	$3.25	254
XA 724	Shim, support	4	2 pcs.1#	.15	254
XA 725	Cover, plate	1	6#	3.50	254
XA 726	Cover, plate	1	7#	1.75	254
XA 727	Seat, operator's HD-3181-25	1	5 3/4#	7.20	255
XA 728	Bolt, carriage-1/2" x 1-1/4"	1	6 pcs.1#	.04	255
XA 729	Hinge, seat	1	2 1/2#	1.40	255
XA 730	Bolt, adjusting	1	2 pcs.1#	.50	255
XA 731	Spacer, pipe	1	16 pcs.1#	.12	255
XA 732	Base, operator's seat	1	3#	2.10	255
XA 733	Bolt, machine-1/2" x 4" N. C.	1	4 pcs.1#	.06	255
XA 734	Pivot, seat	1	3#	1.50	255
XA 735	Bracket, seat shaft	1	6#	4.20	255
XA 736	Bolt, machine-1/2" x 2-1/2" N.C.	1	6 pcs.1#	.05	255
XA 737	Shaft, supporting	1	13 1/4#	3.25	255
XA 738	Clip, tailswing cover	1	5 pcs.1#	.30	256
XA 739	Bolt, machine-3/4" x 1-3/4" N. C.	10	3 pcs.1#	.10	256
XA 740	Tail swing, counter-weight	1	405#	110.00	256
XA 741	Cover, tailswing corner	1	15#	3.75	256
XA 742	Bolt, machine 3/8" x 1-1/4" N. C.	5	17 pcs.1#	.03	
XA 743	Screw, cap- Hex. Hd. 1/2" x 3/4" N. C.	7	10 pcs.1#	.03	
XA 744	Cover, tailswing corner	1	15#	3.75	256
XA 745	Plate, engine	1	30#	3.75	256
XA 746	Plate, tailswing cover	1	31#	8.10	256
XA 747	Cover, tool box	1	18 1/2#	5.00	256
XA 748	Platform, operator's side	1	395#	100.00	256
XA 749	Plate, floor	1	28#	4.80	256
XA 750	Support, platform	1	10#	4.60	256
XA 751	Clip, floor plate	2	3 pcs.1#	.24	256
XA 752	Plate, floor	1	28#	4.80	256
XA 753	Platform, opposite operator's	1	260#	57.50	256
XA 754	Bracket, platform	1	2 1/4#	1.00	256
XA 755	Guard, window	1	11#	2.70	257
XA 756	Guard, window	1	18#	3.00	257
XA 757	Lock, door	1	3#	3.00	257
XA 758	Padlock, door-with keys MA-500	2	2 pcs.1#	.65	
XA 759	Key, padlock	2	16 pcs.1#	.25	257
XA 760	Guard, window	1	7#	1.35	257
XA 761	Guard, window	1	11#	3.50	257
XA 762	Guard, window	2	13 1/2#	3.00	257
XA 763	Bar, guard holder	1	3#	.75	257
XA 764	Holder, window guard	1	9 1/2#	3.35	257
XA 765	Lock, window guard	1	3 pcs.1#	.65	257
XA 766	Bolt, stove-round head 3/16" x 3/4" N. C.	1	90 pcs.1#	.50*	257

* Price Per 100 Pcs.
** Over 200 Pcs. Per Lb.

Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 767	Washer, lock-3/16"	7	**	$ .20*	
XA 768	Nut, square-3/16" N.C.	7	105 pcs.1#	.10*	
XA 769	Nut, square-1/4" N.C.	26	75 pcs.1#	.40*	
XA 770	Washer, lock-1/4"	30	**	.20*	
XA 771	Bolt, stove-flat head 1/4" x 3/4" N. C.	2	50 pcs.1#	.20*	257
XA 772	Holder, window guard	1	9 1/2#	3.35	257
XA 773	Bolt, stove-round head 5/16" x 1/2" N. C.	126	32 pcs.1#	.02	
XA 774	Roof, cab	1	75#	26.50	258
XA 775	Panel, cab-inner section	1	15 1/2#	12.50	258
XA 776	Guide, door	1	8#	2.10	253
XA 777	Nut, hexagon-5/16" N.C.	10	50 pcs.1#	.70*	
XA 778	Washer, flat-5/16" Std.	10	90 pcs.1#	.20*	
XA 779	Panel, cab-outer section	1	145#	34.00	258
XA 780	Door, hinged	1	57#	15.00	258
XA 781	Door, operator's	1	102#	53.10	258
XA 782	Glass, sash	4	3#	.60	258
XA 783	Sash, window-with glazing angles and cork assembled	1	13 1/4#	20.00	258
XA 784	Latch, door	2	16 pcs.1#	.80	
XA 785	Rivet, iron-1/4" x 5/8"	10	77 pcs.1#	.10*	
XA 786	Track, door roller	2	11#	2.75	
XA 787	Lock, door	6	5 pcs.1#	.50	
XA 788	Spring, door lock	6	16 pcs.1#	.35	
XA 789	Sash, window with glazing angles and cork assembled	1	10 1/2#	20.00	258
XA 790	Roller, door	8	1#	.55	
XA 791	Pin, roller	8	5 pcs.1#	.15	
XA 792	Panel, front with window sash	1	56#	17.50	258
XA 793	Door, roof	1	6 3/4#	4.00	258
XA 794	Rivet, iron-1/4" x 1-1/4"	1	43 pcs.1#	.20*	258
XA 795	Filler, latch	1	10 pcs.1#	.15	258
XA 796	Latch, door	1	5 pcs.1#	1.00	258
XA 797	Bolt, machine-3/8" x 1" N. C.	12	19 pcs.1#	.03	
XA 798	Glass, sash	2	2 1/2#	.50	258
XA 799	Sash, window with glaxing angles and cork assembled	1	6 1/2#	12.00	258
XA 800	Panel, cab-inner section	1	90#	42.00	258
XA 801	Glass, sash	2	3 1/2#	.60	258
XA 802	Sash, window with glazing angles and cork assembled	1	10 1/2#	20.00	258
XA 803	Bolt, spring PR-1000	1	16 pcs.1#	.05	258
XA 804	Glass, sash	2	3 3/4#	.70	258
XA 805	Sash, window with glazing angles and cork assembled	1	11#	19.00	258
XA 806	Glass, sash	4	7 1/2#	4.80	253

* Price Per 100 Pcs.
** Over 200 Pcs. Per Lb.

Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 807	Rod, tie	1	3/4#	$ .90	258
XA 808	Spacer, pipe	1	1 1/4#	.35	258
XA 809	Sash, window with glazing angles and cork assembled	1	10 1/2#	17.50	258
XA 810	Lock, window	4	16 pcs.1#	.30	258
XA 811	Nut, wing-1/4" N.C.	8	64 pcs.1#	.02	
XA 812	Bolt, stove-round head 1/4" x 3/4" N.C.	24	48 pcs.1#	.02	
XA 813	Washer, flat-1/4" Std.	8	142 pcs.1#	.10*	258
XA 814	Plate, front	1	9#	2.00	258
XA 815	Bar, latch	4	3 pcs.1#	2.00	258
XA 816	Section, inner-front	1	38#	19.00	259
XA 817	Roof, cab	1	55#	18.00	259
XA 818	Door, upper front	1	25#	7.90	259
XA 819	Slide, door	2	2 1/2#	1.00	259
XA 820	Member, cross-lower front	1	10 1/2#	2.70	259
XA 821	Section, inner-rear	1	22#	10.50	259
XA 822	Guide, door	1	8#	2.40	259
XA 823	Handle, door	1	4 pcs.1#	.24	259
XA 824	Door, sliding	1	20#	7.25	259
XA 825	Connector, panel	1	3/4#	.45	259
XA 826	Section, outer-front	1	155#	43.00	259
XA 827	Panel, rear side	1	35#	8.40	259
XA 828	Door, sliding	1	92#	20.00	259
XA 829	Roof, rear	1	121#	22.00	260
XA 830	Back, cab	1	285#	52.00	260
XA 831	Door, rear-half	1	66#	11.50	260
XA 832	Guide, door	1	11 1/2#	7.00	260
XA 833	Door, rear-half	1	60#	12.00	260
XA 834	Track, door roller	1	30#	10.00	260
XA 835	Guard, bulkhead-top	1	28#	8.10	261
XA 836	Guide, flared	1	2 1/4#	1.45	261
XA 837	Plate, guard	1	3/4#	1.10	261
XA 838	Cover, plate	1	3 1/2#	.85	261
XA 839	Bracket, brake	2	2#	.75	261
XA 840	Door, hinge	1	1 3/4#	2.25	261
XA 841	Rivet, round head 5/16" x 1/2" long (iron)	2	48 pcs.1#	.30*	261
XA 842	Cover, plate	2	3/4#	1.75	261
XA 843	Bulkhead, upper	1	35#	15.00	261
XA 844	Support, angle	1	1#	.65	261
XA 845	Bolt, stove-round head 5/16" x 1-1/4" N.C.	2	23 pcs.1#	.03	261
XA 846	Plate, guard	1	3/4#	.90	261
XA 847	Bulkhead, top-upper	1	.7 1/2#	1.50	261
XA 848	Bulkhead, front	1	19 1/2#	4.20	261
XA 849	Bulkhead, top-lower, with hinged door	1	9 1/2#	5.10	261
XA 850	Plate, side	1	1 1/2#	.85	261
XA 851	Plate, side	1	1 1/2#	.60	261
XA 852	Guard, bulkhead side	1	14 1/2#	3.90	261
XA 853	Plate, connection	1	1#	.30	261
XA 854	Bulkhead, lower-side	1	22 1/2#	12.00	261
XA 855	Support, angle	1	1 1/2#	.60	261

* Price Per 100 Pcs.
** Over 200 Pcs. Per Lb.

Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 856	Guard, bulkhead side	1	11 1/2#	$4.80	261
XA 857	Plate, connection	1	8 pcs.1#	.24	261
XA 858	Bulkhead, lower-side	1	17#	9.90	261
XA 859	Support, angle	1	1#	.70	261
XA 860	Bulkhead, upper	1	32#	15.00	261
XA 861	Support, angle	1	1#	.24	261
XA 862	Nipple, W.I.-1/4" x 1 1/2"	2	22 pcs.1#	.05	
XA 863	Nipple, W.I.-1/4" x 6"	3	5 pcs.1#	.10	
XA 864	Nipple, W.I.-1/4" x 8-1/2"	1	3 pcs.1#	.22	263
XA 865	Bracket, grease pipe	1	10 pcs.1#	.18	263
XA 866	Nipple, W.I.-1/4" x 9"	3	3 pcs.1#	.26	263
XA 867	Nipple, W.I.-1/4" x 5"	2	6 pcs.1#	.08	263
XA 868	Nipple, W.I.-1/4" x 3-1/2"	1	8 pcs.1#	.07	263
XA 869	Support, grease pipe	3	8 pcs.1#	.24	263
XA 870	Pipe, W.I.-1/4" x 25"	2	1#	.55	263
XA 871	Pipe, W.I.-1/4" x 27-1/2"	1	1#	.57	263
XA 872	Pipe, W.I.-1/4" x 15-1/2"	1	2 pcs.1#	.35	263
XA 873	Union, half WE-W48x5	2	20 pcs.1#	.17	263
XA 874	Tubing, flexible grease	2	8 pcs.1#	1.15	263
XA 875	Union, half WE-W48x5A	2	13 pcs.1#	.24	263
XA 876	Nipple, W.I.-1/4" x 3"	4	10 pcs.1#	.06	
XA 877	Elbow, W.I.-1/4" x 45°	2	12 pcs.1#	.14	263
XA 878	Pipe, W.I.-1/4" x 29"	1	1#	.57	263
XA 879	Pipe, W.I.-1/4" x 24"	1	3/4#	.55	263
XA 880	Support, grease pipe	1	1 1/4#	.70	263
XA 881	Pipe, W.I.-1/4" x 13-1/2"	1	2 pcs.1#	.30	263
XA 882	Pipe, W.I.-1/4" x 8"	1	7 pcs.1#	.20	263
XA 883	Nipple, W.I.-1/4" x 10"	1	3 pcs.1#	.28	263
XA 884	Plate, attachment	1	3 pcs.1#	.70	264
XA 885	Screw, drive-#7x1/2" Parker-Kalon	24	16 pcs.1#	.50*	
XA 886	Guard, cable	1	32#	7.50	264
XA 887	Boom, crane inner section	1	780#	270.00	264
XA 888	Sheave, boom suspension with bushing	1	19 1/2#	16.00	265
XA 889	Bushing, bronze	3	1 1/2#	3.50	
XA 890	Dowel, bronze	10	16 pcs.1#	.05	
XA 891	Cotter, 3/8" x 2-1/2"	1	13 pcs.1#	.02	265
XA 892	Pin, housing	1	6 1/2#	1.50	265
XA 893	Pin, lock	2	5 pcs.1#	.30	265
XA 894	Anchor, dead end	1	6#	2.50	265
XA 895	Anchor, dead end	1	6#	2.50	265
XA 896	Pin, sheave	1	4 1/2#	3.00	265
XA 897	Cotter, 3/8" x 3-1/2"	3	10 pcs.1#	.02	
XA 898	Housing, sheave	1	16#	17.50	265
XA 899	Bracket, housing	1	36 1/2#	12.50	265
XA 900	Boom, crane-outer section	1	835#	276.00	265

* Price Per 100 Pcs.
** Over 200 Pcs. Per Lb.

Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 901	Nut, square-3/8" N.C.	8	28 pcs.1#	$ .01	265
XA 902	Bolt, stove-round head 3/8" x 3/4"	8	20 pcs.1#	.03	265
XA 903	Plate, name	2	1#	.90	265
XA 904	Yoke, boom point	1	145#	73.00	265
XA 905	Rivet, button head 5/8" x 1-3/4" (Steel)	18	4 pcs.1#	.02	265
XA 906	Plate, filler	2	3#	.60	265
XA 907	Sheave,point with bushing	2	45#	32.00	266
XA 908	Washer, thrust	2	2 pcs.1#	.17	266
XA 909	Spacer, pipe	2	3/4#	.35	266
XA 910	Sheave, suspension with bushing	2	18 1/2#	12.00	266
XA 911	Spacer, cast iron	2	4 1/4#	1.10	266
XA 912	Bushing, bronze	2	2#	3.00	266
XA 913	Guard, cable-bottom	2	23 1/2#	6.00	266
XA 914	Guard, cable-center	1	7 1/2#	17.00	266
XA 915	Guard, cable-top	1	5#	2.10	266
XA 916	Cotter, 1/2" x 3-1/2"	6	5 pcs.1#	.05	
XA 917	Shaft, boom point sheave	1	31#	7.00	266
XA 918	Washer, thrust	1	1#	2.70	266
XA 919	Sheave, hook block with bushing	1	40#	35.00	268
XA 920	Dowel, bronze-1/4" x 7/8"	1	70 pcs.1#	.02	268
XA 921	Bushing, bronze	1	1 3/4#	3.60	268
XA 922	Washer, thrust	2	1#	.90	268
XA 923	Plate, block	1	65#	35.00	268
XA 924	Plate, cheek	2	145#	27.00	268
XA 925	Spacer, pipe	4	2 pcs.1#	.25	268
XA 926	Bolt, machine-3/4" x 11" N. C.	4	1 1/2#	.20	268
XA 927	Socket, cable wedge	1	8#	4.20	268
XA 928	Cotter, 3/8" x 2-1/4"	2	15 pcs.1#	.02	268
XA 929	Pin, wedge socket	1	2 1/4#	.65	268
XA 930	Screw, cap-flat head 1/2" x 1" N. C.	2	8 pcs.1#	.09	268
XA 931	Washer, 1524-1	2	**	.05	268
XA 932	Plate, lock	1	2 pcs.1#	2.40	268
XA 933	Pin, sheave	1	9#	3.00	268
XA 934	Nipple, W.I.-1/8" x 2"	1	25 pcs.1#	.05	268
XA 935	Plate, block	1	65#	35.00	268
XA 936	Pin, Lock	1	8 pcs.1#	.05	268
XA 937	Nut, slotted	1	4#	2.50	268
XA 938	Bearing, roller RC-CT-19	1	2 1/4#	27.00	268
XA 939	Pin, hook	1	9#	9.50	268
XA 940	Hook, 10 ton - 15 Williams-Vulcan 223B1	1	46#	40.00	268
XA 941	Conduit, 1/2" x 67" long	1	4 1/2#	.50	270
XA 942	Fitting, Kondu-1/2" F-C2	3	1#	.60	
XA 943	Conduit, 1/2" x 7" long	1	2 pcs.1#	.10	270
XA 944	Fitting, Kondu-1/2" K-E2	6	3/4#	.40	

* Price Per 100 Pcs.
** Over 200 Pcs. Per Lb.

Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 945	Receptacle, Kondu-1/2" K-PRS2	3	3 pcs.1#	$ .55	270
XA 946	Bushing, socket-3/8"	3	**	.01	270
XA 947	Cap, socket BR-3981	3	8 pcs.1#	.10	270
XA 948	Body, socket BR-3984	3	5 pcs.1#	.30	270
XA 949	Lamp, 60 watt-110 volt Westinghouse	3	10 pcs.1#	.10	270
XA 950	Fitting, Kondu-1/2" K-T2	4	1#	.75	270
XA 951	Conduit, 1/2" x 36" long 212E367-31	1	2 1/2#	.30	270
XA 952	Wire, R.C #14-90' 0" long	1	1 1/4#	1.80	270
XA 953	Nut, wire	12	112 pcs.1#	.05	
XA 954	Cover, Kondu K-200	4	9 pcs.1#	.07	270
XA 955	Conduit, 1/2" x 73" long	1	4 3/4#	.55	270
XA 956	Strap, pipe-1/2"	2	25 pcs.1#	.01	270
XA 957	Cover, Kondu-1/2" K-210G23	3	8 pcs.1#	.35	270
XA 958	Cord, 16-2 Super Service 7" long	3	10 pcs.1#	.10	270
XA 959	Conduit, 1/2" x 61" long	1	4#	.45	270
XA 960	Fitting, Kondu-1/2" K-LR2	1	1#	.60	270
XA 961	Nut, wire 106	11	48 pcs.1#	.05	
XA 962	Conduit, 1/2" x 26" long	1	1 3/4#	.20	270
XA 963	Fitting, Kondu-1/2" K-A2	2	3/4#	.40	270
XA 964	Gasket, Kondu K-GR2	10	80 pcs.1#	.12	
XA 965	Support, light	1	11 3/4#	1.20	270
XA 966	Brace, support	2	8 pcs.1#	.25	270
XA 967	Bolt, stove-round head 5/16" x 3"	2	13 pcs.1#	.04	270
XA 968	Connector, Greenfield KC12	1	5 pcs.1#	.10	270
XA 969	Conduit,1/2" x 2-1/2" long	2	7 pcs.1#	.05	270
XA 970	Conduit, 1/2" x 50" long	1	3 1/4#	.40	270
XA 971	Plate, switch K-1781B	1	6 pcs.1#	.10	270
XA 972	Conduit, 1/2" x 29" long	1	2#	.20	270
XA 973	Fitting, Kondu-1/2" K-LB2	1	1#	.60	270
XA 974	Conduit, 1/2" x 42" long	1	2 3/4#	.25	270
XA 975	Nipple, special 1/2" x 1-1/4" thread one end	1	5 pcs.1#	.05	270
XA 976	Elbow, Pyle-National PN-FCCF-11-L	1	3/4#	.50	270
XA 977	Conduit, Greenfield-1/2" x 10"	1	2 pcs.1#	.10	270
XA 978	Conduit, 1/2" x 28" long	1	2#	.20	270
XA 979	Cover, Kondu K-21F4	6	6 pcs.1#	.35	
XA 980	Grip, cord-complete PN-DB3	7	6 pcs.1#	.30	
XA 981	Body, cable grip PN-DB-3-A	7	9 pcs.1#	.15	
XA 982	Grommet, rubber PN-DB-4-C	13	**	.08	

* Price Per 100 Pcs.
** Over 200 Pcs. Per Lb.

Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 983	Nut, cable grip PN-DB-4-B	13	32 pcs.1#	$ .15	
XA 984	Support, light	1	4 1/2#	1.85	270
XA 985	Bracket, switch	1	3 pcs.1#	.30	270
XA 986	Fitting, Kondu-1/2" K-FSE12	1	2#	1.00	270
XA 987	Switch, toggle K-1L1311	2	11 pcs.1#	.40	270
XA 988	Receptacle-2 Pole Midget Triploc "Female" PN-RAD-3115221	3	5 pcs.1#	1.50	
XA 989	Contact, female PN-RA215	3	16 pcs.1#	.95	
XA 990	Shell, plug-female PN-RAD15031	3	8 pcs.1#	.85	
XA 991	Cord, 16-2 Super Service 10-1/2" long	1	8 pcs.1#	.10	270
XA 992	Conduit,1/2" x 16'-0"long	1	12 1/2#	1.44	271
XA 993	Wire, #14R.C.-85'-0" long	1	5#	1.70	271
XA 994	Cord, 16-2 Super Service 16" long	1	4 pcs.1#	.10	271
XA 995	Shell,plug-male PN-PA15031	3	5 pcs.1#	.85	
XA 996	Contact, male PN-PA215	3	21 pcs.1#	.95	
XA 997	Plug, male-2 pole PN-Midget Triploc PAD3115221	3	3 pcs.1#	1.50	
XA 998	Conduit,1/2" x 28-1/2"long	1	2#	.20	271
XA 999	Pin, swivel	1	1 1/2#	1.00	271
XA 1000	Bracket, angle	1	5 1/2#	1.70	271
XA 1001	Bracket, angle	1	5 1/2#	1.70	271
XA 1002	Conduit,1/2" x 18'-0" long	1	16#	1.60	271
XA 1003	Cord, 16-2 Super Service 12" long	3	5 pcs.1#	.10	271
XA 1004	Closure, reflector CH-KL5694	2	1 1/4#	2.30	272
XA 1005	Screw, machine-round head #6-32x3/4"	4	**	.01	272
XA 1006	Bolt, carriage-1/4"-20 x 3/4" long	4	35 pcs.1#	.02	272
XA 1007	Washer, lock CH-KL5296	4	48 pcs.1#	.04	272
XA 1008	Support, reflector CH-KL1193	2	2 pcs.1#	.75	272
XA 1009	Lens, reflector CH-HL6814	2	1 1/2#	3.50	272
XA 1010	Reflector, flood light CH-KL5366	2	1 3/4#	8.50	272
XA 1011	Ring, lens clamping with screws CH-KL5675	2	3 pcs.1#	1.50	272
XA 1012	Grommet, rubber CH-HL6537	2	48 pcs.1#	.13	272
XA 1013	Washer, retainer CH-KL5695	2	16 pcs.1#	.35	272
XA 1014	Holder, socket CH-KL5691	2	3 pcs.1#	.75	272
XA 1015	Socket, lamp CH-KL1198	2	4 pcs.1#	.50	272
XA 1016	Lamp, 250 Watt.-110 volts Westinghouse	2	4 pcs.1#	1.15	272
XA 1017	Screw, machine-round head #8-32x1/2"	2	**	.01	272

* Price Per 100 Pcs.
** Over 200 Pcs. Per Lb.

Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 1018	Cord, service CH-KL5700	2	4 pcs.1#	$1.00	272
XA 1019	Plug, Benjamin 903	3	12 pcs.1#	.20	
XA 1020	Socket, light	3	1 1/2#	1.05	
XA 1021	Lamp, 100 Watt-110 volts Westinghouse	1	10 pcs.1#	.15	273
XA 1022	Ell, Condulet VEL1190	1	3/4#	.35	273
XA 1023	Nipple, close-1/2" W.I.	2	14 pcs.1#	.05	273
XA 1024	Bolt, stove-flat head 1/4-20x3/4"	4	50 pcs.1#	.02	273
XA 1025	Flange, floor-1/2"	1	2 pcs.1#	.25	273
XA 1026	Reflector, light G0-90228	1	1 3/4#	1.90	273
XA 1027	Cord, Super Service 16-2 x 23" long	1	10 pcs.1#	.10	273
XA 1028	Cord, 16-2 Super Service 24" long	1	3 pcs.1#	.15	274
XA 1029	Screw, machine #4-36x 5/32" Hd. Stl.Rolled thread (Cad.Pct.)	2	**	.02	274
XA 1030	Grip, cord PN-BD945	1	2 pcs.1#	.65	274
XA 1031	Nut, compression PN-DB-9-B	1	4 pcs.1#	.18	274
XA 1032	Grommet, rubber PN-DB-9-D	1	**	.12	274
XA 1033	Elbow, cord grip PN-DB945-A	1	3 pcs.1#	.48	274
XA 1034	Bracket, swivel	1	3 3/4#	1.30	274
XA 1035	Reflector, light- less socket G0-50216	2	4 1/2#	3.05	274
XA 1036	Lamp, 200 Watt-110 volts Westinghouse	2	4 pcs.1#	.27	
XA 1037	Cord, 16-2 Super Service 17" long	1	4 pcs.1#	.10	275
XA 1038	Bracket, reflector	1	8 3/4#	1.25	275
XA 1039	Pliers, 6"	1	2 pcs.1#	.50	276
XA 1040	Wrench, spanner for brakes	1	1 1/2#	.70	276
XA 1041	Wrench, water pump	1	10 pcs.1#	.20	276
XA 1042	Wrench, open end-Bonney 1-1/4" for adjusting clutches ~~1240~~	1	3 pcs.1#	1.65	276
XA 1043	Wrench, adjusting cres-ent 10"	1	1#	1.55	276
XA 1044	Gun, Alemite Grease-13 oz. A-6637	1	3 1/2#	5.75	276
XA 1045	Wrench, double head for 5/8" and 3/4" nuts 37	1	2#	1.75	276
XA 1046	Hose, grease gun-Alemite 15" with coup-ling A-5823	1	3/4#	6.30	276
XA 1047	Wrench, double head for 7/8" and 1" nuts 41	1	4#	4.20	276
XA 1048	Can, oil-1/2 pint	1	3 pcs.1#	.40	276
XA 1049	Wrench, 18" pipe	1	4 1/4#	2.65	276
XA 1050	Grit, Aloxite cloth 2" x 18" #50	1	16 pcs.1#	.10	276
XA 1051	Wrench, monkey-12"	1	2 1/2#	2.55	276
XA 1052	Wrench, box for 5/8" nuts	1	1#	1.20	276

* Price Per 100 Pcs.
** Over 200 Pcs. Per Lb.

Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 1054	Padlock, laminated with chain and keys	3	2 pcs.1#	$ .65	276
XA 1056	Wrench, spark plug with handle	1	2 pcs.1#	.25	276
XA 1057	Crank, starting	1	6#	7.00	276
XA 1058	Wrench, socket for crawler tie bracket bolts	1	3#	1.50	276
XA 1059	Wrench, offset socket for 3/4" nuts	1	2 3/4#	2.10	276
XA 1060	Extinguisher, fire-Pyrene PY-C31-T	1	9 3/4#	11.50	276
XA 1061	Wrench, drum barrel for 3/4" x 7/8" nuts	1	3/4#	1.65	276
XA 1062	Chisel, Doso-3/4" x 9"	1	1#	.75	276
XA 1063	Bolt, stove-round head 3/16" x 1/2"	12	106 pcs.1#	.50*	
XA 1064	Wrench, crawler	1	8 1/2#	4.30	276
XA 1065	Driver, screw	1	2 pcs.1#	.70	276
XA 1066	Link, repair for traction chain	1	3#	1.40	276
XA 1067	Pipe, grease for pilot bearing	1	6 pcs.1#	.31	276
XA 1068	Hammer, ball Peen-2 lbs.	1	2 1/4#	1.20	276
XA 1069	Pin, drift	1	1#	.40	276
XA 1070	Pin, rivet-43/64" long A-51538	1	165 pcs.1#	.02	278
XA 1071	Pin, rivet-21/32" long A-50897	2	192 pcs.1#	.05	278
XA 1072	Spacer, link A-50899	1	**	.03	278
XA 1073	Pin, rivet-17/32" long A-50896	1	**	.05	278
XA 1074	Link, pivot A-50898	2	48 pcs.1#	.10	278
XA 1075	Piston,head- Not sold separately Order XA 1076				
XA 1076	Head, piston and A-G50911	1	3/4#	2.15	278
XA 1077	Plug, adjusting-1/8" A-A-155	1	55 pcs.1#	.02	278
XA 1078	Follower, grease A-G52036	1	20 pcs.1#	.60	278
XA 1079	Nut, hexagon-1/4" x 20 A-40855	1	125 pcs.1#	.05	278
XA 1080	Packing, cord A-52038	1	**	.05	278
XA 1081	Nut, Hexagon A-53735	1	22 pcs.1#	.25	278
XA 1082	Spring, main A-52032	1	4 pcs.1#	.50	278
XA 1083	Lever, hand A-5092	1	3/4#	1.00	278
XA 1084	Sleeve, piston A-51914	1	18 pcs.1#	.10	278
XA 1085	Gasket, cylinder A-50903	1	**	.05	278
XA 1086	Cylinder, grease A-G50888	1	1#	2.00	278
XA 1087	Latch, release A-52031	1	10 pcs.1#	.15	278
XA 1088	Knob, follower A-42221	1	3 pcs.1#	.35	278
XA 1089	Rod, follower A-52037	1	4 pcs.1#	.50	278

* Price Per 100 Pcs.
** Over 200 Pcs. Per Lb.

Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 1090	Spring, follower A-53751	1	45 pcs.1#	$ .10	278
XA 1091	Plug, body A-42023	1	28 pcs.1#	.30	277
XA 1092	Gasket, plug A-G-985	1	**	.05	277
XA 1093	Seal, rubber A-301080	1	**	.25	277
XA 1094	Washer, steel A-301081	1	**	.03	277
XA 1095	Spring, check A-Z715	1	**	.03	277
XA 1096	Adaptor, hose A-301976	1	8 pcs.1#	.30	277
XA 1097	Ball, steel A-C-122	1	**	.05	277
XA 1098	Body, coupling A-42035	1	2 pcs.1#	2.25	277
XA 1099	Hose, grease-18" A-G51410	1	3 pcs.1#	1.60	277
XA 1100	Ring, hose A-43809	1	10 pcs.1#	.10	277
XA 1101	Stud, female A-H-15-100	1	17 pcs.1#	.15	277
XA 1102	Cup, leather A-46118	1	**	.04	277
XA 1103	Body, connection A-H-15-99	1	7 pcs.1#	.25	277
XA 1104	Spring, swivel A-A-618	1	**	.03	277
XA 1105	Washer, steel A-43851	1	**	.02	277
XA 1106	Stem, lock plate PY-6B	1	20 pcs.1#	.09	280
XA 1107	Washer, packing PY-24	2	**	.04	280
XA 1108	Plate, lock PY-6	1	30 pcs.1#	.27	280
XA 1109	Shim, pump PY-20	2	**	.02	280
XA 1110	Sleeve, chamber PY-30A	1	12 pcs.1#	.22	280
XA 1111	Cap, filler PY-4	1	30 pcs.1#	.27	280
XA 1112	Washer, filler cap PY-25	1	**	.05	280
XA 1113	Chamber, upper valve PY-31A	1	6 pcs.1#	.90	280
XA 1114	Sleeve, brass PY-16A	1	20 pcs.1#	.11	280
XA 1115	Cap, top PY-29	1	6 pcs.1#	.36	280
XA 1116	Body, brass PY-35	1	1 1/2#	3.60	280
XA 1117	Ball, valve PY-18 Not sold separately, Order XA 1127and XA 1113	4			280
XA 1118	Tube, suction PY-33	1	24 pcs.1#	.18	280
XA 1119	Tube, pump PY-41	1	6 pcs.1#	1.10	280
XA 1120	Rod, valve ball PY-17	1	66 pcs.1#	.18	280
XA 1121	Tube, piston valve PY-38A	1	6 pcs.1#	.72	280
XA 1122	Spool, slide valve PY-3A	1	32 pcs.1#	.18	280
XA 1123	Nozzle, tube PY-1	1	34 pcs.1#	.13	280
XA 1124	Packing, slide valve PY-10	1	**	.02	280
XA 1125	Nut, packing PY-9C	1	90 pcs.1#	.09	280
XA 1126	Stop, spool PY-2A Not sold separately, Order XA 1121	1			280
XA 1127	Chamber, lower valve PY-31A	1	6 pcs.1#	.90	280
XA 1128	Bracket, extinguisher PY-B4T	1	1#	1.50	280
XA 1129	Pin, handle PY-46	1	**	.04	280
XA 1130	Handle, operating PY-7F	1	1#	1.35	280
XA 1131	Cap, piston valve tube PY-5	1	83 pcs.1#	.09	280
XA 1132	Spring, washer retainer PY-12	1	**	.04	280

* Price Per 100 Pcs.
** Over 200 Pcs. Per Lb.

Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 1133	Sleeve, sealing plug PY-43C	1	50 pcs.1#	$ .18	280
XA 1134	Spring, handle PY-21	1	140 pcs.1#	.05	280
XA 1135	Retainer, sealing washer PY-13	1	41 pcs.1#	.09	280
XA 1136	Washer, handle sealing PY-28	1	**	.05	280
XA 1137	Tube, nozzle PY-39A	1	17 pcs.1#	.18	280
XA 1138	Cable, boom hoist-6 strand 19 wire improved plow steel-hemp center 1/2" x 300'-0"	1	124#	36.00	282
XA 1139	Wedge, socket	1	2 pcs.1#	.50	282
XA 1140	Pin, wedge	1	3/4#	.35	282
XA 1141	Socket, wedge	1	5#	.60	282
XA 1142	Cable, hoist-6 strand-19 wire, improved plow steel Hemp center 5/8" x 213'-0"	1	135#	44.73	282
XA 1145	Plate, capacity	1	3/4#	2.40	283
XA 1146	Screw, drive -#2x1/4"	8	**	.30*	283
XA 1147	Plate, instruction for lower traction brakes	1	4 pcs.1#	.60	283
XA 1148	Chart, cable length	1			283
XA 1149	Plate, serial	1	2 pcs.1#	.85	283
XA 1150	Rivet, round head 3/16" x 1/4"	4	**	.18*	283
XA 1151	Plate, guarantee	1	5 pcs.1#	.30	283
XA 1152	Bolt, machine-1" x 14" N. C.	8	4#	.41	284
XA 1153	Counterweight, corner	2	250#	25.00	284
XA 1154	Counterweight, center	2	250#	25.00	284
XA 1155	Counterweight, iron ore	1	3000#		284
XA 1156	Bolt, lever PM-F3905	1	2 pcs.1#	.20	285
XA 1157	Cotter, 3/16" x 1-3/4"	2	25 pcs.1#	.30*	285
XA 1158	Nut, slotted-Hex.3/4"-10 N. C.	2	6 pcs.1#	.06	285
XA 1159	Bumper, door PM-F3811	2	3 1/2#	2.55	285
XA 1160	Hinge, dipper PM-B3000-A	2	50#	15.60	285
XA 1161	Pivot, latch lever PM-F3977	1	2 1/2#	6.10	285
XA 1162	Nut, slotted Hex.-1"-8 N. C.	1	3 pcs.1#	.11	285
XA 1163	Plate, door PM-B3068	1	160#	39.50	285
XA 1164	Bolt, lever PM-F3906	1	2 pcs.1#	.20	285
XA 1165	Washer, 3/4" wrought	2	8 pcs.1#	.01	285
XA 1166	Bushing, hinge PM-PC974	2	1 1/2#	1.35	285
XA 1167	Rivet, button head 5/8" x 2-1/4"	28	4 pcs.1#	.02	285
XA 1168	Guide, latch lever PM-F3989	1	5 3/4#	2.55	285
XA 1169	Lever, latch PM-F3990	1	6#	1.20	285
XA 1170	Rivet, button head 5/8" x 2-3/4"	5	3 pcs.1#	.02	285
XA 1171	Guide, rear latch bar PM-F3909A	1	31 1/2#	11.35	285

* Price Per 100 Pcs.
** Over 200 Pcs. Per Lb.

Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each
XA 1172	Guide, front latch bar PM-F3808A	1	27 1/2#	$10.35
XA 1173	Bar, latch PM-F3889	1	19#	8.00
XA 1174	Washer, wrought-1-3/4" PM-F3991	2	2 pcs.1#	.40
XA 1175	Bushing, hinge PM-PC973-1	8	1#	1.75
XA 1176	Cotter, 1/2" x 2 1/2"	2	6 pcs.1#	.03
XA 1177	Pin, hinge PM-PC946-4	2	5#	3.25
XA 1178	Cotter, 1/2" x 3"	14	5 pcs.1#	.04
XA 1179	Pin, stick foot PM-PC918-7	2	8#	2.70
XA 1180	Body, dipper PM-AA808	1	600#	353.00
XA 1181	Pin, dipper block	2	10 1/2#	2.35
XA 1182	Cotter, 5/8" x 3"	2	3 pcs.1#	.06
XA 1183	Bushing, dipper block PM-PC973	6	3/4#	1.75
XA 1184	Washer, flat-1-3/4" W.I.	6	2 pcs.1#	.30
XA 1185	Insert, latchkeeper PM-F3985	1	2 3/4#	1.40
XA 1186	Rivet, liverpool-3/4" x 3"	2	2 pcs.1#	.10
XA 1187	Front, dipper PM-A793-A	1	496#	145.00
XA 1188	Point, dipper PM-730-8M	4	15#	6.50
XA 1189	Wedge, point-for driving out socket points PM-F3279	1	4 1/2#	2.20
XA 1190	Rivet, liverpool-3/4" x 2-3/4"	8	2 pcs.1#	.10
XA 1191	Rivet, liverpool 3/4" x 3-1/4"	24	2 pcs.1#	.10
XA 1192	Member, dipper stick side with crowding racks	1	770#	240.00
XA 1193	Stop, crowding	2	5#	5.50
XA 1194	Member, dipper stick side with crowding racks	1	770#	240.00
XA 1195	Spacer, link	2	1 1/2#	1.05
XA 1196	Bushing,adjusting link PM	2	1#	1.15
XA 1197	Spacer, oak block	1	10#	3.85
XA 1198	Bolt, special	8	3 1/4#	.90
XA 1199	Rack, crowding-68 teeth	2	98#	57.50
XA 1200	Cover, wood filler	1	30 1/2#	4.50
XA 1201	Rack, crowding-22 teeth	2	33#	18.00
XA 1202	Spacer, pipe	8	1 1/2#	.40
XA 1203	Link, adjusting	2	18#	6.00
XA 1204	Link, adjusting	2	18#	6.00
XA 1205	Shim, filler block	2	5#	.65
XA 1206	Spacer, oak block	5	11#	2.50
XA 1207	Cover, wood filler	1	31#	4.50
XA 1208	Angle, support	2	2#	1.25
XA 1209	Bushing, stick foot PM-2093	2	1/2#	1.15
XA 1210	Plate, attachment	1	3 pcs.1#	.75
XA 1211	Nut, hexagon-7/16" N.C.	4	20 pcs.1#	.01
XA 1212	Washer, thrust	4	1 1/4#	2.10
XA 1213	Nut, slotted	2	3/4#	1.80
XA 1214	Washer, flat	2	1 1/2#	4.80

* Price Per 100 Pcs.
** Over 200 Pcs. Per Lb.

Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 1215	Bushing, saddle block	4	2 3/4#	$2.75	288
XA 1216	Spacer, saddle block	2	7#	12.50	288
XA 1217	Rod, lock	2	2 pcs.1#	.60	288
XA 1218	Nut, Hex. Half-1-1/8" N. C.	4	3 pcs.1#	.15	288
XA 1219	Nut, Hex.-1-1/8" N.C.	4	3/4#	.12	288
XA 1220	Block, saddle with bushing	2	98#	60.00	288
XA 1221	Nut, square	4	2 pcs.1#	.25	288
XA 1222	Bolt, gib adjusting	4	1 3/4#	1.30	288
XA 1223	Sprocket, chain	1	43#	27.00	288
XA 1224	Bolt, lock	2	5 pcs.1#	.45	288
XA 1225	Bushing, flanged	2	22#	18.50	288
XA 1226	Shim, bushing	2	3 pcs.1#	.50	288
XA 1227	Pinion, crowd	2	55#	42.00	288
XA 1228	Gib, saddle block	2	41#	8.50	288
XA 1229	Key, straight	2	3/4#	.60	288
XA 1230	Shaft, shipper with nuts	1	78#	110.00	288
XA 1231	Pin, lock	1	16 pcs.1#	.24	288
XA 1232	Pin, sheave	1	1#	1.15	288
XA 1233	Pin, sheave	1	1#	1.80	288
XA 1234	Shaft, boom point	1	70 1/2#	11.00	290
XA 1235	Bolt, machine 5/8" x 5-1/2" N. C.	2	2 pcs.1#	.10	290
XA 1236	Guard, sheave	2	10#	8.50	290
XA 1237	Wedge, socket	2	1#	.70	
XA 1238	Bushing, bronze	1	3 1/4#	2.70	290
XA 1239	Sheave, boom point with bushing	1	93#	46.00	290
XA 1240	Sheave, dummy	1	94#	36.00	290
XA 1241	Bushing, sheave pin	2	5 1/2#	7.50	292
XA 1242	Washer, thrust	2	1#	1.20	292
XA 1243	Sheave, padlock block	1	44#	26.50	292
XA 1244	Bolt, machine 7/8" x 6 1/2" N. C.	2	1 1/2#	.22	292
XA 1245	Bolt, machine 7/8" x 7 1/2" N. C.	2	1 3/4#	.24	292
XA 1246	Washer, bevel	2	3 pcs.1#	.50	292
XA 1247	Block, padlock	1	114#	30.00	292
XA 1248	Washer, flat	3	15 pcs.1#	.04	292
XA 1249	Pin, anchor	1	2 pcs.1#	.65	292
XA 1250	Cotter, 1/4" x 1-1/4"	1	55 pcs.1#	.60*	292
XA 1251	Key, lock	1	8 pcs.1#	.30	292
XA 1252	Pin, sheave	1	11 3/4#	3.90	292
XA 1253	Bushing, Manr. steel	4	1 3/4#	1.80	292
XA 1254	Assembly, padlock block	1	200#	96.00	292
XA 1255	Plate, lock	2	5 pcs.1#	.20	293
XA 1256	Screw, cap-3/4" x 1-1/2" N. C.	4	2 pcs.1#	.10	293
XA 1257	Guide, tension bolt	2	2 3/4#	4.00	293
XA 1258	Block, bearing	2	17#	13.50	293
XA 1259	Sprocket, idler with bushing	2	48 1/2#	21.50	293
XA 1260	Bolt, tension	2	5 1/2#	1.80	293
XA 1261	Bolt, anchor	1	3#	.60	293
XA 1262	Shaft, idler sprocket	2	22#	4.50	293

* Price Per 100 Pcs.
** Over 200 Pcs. Per Lb.

Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 1263	Rivet, flat head #250 x 1/2" brass	4	120 pcs.1#	$ .01	293
XA 1264	Guide, chain	1	3/4#	.70	293
XA 1265	Roller, chain link JE-1641AA	2	4 pcs.1#	.25	293
XA 1266	Pin, link with lock pin JE-1641AA	2	3 pcs.1#	.35	
XA 1267	Link, repair with side bars, rollers, link and lock pins JE-1641AA	1	1 3/4#	1.20	293
XA 1268	Bolt, carriage 5/8" x 2-1/2"	1	3 pcs.1#	.08	293
XA 1269	Nut, Hexagon half-1" N. C.	3	4 pcs.1#	.09	
XA 1270	Chain, crowd-144 links Jeffery steel thimble JE-1641AA	1	255#	172.80	293
XA 1271	Bolt, carriage-5/8" x 1-3/4"	2	3 pcs.1#	.08	293
XA 1272	Plate, lock	1	3/4#	.95	293
XA 1273	Guide, chain	1	10#	3.20	293
XA 1274	Cover, inspection	1	9 1/2#	2.20	293
XA 1275	Plate, guide	2	4 3/4#	1.75	293
XA 1276	Casting, foot	2	580#	250.00	
XA 1277	Plate, instruction	1	5 pcs.1#	.50	293
XA 1278	Screw, cap-Hex. Head Parker-Kalon self threaded 3/8" dia. x 3/4"	20	20 pcs.1#	.02	
XA 1279	Plate, name	4	2#	1.50	
XA 1280	Boom, shovel	1	2565#	780.00	293
XA 1281	Plate, serial number	1	3 pcs.1#	.80	293
XA 1282	Bumper, oak	1	15#	2.70	293
XA 1283	Support, bumper	1	35#	6.60	293
XA 1284	Bolt, machine 3/4" x 7-1/2" N. C.	2	1 1/4#	.16	293
XA 1285	Plunger, dipper trip	1	6 1/4#	5.40	294
XA 1286	Bolt, blank	1	6 pcs.1#	.14	294
XA 1287	Rod, plunger	1	6 1/2#	1.35	294
XA 1288	Stop, spring	1	3/4#	.18	294
XA 1289	Spring, plunger	1	1 1/4#	.90	294
XA 1290	Wedge, socket	2	6 pcs.1#	.35	
XA 1291	Socket, wedge	1	1#	.85	294
XA 1292	Washer, flat	1	60 pcs.1#	.04	294
XA 1293	Link, special	4	18 pcs.1#	.75	294
XA 1294	Nut, Hex. Half-1-1/4" N. C.	2	2 pcs.1#	.21	294
XA 1295	Chain, trip	1	4 1/2#	4.00	294
XA 1296	Pin, shackle	1	3 pcs.1#	.35	294
XA 1297	Shackle, chain	1	1#	.95	294
XA 1298	Spacer, bearing	1	3/4#	1.70	295
XA 1299	Bearing, ball-N.D. ND-1209	1	1#	4.70	295
XA 1300	Guard, cable	1	4#	3.90	295
XA 1301	Link, clutch band-live end	1	2 1/4#	.70	295

* Price Per 100 Pcs.
** Over 200 Pcs. Per Lb.

Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 1302	Link,clutch band-dead end	1	8 pcs.1#	$ .40	295
XA 1303	Pin, one hole	1	16 pcs.1#	.24	295
XA 1304	Pin, one hole	2	16 pcs.1#	.25	295
XA 1305	Cotter, 1/8" x 3/4"	4	**	.10*	
XA 1306	Bearing, ball-N.D. N.D.-7209	2	1#	4.75	
XA 1307	Drum, clutch and winding	1	46#	24.00	295
XA 1308	Spring, tension	1	1 1/4#	.60	295
XA 1309	Pin, one hole	1	16 pcs.1#	.24	295
XA 1310	Cotter, 1/8" x 1-3/4"	1	**	.15*	295
XA 1311	Lining, clutch-J.M.200	1	3/4#	1.30	295
XA 1312	Rivet, brass-3/16" x 3/8"	14	**	.01	295
XA 1313	Band, friction with lining	1	3#	9.90	295
XA 1314	Cotter, 1/8" x 1-1/2"	2	**	.10*	
XA 1315	Lever, operating	1	3/4#	3.30	295
XA 1316	Screw, cap-Hex. head 1/2" x 1-1/2" N. C.	1	8 pcs.1#	.04	295
XA 1317	Pin, lift	1	40 pcs.1#	.80	295
XA 1318	Bushing, bronze	1	40 pcs.1#	.65	295
XA 1319	Pin, one hole	1	8 pcs.1#	.70	295
XA 1320	Spider, clutch with bushing	1	6 1/2#	16.00	295
XA 1321	Screw, drive-#7x1/4"	4	**	.50*	296
XA 1322	Plate, patent	1	16 pcs.1#	.75	296
XA 1323	Nut, castle-7/8" N.F.	1	2 pcs.1#	.08	296
XA 1324	Retainer, bearing	1	2 1/4#	5.00	296
XA 1325	Washer, flat-7/8"	2	8 pcs.1#	.02	296
XA 1326	Cover, gear case	1	62#	48.00	296
XA 1327	Bearing, ball-N.D. ND-7207	1	3/4#	2.60	296
XA 1328	Spacer, bearing	1	3 pcs.1#	1.10	296
XA 1329	Gear, drive	1	25#	22.00	296
XA 1330	Shaft, shifter	1	4#	2.25	296
XA 1331	Spacer, bearing	1	1#	1.70	296
XA 1332	Spacer, bearing	1	4 pcs.1#	1.70	296
XA 1333	Pin, one hole	1	1#	.60	296
XA 1334	Ring, shifter	1	1#	3.00	296
XA 1335	Spring, tagline	1	3/4#	1.10	296
XA 1336	Lever, hand	1	1 1/4#	2.70	296
XA 1337	Screw, cap-Hex. head 1/2" x 2" N. C.	1	6 pcs.1#	.05	296
XA 1338	Crank, shifting	1	1 3/4#	4.20	296
XA 1339	Bolt, special	1	4 pcs.1#	.24	296
XA 1340	Crank, adjusting yoke	1	3#	6.00	296
XA 1341	Pin, plunger	1	1#	4.80	296
XA 1342	Shaft, dipper trip	1	8 1/4#	18.75	296
XA 1343	Key, straight	1	4 pcs.1#	.24	296
XA 1344	Ring, shifter	1	2 pcs.1#	.95	296
XA 1345	Sheave, cable with bushing	1	1#	4.80	296
XA 1346	Bushing, bronze	1	12 pcs.1#	2.20	296
XA 1347	Bolt, shoulder	1	2 pcs.1#	.90	296
XA 1348	Bracket, sheave	1	4 1/2#	1.50	296
XA 1349	Cable, operating	1	1 3/4#	6.30	296
XA 1350	Drum, hoist	1	230#	78.00	298

* Price Per 100 Pcs.
** Over 200 Pcs. Per Lb.

Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 1351	Bolt, machine-3/4" x 5-1/2" N. C.	4	3/4#	$ .14	298
XA 1352	Sprocket, drive	1	224#	67.00	298
XA 1353	Bolt, stove-round head 5/16" x 5/8" long	6	30 pcs.1#	.02	300
XA 1354	Bracket, pan	1	1/2#	.50	300
XA 1355	Pan, drip	1	3 1/2#	1.00	300
XA 1356	Bracket, pan	1	1/2#	.50	300
XA 1357	Chain, reverse-39 links Jeffery Steel Thimble JE-1641AA	1	65#	46.80	300
XA 1358	Socket, wedge	1	8 1/2#	4.20	301
XA 1359	Cable, boom hoist - 6 strand, 19 wire, improved Plow Steel-Hemp Center Brown Strand 5/8" x 120'-0"	1	77#	25.20	301
XA 1360	Cable, dipper trip - 6 strand, 19 wire-Hemp Center-Plow Steel 5/16" x 33'-0"	1	6#	2.64	301
XA 1361	Cable, hoist- 6 Strand, 19 wire, improved Plow Steel-Hemp Center-Brown Strand 5/8" x 65'-0"	1	42#	13.65	301
XA 1362	Sheave, cable with bushing	3	89#	52.00	
XA 1363	Guard, sheave	1	4#	2.45	302
XA 1364	Bushing, bronze	3	4#	6.80	
XA 1365	Casting, dead end	1	11 1/4#	7.25	302
XA 1366	Shaft, suspension	1	70#	11.00	302
XA 1367	Bolt, machine-5/8" x 5-3/4" N. C.	2	2 pcs.1#	.10	302
XA 1368	Collar, set	2	3 1/2#	2.75	302
XA 1369	Shim 6½" x ¼" x 7"	1	2 1/2#	.55	302
XA 1369A	Shim 6½" x #10 x 7"	1	1 3/4#	.50	302
XA 1369B	Shim 6½" x #14 x 7"	2	1#	.45	302
XA 1370	Bolt, S.A.E.	4	2 pcs.1#	1.55	302
XA 1371	Washer, bevel - 3/4"	4	6 pcs.1#	.06	
XA 1372	Adaptor, boom foot	1	575#	190.00	302
XA 1373	Pin, foot	2	7#	1.80	302
XA 1374	Bolt, thru	4	3 1/2#	.60	302
XA 1375	Bolt, thru	4	3 3/4#	.60	302
XA 1376	Frame, jib	1	510#	246.00	302
XA 1377	Box, Torsion	1	440#	150.00	302
XA 1378	Plate, attachment	1	3 pcs.1#	.85	302
XA 1379	Bolt, machine-5/8" x 4-3/4" N. C.	2	2 pcs.1#	.09	302
XA 1380	Pin, boom pivot	2	20#	6.00	302
XA 1381	Bolt, thru	4	3 1/2#	.60	302
XA 1382	Cotter, 5/16" x 2-3/4"	2	18 pcs.1#	.01	302
XA 1383	Pin, wedge socket	1	2#	1.10	302
XA 1384	Bushing, Manganese	1	2 pcs.1#	1.20	302
XA 1385	Socket, wedge	1	11#	6.00	302
XA 1386	Guard, sheave	1	4#	5.10	302

* Price Per 100 Pcs.
** Over 200 Pcs. Per Lb.

Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 1387	Boom, pull shovel with Torsion box	1	2700#	680.00	302
XA 1388	Bushing, bronze	2	1#	3.10	302
XA 1389	Drum, idler with bushings	1	90#	45.00	302
XA 1390	Shaft, idler drum	1	15 3/4#	4.60	302
XA 1391	Collar, set	2	1 1/2#	3.25	302
XA 1392	Bolt, machine-1/2" x 3-3/4" N. C.	1	4 pcs.1#	.06	302
XA 1393	Key, straight	1	3/4#	.30	302
XA 1394	Cotter, 5/8" x 5"	3	2 pcs.1#	.14	
XA 1395	Cotter, 5/8" x 4"	3	2 pcs.1#	.10	
XA 1396	Shaft, idler	1	33#	6.25	302
XA 1397	Screw, set - square head cup point 5/8" x 1¼" N. C.	2	4 pcs.1#	.06	302
XA 1398	Sleeve, tube	1	17 1/2#	21.00	302
XA 1399	Roller, cable deflector	1	21 1/4#	5.70	302
XA 1400	Washer, thrust	2	1 3/4#	3.95	302
XA 1401	Shaft, boom point	1	47#	26.50	302
XA 1402	Plate, lock	2	1 1/4#	.65	302
XA 1403	Nut, half-Hex. 3" x 8 N. F.	2	5 3/4#	3.00	302
XA 1404	Link, dipper	1	102#	70.00	303
XA 1405	Pin, link	1	14 1/4#	4.50	303
XA 1406	Housing, sheave	1	19#	15.00	303
XA 1407	Dowel, brass-3/8" x 1-1/8"	2	25 pcs.1#	.05	303
XA 1408	Pin, adjusting link	2	10 1/4#	3.00	303
XA 1409	Arm, dipper	1	720#	275.00	303
XA 1410	Pin, dipper arm	1	21#	4.50	303
XA 1411	Bushing, bronze	2	2 3/4#	3.60	303
XA 1412	Bumper, wood	1	4#	2.25	303
XA 1413	Bolt, carriage-5/8" x 3-1/2"	2	2 pcs.1#	.09	303
XA 1414	Bushing, bronze	2	5 3/4#	11.00	303
XA 1415	Dowel, brass	2	18 pcs.1#	.04	303
XA 1416	Support, "A" Frame yoke	1	8 1/2#	4.30	303
XA 1417	Plate, wearing	1	48#	15.00	303
XA 1418	Spacer, pipe	1	4 3/4#	1.00	303
XA 1419	Link, adjusting dipper	1	112#	33.00	303
XA 1420	Bracket, dipper arm	1	84#	43.00	303
XA 1421	Bar, reinforcement	2	14 1/4#	1.15	303
XA 1422	Bolt, carriage-5/8" x 4-1/2"	2	2 pcs.1#	.09	303
XA 1423	Block, bumper	1	4 1/2#	2.30	303
XA 1424	Bracket, dipper arm	1	84 1/2#	43.00	303
XA 1425	Pin, dipper hinge	2	4 3/4#	1.50	303
XA 1426	Bolt, machine-1" x 12"	5	3 1/2#	.40	303
XA 1427	Bracket, scraper	1	5 1/2#	3.45	303
XA 1428	Scraper, sheave	1	3/4#	4.35	303
XA 1429	Screw, cap-flat head 1" x 3-1/2" N.C.	12	1#	.90	303
XA 1430	Dipper, 31" wide	1	1385#	550.00	303
XA 1431	Cutter, side	1	78#	41.00	303
XA 1432	Rivet, countersunk head 5/8" x 3-1/2"	3	3 pcs.1#	.03	303

* Price Per 100 Pcs.
** Over 200 Pcs. Per Lb.

Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 1433	Rivet, countersunk head 5/8" x 4"	3	3 pcs.1#	.03	303
XA 1434	Rivet, countersunk head 5/8" x 5-1/4"	3	2 pcs.1#	.05	303
XA 1435	Rivet, countersunk head 5/8" x 6-3/4"	6	3/4#	.08	303
XA 1436	Base, tooth	3	108#	36.50	303
XA 1437	Pin, tooth point	3	1#	.65	303
XA 1438	Point, tooth	3	17 1/2#	4.15	303
XA 1439	Cutter, side	1	78#	41.00	303
XA 1440	Plate, wearing	1	23#	11.00	303
XA 1441	Bushing, bronze	2	1 1/2#	3.50	303
XA 1442	Block, sheave	1	56 1/2#	70.00	303
XA 1443	Cotter, 1/2" x 4"	4	4 pcs.1#	.02	303
XA 1444	Pin, anchor	1	14 1/4#	3.25	303
XA 1445	Sheave, equalizer with bushing	1	48 1/2#	35.00	303
XA 1446	Bushing, bronze	1	2#	8.50	303
XA 1447	Pin, sheave	1	7#	2.25	303
XA 1448	Cable, Jib Frame Hoist 6 strand, 19 wire Plow Steel, Hemp Center 1/2" x 80'-0"	1	33#	9.60	306
XA 1449	Cable, boom hoist- 6 strand, 19 Wire, Flexible Seal Construction Langlay with Independent Wire Rope Center 5/8"x75'-0"	1	47#	17.25	306
XA 1450	Clamp, cable CR- 5/8"	6	1 1/4#	.58	
XA 1451	Cable, Shovel Digging 6 strand, 19 wire, Flexible Seal Construction Langlay with Independent Wire Rope Center 3/4" x 60'-0"	1	64#	22.80	306
XA 1452	Drum, cable dragline and digging cable for pull shovel	1	238#	96.00	304
XA 1453	Spring, operating RU-Y38	1	54#	25.00	310
XA 1454	Tube, operating RU-Y36	1	17#	4.50	310
XA 1455	Bushing, tube RU-Y28	1	3#	3.50	310
XA 1456	Shaft, coupling RU-Y35	1	9#	5.00	310
XA 1457	Bolt, machine 5/8" x 9-1/2" N. C.	2	1#	.13	310
XA 1458	Bearing, wheel RU-Y27	1	18#	15.00	310
XA 1459	Cable, tagline- 6 strand, 19 wire, Improved Plow Cable-Hemp Center- 3/8" x 60'-0"	1	13#	6.00	310
XA 1460	Wheel, cable RU-Y26	1	31#	25.00	310
XA 1461	Plate, safety RU-Y34	1	12 pcs.1#	1.00	310
XA 1462	Propellor, tagline RU-Y29	1	3 1/2#	3.50	310
XA 1463	Bolt, "U" 5/8" x 30" long	1	2 1/2#	4.50	310
XA 1464	Plug, pipe 2"	1	1#	.18	310

* Price Per 100 Pcs.
** Over 200 Pcs. Per Lb.

Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 1465	Plate, end RU-Y24	1	3#	$6.00	310
XA 1466	Housing , tagline RU-Y39	1	54#	15.00	310
XA 1467	Frame, Fairlead RU-Y30	1	13#	3.00	310
XA 1468	Pin, sheave RU-Y33	2	4 pcs.1#	1.00	310
XA 1469	Sheave, Fairlead RU-Y31	2	5#	4.00	310
XA 1470	Hook, Grab - 3/8"	1	3/4#	.25	310
XA 1471	Chain, tagline	1	10 3/4#	4.75	310
XA 1472	Cable, closing- 6 strand 19 wire, Improved Plow Steel Hemp Center 5/8" x 130'-0"	1	82#	27.30	312
XA 1473	Cable, holding- 6 strand 19 wire, Improved Plow Steel Hemp Center 5/8"x101'-0"	1	64#	21.21	312
XA 1474	Plug, pipe	1	2 pcs.1#	3.25	308
XA 1475	Screw, cap-Hex. Head 7/8" x 2-3/4" N.F.	4	1#	.18	308
XA 1476	Screw, cap-Hex. Head 7/8" x 2-1/4" N.F.	4	1#	.16	308
XA 1477	Key, Woodruff 21	2	20 pcs.1#	.04	308
XA 1478	Shaft, sheave	2	6#	2.00	308
XA 1479	Bushing, flanged	4	3 1/2#	6.60	308
XA 1480	Bearing, Fairlead	1	115#	90.00	308
XA 1481	Roller, bearing	31	4 pcs.1#	.12	308
XA 1482	Ball, New Departure-1"	22	6 pcs.1#	.25	308
XA 1483	Cap, Fairlead Frame	2	3 3/4#	2.30	308
XA 1484	Screw, cap-Hex.Head 5/8" x 2-3/4" N.C.	4	3 pcs.1#	.09	308
XA 1485	Sheave, Fairlead	2	25#	24.00	308
XA 1486	Frame, Fairlead	1	225#	118.00	308
XA 1487	Stud, grease	2	5 pcs.1#	.70	308
XA 1488	Plate, lock	2	18 pcs.1#	.24	308
XA 1489	Plate, lock	2	1#	.30	308
XA 1490	Shim .015x1-11/32" O.D.	14	192 pcs.1#	.02	308
XA 1490A	Shim .025x1-11/32" O.D.	2	118 pcs.1#	.02	308
XA 1491	Bushing, roller	2	1#	1.10	308
XA 1492	Seal, T-50000	4	8 pcs.1#	.18	308
XA 1493	Bearing,roller T-14137-14274	4	3/4#	2.15	308
XA 1494	Retainer, bearing T-49574	4	4 pcs.1#	.12	308
XA 1495	Shaft, roller	2	11#	8.60	308
XA 1496	Tube, roller	2	21#	12.50	308
XA 1497	Cable, drag - 6 strand, 19 wire, Flexible Seal Construction Langlay with Independent Wire Rope Center 3/4" x 54'-0"	1	57#	14.04	307

* Price Per 100 Pcs.
** Over 200 Pcs. Per Lb.

ENGINE PARTS SECTION

FOR

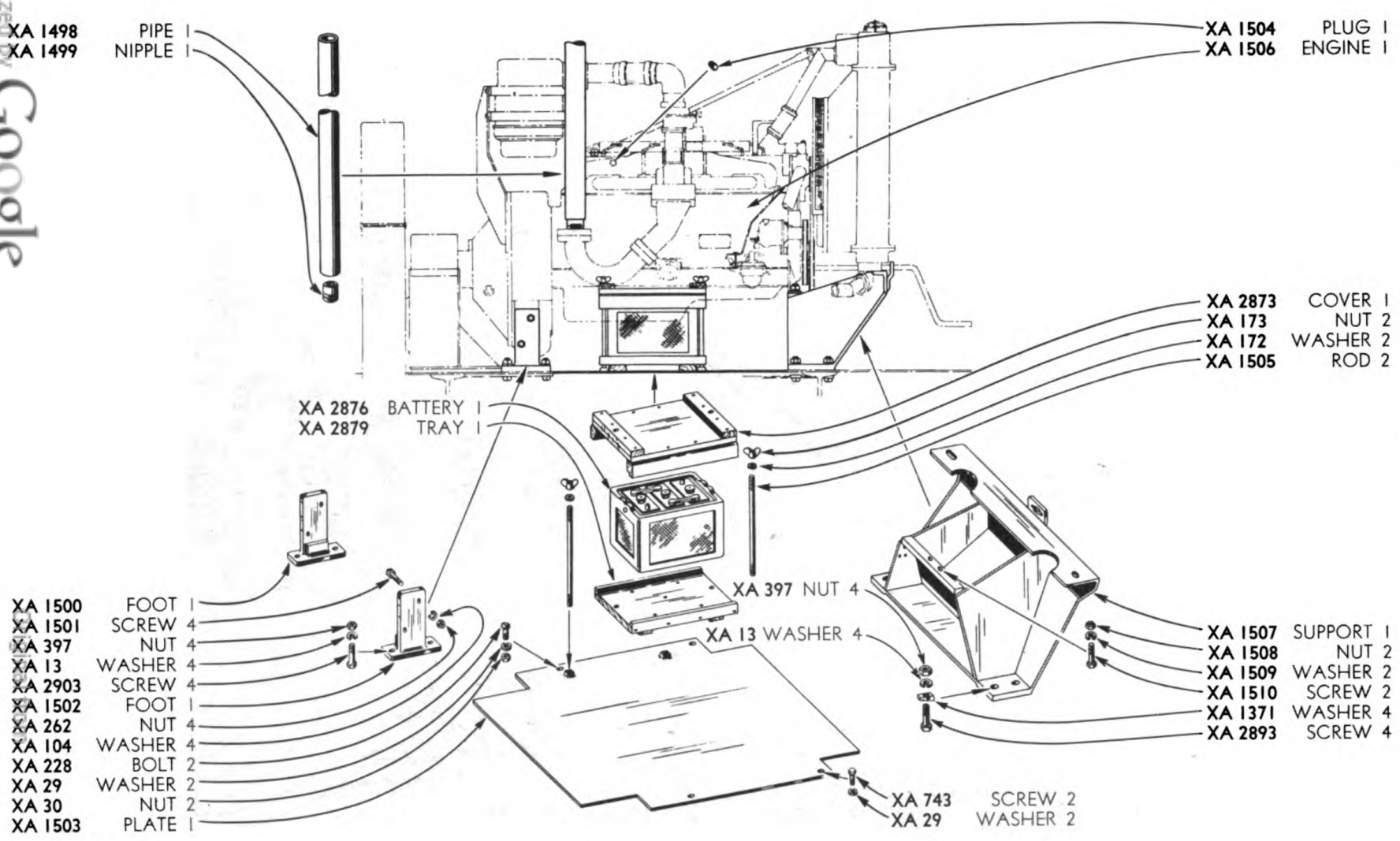
CHRYSLER MODEL C36-520 GASOLINE POWER UNIT
USED ON
KOEHRING COMPANY MODEL 304 CRANE

CONTENTS

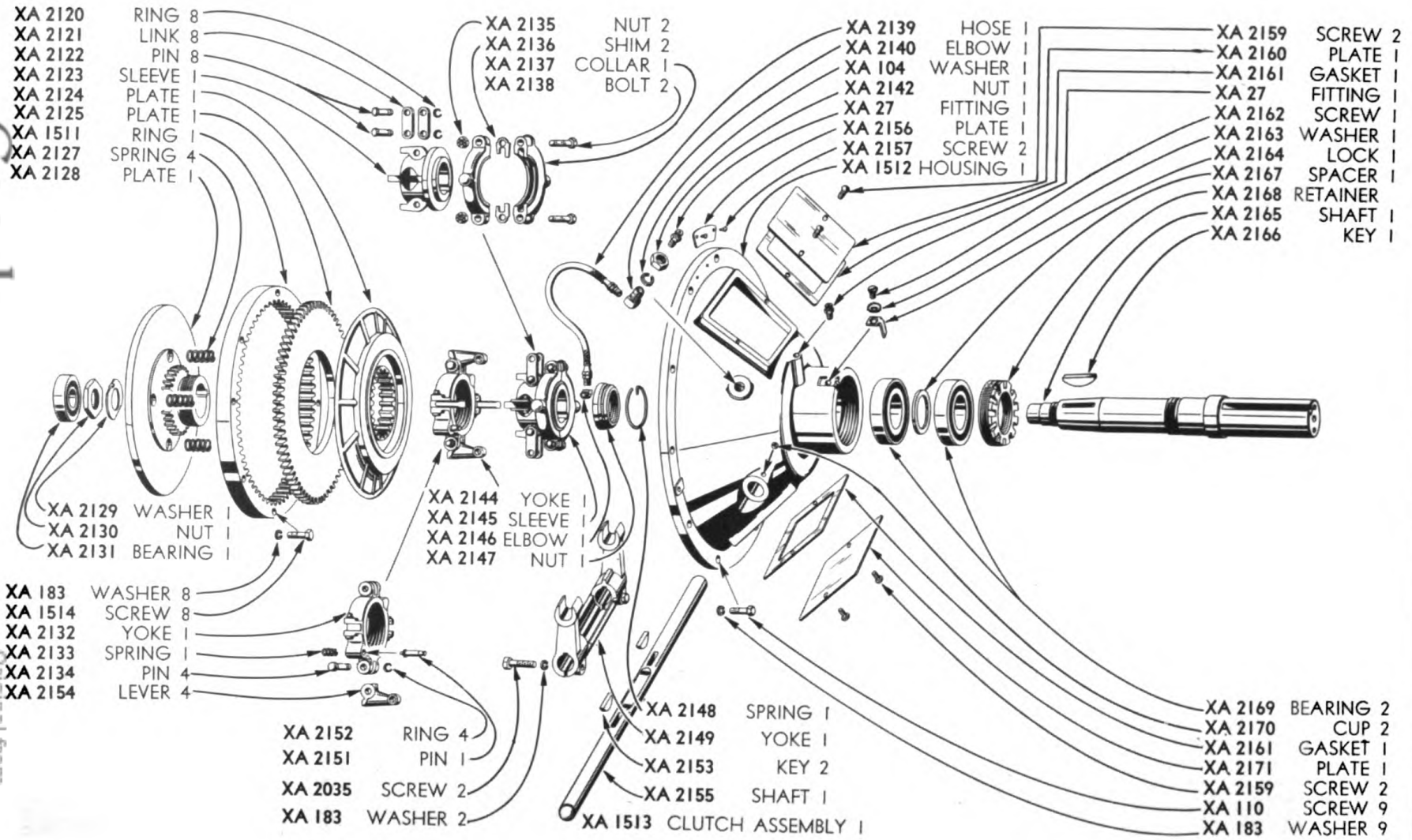
IMPORTANT

Parts listed in this section are furnished and installed on the Chrysler Engine by the Koehring Company. Engine parts not listed in this section are furnished by Chrysler Corporation and called for in the Chrysler Engine Parts Catalog.

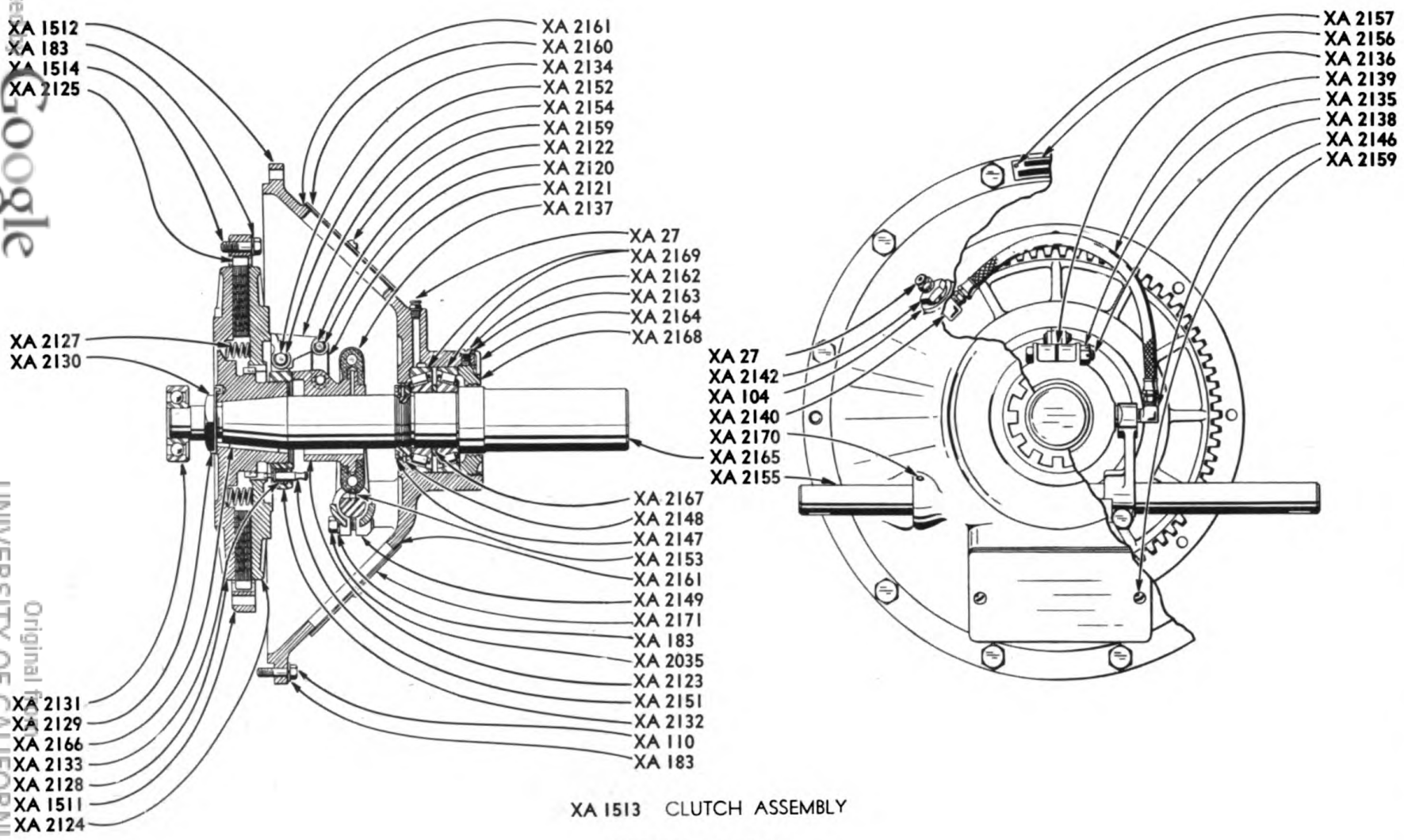
Hardware quantities are for the Chrysler Engine installation only and are separated from the totals required for basic machine listed on pages 314 to 348 inclusive.



ENGINE ACCESSORIES

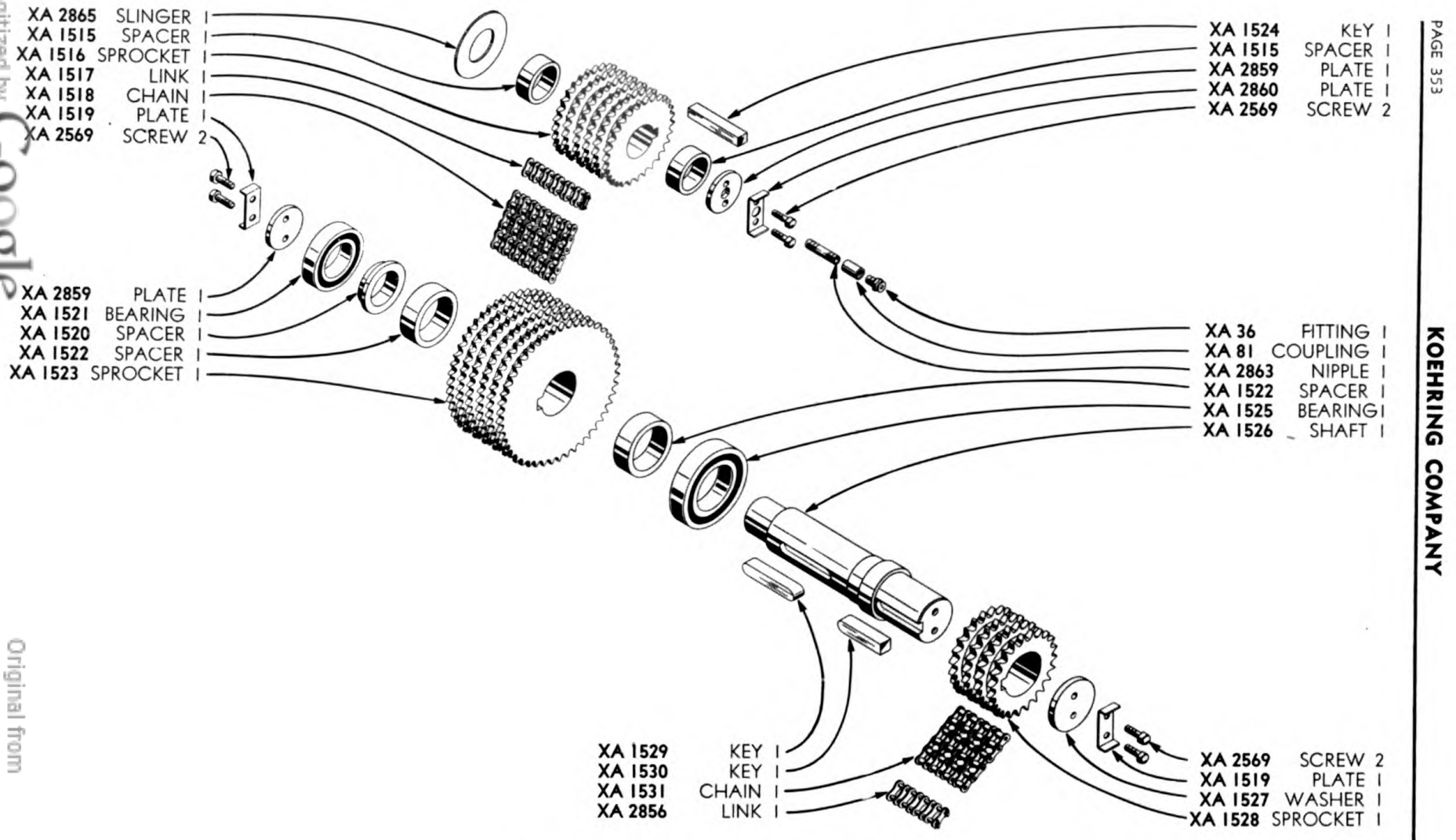


ENGINE CLUTCH

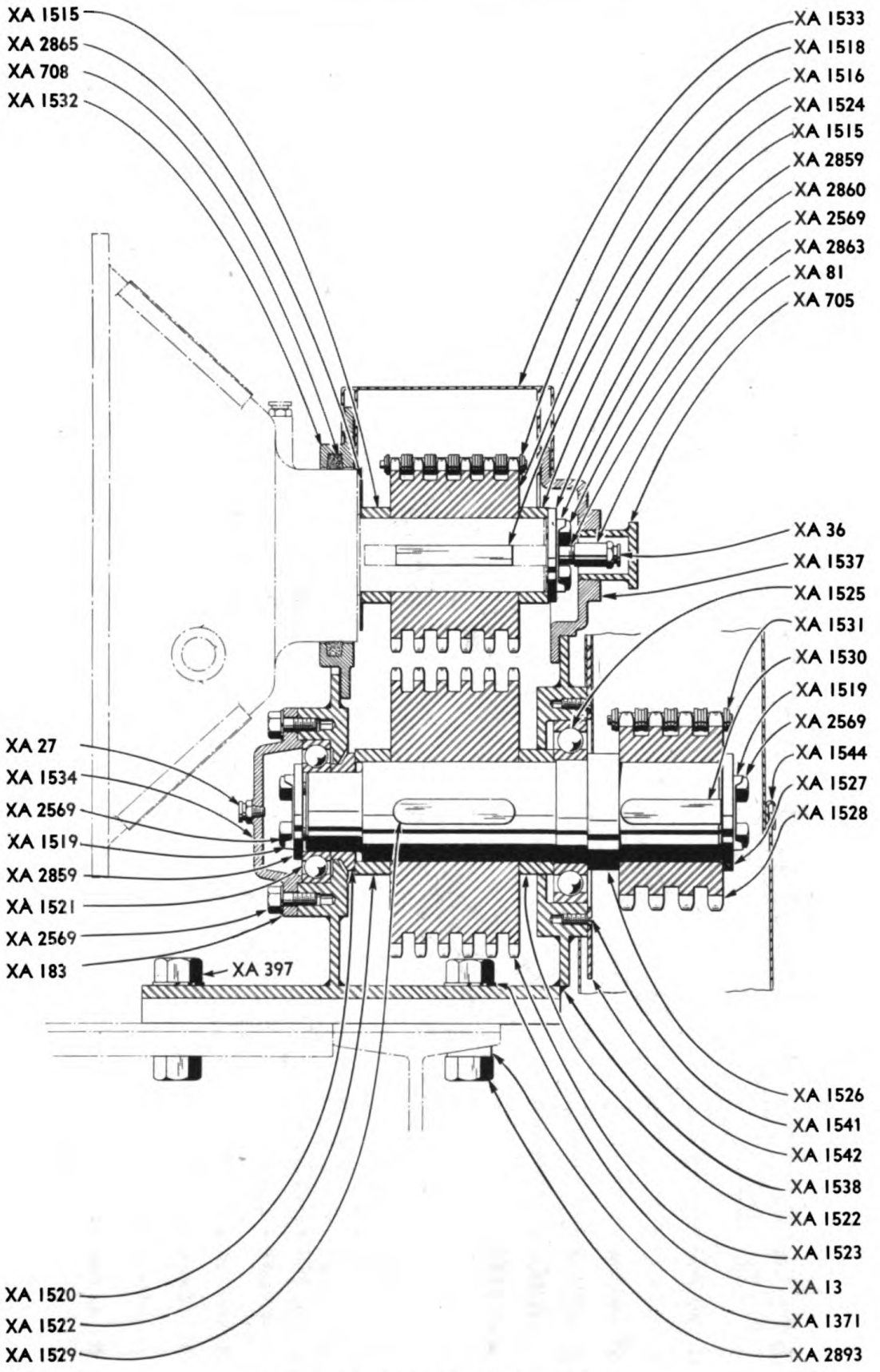


XA 1513 CLUTCH ASSEMBLY

ENGINE CLUTCH



DOUBLE REDUCTION CHAIN DRIVE



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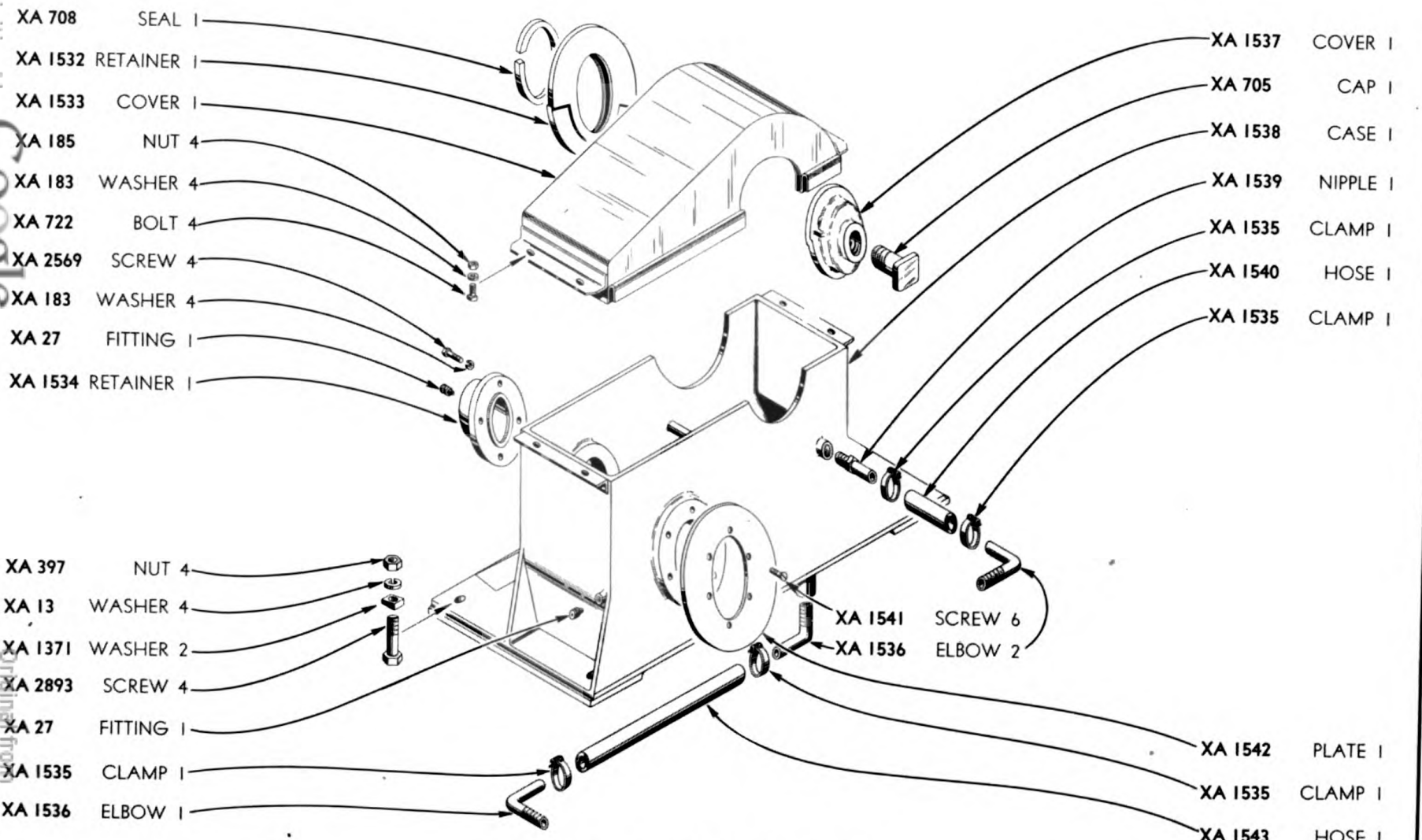
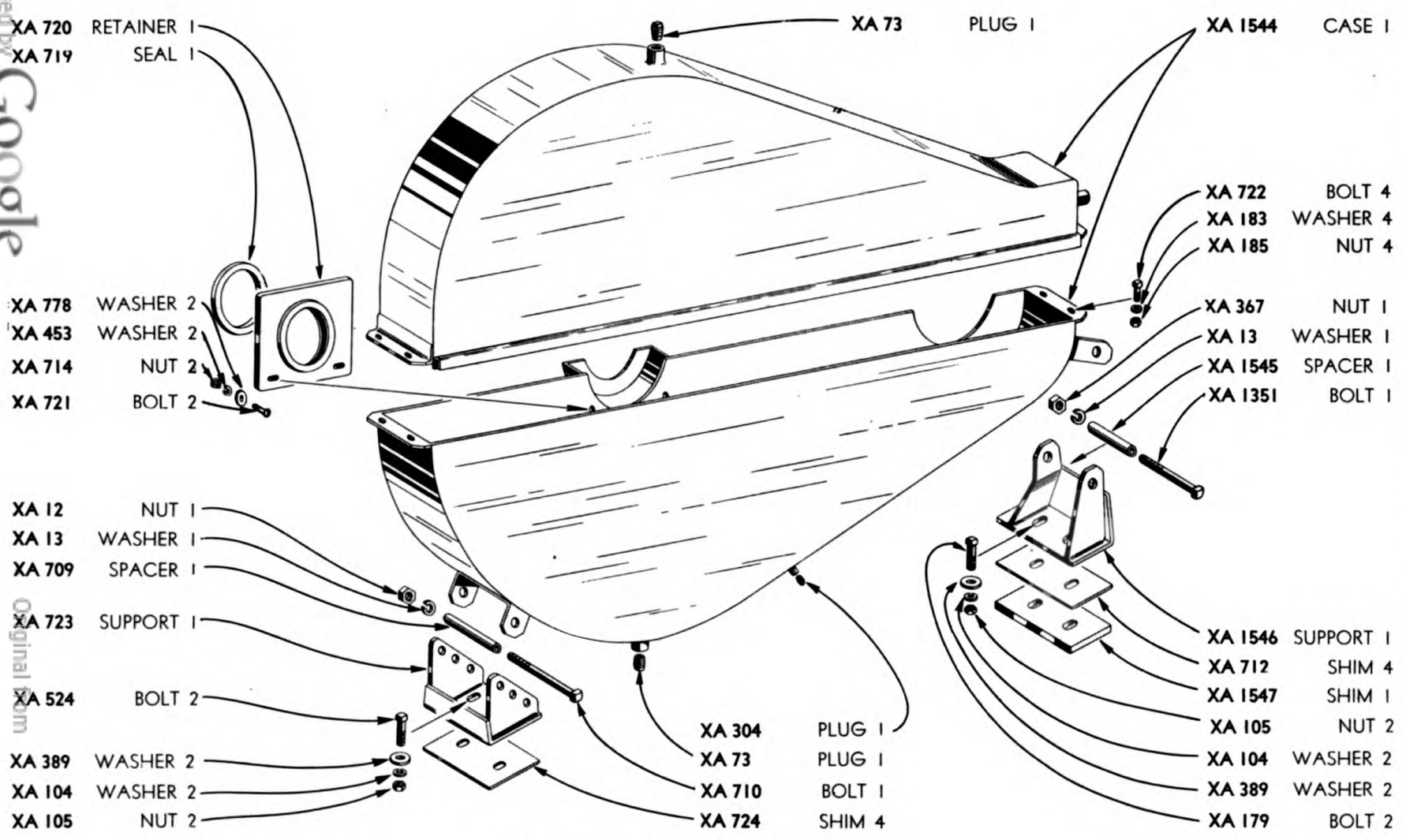


CHAIN CASE - FIRST REDUCTION



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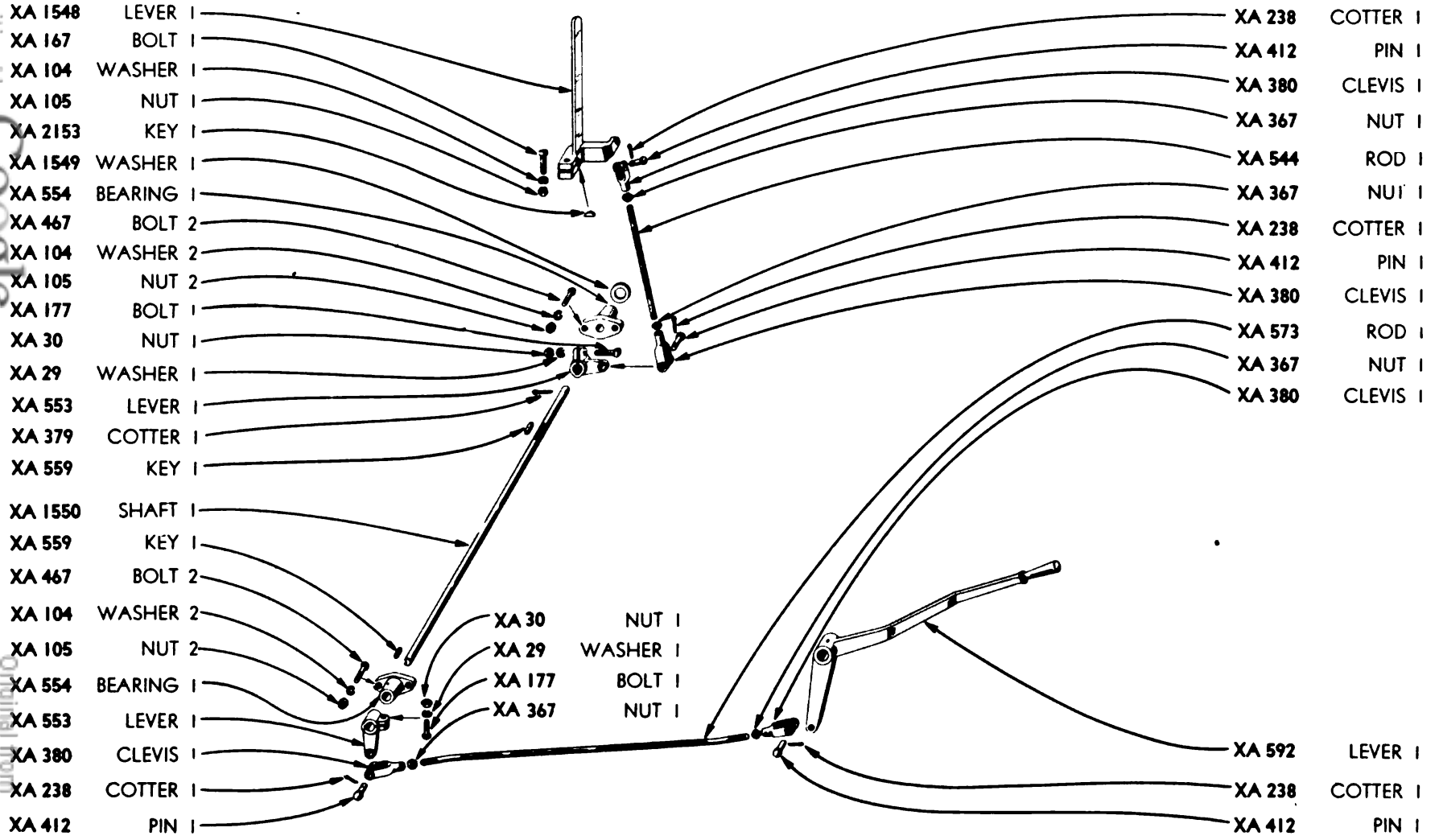
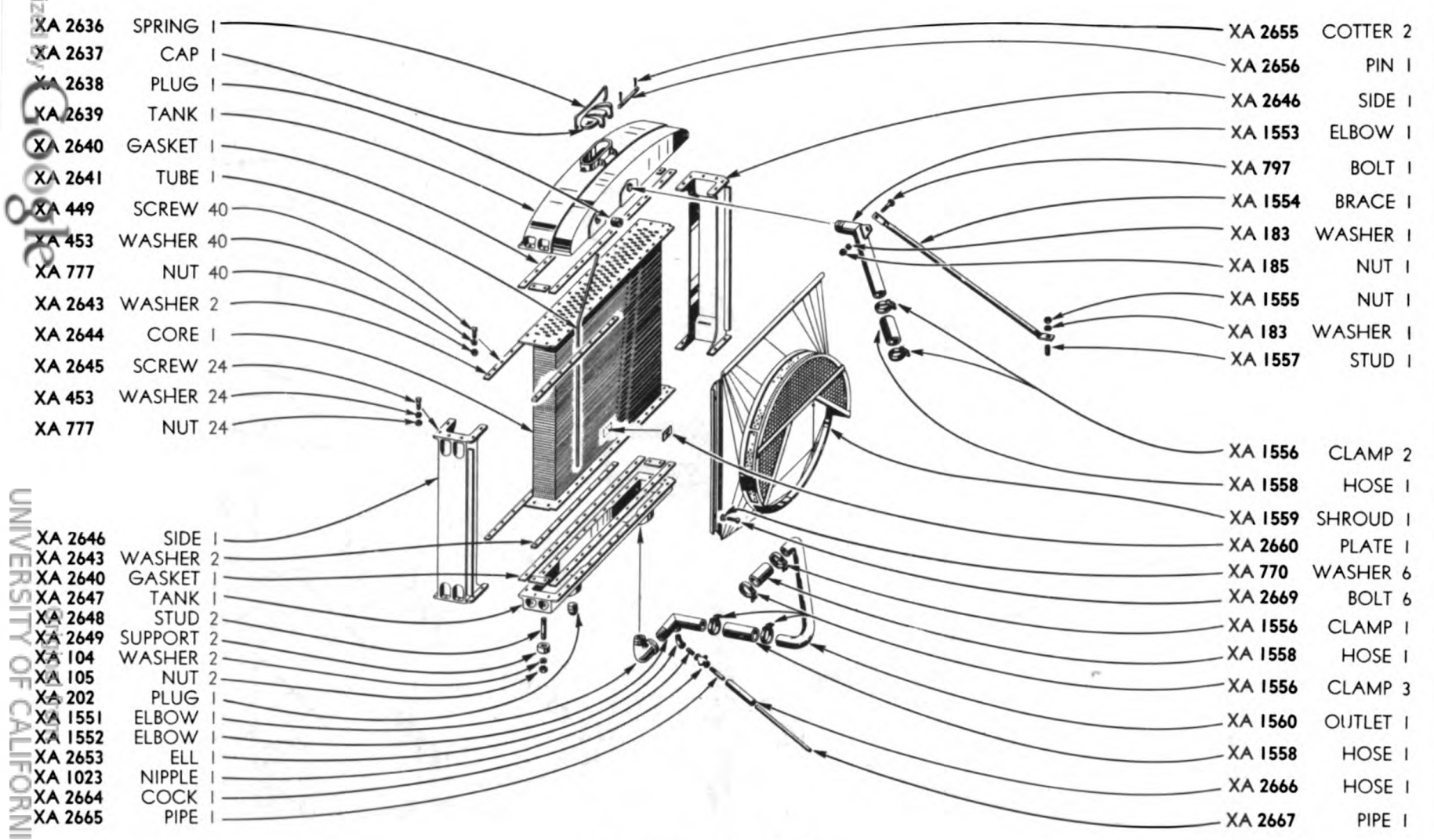


ENGINE CLUTCH LEVER



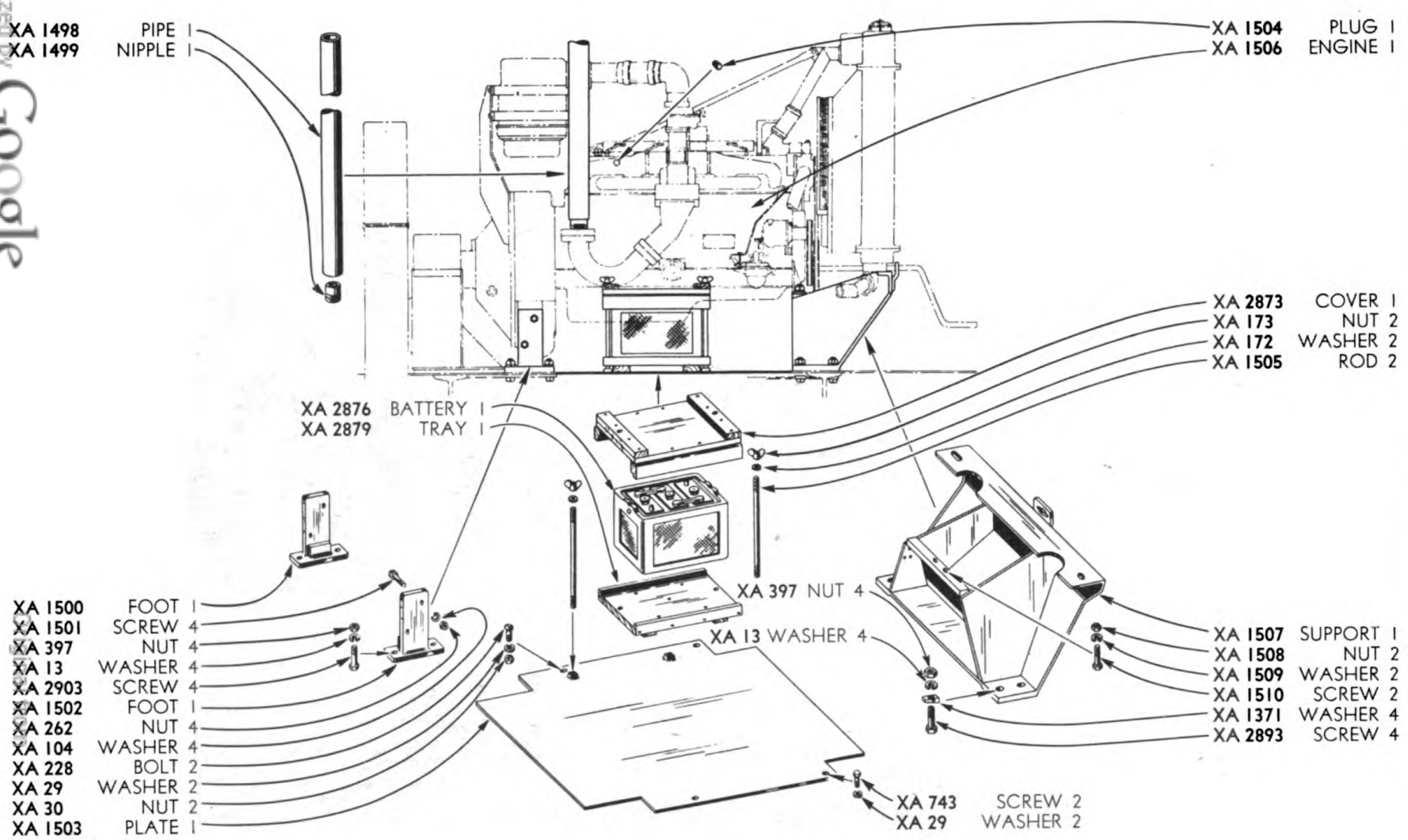
XA 2636 SPRING 1
XA 2637 CAP 1
XA 2638 PLUG 1
XA 2639 TANK 1
XA 2640 GASKET 1
XA 2641 TUBE 1
XA 449 SCREW 40
XA 453 WASHER 40
XA 777 NUT 40
XA 2643 WASHER 2
XA 2644 CORE 1
XA 2645 SCREW 24
XA 453 WASHER 24
XA 777 NUT 24

XA 2646 SIDE 1
XA 2643 WASHER 2
XA 2640 GASKET 1
XA 2647 TANK 1
XA 2648 STUD 2
XA 2649 SUPPORT 2
XA 104 WASHER 2
XA 105 NUT 2
XA 202 PLUG 1
XA 1551 ELBOW 1
XA 1552 ELBOW 1
XA 2653 ELL 1
XA 1023 NIPPLE 1
XA 2664 COCK 1
XA 2665 PIPE 1

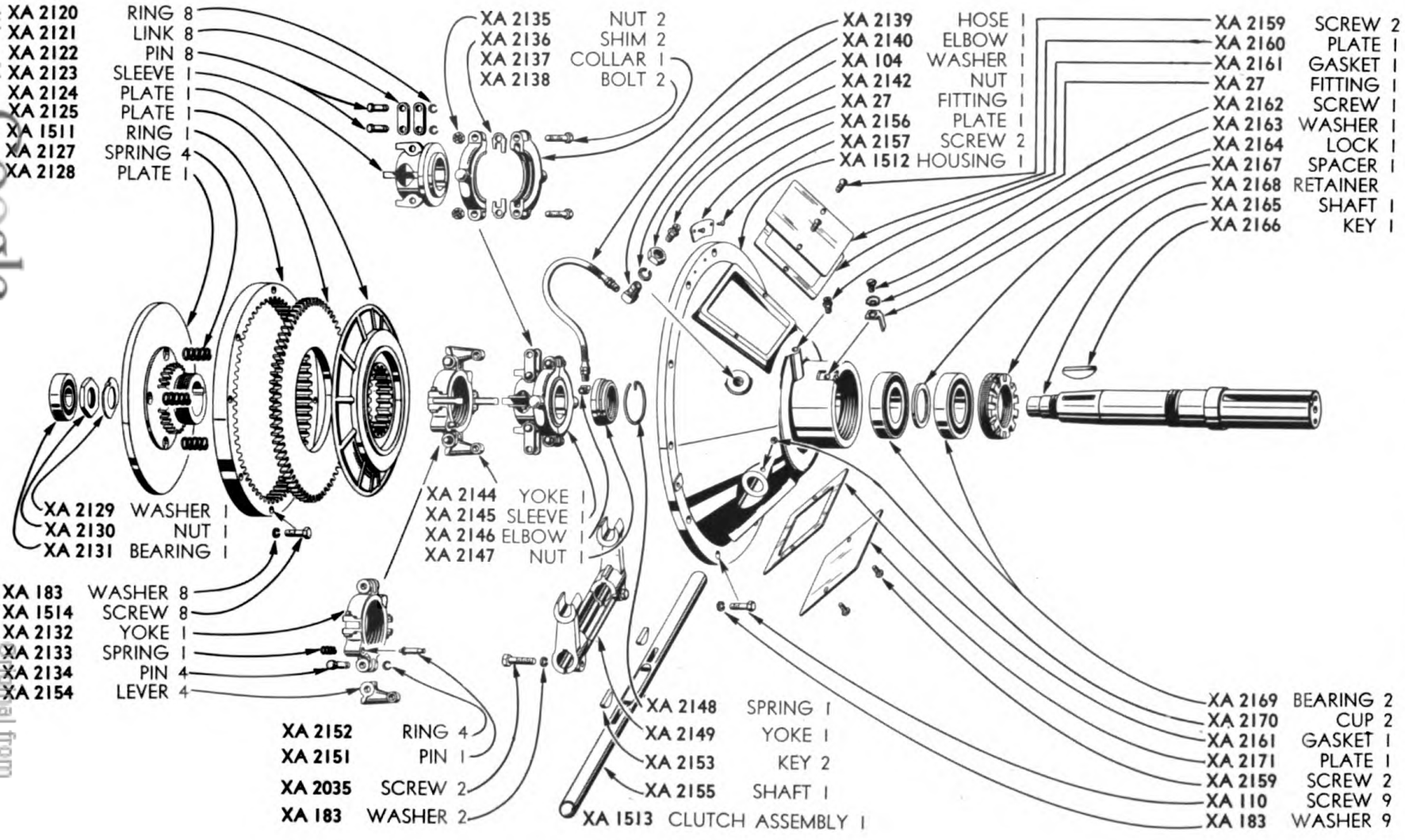
XA 2655 COTTER 2
XA 2656 PIN 1
XA 2646 SIDE 1
XA 1553 ELBOW 1
XA 797 BOLT 1
XA 1554 BRACE 1
XA 183 WASHER 1
XA 185 NUT 1
XA 1555 NUT 1
XA 183 WASHER 1
XA 1557 STUD 1

XA 1556 CLAMP 2
XA 1558 HOSE 1
XA 1559 SHROUD 1
XA 2660 PLATE 1
XA 770 WASHER 6
XA 2669 BOLT 6
XA 1556 CLAMP 1
XA 1558 HOSE 1
XA 1556 CLAMP 3
XA 1560 OUTLET 1
XA 1558 HOSE 1
XA 2666 HOSE 1
XA 2667 PIPE 1

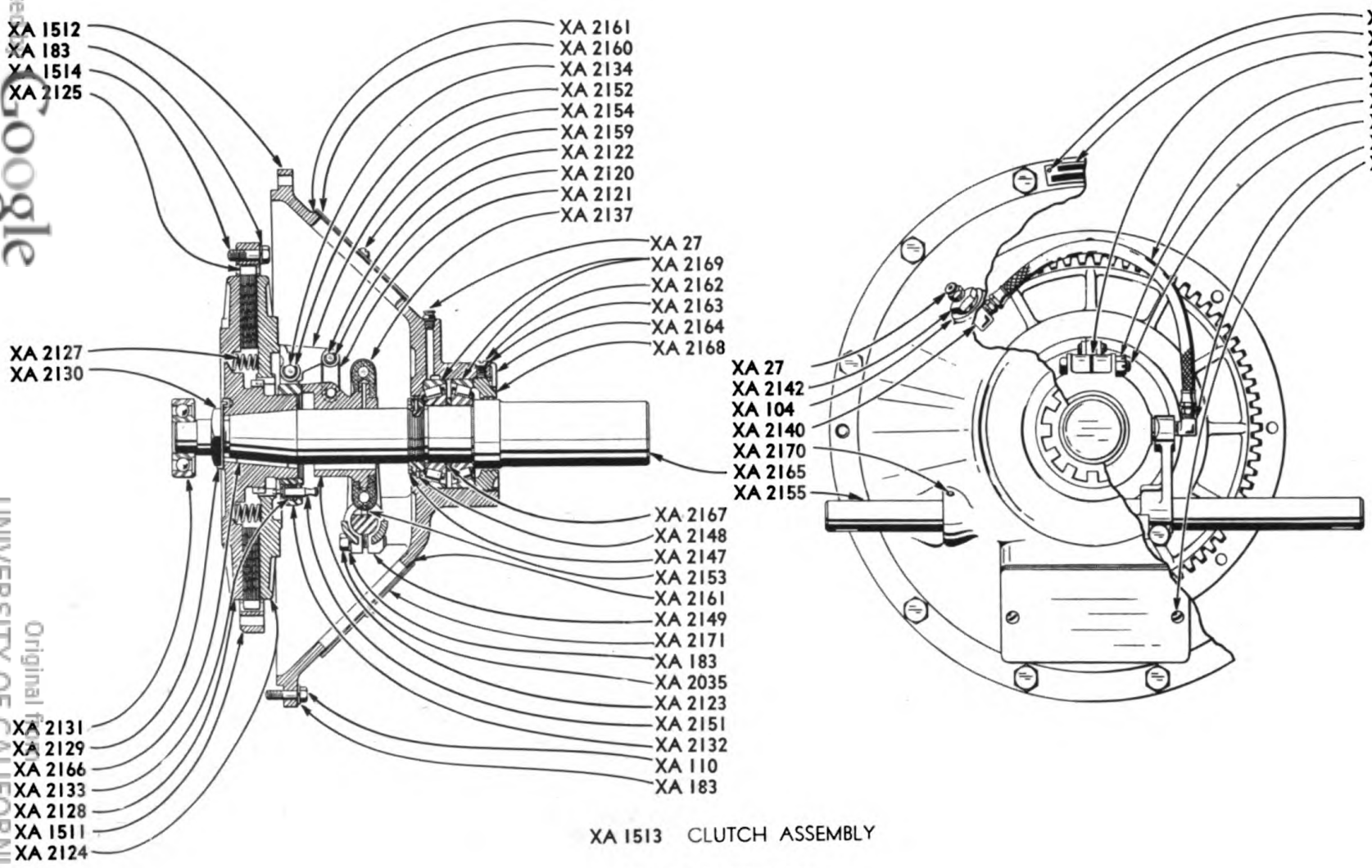
RADIATOR AND PIPING



ENGINE ACCESSORIES

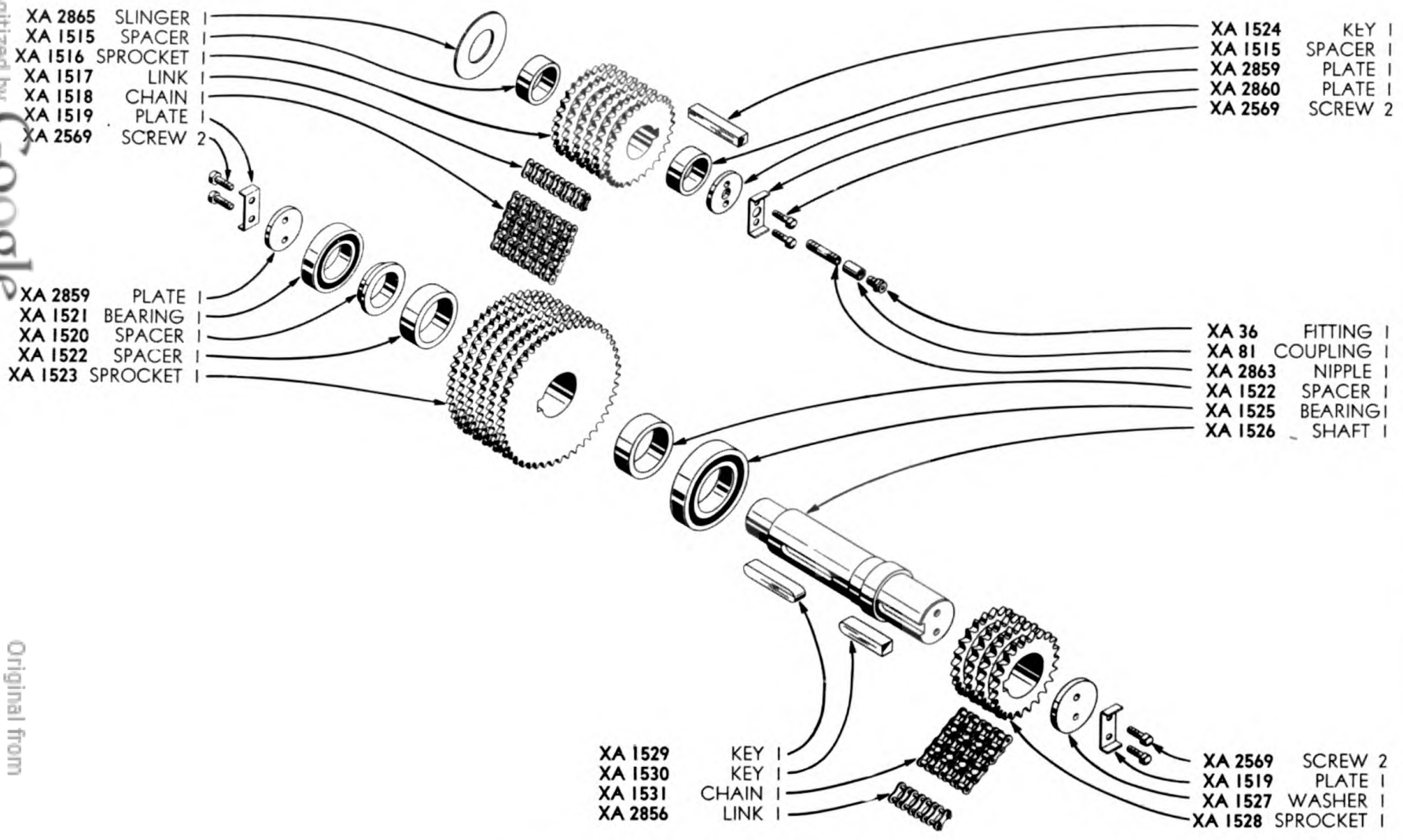


ENGINE CLUTCH

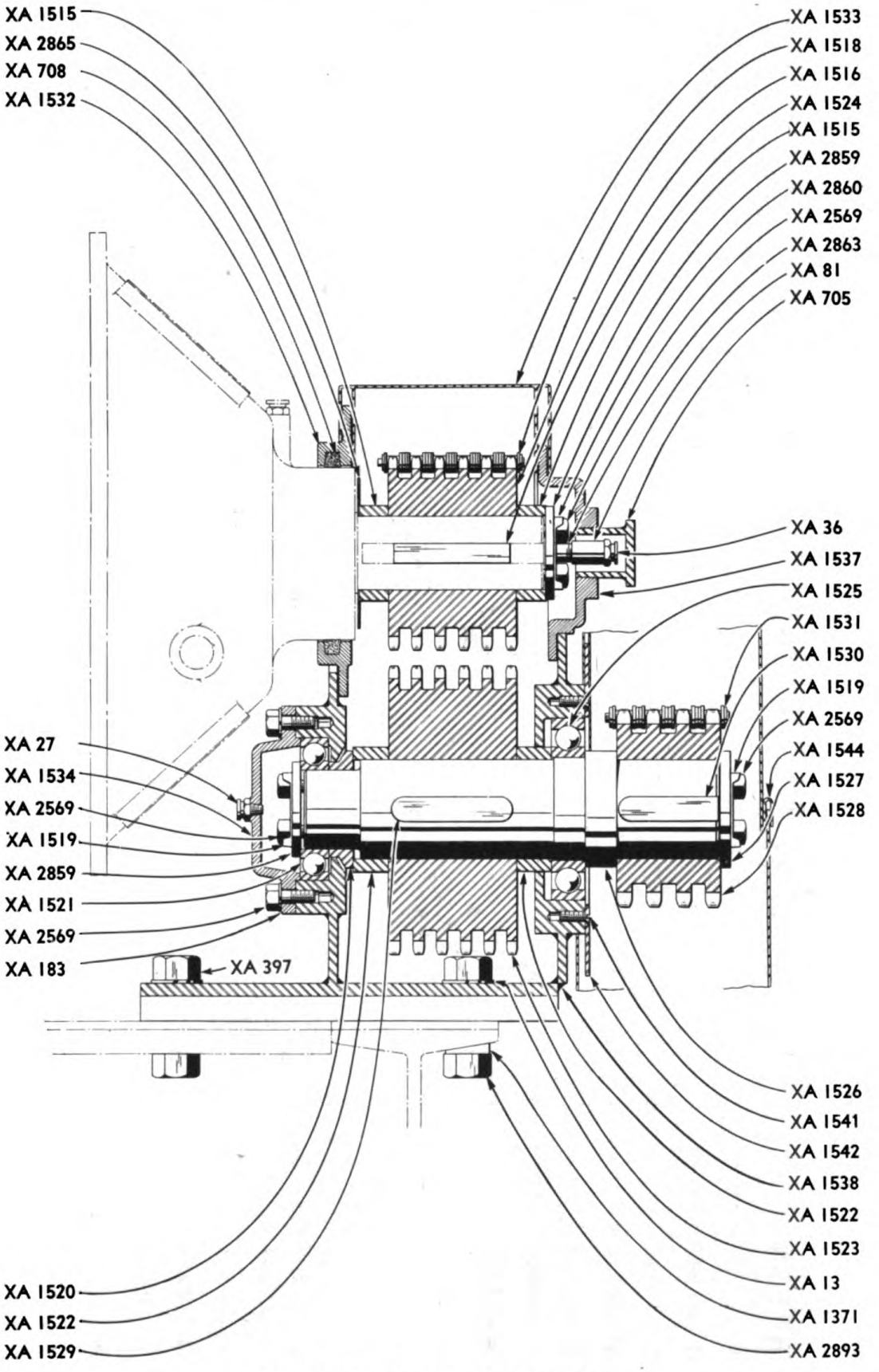


XA 1513 CLUTCH ASSEMBLY

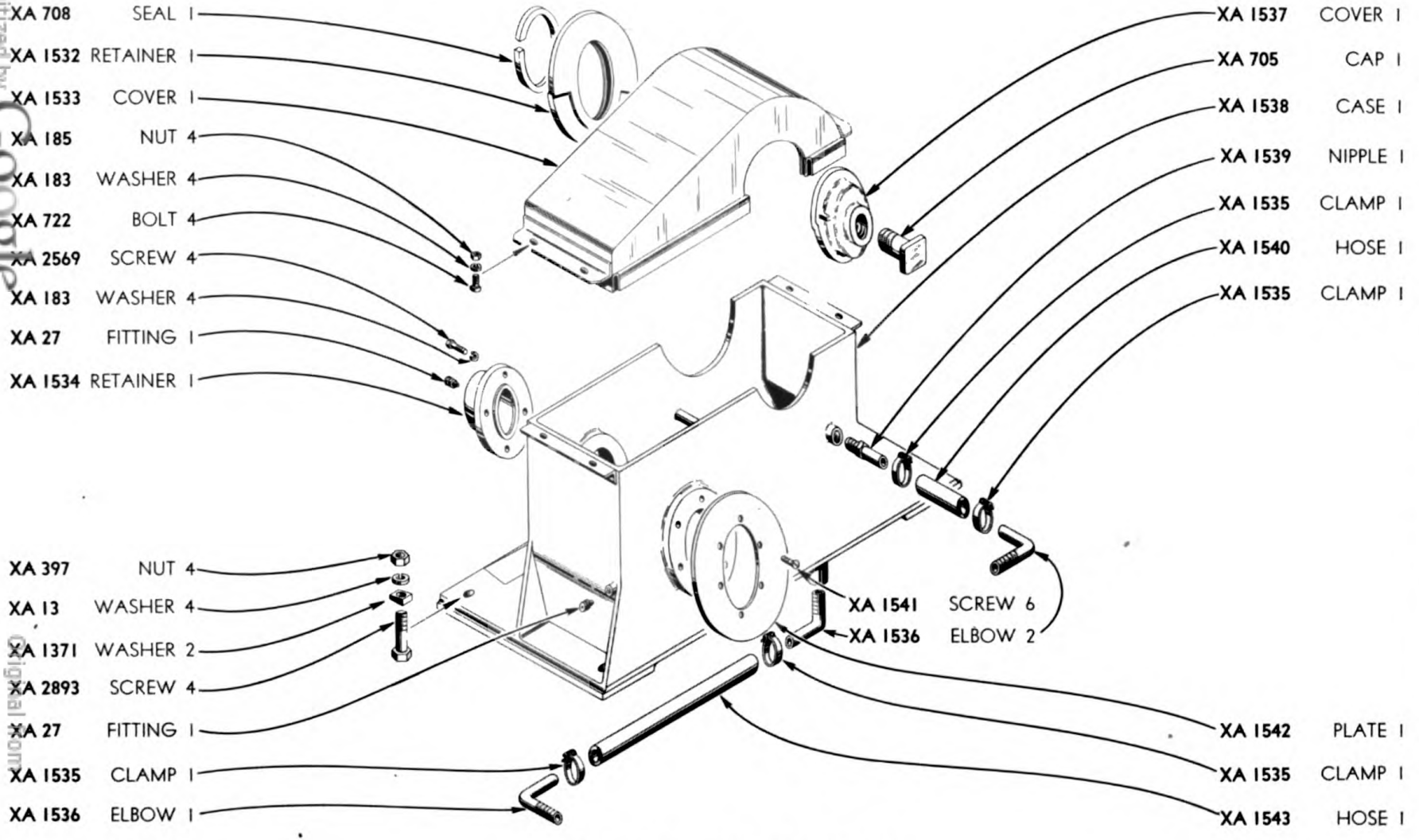
ENGINE CLUTCH



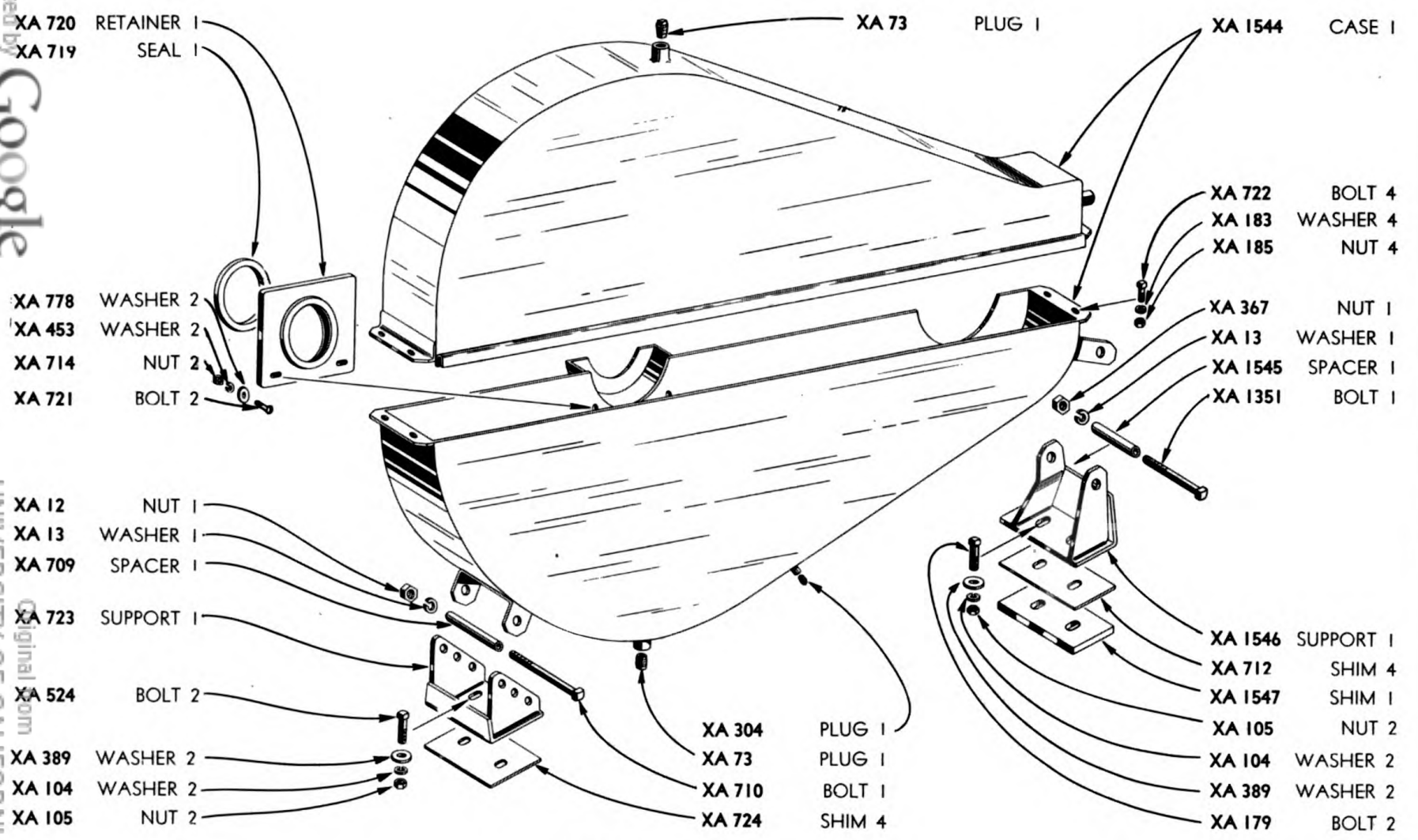
DOUBLE REDUCTION CHAIN DRIVE



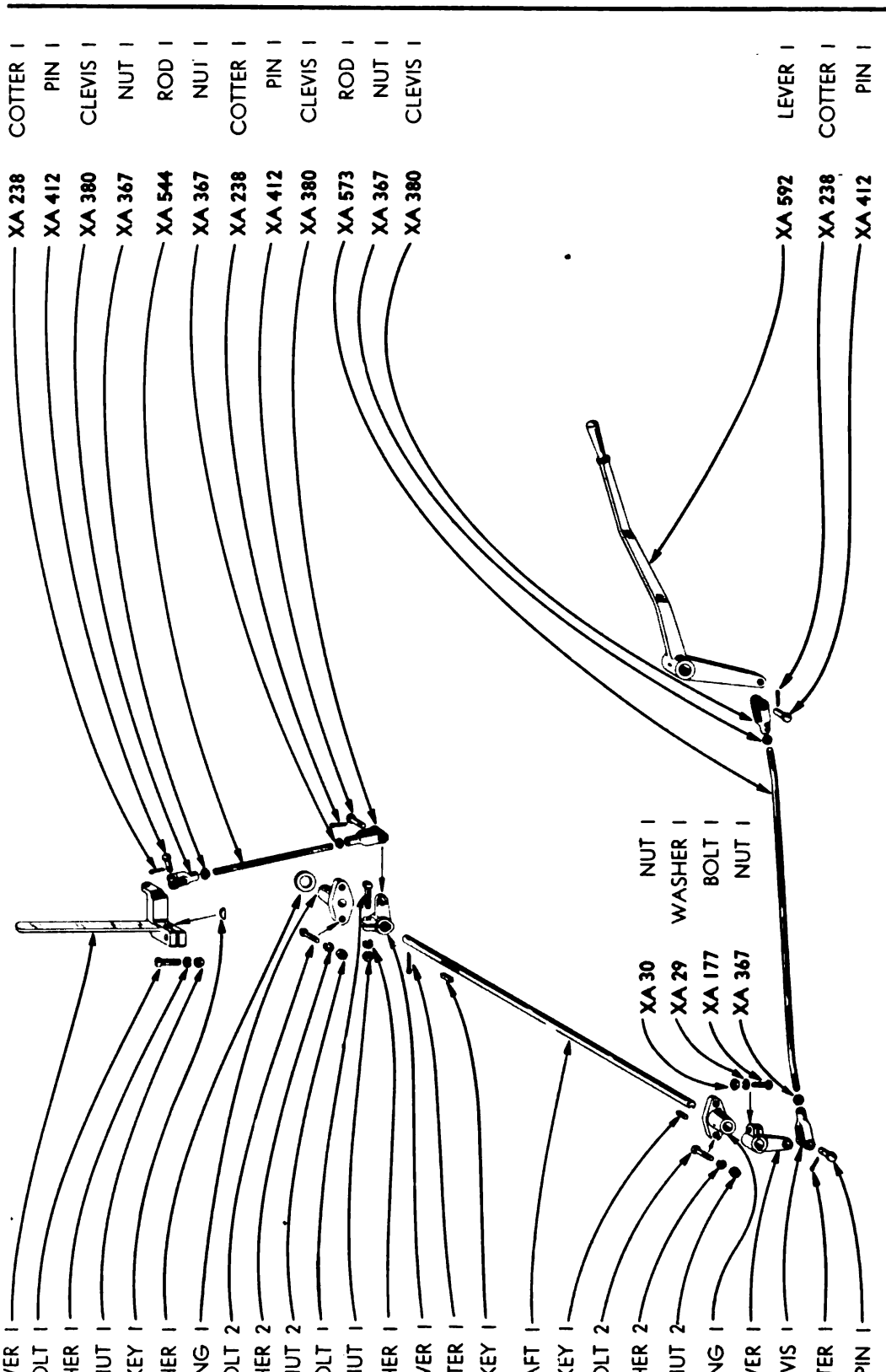
DOUBLE REDUCTION CHAIN DRIVE



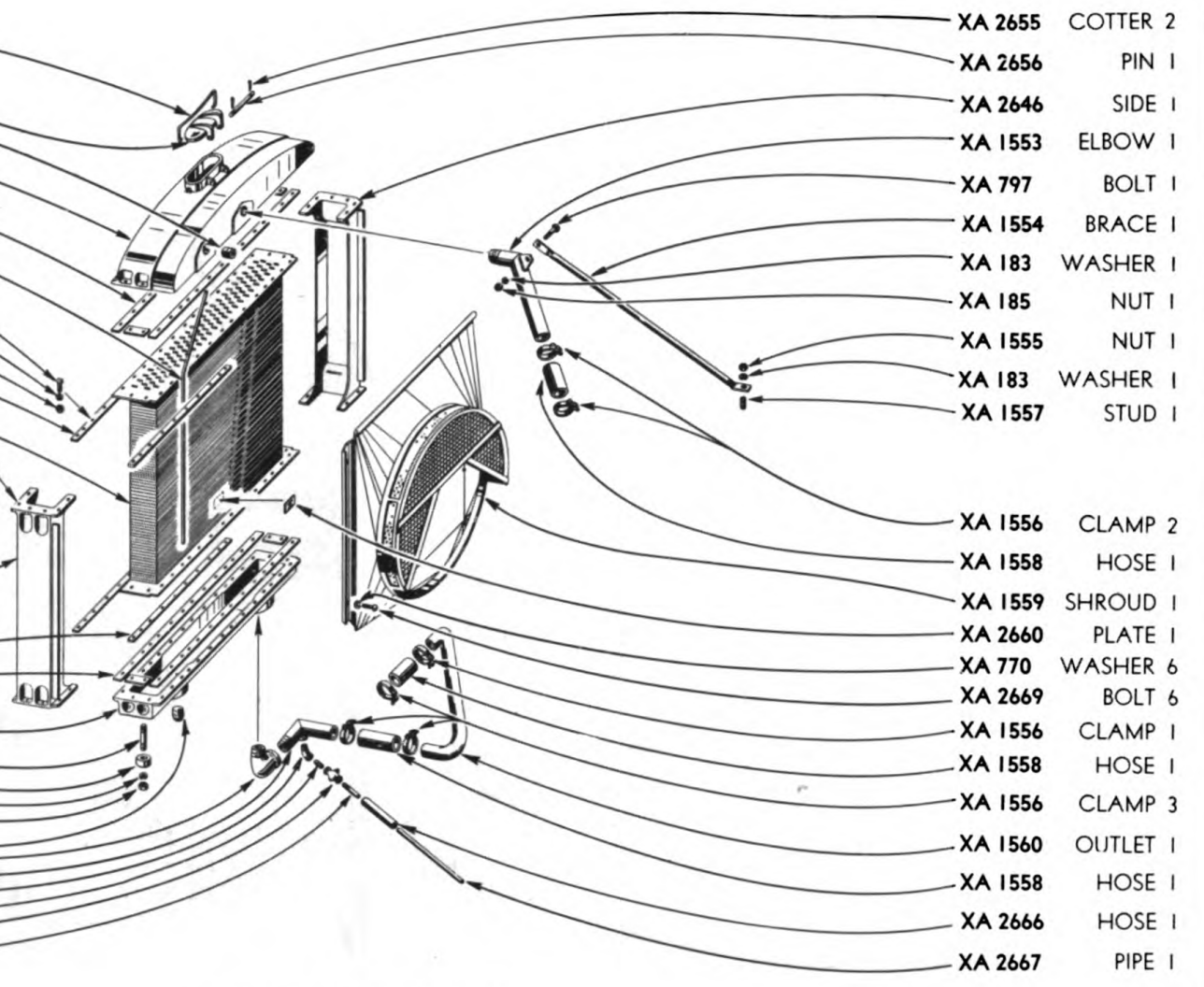
CHAIN CASE - FIRST REDUCTION



CHAIN CASE - SECOND REDUCTION

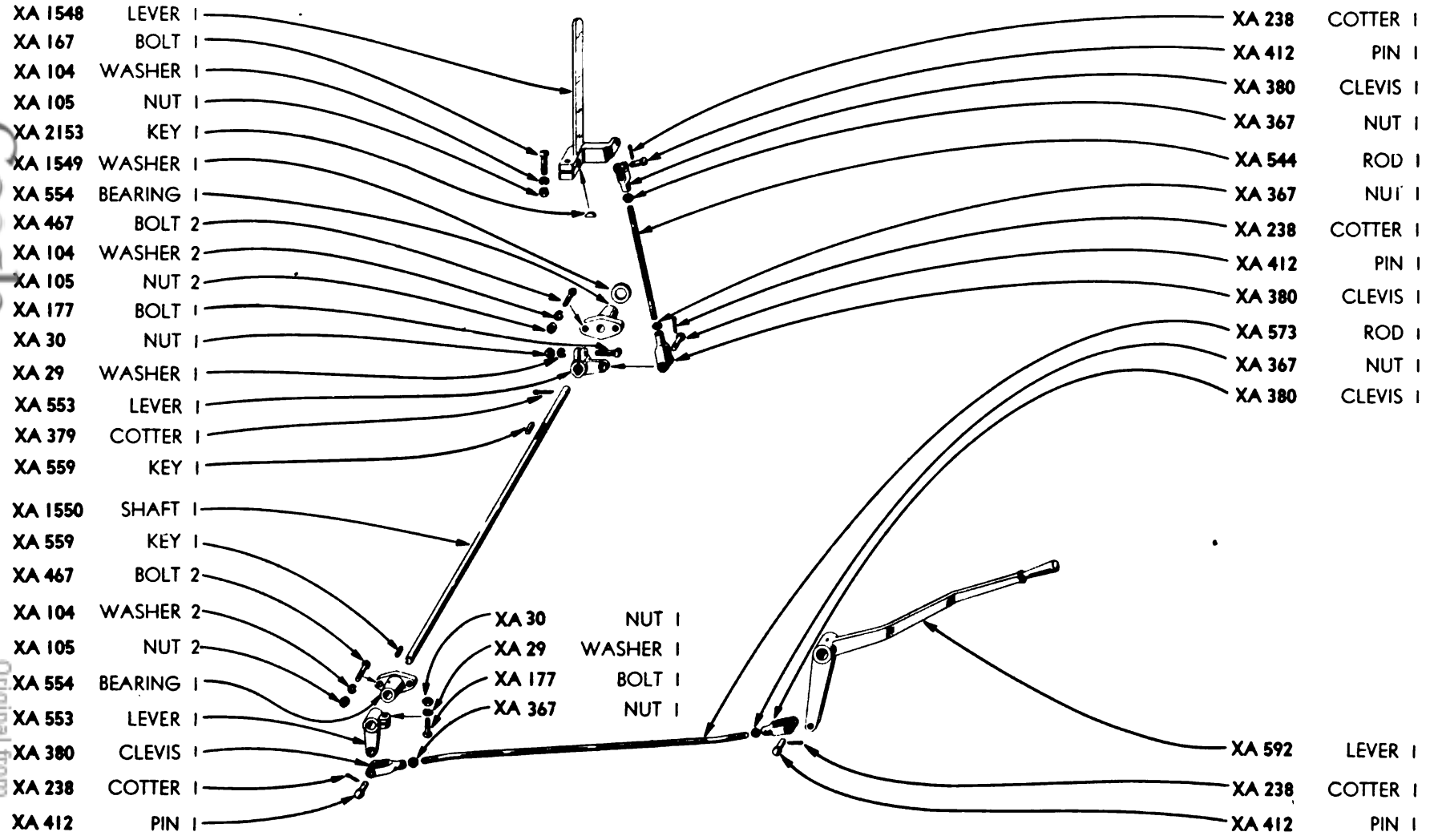


ENGINE CLUTCH LEVER

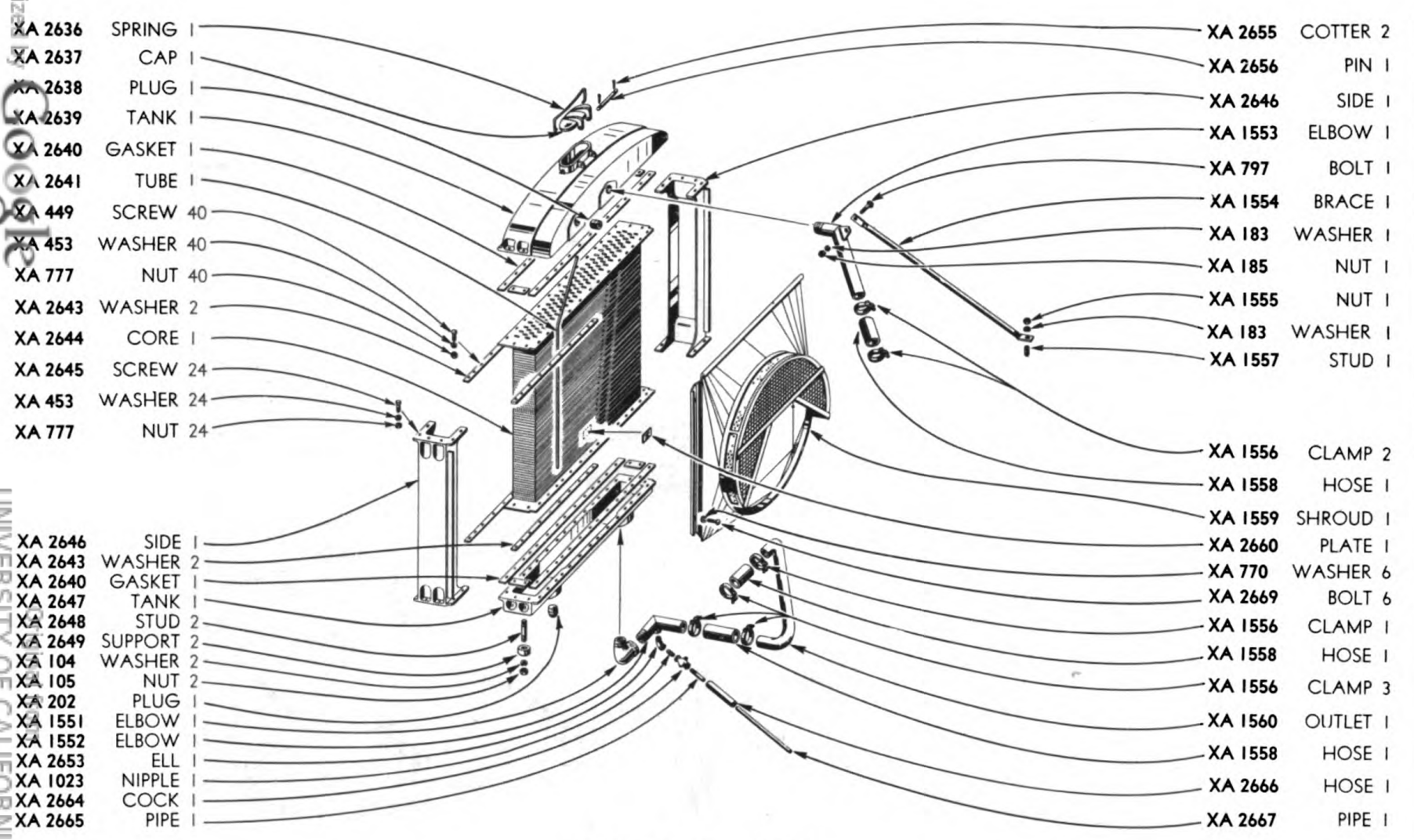


XA 2636	SPRING	1
XA 2637	CAP	1
XA 2638	PLUG	1
XA 2639	TANK	1
XA 2640	GASKET	1
XA 2641	TUBE	1
XA 449	SCREW	40
XA 453	WASHER	40
XA 777	NUT	40
XA 2643	WASHER	2
XA 2644	CORE	1
XA 2645	SCREW	24
XA 453	WASHER	24
XA 777	NUT	24
XA 2646	SIDE	1
XA 2643	WASHER	2
XA 2640	GASKET	1
XA 2647	TANK	1
XA 2648	STUD	2
XA 2649	SUPPORT	2
XA 104	WASHER	2
XA 105	NUT	2
XA 202	PLUG	1
XA 1551	ELBOW	1
XA 1552	ELBOW	1
XA 2653	ELL	1
XA 1023	NIPPLE	1
XA 2664	COCK	1
XA 2665	PIPE	1
XA 2655	COTTER	2
XA 2656	PIN	1
XA 2646	SIDE	1
XA 1553	ELBOW	1
XA 797	BOLT	1
XA 1554	BRACE	1
XA 183	WASHER	1
XA 185	NUT	1
XA 1555	NUT	1
XA 183	WASHER	1
XA 1557	STUD	1
XA 1556	CLAMP	2
XA 1558	HOSE	1
XA 1559	SHROUD	1
XA 2660	PLATE	1
XA 770	WASHER	6
XA 2669	BOLT	6
XA 1556	CLAMP	1
XA 1558	HOSE	1
XA 1556	CLAMP	3
XA 1560	OUTLET	1
XA 1558	HOSE	1
XA 2666	HOSE	1
XA 2667	PIPE	1

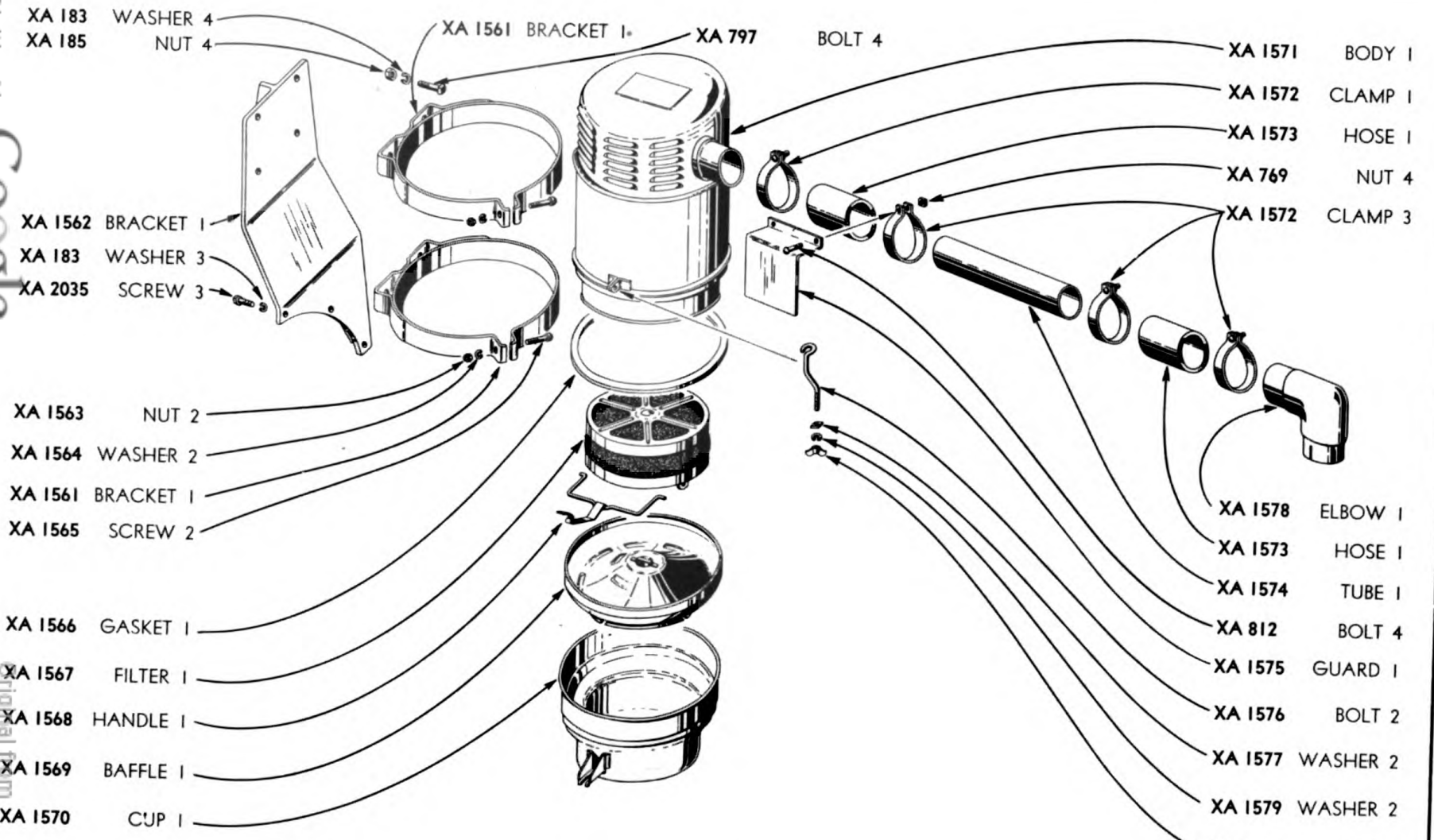
RADIATOR AND PIPING



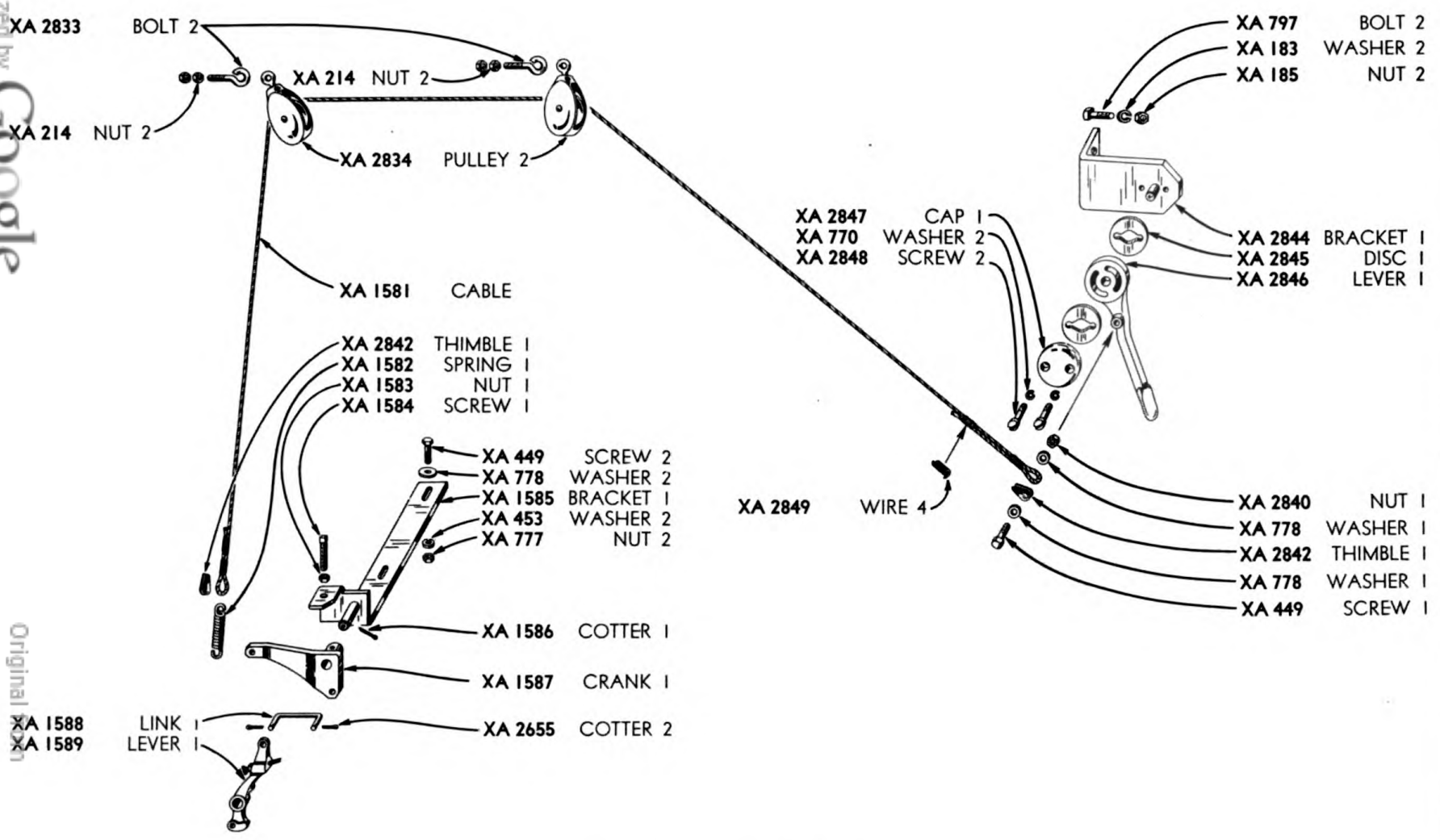
ENGINE CLUTCH LEVER



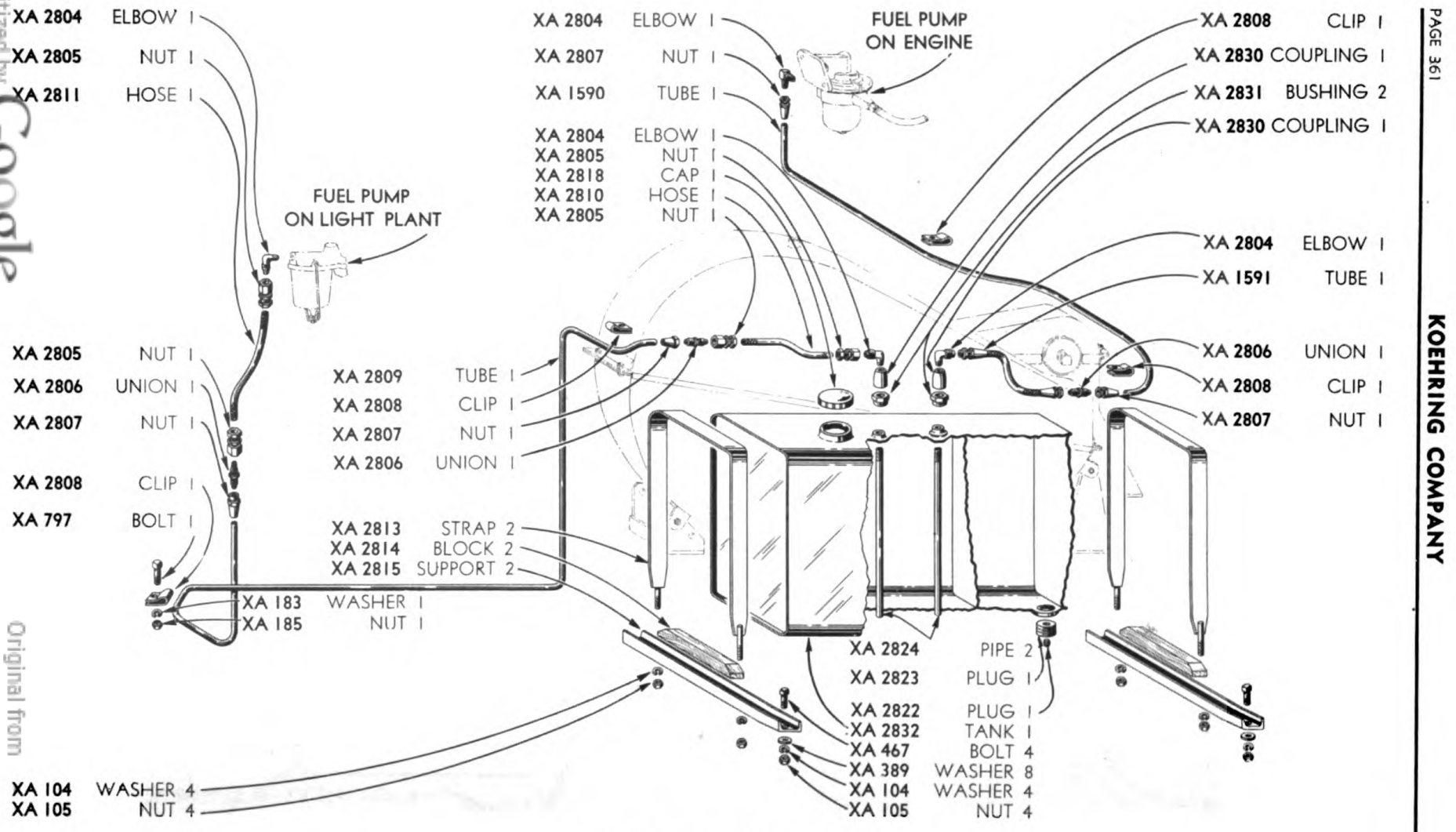
RADIATOR AND PIPING



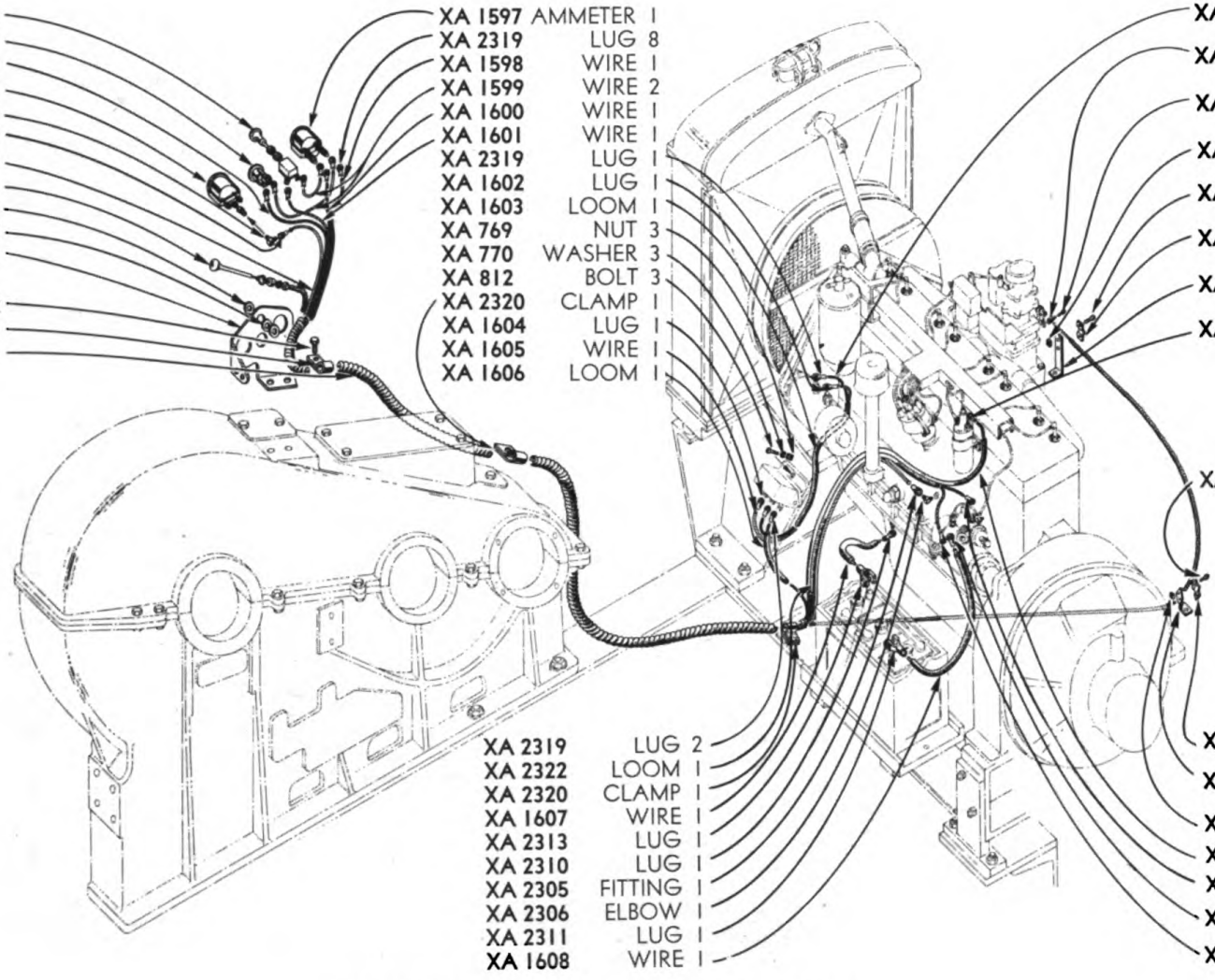
AIR CLEANER AND PARTS



REMOTE GOVERNOR CONTROL



FUEL TANK AND PIPING



XA 1592	SWITCH	1
XA 2335	BUTTON	1
XA 1593	WIRE	1
XA 1594	GAUGE	1
XA 2306	ELBOW	1
XA 2305	FITTING	1
XA 1595	TUBE	1
XA 1596	ROD	1
XA 778	WASHER	1
XA 186	WASHER	2
XA 2327	PANEL	1
XA 194	SCREW	2
XA 2320	CLAMP	1
XA 2321	CONDUIT	1

XA 1597	AMMETER	1
XA 2319	LUG	8
XA 1598	WIRE	1
XA 1599	WIRE	2
XA 1600	WIRE	1
XA 1601	WIRE	1
XA 2319	LUG	1
XA 1602	LUG	1
XA 1603	LOOM	1
XA 769	NUT	3
XA 770	WASHER	3
XA 812	BOLT	3
XA 2320	CLAMP	1
XA 1604	LUG	1
XA 1605	WIRE	1
XA 1606	LOOM	1

XA 1609	WIRE	1
XA 1610	SWIVEL	1
XA 1611	SCREW	1
XA 768	NUT	2
XA 1063	BOLT	2
XA 1612	PLATE	1
XA 1613	BRACKET	1
XA 2319	LUG	1
XA 1063	BOLT	2
XA 1612	PLATE	1
XA 1615	SUPPORT	1
XA 768	NUT	2
XA 2323	LOOM	1
XA 2319	LUG	1
XA 2310	LUG	1
XA 1614	LUG	1

XA 2319	LUG	2
XA 2322	LOOM	1
XA 2320	CLAMP	1
XA 1607	WIRE	1
XA 2313	LUG	1
XA 2310	LUG	1
XA 2305	FITTING	1
XA 2306	ELBOW	1
XA 2311	LUG	1
XA 1608	WIRE	1

ELECTRIC STARTING AND GENERATOR W

304 PARTS SECTION

SYMBOL IDENTIFICATION

A	Alemite (Grease Fittings)
AM	Aircraft Mfg. Co. (Wire Lugs)
BK	Bendix (Pipe Fittings)
C	Clum Mfg. Co. (Switch)
CY	Chrysler (Engine Parts)
DC	Diamond (Chain)
EA	Eaton-Detroit Metal (Tank Cap)
GL	Globe (Battery)
LN	Leece Neville (Electrical Fittings)
MR	Marlin Rockwell Co. (Bearings)
PE	Perfex (Radiator)
PG	Pierce (Governor Parts)
PR	Pritzlaff (Hardware)
R	Ross Gear and Tool (Friction Disc and Cap)
ST	Stromberg (Swivel and Screw)
SW	Stewart and Warner (Gauge)
UA	United Specialties Co. (Air Cleaner)
USG	U. S. Gauge Co. (Ammeter)
TD	Twin Disc (Clutch)
WE	Weatherhead (Hose and Fittings)
WR	Woodruff (Key)

*	Price Per 100 Pieces
**	Over 200 Pieces per Pound

Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 12	Nut, Hexagon - 3/4" N.C.	1	5 pcs.1#	$ .03	
XA 13	Washer, Lock - 3/4"	14	23 pcs.1#	.01	
XA 27	Fitting, Alemite (A-A1184)	4	23 pcs.1#	.12	
XA 29	Washer, Lock - 1/2"	6	80 pcs.1#	.60*	
XA 30	Nut, Hexagon - 1/2" N.C.	4	14 pcs.1#	.01	
XA 36	Fitting,Alemite-¼"(A-A1186)	1	20 pcs.1#	.14	
XA 73	Plug, Pipe - Sq. Head 3/4"	2	7 pcs.1#	.05	
XA 81	Coupling, Pipe - 1/4"	1	16 pcs.1#	.10	
XA 104	Washer, Lock - 5/8"	24	44 pcs.1#	.01	
XA 105	Nut, Hexagon - 5/8" N.C.	19	9 pcs.1#	.03	
XA 110	Screw, Cap - Hex. Head 3/8" x 1¼" N.C.	9	16 pcs.1#	.02	
XA 167	Bolt, Machine - 5/8" x 2½"	1	3 pcs.1#	.07	
XA 172	Washer, Flat - 1/2"	2	26 pcs.1#	.50*	
XA 173	Nut, Wing - 1/2" N.C.	2	10 pcs.1#	.06	
XA 177	Bolt, Machine - 1/2" x 2"	2	6 pcs.1#	.04	
XA 178	Ell, Street - 1/2" x 45° W.I.	1	12 pcs.1#	.18	
XA 179	Bolt, Machine - 5/8" x 2" N.C.	2	3 pcs.1#	.07	
XA 183	Washer, Lock - 3/8"	43	200 pcs.1#	.50*	
XA 185	Nut, Hexagon - 3/8" N.C.	16	32 pcs.1#	.80*	
XA 186	Washer, Flat - 3/8" Std.	2	66 pcs.1#	.20*	
XA 194	Screw, Cap - Hex. Head 5/8" x 1" N.C.	2	5 pcs.1#	.06	
XA 202	Plug, Pipe - Square Head 1½" Male	1	2 pcs.1#	.12	358
XA 214	Nut, Hex. Half - 3/8" N.C.	4	60 pcs.1#	.01	
XA 228	Bolt, Machine - 1/2" x 1¼"	2	9 pcs.1#	.04	
XA 238	Cotter, 3/16" x 1-1/4"	4	105 pcs.1#	.10*	
XA 262	Nut, Hexagon - 5/8" N.F.	4	9 pcs.1#	.03	
XA 304	Plug, Pipe - Sq. Head 1/4"	1	33 pcs.1#	.04	
XA 367	Nut, Hex. Half - 3/4" N.C.	5	10 pcs.1#	.04	
XA 379	Cotter, 1/4" x 2"	1	38 pcs.1#	.60*	
XA 380	Clevis, Reach rod	4	1#	1.00	357
XA 389	Washer, Flat - 5/8" Std.	12	13 pcs.1#	.60*	
XA 397	Nut, Hexagon - 3/4" N.F.	12	5 pcs.1#	.05	
XA 412	Pin, Clevis	4	4 pcs.1#	.14	357
XA 449	Screw, Cap - Hex. Head 5/16" x 1" N.C.	43	28 pcs.1#	.01	
XA 453	Washer, Lock - 5/16"	68	**	.30*	
XA 467	Bolt, Machine 5/8" x 1-3/4" N.C.	8	4 pcs.1#	.07	
XA 524	Bolt, Machine 5/8" x 1½"	2	5 pcs.1#	.07	
XA 544	Rod, reach	1	1-3/4"	.70	357
XA 553	Lever, Operating	2	1-3/4#	3.70	357
XA 554	Bearing, Lever Shaft	2	3#	1.60	357
XA 559	Key, Straight	2	32 pcs.1#	.05	357
XA 573	Rod, reach	1	5#	1.90	357
XA 592	Lever, Hand	1	11#	8.75	357
XA 705	Cap, Grease pipe	1	3/4#	1.00	355
XA 708	Seal, felt - Med. Hard 1/2" x 1/2" x 17-3/4"	1	53 pcs.1#	.30	355
XA 709	Spacer, Pipe	1	2 pcs.1#	.17	356
XA 710	Bolt, Machine - 3/4" x 7"	1	1#	.15	
XA 712	Shim, Support	4	2 pcs.1#	.25	356

* Price Per 100 Pcs.
** Over 200 Pcs. Per Lb.

Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 714	Nut, Square - 5/16" N.C.	2	45 pcs.1#	$ .90*	
XA 719	Seal, Felt - 5" I.D. x 3/8" Th. x 5-3/4" O.D.	1	80 pcs.1#	.60	356
XA 720	Retainer, Felt seal	1	5½#	3.00	356
XA 721	Bolt, Stove - Rd. Hd. 5/16" x 1" N.C.	2	25 pcs.1#	.02	
XA 722	Bolt, Machine-3/8" x 3/4" N.C.	8	22 pcs.1#	.03	
XA 723	Support, Case	1	6½#	3.25	356
XA 724	Shim, support	4	2 pcs.1#	.15	356
XA 743	Screw, Cap - Hex. Hd. 1/2" x 3/4" N.C.	2	10 pcs.1#	.03	
XA 768	Nut, Square - 3/16" N.C.	4	105 pcs.1#	.10*	
XA 769	Nut, Square - 1/4" N.C.	7	75 pcs.1#	.40*	
XA 770	Washer, Lock - 1/4"	11	**	.20*	
XA 777	Nut, Hexagon - 5/16" N.C.	66	50 pcs.1#	.70*	
XA 778	Washer, Flat - 5/16" Std.	7	90 pcs.1#	.20*	
XA 797	Bolt, Machine - 3/8" x 1" N.C.	8	19 pcs.1#	.03	
XA 812	Bolt, Stove - Round Head 1/4" x 3/4" N.C.	7	48 pcs.1#	.02	
XA 1023	Nipple, Close - 1/2" W.I.	1	14 pcs.1#	.05	
XA 1063	Bolt, Stove - Round Head 3/16" x 1/2"	4	106 pcs.1#	.50*	
XA 1351	Bolt, Machine - 3/4" x 5½" N.C.	1	3/4#	.14	
XA 1371	Washer, Bevel - 3/4"	6	6 pcs.1#	.06	
XA 1498	Pipe, Exhaust	1	6#	5.00	350
XA 1499	Nipple, Exhaust pipe - 2¼" x 4" Thrd. 1 end	1	2#	.40	350
XA 1500	Foot, Rear Engine	1	9#	6.00	350
XA 1501	Screw, Cap - Hex. Head 5/8" x 2" N.F.	4	2 pcs.1#	.07	
XA 1502	Foot, rear engine	1	9#	6.00	350
XA 1503	Plate, engine	1	32#	6.00	350
XA 1504	Plug, ctsk. pipe - 1/2"	1	16 pcs.1#	.12	
XA 1505	Rod, Tie	2	3/4#	.50	350
XA 1506	Engine, 8 cyl. gas - Model C36-520 CY	1	1014#	540.00	350
XA 1507	Support, Radiator & engine	1	76#	42.00	350
XA 1508	Nut, hexagon - 7/16" N.F.	2	20 pcs.1#	.01	
XA 1509	Washer, Lock - 7/16"	2	16 pcs.1#	.50*	
XA 1510	Screw, Cap - Hex. Head 7/16" x 1½" N.F.	2	8 pcs.1#	.04	
XA 1511	Ring, Driving (TD-6625B)	1	8#	5.60	351
XA 1512	Housing, Clutch (TD-7351)	1	44#	26.40	351
XA 1513	Clutch, Power Takeoff - Assembly (TD-X7350A)	1	112#	106.70	351
XA 1514	Screw, Cap - Hex. Head 3/8" x 2" N.C.	8	12 pcs.1#	.03	351
XA 1515	Spacer, Clutch Shaft	2	3/4#	1.25	353
XA 1516	Sprocket, engine	1	21#	29.25	353
XA 1517	Link, connecting w/#184806 cover plate DC148	1	1/4#	.60	353
XA 1518	Chain, engine drive - 72 lks., 5/8" pitch, 6 strand sextuple (DC-XTT1548-06)	1	15#	20.20	353

* Price Per 100 Pcs.
** Over 200 Pcs. Per Lb.

Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 1519	Plate, lock	2	160 pcs.1#	$ .08	353
XA 1520	Spacer, countershaft	1	3/4#	3.00	353
XA 1521	Bearing, Ball (MR-212MF)	1	2#	3.00	353
XA 1522	Spacer, Countershaft	2	1#	2.50	353
XA 1523	Sprocket, Driven - "First reduction"	1	61#	49.75	353
XA 1524	Key, Straight	1	1/2#	.12	353
XA 1525	Bearing, Ball (MR-216MF)	1	4#	5.50	353
XA 1526	Shaft, Counter	1	24#	20.00	353
XA 1527	Washer, retainer	1	3/4#	.20	353
XA 1528	Sprocket, Driving	1	11#	20.00	353
XA 1529	Key, Straight	1	1/2#	.35	353
XA 1530	Key, Straight	1	1/4#	.25	353
XA 1531	Chain, drive - 2nd red., 3/4" pitch, Four Strand, 186 pitch length, 185 pitches, roller link each end (DC-XTT123304)	1	42#	58.60	353
XA 1532	Retainer, Felt Seal	1	5#	1.50	355
XA 1533	Cover, chain case	1	6#	12.00	355
XA 1534	Retainer, Bearing	1	4#	3.75	355
XA 1535	Clamp, Hose - 3/4" x 5 ply	4	16 pcs.1#	.05	355
XA 1536	Elbow, oil pipe (BK-BK10450)	3	5 pcs.1#	.25	355
XA 1537	Cover, grease pipe	1	3 1/2#	1.85	355
XA 1538	Case, chain - First red.	1	120#	120.00	355
XA 1539	Nipple, Straight (BK-372421)	1	8 pcs.1#	.20	355
XA 1540	Hose, oil pipe-3/4"x3" (BK)	1	24 pcs.1#	.16	355
XA 1541	Screw, Machine - Flat Head 5/16" x 3/4" N.C.	6	32 pcs.1#	.04	
XA 1542	Plate, Oil seal	1	2#	1.25	355
XA 1543	Hose, oil pipe-3/4"x12" (BK)	1	3 pcs.1#	.63	355
XA 1544	Case, Chain upper & lower	1	108#	75.00	356
XA 1545	Spacer, Pipe	1	2 pcs.1#	.15	356
XA 1546	Support, Case	1	6#	3.50	356
XA 1547	Shim, support	1	4-1/2#	.75	356
XA 1548	Lever, hand	1	5#	6.25	357
XA 1549	Washer, flat - 1" SAE	1	8 pcs.1#	.03	
XA 1550	Shaft, lever	1	13 1/2"	4.50	357
XA 1551	Ell, Street, 1-1/2" x 90°	1	1 1/2#	.60	358
XA 1552	Elbow, Outlet	1	1#	2.75	358
XA 1553	Elbow, Inlet	1	2 1/2	2.25	358
XA 1554	Brace, Radiator	1	1 1/2#	.90	358
XA 1555	Nut, Hexagon - 3/8" N.F.	1	32 pcs.1#	.80*	
XA 1556	Clamp, Hose - J.R. Clancy 1 1/2" x 4 Ply with bolt	6	5 pcs.1#	.60	358
XA 1557	Stud, Brace	1	5 pcs.1#	.20	358
XA 1558	Hose, radiator - 1-3/4" x 3 ply x 4-1/2"	3	3 pcs.1#	.15	358
XA 1559	Shroud, Fan - Complete w/ screen PE-A-11-81	1	9#	16.30	358
XA 1560	Outlet, Radiator (CY-1074905)	1	1 1/2#	1.85	358
XA 1561	Bracket, Slip Ring (UA-B11875)	2	1 1/2#	1.50	359
XA 1562	Bracket, Air Cleaner	1	12 1/2#	3.50	359
XA 1563	Nut, Hexagon (UA-A12032)	2	64 pcs.1#	.20*	359
XA 1564	Washer, Lock (UA-A12033)	2	**	.50*	359
XA 1565	Screw, Fillister (UA-A12034)	2	32 pcs.1#	.03	359

* Price Per 100 Pcs.
** Over 200 Pcs. Per Lb.

Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 1566	Gasket,Oil Cup (UA-A12004)	1	32 pcs.1#	$ .06	359
XA 1567	Filter,Removable(UA-B12271)	1	1-1/4#	3.55	359
XA 1568	Handle, Filter - Assembly (UA-B12142)	1	16 pcs.1#	.12	359
XA 1569	Baffle, Oil Cup - Assembly (UA-B12272)	1	1#	.70	359
XA 1570	Cup, Oil - Assembly (UA-C12268)	1	2#	.90	359
XA 1571	Body, Cleaner - Assembly (UA-C12556)	1	9-1/4#	6.60	359
XA 1572	Clamp, Hose	4	8 pcs.1#	.35	359
XA 1573	Hose, Radiator - 2½" I.D. x 3 ply x 3"	2	8 pcs.1#	.15	359
XA 1574	Tube, Air Cleaner	1	2#	3.50	359
XA 1575	Guard, Hose	1	5 pcs.1#	.35	359
XA 1576	Bolt, Eye (UA-A12007)	2	16 pcs.1#	.09	359
XA 1577	Washer, Square (UA-A12612)	2	128 pcs.1#	.02	359
XA 1578	Elbow, Air Cleaner - with felt washer (CY-1075585)	1	3/4#	2.00	359
XA 1579	Washer, Lock (UA-A4092)	2	**	.50*	359
XA 1580	Nut, Wing (UA-A1317)	2	64 pcs.1#	.06	359
XA 1581	Cable, Aircraft - 1/8" x 13'-6" (7x19 Tinned)	1	1/2#	.95	360
XA 1582	Spring, Tension	1	8 pcs.1#	.70	360
XA 1583	Nut, Hexagon - 1/4" N.C.	1	56 pcs.1#	.50*	
XA 1584	Screw, set - Square Head 1/4" x 2" N.C.	1	52 pcs.1#	.03	
CA 1585	Bracket, Bell Crank	1	1-1/2#	.60	360
CA 1586	Cotter, 1/8" x 1/2"	1	**	.10*	
XA 1587	Crank, bell	1	3/4#	2.75	360
XA 1588	Link, Crank	1	16 pcs.1#	.60	360
XA 1589	Lever, Control - with set screws (PG-3266)	1	3 pcs.1#	2.40	360
XA 1590	Tube, Copper - 5/16" x 5'-6" (.035 wall)	1	1#	.65	361
XA 1591	Tube, Flex-O	1	4 pcs.1#	.90	361
XA 1592	Switch, Ignition (C-18831)	1	1/4#	.80	362
XA 1593	Wire, Anaconda - #14 x 10'-6"	1	3-1/2#	.32	362
XA 1594	Gauge, Oil (SW-95218)	1	1/2#	2.00	362
XA 1595	Tube, copper - 1/4" x 9'-0" (.035 wall)	1	3/4#	.90	362
XA 1596	Rod, control - 13'-0" long	1	2#	2.30	362
XA 1597	Ammeter, 30 Ampere - 2" (USG-A09265)	1	1/2#	1.50	362
XA 1598	Wire, Anaconda - #14 x 10'-6"	1	3-1/2#	.32	362
XA 1599	Wire, Anaconda - #14 x 3½"	2	10 pcs.1#	.01	362
XA 1600	Wire, Anaconda - #14 x 8'-2"	1	2-3/4#	.25	362
XA 1601	Wire, Anaconda - #14 x 10'-10"	1	3-1/2#	.35	362
XA 1602	Lug, wire (AM-81118)	1	**	.03	362
XA 1603	Loom, 1/4" x 17"	1	14 pcs.1#	.05	362
XA 1604	Lug, wire (AM-30465)	1	**	.03	362
XA 1605	Wire, Anaconda - #10 x 23"	1	15 pcs.1#	.20	362
XA 1606	Loom, 1/4" x 8"	1	**	.02	362
XA 1607	Wire, #1 R.C. x 8"	1	**	.10	362
XA 1608	Wire, #1 R.C. x 22"	1	**	.28	362

* Price Per 100 Pcs.
** Over 200 Pcs. Per Lb.

Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 1609	Wire, Anaconda - #14 x 23"	1	23 pcs.1#	$ .06	362
XA 1610	Swivel, Control Rod (ST-8893)	1	160 pcs.1#	.10	362
XA 1611	Screw, control rod (ST-9270)	1	**	.05	362
XA 1612	Plate, Clamping	2	96 pcs.1#	.24	362
XA 1613	Bracket, Control	1	8 pcs.1#	.30	362
XA 1614	Lug, Wire (AM-31464)	1	105 pcs.1#	.03	362
XA 1615	Support, Control Rod	1	24 pcs.1#	.24	362
XA 2035	Screw, Cap - Hex. Head 3/8" x 1½" N.C.	5	12 pcs.1#	.03	
XA 2120	Ring, Snap (TD-M642)	8	**	.01	351
XA 2121	Link, Lever (TD-2617)	8	3/4#	.22	351
XA 2122	Pin, Lever Link (TD-1968A)	8	30 pcs.1#	.11	351
XA 2123	Sleeve, Sliding (TD-A1974)	1	2-1/4#	6.38	351
XA 2124	Plate, Floating (TD-5470)	1	16-1/4#	4.95	351
XA 2125	Plate, Driving (TD-A5579A)	1	2-3/4#	7.25	351
XA 2127	Spring, Release (TD-113)	4	50 pcs.1#	.11	351
XA 2128	Plate, Hub and Backing (TD-Z5467C)	1	16-1/2#	7.20	351
XA 2129	Washer, Lock (TD-A1588)	1	15 pcs.1#	.06	351
XA 2130	Nut, Lock (TD-1092A)	1	8 pcs.1#	.60	351
XA 2131	Bearing, Pilot (TD-M167)	1	3/4#	5.35	351
XA 2132	Yoke, Adjusting (TD-3322)	1	1-1/2#	3.63	351
XA 2133	Spring, Lock pin (TD-115)	1	50 pcs.1#	.06	351
XA 2134	Pin, Finger (TD-106A)	4	**	.16	351
XA 2135	Nut, slotted (TD-M645)	2	50 pcs.1#	.03	351
XA 2136	Shim, collar (TD-120)	2	100 pcs.1#	.11	351
XA 2137	Collar, cone - assembly with shims and bolts (TD-117)	1	2#	4.40	351
XA 2138	Bolt, cone collar (TD-M649)	2	8 pcs.1#	.04	351
XA 2139	Hose, flexible - assembly - with elbows (TD-A1663)	1	3/8#	1.10	351
XA 2140	Elbow, 90° (TD-M1283)	1	1/8#	.15	351
XA 2142	Nut, Jam (TD-M309)	1	15 pcs.1#	.05	351
XA 2144	Yoke, adjusting - assembly (TD-A112)	1	2-1/2#	7.50	351
XA 2145	Sleeve, Sliding - assembly (TD-S232)	1	4-3/4#	15.00	351
XA 2146	Elbow, 90° (TD-M1284)	1	20 pcs.1#	.15	351
XA 2147	Nut, retainer (TD-1213)	1	3/8#	1.35	351
XA 2148	Spring, lock (TD-1214)	1	20 pcs.1#	.12	351
XA 2149	Yoke, throwout (TD-125A)	1	2#	1.85	351
XA 2151	Pin, lock (TD-114A)	1	25 pcs.1#	.24	351
XA 2152	Ring, snap (TD-M641)	4	**	.01	351
XA 2153	Key, Woodruff (WR-15)	3	40 pcs.1#	.10	
XA 2154	Lever, finger (TD-103F)	4	1/8#	.55	351
XA 2155	Shaft, operating (TD-1144A)	1	4-1/4#	2.20	351
XA 2156	Plate, name (TD-A1664)	1	100 pcs.1#	.10	351
XA 2157	Screw, drive (TD-M422)	2	**	.01	351
XA 2159	Screw, button head - 1/4"-20 x 1/2" long (TD-M227)	4	100 pcs.1#	.01	351
XA 2160	Plate, hand hole (TD-2815)	1	8 pcs.1#	.70	351
XA 2161	Gasket, plate (TD-A1111)	2	40 pcs.1#	.28	351
XA 2162	Screw, machine (TD-A1352)	1	80 pcs.1#	.17	351

* Price Per 100 Pcs.
** Over 200 Pcs. Per Lb.

Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 2163	Washer, lock (TD-M1527)	1	**	$ .01	351
XA 2164	Lock, retainer (TD-1216A)	1	25 pcs.1#	.22	351
XA 2165	Shaft, clutch	1	11#	37.30	351
XA 2166	Key, Whitney - TX (TD-M1089)	1	10 pcs.1#	.15	351
XA 2167	Spacer, bearing (TD-1215)	1	1/8#	.57	351
XA 2168	Retainer, bearing (TD-1212)	1	1-3/4#	7.10	351
XA 2169	Bearing, roller (TD-M205)	2	1-1/2#	4.90	351
XA 2170	Cup, oil (TD-M102)	2	**	.06	351
XA 2171	Plate, hand hole (TD-2816)	1	3/8#	.22	351
XA 2305	Fitting, Tube - 1/4" (WE-W41X4)	2	50 pcs.1#	.13	362
XA 2306	Elbow, 1/4" x 1/8" (WE-W49X4)	2	30 pcs.1#	.20	362
XA 2310	Lug, wire - 150 amp.	2	15 pcs.1#	.14	362
XA 2311	Lug, Battery - Negative	1	1/4#	.25	362
XA 2313	Lug, Battery - Positive	1	1/4#	.25	362
XA 2319	Lug, wire (AM-31075)	13	**	.04	362
XA 2320	Clamp, cable	3	1/4#	.40	362
XA 2321	Conduit, Greenfield - 3/4" x 85"	1	4-1/4#	.70	362
XA 2322	Loom, 1/4" x 38"	1	14 pcs.1#	.10	362
XA 2323	Loom, 1/4" x 36"	1	14 pcs.1#	.10	362
XA 2327	Panel, Instrument	1	3#	2.00	362
XA 2335	Button, starter (LN-103SS)	1	1/4#	3.75	362
XA 2569	Screw, Cap - Hex. Head 3/8" x 1" N.C.	10	20 pcs.1#	.04	
XA 2636	Spring, filler cap (PE-G24040)	1	**	.15	358
XA 2637	Cap, radiator (PE-A9-1)	1	2#	1.50	358
XA 2638	Plug, Pipe - Ctsk. head 1½"	1	2 pcs.1#	.19	358
XA 2639	Tank, top (PE-G1308)	1	48#	22.50	358
XA 2640	Gasket, Cork - 5 pcs. make up 2 gaskets (PE-G24028)	2	**	.18	358
XA 2641	Tube, overflow (PE-G21499)	1	4 pcs.1#	.90	358
XA 2643	Washer, Core (PE-G21841)	4	2 pcs.1#	.38	358
XA 2644	Core, radiator - assembly (PE-TC415)	1	47#	43.50	358
XA 2645	Screw, cap (PE-G2038)	24	20 pcs.1#	.02	358
XA 2646	Side, radiator (PE-G5730)	2	18#	8.25	358
XA 2647	Tank, bottom (PE-G407)	1	34½#	15.00	358
XA 2648	Stud, support (PE-G21141)	2	4 pcs.1#	.90	358
XA 2649	Support, Radiator	2	8 pcs.1#	.35	358
XA 2653	Ell, Street - 1/2" x 45° W.I.	1	1/4#	.20	
XA 2655	Cotter, 1/16" x 1/2" (PE-578)	4	**	.10*	
XA 2656	Pin, hinge (PE-G21094)	1	15 pcs.1#	.08	358
XA 2660	Plate, serial number (PE-G24000)	1	**	.15	358
XA 2664	Cock, brass stop - 1/2"	1	3/4#	1.95	358
XA 2665	Pipe, 1/2" x 1½" - W.I. Thread on one end	1	8 pcs.1#	.05	358
XA 2666	Hose, rubber - 3/4" I.D. x 7"	1	4 pcs.1#	.15	358
XA 2667	Pipe, drain	1	1-1/4#	.20	358

* Price Per 100 Pcs.
** Over 200 Pcs. Per Lb.

Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 2669	Bolt, stove - round head 1/4" x 1/2"	6	50 pcs.1#	$ .02	
XA 2804	Elbow, 5/16" x 1/8" (WE-W49X5)	4	20 pcs.1#	.23	361
XA 2805	Nut, 1/4" x 5/16" (WE-A4125)	4	15 pcs.1#	.25	361
XA 2806	Union, 5/16" (WE-W42X5)	3	15 pcs.1#	.23	361
XA 2807	Nut, hose - 5/16" (WE-W41X5)	4	20 pcs.1#	.17	361
XA 2808	Clip, fuel line	4	50 pcs.1#	.30	361
XA 2809	Tube, copper - 5/16" x 8'-0" (.049 wall)	1	1#	.75	361
XA 2810	Hose, 1/4" x 23" (WE)	1	10 pcs.1#	.75	361
XA 2811	Hose, 1/4" x 9" (WE)	1	25 pcs.1#	.30	361
XA 2813	Strap, fuel tank	2	7-1/4#	2.85	361
XA 2814	Block, oak	2	2 pcs.1#	.30	361
XA 2815	Support, fuel tank	2	8-1/2#	1.75	361
XA 2818	Cap, filler (EA-GD297)	1	1/4#	.60	361
XA 2822	Plug, Pipe - 3/8" sq. hd.	1	20 pcs.1#	.04	361
XA 2823	Plug, Drain	1	1-3/4#	.70	361
XA 2824	Pipe, stand	2	1#	1.00	361
XA 2830	Coupling, Reducer - 1/4" to 1/8"	2	16 pcs.1#	.10	
XA 2831	Bushing, Reducer	2	8 pcs.1#	.30	361
XA 2832	Tank, fuel	1	100#	45.50	361
XA 2833	Bolt, eye	2	8 pcs.1#	.40	360
XA 2834	Pulley, Swivel - 2" (PR-73)	2	1#	.40	360
XA 2840	Nut, hex half - 5/16" N.C.	1	100 pcs.1#	.70*	
XA 2842	Thimble, cable - Aircraft 1/8" SAE	2	150 pcs.1#	.05	360
XA 2844	Bracket, hand lever - with 1/2" x 3/4" Rd. Hd. Rivet	1	2#	1.80	360
XA 2845	Disc, Friction (R-E35DS)	2	50 pcs.1#	.10	360
XA 2846	Lever, Hand	1	1-1/4#	2.75	360
XA 2847	Cap, Hand Lever (R-E116E6692)	1	8 pcs.1#	.70	360
XA 2848	Screw, Cap - Fillister Head 1/4" x 1" N.C.	2	50 pcs.1#	.03	
XA 2849	Wire, Blue Anneales #22 x 8" Long	4	**	.01	360
XA 2856	Link, Connecting - Slip fit center plate (DC-XTT123304)	1	1/4#	.50	353
XA 2859	Plate, Retainer	2	2 pcs.1#	1.50	353
XA 2860	Plate, Lock	1	20 pcs.1#	.30	353
XA 2863	Nipple, 1/4" x 2"	1	14 pcs.1#	.06	
XA 2865	Slinger, Oil	1	1/4"	.24	353
XA 2873	Cover, Battery Tray	1	2-1/4#	3.00	350
XA 2876	Battery, 6 volt - 19 plate (GL-V89)	1	57#	20.95	350
XA 2879	Tray, Battery	1	2-3/4#	3.25	350
XA 2893	Screw, Cap - Hex. Head 3/4" x 3" N.F.	8	2 pcs.1#	.12	
XA 2903	Screw, Cap - Hex. Head 3/4" x 2½" N.F.	4	2 pcs.1#	.11	

* Price Per 100 Pcs.
** Over 200 Pcs. Per Lb.

INDEX, CROSS REFERENCE FROM TECHNICAL MANUAL REFERENCE NUMBERS TO KOEHRING AND VENDORS PART NUMBERS

FOR WAR DEPARTMENT TECHNICAL MANUAL TM5-1172

CRANE, CRAWLER MOUNTED,
GASOLINE, 3/4 CU. YARD,
WITH ATTACHMENTS,
KOEHRING, MODEL 304

The catalog reference numbers (XA) are to be used only for reference. The actual part numbers are shown in this index and are to be used for ordering.

VENDORS SYMBOL IDENTIFICATION

A	Alemite (grease fittings)
BK	Bendix (pipe fittings)
CY	Chrysler (engine parts)
F	Fafnir (bearing)
GL	Globe (battery)
H	Hyatt (bearing)
LN	Leece Neville (electrical fittings)
MR	Marlin Rockwell Co. (bearings)
ND	New departure (bearings)
PG	Pierce (Governor parts)
PY	Pyrene (fire extinguisher)
R	Ross Gear and Tool (friction disc)
RC	Rollway (bearing)
ST	Stromberg (swivel and screw)
SW	Stewart and Warner (gauge)
T	Timken (bearing)
TD	Twin Disc (clutch)
UA	United Specialties Co. (air cleaner)
WE	Weatherhead (hose and fittings)

* Hardware, fittings etc.

WAR DEPT. TECHNICAL MANUAL PART NO.	KOEHRING PART NO.	VENDORS SYMBOL	VENDORS PART NO.
XA 1	1803A-RL		
XA 2	1803A-P		
XA 3	1803A-R		
XA 4	1803A-52		
XA 5	*		
XA 6	*		
XA 7	4225A258		
XA 8	89B233A		
XA 9	*		
XA 10	1938A15A		
XA 11	4225A294		
XA 12	*		
XA 13	*		
XA 14	*		
XA 15	41CA26B		
XA 16	4225A222		
XA 17	89G414B		
XA 18	89B534		
XA 19	35ST11A		
XA 20	*		
XA 21	4226A165		
XA 22	4225A51C		
XA 23	89B412		
XA 24	4206A306		
XA 25	90B124		
XA 26	69A367		
XA 27		A	A-1184
XA 28	4234A47		
XA 29	*		
XA 30	*		
XA 31	*		
XA 32	C4-61H		
XA 33	3400A2		
XA 34	4225B248B		
XA 35	200A408		
XA 36		A	A-1186
XA 37	4206A998		
XA 38	89A235A		
XA 39	63CA22A		
XA 40	4206A11		
XA 41	89B522B		
XA 42	4234B21A		
XA 43	4226A864		
XA 44	89B230A		
XA 45	4206A999		
XA 46	89E58D		
XA 47	89B228A		
XA 48	89B229A		
XA 49	4234B10		
XA 50	89E516B		
XA 51	89D453		
XA 52	70CA11B		
XA 53	89A105-1		
XA 54	4225A201-1		
XA 55	4225A201-2		
XA 56	89B54		
XA 57	*		
XA 58	*		
XA 59	*		
XA 60	69A251-1		
XA 61	4225A228-1		
XA 62	4225A228-2		
XA 63	*		
XA 64	89B451		
XA 65	*		
XA 66	89A140		
XA 67	*		
XA 68	*		
XA 69	*		
XA 70	*		
XA 71	*		
XA 72	89D452		
XA 73	*		
XA 74	*		
XA 75	59CA33		
XA 76	89D93C		
XA 77	89E458		
XA 78	89A104		
XA 79	89A103		
XA 80	*		
XA 81	*		
XA 82	69A326A		
XA 83	4225D79A		
XA 84	40SA172B		
XA 85	*		
XA 86		T	K10339
XA 87	200A53		
XA 88		H	A1216TS
XA 89	89B11C		
XA 90	212B363		
XA 91	89B29-2		
XA 92	4225A40		
XA 93	89B565		
XA 94	OS5250		
XA 95	212UA4		
XA 96	C826A3		
XA 97	4225A41A		
XA 98	212UA3		
XA 99	212B64A		
XA 100	89B30A		
XA 101		T	462-453X
XA 102	*		
XA 103	4225A37-1		
XA 103A	4225A37-2		
XA 103B	4225A37-3		
XA 104	*		
XA 105	*		
XA 106	*		
XA 107	4225A39		
XA 108	4225A38		
XA 109	*		
XA 110	*		
XA 111	*		
XA 112	4225A36-2B		
XA 113	4225A36-1B		
XA 114	89A22A		
XA 115	*		
XA 116	89A24		
XA 117		H	CD211
XA 118	212D63		
XA 119	89A25A		
XA 120		H	CW211
XA 121	89A23A		
XA 122	4225A4A		
XA 123	4236A162		
XA 124	4236A161		
XA 125	89B55C		
XA 126	4225A929		
XA 127	89B514		
XA 128	26CA103		
XA 129	89A513		
XA 130	4225B164E		
XA 131	4225A611		
XA 132	4225A475		
XA 133	4225A54		
XA 134	4225A15A		

* Hardware, Fittings etc.

WAR DEPT. TECHNICAL MANUAL PART NO.	KOEHRING PART NO.	VENDORS SYMBOL PART NO.	WAR DEPT. TECHNICAL MANUAL PART NO.	KOEHRING PART NO.	VENDORS SYMBOL PART NO.
XA 135	89D56C		XA 200B	4225B241-3	
XA 136	*		XA 201	*	
XA 137	4234B5A		XA 202	*	
XA 138	4225A44		XA 203	*	
XA 139	89D442		XA 204	*	
XA 140	89B443A		XA 205	25CA14A	
XA 141	40SA171B		XA 206	*	
XA 142	89A142		XA 207	2447-13	
XA 143	89D457A		XA 208	4226A30	
XA 144	4206A90		XA 209	*	
XA 145	4225A90		XA 210	*	
XA 146	*		XA 211	68CA8B	
XA 147	89D436		XA 212	C724-5	
XA 148	63CA24C		XA 213	*	
XA 149	89D296C		XA 214	*	
XA 150	4226A315		XA 215	4225A855	
XA 151	4226A316		XA 216	*	
XA 152	4225A780		XA 217	89B300	
XA 153	212A384		XA 218	4226A136	
XA 154	*		XA 219	49CA67	
XA 155	C92-3A		XA 220	4225A55A	
XA 156	4226A134B		XA 221	*	
XA 157	89D437		XA 222	*	
XA 158	64ST5C		XA 223	4225A390	
XA 159	4225B185		XA 224	69A256	
XA 160	4225B184		XA 225	*	
XA 161	69A355		XA 226	4226A80	
XA 162	89A141		XA 227	4226A81	
XA 163	*		XA 228	*	
XA 164	4206A626		XA 229	*	
XA 165	*		XA 230	*	
XA 166	*		XA 231	945A17	
XA 167	*		XA 232	4226A141	
XA 168	89E18B		XA 233	212UA22	
XA 169	*		XA 234	*	
XA 170	212A10		XA 235	49CA64A	
XA 170A	4225B347-1A		XA 236	4226A2	
XA 171	*		XA 237	4226A4	
XA 172	*		XA 238	*	
XA 173	*		XA 239	4226A1	
XA 174	89D128C-1		XA 240	54ST4A	
XA 175	*		XA 241	4225A89	
XA 176	4226A496		XA 242	4226A21	
XA 177	*		XA 243	4225B56A	
XA 178	*		XA 244	*	
XA 179	*		XA 245	C74-B	
XA 180	*		XA 246	25ST240B	
XA 181	4225G738-32A		XA 247	69A246	
XA 182	*		XA 248	4226A3	
XA 183	*		XA 249	69A263	
XA 184	4225A35		XA 250		F 120WD-2N
XA 185	*		XA 251		F 122WD-2N
XA 186	*		XA 252	*	
XA 187	*		XA 253	*	
XA 188	28CA35		XA 254	89B476	
XA 189	*		XA 255	89B550	
XA 190	*		XA 256	4234A115	
XA 191	*		XA 257	89D6	
XA 192	89A69B		XA 258	4225A267	
XA 193	4225A226		XA 259	*	
XA 194	*		XA 260	4222D30-5	
XA 195	4225A255		XA 261	89E479A	
XA 196	*		XA 262	*	
XA 197	4225A442		XA 263	89E478A	
XA 198	4225A919		XA 264	89B477	
XA 199	89E490A		XA 265	89E482A	
XA 200	4225B241-1		XA 266		F 215W
XA 200A	4225B241-2		XA 267	89E484A	

* Hardware, Fittings etc.

WAR DEPT. TECHNICAL MANUAL PART NO.	KOEHRING PART NO.	VENDORS SYMBOL PART NO.	WAR DEPT. TECHNICAL MANUAL PART NO.	KOEHRING PART NO.	VENDORS SYMBOL PART NO.
XA 268	89E481A		XA 335	*	
XA 269	89A378		XA 336	*	
XA 270	4226A7		XA 337	*	
XA 271	89D264		XA 338	69CA29A	
XA 272	89B265		XA 339	89E261	
XA 273		F 218-WD	XA 340	*	
XA 274	4226A6A		XA 341	89A60A	
XA 275	4225E943C		XA 342	4225A17A	
XA 276	4200A786-1		XA 343	*	
XA 277	*		XA 344	34ML21	
XA 278	212UA16		XA 345	62CA98	
XA 279	200A162		XA 346	4206A286	
XA 280	C74-6A		XA 347	89A66	
XA 281	200A163		XA 348	4225A473	
XA 282	212A195		XA 349	4225A592	
XA 283	212D122B		XA 350	*	
XA 284	*		XA 351	*	
XA 285	89D343A-1		XA 352	54CA56B	
XA 286	4226A504		XA 353	69A258	
XA 287	*		XA 354	C806-32	
XA 288		ND 7215	XA 355	*	
XA 289	4234A89A		XA 356	*	
XA 290	89E355B		XA 357	4226A191A	
XA 291	212UA51		XA 358	4226A245	
XA 292	89A340		XA 359	89B353	
XA 293	200A144		XA 360	4225B384-1A	
XA 294	4226A858		XA 361	4225A23A	
XA 295	4226A194		XA 362	89B330A	
XA 296	4226A197		XA 363	6FB116C	
XA 297	59CA31B		XA 364	*	
XA 298	89E549-1		XA 365	*	
XA 299	212A104		XA 366	4225A487	
XA 300	89B493		XA 367	*	
XA 301	89D548		XA 368	34ML20	
XA 302		ND 7310	XA 369	4236A199	
XA 303	*		XA 370	89D34	
XA 304	*		XA 371	1132	
XA 305	575412		XA 372	C735-14	
XA 306		F 220W	XA 373	6FB140B	
XA 307	4234A114		XA 374	212B91	
XA 308	4225A448		XA 375	89B547A	
XA 309	89B485A		XA 376	4206A718	
XA 310	4225A33		XA 377	4206A719	
XA 311	89D557-1		XA 378	4225A26	
XA 312		F 215WD	XA 379	*	
XA 313	4226A12		XA 380	CA11-1	
XA 314	4225A916-1		XA 381	4234A135	
XA 314A	4225A916-3		XA 382	93B353	
XA 315		F N19	XA 383	*	
XA 316		F W19	XA 384	4236A178A	
XA 317	4226A658		XA 385	*	
XA 318	28CA36C		XA 386	4236A26A	
XA 319	4226A14		XA 387	89B554	
XA 320	4225B917B		XA 388	*	
XA 321	*		XA 389	*	
XA 322	4225B921		XA 390	4225A747	
XA 323		F 120W-2	XA 391	1953A8	
XA 324	4226A659		XA 392	4200A6	
XA 325	40SA179B		XA 393	89A127A	
XA 326	4225B2C		XA 394	4206A551	
XA 327		F 315WD	XA 395	CA41-5	
XA 328	89B486-1		XA 396	4231A290A	
XA 329	4226A919		XA 397	*	
XA 330	4230A358A		XA 398	C808-26	
XA 331	1520		XA 399	*	
XA 332	*		XA 400	4225A748	
XA 333	4226A922		XA 401	4226A295	
XA 334	4225A486A		XA 402	2447A13	

* Hardware, Fittings etc.

WAR DEPT. TECHNICAL MANUAL PART NO.	KOEHRING PART NO.	VENDORS SYMBOL PART NO.	WAR DEPT. TECHNICAL MANUAL PART NO.	KOEHRING PART NO.	VENDORS SYMBOL PART NO.
XA 403	54CA55B		XA 471	3174-23	
XA 404	*		XA 472	89A447B	
XA 405	*		XA 473	CA41-21	
XA 406	*		XA 474	*	
XA 407	*		XA 475	CA41-39	
XA 408	89B113A		XA 476	4200A71	
XA 409	4225A66		XA 477	89A297	
XA 410	5CA69A		XA 478	89A153B	
XA 411	43-611		XA 479	2536-5	
XA 412	C86-A		XA 480	89A401	
XA 413	33CA105		XA 481	4206A346	
XA 414	69A402		XA 482	4225D130A	
XA 415	89A555		XA 484	6FB110A	
XA 416	*		XA 485	4225D109-2	
XA 417	C827-187		XA 486	*	
XA 418	*		XA 487	CA41-19	
XA 419	89B91A		XA 488	62A901	
XA 420	89A89		XA 489	*	
XA 421	6FB105		XA 490	89B366A	
XA 422	4225A84A		XA 491	4225A121	
XA 423	4225D82-2		XA 492	*	
XA 424	4226A103		XA 493	4225B120	
XA 425	C667A19		XA 494	89A171	
XA 426	4225A325		XA 495	4226A32	
XA 427	4236A85		XA 496	89A166A	
XA 428	89A107		XA 497	C793-2	
XA 429	89A108		XA 498	4226A190	
XA 430	*		XA 499	4225A114	
XA 431	4226A5		XA 500	89B162	
XA 432	*		XA 501	4225A186	
XA 433	*		XA 502	89A165B	
XA 434	*		XA 503	4225A113	
XA 435	*		XA 504	89A440	
XA 436	*		XA 505	4226A193	
XA 437	55ML35		XA 506	*	
XA 438	CA41-17		XA 507	89B331A	
XA 439	54CA7B		XA 508	4218D8-8	
XA 440	93A248		XA 509	*	
XA 441	89A177A		XA 510	53-396	
XA 442	*		XA 511	*	
XA 443	*		XA 512	89B277-1	
XA 444	4225B172A		XA 513	*	
XA 445	4226A615		XA 514	565-37	
XA 446	212A65		XA 515	4226A121	
XA 447	4225B171A		XA 516	4225B512	
XA 448	C665-38		XA 517	*	
XA 449	*		XA 518	89A163A	
XA 450	4225D177A		XA 519	89D332A	
XA 451	4226A84A		XA 520	*	
XA 452	4225D178A		XA 521	*	
XA 453	*		XA 522	C827-137	
XA 454	212A66		XA 523	52-355B	
XA 455	*		XA 524	*	
XA 456	C665-39		XA 525	52D464	
XA 457	*		XA 526	52-356C	
XA 458	89D154		XA 527	4225D131	
XA 459	4225A104		XA 528	4206A817	
XA 460	93A249		XA 529	C39-A	
XA 461	89A358A		XA 530	*	
XA 462	*		XA 531	*	
XA 463	*		XA 532	4225D119	
XA 464	4225A102		XA 533	62A902	
XA 465	4225B180		XA 534	4226A428	
XA 466	89A362A		XA 535	89D333A	
XA 467	*		XA 536	89B149	
XA 468	3173-28		XA 537	*	
XA 469	69A192		XA 538	4225A112C	
XA 470	89B130B		XA 539	4225D110-1	

* Hardware, Fittings etc.

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XA 540	89B161		XA 608	X-08	
XA 541	40ML19A		XA 609	X-55	
XA 542	6FB111C		XA 610	89B396B	
XA 543	89B160		XA 611	*	
XA 544	CA41-14		XA 612	89B397	
XA 545	*		XA 613	*	
XA 546	89A363		XA 614	4206A803	
XA 547	C53-R		XA 615	89D134	
XA 548	C1147-7		XA 616	89D400A	
XA 549	*		XA 617	89B395	
XA 550	33FB91		XA 618	4226A17A	
XA 551	4206A330		XA 619	*	
XA 552	4200A514		XA 620	89A251A	
XA 553	89A200A		XA 621	4225A543	
XA 554	89A391		XA 622	4226A16	
XA 555	4225B523A		XA 623	89A342A	
XA 556	89B392		XA 624	*	
XA 557	4225D139-2A		XA 625	89B131C	
XA 558	808		XA 626	4226A18A	
XA 559	4226A277		XA 627	3068-13	
XA 560	6FB109A		XA 628	89B132A	
XA 561	4206A441		XA 629	89A364	
XA 562	4225A138		XA 630	69A322	
XA 563	*		XA 631	89B361	
XA 564	4226A74		XA 632	*	
XA 565	89A186A		XA 633	5CA80	
XA 566	*		XA 634	89A399A	
XA 567	C840-12		XA 635	4226A15	
XA 568	*		XA 636	89A306A	
XA 569	*		XA 637	*	
XA 570	89B387A		XA 638	*	
XA 571	4226A276		XA 639	CA41-15	
XA 572	4225B510		XA 640	40ML18	
XA 573	4225B524		XA 641	33FB184	
XA 574	CA41-49		XA 642	200A210	
XA 575	X-04		XA 643	200A276	
XA 576	X-05		XA 644	89A164A	
XA 577	X-06-4		XA 645	89A143B	
XA 578	4225A624		XA 646	4226A158-1	
XA 579	4209A380		XA 647	4226A158-2	
XA 580	4225D508		XA 648	CA41-7	
XA 581	X-07C-36B		XA 649	89B329A	
XA 582	X-09		XA 650	CA41-22	
XA 583	X-20		XA 651	89B328A	
XA 584	649-56		XA 652	4225A394	
XA 585	89A187		XA 653	89B283	
XA 586	4226A40		XA 654	C840-17	
XA 587	C735-13		XA 655	4225B497	
XA 588	4225A136		XA 656	4226A19	
XA 589	89B185		XA 657	89B390	
XA 590	39ML305		XA 658	4226A20	
XA 591	4225B514		XA 659	CA41-78	
XA 592	4225D511A		XA 660	*	
XA 593	89B388B		XA 661	89D146A	
XA 594	4226A752		XA 662	*	
XA 595	89D182B		XA 663	4225A92	
XA 596	54CA54		XA 664	4225B496-1	
XA 597	4225A238		XA 665	4225B496-2	
XA 598	*		XA 666	4226A45	
XA 599	X-03		XA 667	*	
XA 600	4225D507A		XA 668	40ML31	
XA 601	X-02		XA 669	*	
XA 602	X14-4B		XA 670	*	
XA 603	89B386		XA 671	4225D515	
XA 604	*		XA 672	*	
XA 605	89A385		XA 673	89B389	
XA 606	CA41-53		XA 674	200A539	
XA 607	4225A506		XA 675	4206A299	

* Hardware, Fittings etc.

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XA 676	212A391		XA 744	90SM82	
XA 677	212A390		XA 745	212B192	
XA 678	212B392		XA 746	212D383	
XA 679	*		XA 747	4225E505-11A	
XA 680	4206A707		XA 748	36ST88B	
XA 681	*		XA 749	4225B489-1A	
XA 682	212A123		XA 750	43ST306B	
XA 683	212B134A		XA 751	4225B489-3	
XA 684	4225A262		XA 752	4225B489-2A	
XA 685	4225A737		XA 753	36ST89C	
XA 686	57-385		XA 754	212A285	
XA 687	4206A386		XA 755	27SM393	
XA 688	*		XA 756	27SM370	
XA 689	212A398		XA 757	124ST3	
XA 690	89A244A		XA 758	500	
XA 691	212A404		XA 759	*	
XA 692	4206A96		XA 760	4225E344-6	
XA 693	4206A97		XA 761	27SM394	
XA 694	212A386		XA 762	27SM373A	
XA 695	4225B528		XA 763	4225E260-12	
XA 696	212A399		XA 764	110SM5	
XA 697	212A397		XA 765	4225E344-7	
XA 698	4226A760		XA 766	*	
XA 699	212A388		XA 767	*	
XA 700	212A387		XA 768	*	
XA 701	89B393A		XA 769	*	
XA 702	212B401		XA 770	*	
XA 703	2821-8A		XA 771	*	
XA 704	212B40C		XA 772	110SM6	
XA 705	85ML1		XA 773	*	
XA 706	89D448		XA 774	94SM199B	
XA 707	212D112		XA 775	94SM205	
XA 708	*		XA 776	27SM392	
XA 709	1293A14		XA 777	*	
XA 710	*		XA 778	*	
XA 711	43ST366		XA 779	94SM201	
XA 712	4225A859		XA 780	22SM143	
XA 713	*		XA 781	22SM136D	
XA 714	*		XA 782	4225E159-5	
XA 715	4225D237-1		XA 783	4225E159-16	
XA 716	27SM401A		XA 784	C696-72	
XA 717	4225D922		XA 785	*	
XA 718	212UA20		XA 786	94SM165A	
XA 719	*		XA 787	4200B803-2	
XA 720	89B317A		XA 788	4202A35	
XA 721	*		XA 789	4225E159-23	
XA 722	*		XA 790	4226A203	
XA 723	43ST365		XA 791	200A336	
XA 724	4225A860		XA 792	94SM202B	
XA 725	4225B471-1&3		XA 793	4225E467-19	
XA 726	4225B471-2		XA 794	*	
XA 727	3181-25		XA 795	4225E467-22	
XA 728	*		XA 796	4225E467-14	
XA 729	52-233B		XA 797	*	
XA 730	4206A693A		XA 798	4225E159-14	
XA 731	C1159-80		XA 799	4225E159-13	
XA 732	43ST185		XA 800	94SM204C	
XA 733	*		XA 801	4225E159-26	
XA 734	52-231C		XA 802	4225E159-24	
XA 735	52-232C		XA 803	1000	
XA 736	*		XA 804	4225E159-25	
XA 737	C714-4C		XA 805	4225E159-20	
XA 738	212D382		XA 806	4225E159-12	
XA 739	*		XA 807	39ML309	
XA 740	135ST2A		XA 808	4225E215-6	
XA 741	90ST83		XA 809	4225E159-19	
XA 742	*		XA 810	4225E215-11	
XA 743	*		XA 811	*	

* Hardware, Fittings etc.

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XA 812	*		XA 880	4225A830	
XA 813	*		XA 881	*	
XA 814	94SM203		XA 882	*	
XA 815	4225E215-9		XA 883	*	
XA 816	94SM172C		XA 884	4205B200B	
XA 817	94SM200B		XA 885	*	
XA 818	22SM164		XA 886	27ST7	
XA 819	4225D732-6		XA 887	9ST100B	
XA 820	94SM212		XA 888	49CA10	
XA 821	94SM171A		XA 889	52-352	
XA 822	27SM369		XA 890	CA37-1	
XA 823	CA20-1		XA 891	*	
XA 824	22SM163		XA 892	4225A532	
XA 825	4225D402-17		XA 893	4226A189	
XA 826	94SM174C		XA 894	C689-46	
XA 827	94SM186B		XA 895	C689-45	
XA 828	22SM137C		XA 896	4225A533	
XA 829	94SM198A		XA 897	*	
XA 830	94SM194A		XA 898	28ST10	
XA 831	22SM134C		XA 899	5ST49	
XA 832	27SM376		XA 900	9ST126C	
XA 833	22SM133C		XA 901	*	
XA 834	27SM375		XA 902	*	
XA 835	4225E160-20B		XA 903	209B6	
XA 836	4225A346		XA 904	212D360	
XA 837	4225E160-16		XA 905	*	
XA 838	4225E365-8		XA 906	4225B930	
XA 839	212A350		XA 907	49CA73	
XA 840	4225E365-7		XA 908	200A274	
XA 841	*		XA 909	200A10	
XA 842	4225E365-15		XA 910	49CA76	
XA 843	94SM197		XA 911	69A318	
XA 844	4225E160-19B		XA 912	89A467	
XA 845	*		XA 913	89D465B	
XA 846	4225E160-17		XA 914	27ST6	
XA 847	4225E160-9		XA 915	4225A885A	
XA 848	4225E365-3		XA 916	*	
XA 849	94SM167		XA 917	212A249	
XA 850	4225E365-10		XA 918	89A468	
XA 851	4225E365-9		XA 919	49CA70	
XA 852	94SM145C		XA 920	*	
XA 853	4225E160-11		XA 921	69A261	
XA 854	94SM168A		XA 922	69A262	
XA 855	4225E365-13A		XA 923	223E5-1-3-4	
XA 856	94SM146C		XA 924	212D361	
XA 857	4225E160-10		XA 925	200A240	
XA 858	94SM169A		XA 926	*	
XA 859	4225E160-15A		XA 927	C74-2	
XA 860	94SM164		XA 928	*	
XA 861	4225E365-14A		XA 929	4206A8	
XA 862	*		XA 930	*	
XA 863	*		XA 931	1524-1	
XA 864	*		XA 932	4225A460	
XA 865	4225A948		XA 933	223A4	
XA 866	*		XA 934	*	
XA 867	*		XA 935	223E5-2-3-4	
XA 868	*		XA 936	200A238	
XA 869	4225A231		XA 937	200A239	
XA 870	*		XA 938		RC CT-19
XA 871	*		XA 939	223A3	
XA 872	*		XA 940	223B1	
XA 873		WE W48X5	XA 941	212E367-4	
XA 874	4226A417		XA 942	C2	
XA 875		WE W48X5A	XA 943	212E367-5	
XA 876	*		XA 944	E2	
XA 877	*		XA 945	PRS2	
XA 878	*		XA 946	*	
XA 879	*		XA 947	3981	

* Hardware, Fittings etc.

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XA 948	3984		XA 1016	*	
XA 949	*		XA 1017	*	
XA 950	T2		XA 1018	KL5700	
XA 951	212E367-31		XA 1019	*	
XA 952	*		XA 1020	*	
XA 953	*		XA 1021	*	
XA 954	200		XA 1022	*	
XA 955	212E367-6		XA 1023	*	
XA 956	*		XA 1024	*	
XA 957	210G23		XA 1025	*	
XA 958	*		XA 1026	90228	
XA 959	212E367-7		XA 1027	*	
XA 960	LR2		XA 1028	*	
XA 961	*		XA 1029	*	
XA 962	212E367-8		XA 1030	BD945	
XA 963	A2		XA 1031	DB-9-B	
XA 964	GR2		XA 1032	DB-9-D	
XA 965	4225E261-13A		XA 1033	DB945-A	
XA 966	4225E261-19		XA 1034	212B346	
XA 967	*		XA 1035	50216	
XA 968	*		XA 1036	*	
XA 969	212E367-1		XA 1037	*	
XA 970	212E367-32		XA 1038	212B362A	
XA 971	1781B		XA 1039	*	
XA 972	212E367-9		XA 1040	65B356	
XA 973	LB2		XA 1041	*	
XA 974	212E367-3		XA 1042	*	
XA 975	*		XA 1043	*	
XA 976	FCCF-11-L		XA 1044		A 6637
XA 977	*		XA 1045	*	
XA 978	212E367-10		XA 1046		A S823
XA 979	21F4		XA 1047	*	
XA 980	DB3		XA 1048	*	
XA 981	DB-3-A		XA 1049	*	
XA 982	DB-4-C		XA 1050	*	
XA 983	DB-4-B		XA 1051	*	
XA 984	212B385		XA 1052	*	
XA 985	212A374		XA 1054	*	
XA 986	FSE12		XA 1056	*	
XA 987	1L1311		XA 1057	212UA13	
XA 988	RAD3115221		XA 1058	89B360	
XA 989	RA215		XA 1059	*	
XA 990	RAD15031		XA 1060		PY C31-T
XA 991	*		XA 1061	*	
XA 992	212D364-2		XA 1062	*	
XA 993	*		XA 1063	*	
XA 994	*		XA 1064	89B215	
XA 995	PAD15031		XA 1065	*	
XA 996	PA215		XA 1066	1803A-RL	
XA 997	PAD3115221		XA 1067	*	
XA 998	212D364-3		XA 1068	*	
XA 999	4236A168		XA 1069	*	
XA 1000	212D347-1		XA 1070		A 51538
XA 1001	212D347-2		XA 1071		A 50897
XA 1002	212D364-1		XA 1072		A 50899
XA 1003	*		XA 1073		A 50896
XA 1004	KL5694		XA 1074		A 50898
XA 1005	*		XA 1075		A G50911
XA 1006	*		XA 1076		A G50911
XA 1007	KL5296		XA 1077		A A-155
XA 1008	KL1193		XA 1078		A G52036
XA 1009	HL6814		XA 1079		A 40855
XA 1010	KL5366		XA 1080		A 52038
XA 1011	KL5675		XA 1081		A 53735
XA 1012	HL6537		XA 1082		A 52032
XA 1013	KL5695		XA 1083		A 50902
XA 1014	KL5691		XA 1084		A 51914
XA 1015	KL1198		XA 1085		A 50903

* Hardware, fittings etc.

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XA 1086		A G50888	XA 1154	89B430	
XA 1087		A 52031	XA 1155	*	
XA 1088		A 42221	XA 1156	F3905	
XA 1089		A 52037	XA 1157	*	
XA 1090		A 53751	XA 1158	*	
XA 1091		A 42023	XA 1159	F3811	
XA 1092		A G-985	XA 1160	B3000-A	
XA 1093		A 301080	XA 1161	F3977	
XA 1094		A 301081	XA 1162	*	
XA 1095		A Z715	XA 1163	B3068	
XA 1096		A 301976	XA 1164	F3906	
XA 1097		A C-122	XA 1165	*	
XA 1098		A 42035	XA 1166	PC974	
XA 1099		A G51410	XA 1167	*	
XA 1100		A 43809	XA 1168	F3989	
XA 1101		A H-15-100	XA 1169	F3990	
XA 1102		A 46118	XA 1170	*	
XA 1103		A H-15-99	XA 1171	F3809A	
XA 1104		A A-618	XA 1172	F3808A	
XA 1105		A 43851	XA 1173	F3889	
XA 1106		PY 6B	XA 1174	F3991	
XA 1107		PY 24	XA 1175	PC973-1	
XA 1108		PY 6	XA 1176	*	
XA 1109		PY 20	XA 1177	PC946-4	
XA 1110		PY 30A	XA 1178	*	
XA 1111		PY 4	XA 1179	PC918-7	
XA 1112		PY 25	XA 1180	AA808	
1113		PY 31A	XA 1181	4225A883	
1114		PY 16A	XA 1182	*	
1115		PY 29	XA 1183	PC973	
1116		PY 35	XA 1184	*	
1117		PY 18	XA 1185	F3985	
1118		PY 33	XA 1186	*	
1119		PY 41	XA 1187	A793-A	
1120		PY 17	XA 1188	730-8M	
XA 1121		PY 38A	XA 1189	F3279	
XA 1122		PY 3A	XA 1190	*	
XA 1123		PY 1	XA 1191	*	
XA 1124		PY 10	XA 1192	79ST81B	
XA 1125		PY 9C	XA 1193	212B69	
XA 1126		PY 2A	XA 1194	79ST80B	
XA 1127		PY 31A	XA 1195	4226A868	
XA 1128		PY B4T	XA 1196	PMD-4856-3	
XA 1129		PY 46	XA 1197	4234B139	
XA 1130		PY 7F	XA 1198	4226A37	
XA 1131		PY 5	XA 1199	89D190	
XA 1132		PY 12	XA 1200	4234B3-1	
XA 1133		PY 43C	XA 1201	89B459	
XA 1134		PY PY-21	XA 1202	4226A620	
XA 1135		PY 13	XA 1203	4234B54	
XA 1136		PY 28	XA 1204	4234B53	
XA 1137		PY 39A	XA 1205	4225A931	
XA 1138	*		XA 1206	4225B879	
XA 1139	C74-5		XA 1207	4234B3-2	
XA 1140	C74-A		XA 1208	4234G52-7	
XA 1141	C74B1A		XA 1209	PMC-2093	
XA 1142	*		XA 1210	4205B515A	
XA 1143	*		XA 1211	*	
XA 1144	212B395		XA 1212	89A257	
XA 1145	4230B737		XA 1213	4206A920	
XA 1146	*		XA 1214	4206A997	
XA 1147	4230A724		XA 1215	69A254	
XA 1148	4225B548A		XA 1216	4225A303	
XA 1149	4205B514A		XA 1217	4205A332A	
XA 1150	*		XA 1218	*	
XA 1151	4230A916B		XA 1219	*	
XA 1152	*		XA 1220	96CA8C	
XA 1153	89B431		XA 1221	4227A290	

* Hardware, Fittings etc.

WAR DEPT. TECHNICAL MANUAL PART NO.	KOEHRING PART NO.	VENDORS SYMBOL PART NO.	WAR DEPT. TECHNICAL MANUAL PART NO.	KOEHRING PART NO.	VENDORS SYMBOL PART NO.
XA 1222	4205A333-2B		XA 1290	69A137	
XA 1223	89D75A		XA 1291	69A138	
XA 1224	212A142		XA 1292	4206A791	
XA 1225	69A347		XA 1293	C473-18	
XA 1226	4226A912		XA 1294	*	
XA 1227	89D499B		XA 1295	212UA79	
XA 1228	212B312		XA 1296	C906-4	
XA 1229	4226A115		XA 1297	C906-1	
XA 1230	40SA164B		XA 1298	4225A63	
XA 1231	4225A493		XA 1299		ND 1209
XA 1232	38ML24		XA 1300	27SM351	
XA 1233	38ML25		XA 1301	4225A749	
XA 1234	4225B643		XA 1302	4225A99	
XA 1235	*		XA 1303	4226A23	
XA 1236	89D176		XA 1304	4226A26	
XA 1237	C74-7A		XA 1305	*	
XA 1238	89A85-1		XA 1306		ND 7209
XA 1239	49CA65		XA 1307	89D100	
XA 1240	89E152A		XA 1308	4226A29	
XA 1241	89A174		XA 1309	4226A24	
XA 1242	69A398A		XA 1310	*	
XA 1243	89D559		XA 1311	4225D96-2	
XA 1244	*		XA 1312	*	
XA 1245	*		XA 1313	6FB108A	
XA 1246	52-313		XA 1314	*	
XA 1247	89E172A		XA 1315	89B151A	
XA 1248	2283-12		XA 1316	*	
XA 1249	4225A124		XA 1317	4225A98A	
XA 1250	*		XA 1318	4206A98A	
XA 1251	4225A123		XA 1319	4225A223	
XA 1252	4225A122		XA 1320	20CA72	
XA 1253	89A175		XA 1321	*	
XA 1254	12UA11A		XA 1322	4200A891A	
XA 1255	4205A511		XA 1323	*	
XA 1256	*		XA 1324	89B99A	
XA 1257	89A50		XA 1325	*	
XA 1258	89B49		XA 1326	89D106-3	
XA 1259	59CA27		XA 1327		ND 7207
XA 1260	55ML22		XA 1328	4225A62	
XA 1261	4206A995		XA 1329	89B98A	
XA 1262	4225A9		XA 1330	4225A100	
XA 1263	*		XA 1331	4225A97	
XA 1264	4225B347-3A		XA 1332	4225A61A	
XA 1265	1641AA-R		XA 1333	4226A44	
XA 1266	1641AA-P		XA 1334	4225A194	
XA 1267	1641AA-RL		XA 1335	138ML4A	
XA 1268	*		XA 1336	89B503	
XA 1269	*		XA 1337	*	
XA 1270	1641AA-144		XA 1338	89A195A	
XA 1271	*		XA 1339	4226A231	
XA 1272	4234A13		XA 1340	89B196	
XA 1273	4234B12		XA 1341	4225A140A	
XA 1274	4234A9		XA 1342	4225D65	
XA 1275	4225B10		XA 1343	4226A46	
XA 1276	89G46B		XA 1344	89A194	
XA 1277	4205A513		XA 1345	49CA66B	
XA 1278	*		XA 1346	69A255A	
XA 1279	C843-1		XA 1347	4225A147	
XA 1280	9ST132		XA 1348	4225A522	
XA 1281	4205B245B		XA 1349	4225A148-1	
XA 1282	4234A8		XA 1350	89E502A	
XA 1283	113ML3		XA 1351	*	
XA 1284	*		XA 1352	59CA38	
XA 1285	65B423A-1		XA 1353	*	
XA 1286	1386-10		XA 1354	4234A92	
XA 1287	4225A877		XA 1355	4234B88	
XA 1288	65A425A		XA 1356	4234A91	
XA 1289	4206A411L		XA 1357	1641AA-39	

* Hardware, Fittings etc.

WAR DEPT. TECHNICAL MANUAL PART NO.	KOEHRING PART NO.	VENDORS SYMBOL PART NO.	WAR DEPT. TECHNICAL MANUAL PART NO.	KOEHRING PART NO.	VENDORS SYMBOL PART NO.
XA 1358	C74B2A		XA 1424	5ST104	
XA 1359	*		XA 1425	4226A97	
XA 1360	*		XA 1426	*	
XA 1361	*		XA 1427	4225A862	
XA 1362	49CA27		XA 1428	4225A863	
XA 1363	4225A758		XA 1429	*	
XA 1364	C6-67L		XA 1430	80ST31A	
XA 1365	89A509-1		XA 1431	89E445A	
XA 1366	4225B125A		XA 1432	*	
XA 1367	*		XA 1433	*	
XA 1368	C17-98D		XA 1434	*	
XA 1369	212A9-1		XA 1435	*	
XA 1369A	212A9-2		XA 1436	89D508	
XA 1369B	212A9-3		XA 1437	TP18	
XA 1370	4206A527A		XA 1438	154869	
XA 1371	*		XA 1439	89E444A	
XA 1372	43ST361B		XA 1440	4225G778-13A	
XA 1373	C828-71		XA 1441	52-352	
XA 1374	CA41-31		XA 1442	28ML7	
XA 1375	CA41-32		XA 1443	*	
XA 1376	25ST281		XA 1444	4226A729	
XA 1377	4225E766		XA 1445	49CA71A	
XA 1378	C974B6A		XA 1446	69A273	
XA 1379	*		XA 1447	4206A789	
XA 1380	4225A757A		XA 1448	*	
XA 1381	CA41-30		XA 1449	*	
XA 1382	*		XA 1450	*	
XA 1383	C74-C		XA 1451	*	
1384	89627		XA 1452	89E483A	
1385	C74B3A		XA 1453	Y38	
1386	4225A288		XA 1454	Y36	
1387	9ST113B		XA 1455	Y28	
1388	C3-59E		XA 1456	Y35	
XA 1389	49ST2		XA 1457	*	
XA 1390	4225A850		XA 1458	Y27	
XA 1391	C17-98H		XA 1459	*	
XA 1392	*		XA 1460	Y26	
XA 1393	4226A562		XA 1461	Y34	
XA 1394	*		XA 1462	Y29	
XA 1395	*		XA 1463	*	
XA 1396	4226A490		XA 1464	*	
XA 1397	*		XA 1465	Y24	
XA 1398	4226A493A		XA 1466	Y39	
XA 1399	89D456A		XA 1467	Y30	
XA 1400	52A95		XA 1468	Y33	
XA 1401	4225A783A		XA 1469	Y31	
XA 1402	4225A690		XA 1470	*	
XA 1403	*		XA 1471	C88-A	
XA 1404	34ML19A		XA 1472	*	
XA 1405	4226A266		XA 1473	*	
XA 1406	28ST13		XA 1474	212A59	
XA 1407	*		XA 1475	*	
XA 1408	4225A280		XA 1476	*	
XA 1409	148ST9C		XA 1477	WR21	
XA 1410	4226A491		XA 1478	212A308	
XA 1411	C6-67D		XA 1479	89A214	
XA 1412	4234A132		XA 1480	89E246C	
XA 1413	*		XA 1481	4225A270	
XA 1414	C8-75E		XA 1482		ND 1*
XA 1415	CA37-8		XA 1483	89D408	
XA 1416	212B68-1&2		XA 1484	*	
XA 1417	4225G778-14A		XA 1485	212D307	
XA 1418	200A74		XA 1486	89E407B	
XA 1419	34ST12A		XA 1487	4225A54	
XA 1420	5ST105		XA 1488	4225A256	
XA 1421	212D34		XA 1489	4226A59	
XA 1422	*		XA 1490	4226A60-1	
XA 1423	4226A875		XA 1490A	4226A60-2	

* Hardware, Fittings etc.

WAR DEPT. TECHNICAL MANUAL PART NO.	KOEHRING PART NO.	VENDORS SYMBOL	VENDORS PART NO.
XA 1491	4225A207		
XA 1492	T50000		
XA 1493		T	14137-14274
XA 1494	T49574		
XA 1495	40ML17		
XA 1496	4225A603		
XA 1497	*		
XA 1498	212A518		
XA 1499	*		
XA 1500	212UA74		
XA 1501	*		
XA 1502	212UA75		
XA 1503	212B527		
XA 1504	*		
XA 1505	200A694		
XA 1506	212UA69		
XA 1507	212UA76		
XA 1508	*		
XA 1509	*		
XA 1510	*		
XA 1511		TD	6625 B
XA 1512		TD	7351
XA 1513		TD	X7350A
XA 1514	*		
XA 1515	212A491		
XA 1516	212D476		
XA 1517	148		
XA 1518	XTT1548-06		
XA 1519	200A421		
XA 1520	212A489		
XA 1521		MR	212MF
XA 1522	212A488		
XA 1523	212D477		
XA 1524	200A666		
XA 1525		MR	216MF
XA 1526	212D485		
XA 1527	200A642		
XA 1528	212D478		
XA 1529	4206A996		
XA 1530	CA36-3		
XA 1531	XTT123304-186		
XA 1532	212B494		
XA 1533	212UA73		
XA 1534	212B486		
XA 1535	*		
XA 1536		BK	BK10450
XA 1537	212B516		
XA 1538	212UA70		
XA 1539		BK	372421
XA 1540	*		
XA 1541	*		
XA 1542	212A490		
XA 1543	*		
XA 1544	212UA67		
XA 1545	4226A750		
XA 1546	212B515		
XA 1547	212A522		
XA 1548	212UA78		
XA 1549	*		
XA 1550	212B523		
XA 1551	*		
XA 1552	212UA77		
XA 1553	212UA72		
XA 1554	212A528		
XA 1555	*		
XA 1556	*		
XA 1557	200A696		
XA 1558	*		
XA 1559	A-11-81		
XA 1560		CY	1074905
XA 1561		UA	B11875
XA 1562	*		
XA 1563		UA	A12032
XA 1564		UA	A12033
XA 1565		UA	A12034
XA 1566		UA	A12004
XA 1567		UA	B12271
XA 1568		UA	B12142
XA 1569		UA	B12272
XA 1570		UA	C12268
XA 1571		UA	C12556
XA 1572	212A537		
XA 1573	*		
XA 1574	212A544		
XA 1575	212A545		
XA 1576		UA	A12007
XA 1577		UA	A12612
XA 1578		CY	1075585
XA 1579		UA	A4092
XA 1580		UA	A1317
XA 1581	*		
XA 1582	C793-17		
XA 1583	*		
XA 1584	*		
XA 1585	212UA83B		
XA 1586	*		
XA 1587	212B533		
XA 1588	212A535		
XA 1589		PG	3266
XA 1590	*		
XA 1591	4226A418		
XA 1592	18831		
XA 1593	*		
XA 1594		SW	95218
XA 1595	*		
XA 1596	C1187B5		
XA 1597	A09265		
XA 1598	*		
XA 1599	*		
XA 1600	*		
XA 1601	*		
XA 1602	81118		
XA 1603	*		
XA 1604	30465		
XA 1605	*		
XA 1606	*		
XA 1607	*		
XA 1608	*		
XA 1609	*		
XA 1610		ST	8893
XA 1611		ST	927Q
XA 1612	C949-3		
XA 1613	212A543		
XA 1614	31464		
XA 1615	C983-5		
XA 2035	*		
XA 2120		TD	M642
XA 2121		TD	2617
XA 2122		TD	1968A
XA 2123		TD	A1974
XA 2124		TD	5470
XA 2125		TD	A5579A
XA 2127		TD	113
XA 2128		TD	Z5467C
XA 2129		TD	A1588
XA 2130		TD	1092A

* Hardware, Fittings etc.

WAR DEPT. TECHNICAL MANUAL PART NO.	KOEHRING PART NO.	VENDORS SYMBOL	VENDORS PART NO.
XA 2131		TD	M167
XA 2132		TD	3322
XA 2133		TD	115
XA 2134		TD	106A
XA 2135		TD	M645
XA 2136		TD	120
XA 2137		TD	117
XA 2138		TD	M649
XA 2139		TD	A1663
XA 2140		TD	M1283
XA 2142		TD	M309
XA 2144		TD	A112
XA 2145		TD	S232
XA 2146		TD	M1284
XA 2147		TD	1213
XA 2148		TD	1214
XA 2149		TD	125A
XA 2151		TD	114A
XA 2152		TD	M641
XA 2153	15		
XA 2154		TD	103F
XA 2155		TD	1144A
XA 2156		TD	A1664
XA 2157		TD	M422
XA 2159		TD	M227
XA 2160		TD	2815
XA 2161		TD	A1111
XA 2162		TD	A1352
XA 2163		TD	M1527
2164		TD	1216A
2165	4225A7		
2166		TD	M1089
2167		TD	1215
2168		TD	1212
XA 2169		TD	M205
XA 2170		TD	M102
XA 2171		TD	2816
XA 2305		WE	W41X4
XA 2306		WE	W49X4
XA 2310	*		
XA 2311	*		
XA 2313	*		
XA 2319	31075		
XA 2320	4225E246-29		
XA 2321	*		
XA 2322	*		
XA 2323	*		
XA 2327	4234D162		
XA 2335		LN	103SS
XA 2569	*		
XA 2636	G24040		
XA 2637	A9-1		
XA 2638	*		
XA 2639	G1308		
XA 2640	G24028		
XA 2641	G21499		
XA 2643	G21841		
XA 2644	TC415		
XA 2645	G2038		
XA 2646	G5730		
XA 2647	G407		
XA 2648	G21141		
XA 2649	4206A501		
XA 2653	*		
XA 2655	578		
XA 2656	G21094		
XA 2660	G24000		
XA 2664	*		
XA 2665	*		
XA 2666	*		
XA 2667	C808-33		
XA 2669	*		
XA 2804		WE	W49X5
XA 2805		WE	A4125
XA 2806		WE	W42X5
XA 2807		WE	W41X5
XA 2808	200A633		
XA 2809	*		
XA 2810	*		
XA 2811	*		
XA 2813	77FB12		
XA 2814	4225D531-3		
XA 2815	4225D531-4		
XA 2818	GD 297		
XA 2822	*		
XA 2823	4225A911		
XA 2824	4225D117-4		
XA 2830	*		
XA 2831	4236A29		
XA 2832	51PM63D		
XA 2833	4236A274		
XA 2834	73		
XA 2840	*		
XA 2842	*		
XA 2844	212B1		
XA 2845		R	E35DS
XA 2846	212D375		
XA 2847		R	E116E6692
XA 2848	*		
XA 2849	*		
XA 2856	XTT123304-L		
XA 2859	4225A34A		
XA 2860	4213A176		
XA 2863	*		
XA 2865	4226A554		
XA 2873	212UA28		
XA 2876		GL	V89
XA 2879	212UA29		
XA 2893	*		
XA 2903	*		

* Hardware, Fittings etc.

NOTES

NOTES

LIGHT PLANT SECTION

OPERATION
AND
MAINTENANCE MANUAL
AND
PARTS CATALOG

MODEL E
KOHLER ELECTRIC PLANT

MANUFACTURED FOR CORPS OF ENGINEERS

SERIAL NOS. . . . . LOWEST 81186
HIGHEST 99890

THE KOHLER COMPANY
KOHLER — WISCONSIN

INDEX OPERATION SECTION

ILLUSTRATIONS

INDEX MAINTENANCE SECTION

ILLUSTRATIONS

INDEX PARTS SECTION

DESCRIPTION

The Kohler Electric Plant Model E consists of a direct connected gasoline engine driven generator set.

The engine is a four cylinder valve-in-head unit with a 2" bore and a 3" stroke. Oil bath air cleaner, conventional type carburetor, high tension magneto, and fuel pump are included as standard equipment.

A plunger type oil pump forces oil to main bearings and rocker arms. The rods and cylinders are splash lubricated.

The plant is started by means of a hand crank and operates at a speed of 1000 R.P.M. The generator is compound wound 115 volts, DC, and has a rated capacity of 1500 watts.

The cooling system if of the thermo syphon type with radiator and fan.

SAFETY PRECAUTIONS AND PROPER OPERATING PROCEDURE

When the plant is uncrated, a general inspection should be made to determine whether it has been damaged in transit. The governor operating lever should be checked to observe whether it moves freely, and before the plant is placed in operation, starting instructions should be followed as covered in detail on Page 10.

WARRANTY

We warrant and will replace free of charge for a period of three months from date of delivery of plant to original consumer, all parts of Kohler Electric Plants returned to our nearest branch office, prepaid, which our examination shall disclose to our satisfaction to be defective in manufacture.

This warranty shall not apply to any electric plant which shall have been repaired or altered by anyone other than an employee of the Manufacturer, or which has been improperly installed or repaired, neglected or operated contrary to our instructions.

We make no warranty whatever in respect to the battery or magneto inasmuch as they are warranted by their respective manufacturers.

This warranty is in lieu of all other warranties, obligations, and liabilities on our part, express or implied, and we neither assume nor authorize any other person to assume for us, any other liability in connection with the sale of Kohler Electric Plants.

NOTES

SPECIFICATIONS OF MODEL E

OPERATION -- Designed for hand starting. Self-contained and compact.

ENGINE -- Four cylinder, four cycle, valve-in-head type, bore 2", stroke 3", 1000 R.P.M., 3 horsepower. High tension magneto ignition. Enclosed mechanical governor maintains constant voltage and regulates fuel consumption to load.

GENERATOR -- 1500 watts, 115 volt DC. Four pole, compound wound with self-adjusting brushes. Will operate electric motors up to 1-1/2 H.P.

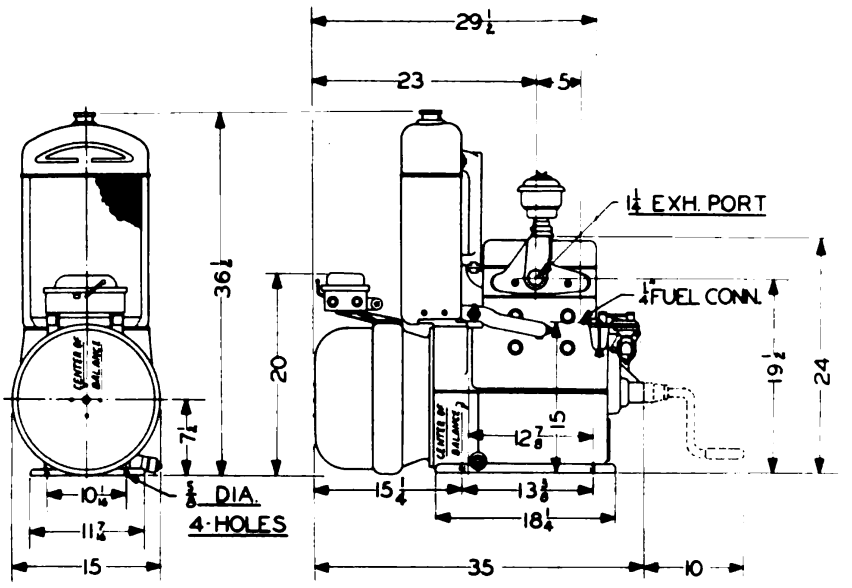
LUBRICATION -- Pressure pump forces oil to rocker arms and main bearings--splash system to cylinders and connecting rods.

COOLING -- Water cooled, with efficient radiator and fan.

FUEL SUPPLY -- Fuel pump to deliver gasoline to carburetor.

WEIGHTS AND MEASUREMENTS

MODEL	PLANT				
	LENGTH INCHES	WIDTH INCHES	HEIGTH INCHES	WEIGHT UNCRATED	WEIGHT CRATED
E	35	15	36 1/2	490 LBS.	600 LBS.



TOTAL WEIGHT ———————— 490

WEIGHT AT EACH FRONT MTG. HOLE —— 10

WEIGHT AT EACH REAR MTG. HOLE —— 235

FIGURE 1

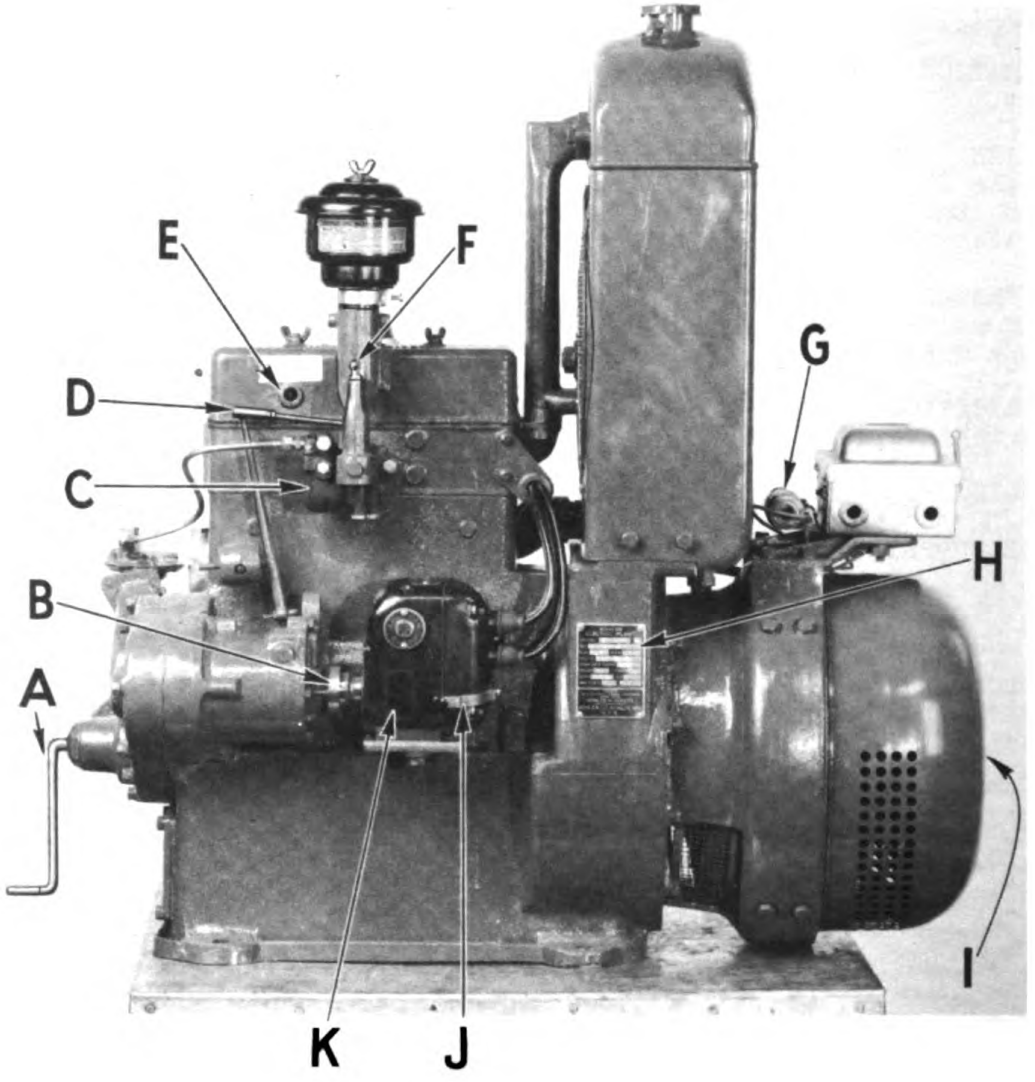


FIGURE 2

MODEL E, MAGNETO SIDE

A. Starting crank
B. Magneto coupling
C. Carburetor
D. Carburetor operating lever
E. Oil sight hole
F. Choker
G. Field resistance
H. Name plate
I. Generator bearing
J. Magneto ground contact
K. Magneto

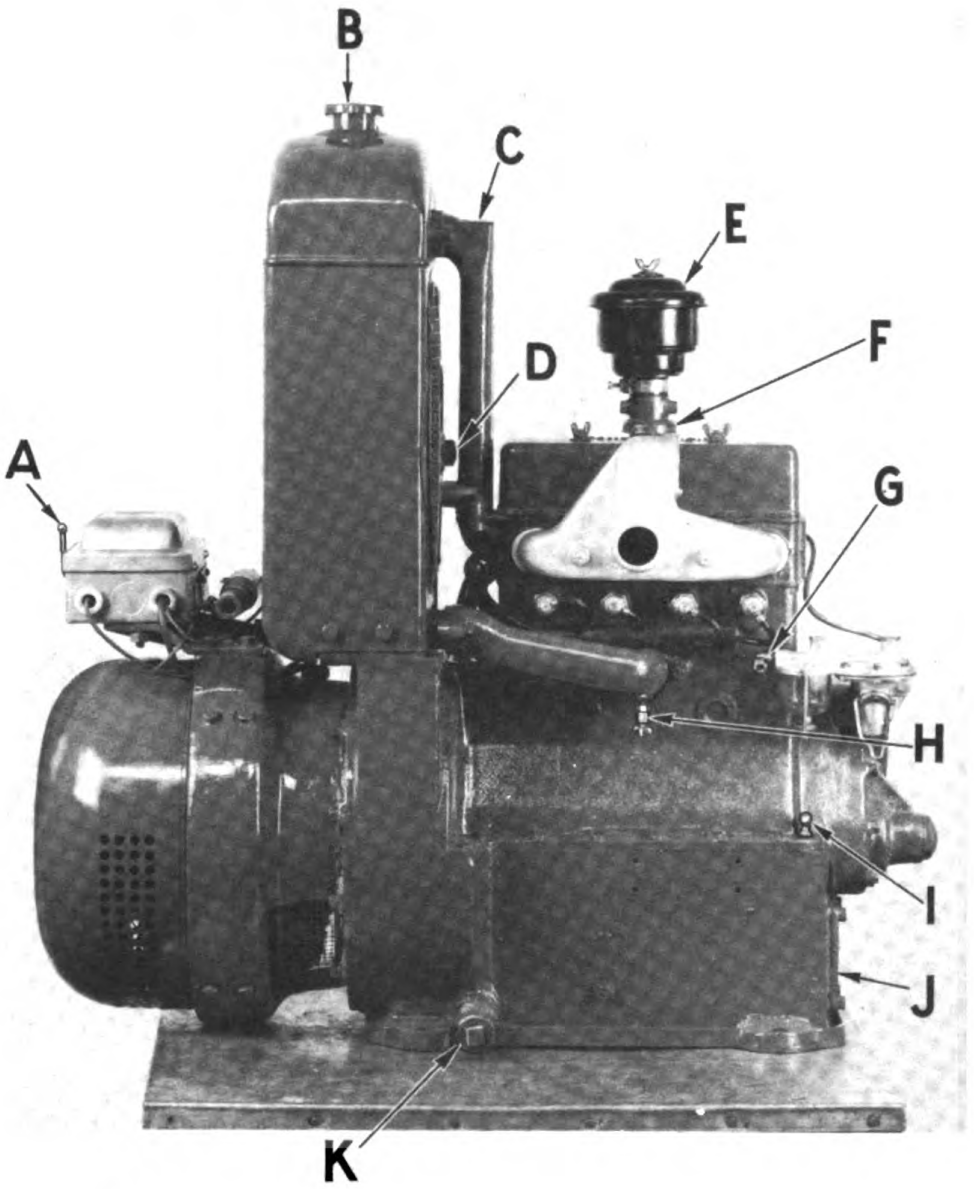


FIGURE 3

MODEL E, EXHAUST SIDE

A. Switch
B. Radiator inlet
C. Water outlet manifold
D. Fan
E. Oil bath air cleaner
F. Oil filler opening
G. Fuel pump inlet
H. Water drain
I. Oil level gauge
J. Clean out plate
K. Oil drain

STARTING A NEW PLANT

Before starting a new plant for the first time, a definite procedure should be observed. We recommend the following:-

FILL THE CRANKCASE: The engine holds approximately seven quarts of oil and is filled through the top of the cylinder head cover marked "OIL FILL HERE". For temperatures above 32° F. use OE-S.A.E. 30 and for temperatures of 32° F. to 0° F. use OE-S.A.E. 10 -- for temperatures below 0° F. refer to EFSB-L-1000-D. Keep the oil level between the marks H and L on the oil level gauge. Plant must set level.
SEE FIGURE 4

FILL RADIATOR with soft water.

GASOLINE SUPPLY: Gasoline for Kohler plant is furnished from fuel tank on engine of prime unit. Gasoline supply tank of engine on machine must be filled to operate the plant. Fresh non-gummy gasoline should be used. A regular is preferable.

EXHAUST LINE: Inspect exhaust line joints to see that they are properly installed and tight.

FUEL LINES: Check all fuel line connections from plant to tank. Connections must be tight.

FUEL PUMP: Operate priming lever of fuel pump until bowl is full.

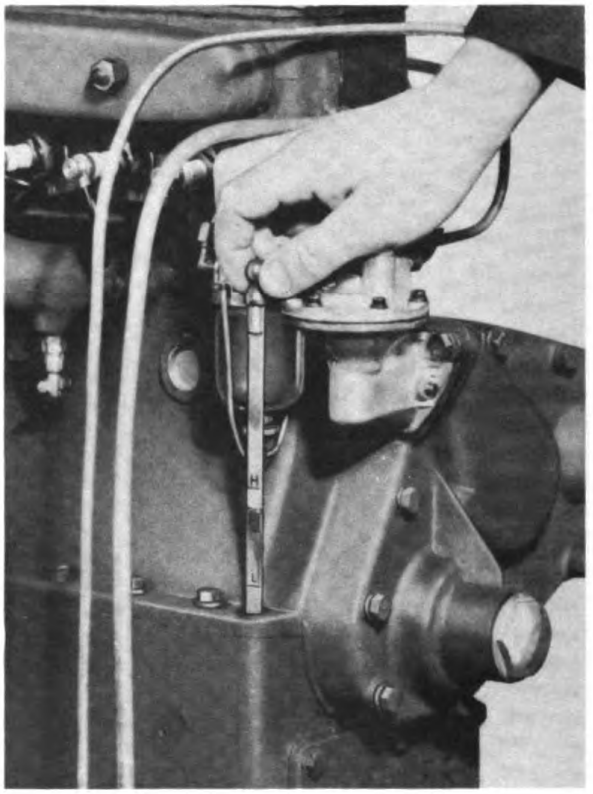


FIGURE 4

Testing Oil Level with Oil Gauge
(Test when plant is idle)

START PLANT: Crank the engine with the hand crank and lift choker while doing so. After plant starts, close the main line switch and turn on lamps or appliances as required.

OIL CIRCULATION: After starting a new plant or after changing oil, look through the small hole in the cylinder head cover and observe whether the oil pump is delivering oil. Oil will be discharged from the copper tubing visible in this opening. In the event the oil is not visible, hold the butterfly valve of the carburetor almost closed so that the plant operates at very slow speed. Do not operate the plant if the oil does not circulate. See "E" Fig. 2

OPERATION AND CARE

To keep your plant in first class operating condition we recommend inspections at regular intervals.

AFTER 8 HOURS OF OPERATION

COOLING SYSTEM: Check the water in the radiator regularly. If the plant is exposed to high temperatures, these inspections must be more frequent. If the plant is exposed to freezing temperatures, use anti-freeze solution.

FAN BELT: Examine the fan belt.

OIL: Check oil level in crankcase.

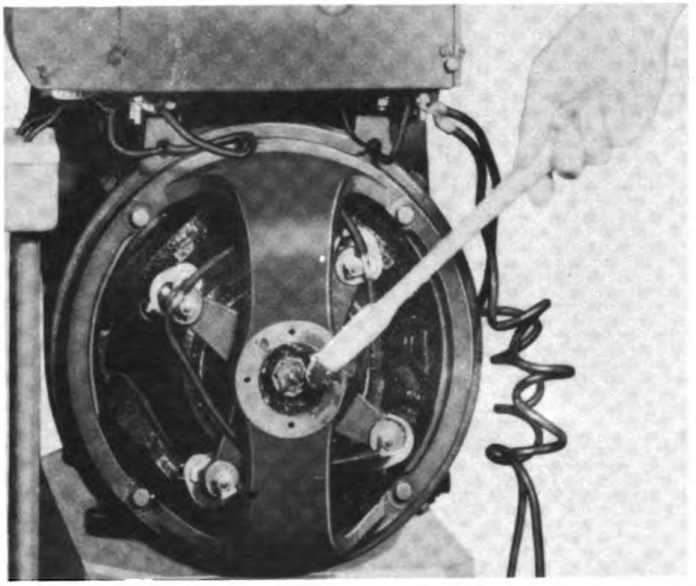


FIGURE 5

Lubrication of Generator Ball Bearing

AFTER 512 HOURS OF OPERATION

MUFFLER: If muffler is used clean if necessary.

VALVE CLEARANCE: Check valve clearances and if necessary adjust clearance, when plant is hot, between .006" and .008".

SPARK PLUGS: Remove, clean and adjust. Plugs with small electrodes should be adjusted to .025" and plugs with heavy electrodes should be adjusted from .030" to .035".

GENERATOR BALL BEARING: Lubricate by applying CG. Do not permit grease to get on commutator.

COMPRESSION: Try the engine for compression and if valves leak, regrind them.

FUEL STRAINERS: Check strainers in fuel line and clean if necessary.

COMMUTATOR: Clean commutator. If necessary, sand brushes and commutator with "00" sandpaper. Adjust spring tension of brushes evenly.

MAGNETO: Check the magneto according to instructions on magneto.

LUBRICATION SYSTEM

The lubrication system provides for forced lubrication to main bearings and rocker arms, and splash to connecting rods, pistons and pins.

Changing Oil: The crankcase holds seven quarts of oil and this should be changed every 128 hours.

FIGURE 6

Filling Oil Base
(Capacity 7 Quarts)

FIGURE 7

Draining Oil Base

TABLE OF CAPACITY AND LUBRICANT TO BE USED

UNIT	CAPACITY (APPROX.)	LOWEST EXPECTED AIR TEMPERATURE		
		ABOVE 32° F.	32° F. TO 0° F.	BELOW 0° F.
CRANKCASE	7 QUARTS	OE SAE-30	OE SAE - 10	REFER TO EFSB L-1000-D

IGNITION SYSTEM

The ignition system consists of a high tension magneto, magneto cables, and spark plugs.

Magneto: The magneto requires attention at regular intervals.

Timing Magneto to Engine: First remove the cylinder head cover and tighten down the cylinder head and rocker arm bolt nuts securely. Next adjust the valve clearance as previously described.

The firing order is 1-3-4-2. The engine cylinder at crank end is No. 1, and numbered in consecutive order, No. 4 being next to the radiator. To place the engine in position, crank the motor until

No. 8 valve (first from radiator) has opened and is almost closed. Now take hold of No. 7 rocker arm (second from radiator) and turn the engine VERY SLOWLY; just keep jarring the handle slightly until the least bit of lost motion is felt in No. 7 and No. 8 rocker arms. The piston in No. 1 cylinder is now at the top of its stroke and in firing position. This can be verified by removing the spark plug from No. 1 cylinder and inserting the little finger, a wire or screwdriver in the spark plug hole.

Next set the magneto for firing No. 1 cylinder, - The exact setting will vary slightly on different engines; if timed too late, loss of power and overheating will result. The best results are obtained by advancing the timing until the engine begins to kick back, and then retarding the magneto one or two teeth. Mesh the coupling teeth together in this position, insert the bolts but leave them slack. Start the plant and the magneto will align itself, then tighten the magneto in place, taking care that the magneto and governor shafts are in line and the coupling is not binding. When the magneto is properly located, a very slight lost motion will be felt in the magneto coupling.

REMOVING AND REPLACING MAGNETO: The magneto may be removed without retiming the engine, by placing timing marks in line when magneto is removed. If the engine is not moved, it will be in proper position when the magneto is replaced. When replacing the magneto, turn until setting marks are in line, and mesh the couplings together in this position.

CLEANING BREAKER POINTS: A film of oil or dirt may at times collect on the contact points, which will prevent perfect short circuiting of the low tension winding. The points are best cleaned with a fine file or with a hone, taking care not to round off the edges. The points must face up SQUARELY OVER THE ENTIRE AREA.

ATTACHING CABLES: The firing order is 1-3-4-2. Attach cables accordingly. If insulation on cables becomes worn or oil soaked, they should be replaced.

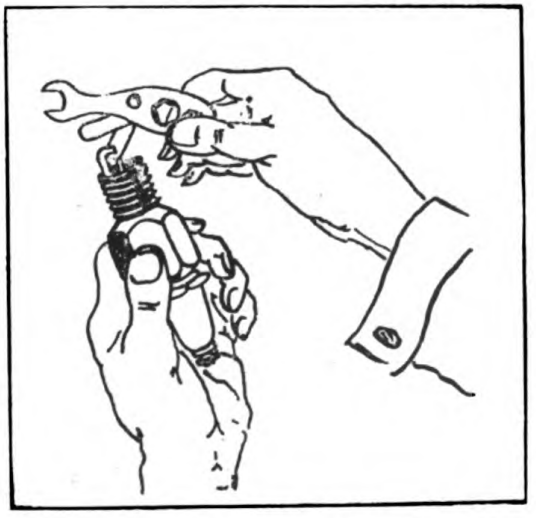


FIGURE 8

Adjust Gap to 1/32 inch

TESTING MAGNETO FOR SPARK: The magneto may be tested when engine is in operation. To do this, disconnect one cable from the spark plug. Start the engine under its own power and hold the end of detached cable within 1/16" of engine frame. The spark for each cylinder may be tested one at a time in this manner. Pliers with insulated handles should be used for holding the cable when making tests with plant in operation, or a slight shock or burn may result.

For further information see pamphlet on magneto.

SPARK PLUGS: Spark plugs are the most common causes of misfiring, and in case of trouble they should be inspected first. Many times the magneto is blamed for trouble

which is due entirely to the spark plugs. If the points are too far apart, the windings of the magneto will be forced to carry the burden and the armature, condenser or collector ring may break down.

The distance between points should be .025" for plugs having 1/32" wire electrodes. Heavy duty plugs, having 1/16" wire electrodes should have a gap adjustment of .030" to .035". This is equivalent to 1/32".

If porcelains are chipped or cracked, they must be renewed or new plugs put in. Plugs should be clean inside and out.

HOW TO TEST FOR SPARK: To test whether spark is being furnished, first disconnect magneto ground wire; then remove plug with cable attached. Next hold spark plug against engine frame (do not touch spark plug points to frame). If a spark is being furnished, it will jump across the gap when engine is cranked. If there is no spark and the magneto is suspected, remove cable from plug and hold end of cable 1/32 of an inch from engine frame. If magneto is not at fault, a spark will be observed as crank is turned.

The spark plugs may also be tested when engine is operating by short circuiting between end of plug and engine frame. If the plug is firing, the speed of motor will be reduced. If shorting out the plug has no effect on engine speed, it indicates the plug is not firing. Be careful of shocks when testing in this manner.

When necessary to replace spark plugs, order them from the Kohler Co. so as to secure the correct type, which is important.

COOLING SYSTEM

The cooling system consists of a radiator and fan with a thermo syphon system.

FAN: Check the fan belt. Replace if necessary. See instructions on installing fan belt.

RADIATOR: Check the water in the radiator the same as you do in your car and make sure that the air passages are kept clean and the air around the radiator circulates freely.

If the plant is exposed to freezing temperatures, add anti-freeze accordingly. The cooling system holds approximately 9-1/2 quarts.

ANTI-FREEZE SOLUTION REQUIRED

Per Cent by Volume	Temp. for Alchohol	Temp. for Glycerine	Temp. for Etheline Glycol	Temp. for Prestone
10	+ 27° F.	+ 29° F.		
20	+ 19° F.	+ 21° F.	+ 16° F.	+ 17° F.
30	+ 10° F.	+ 12° F.	+ 3° F.	+ 2° F.
40	- 2° F.	0° F.	- 11° F.	- 12° F.
50	- 18° F.	- 15° F.	- 31° F.	- 35° F.

FUEL SYSTEM

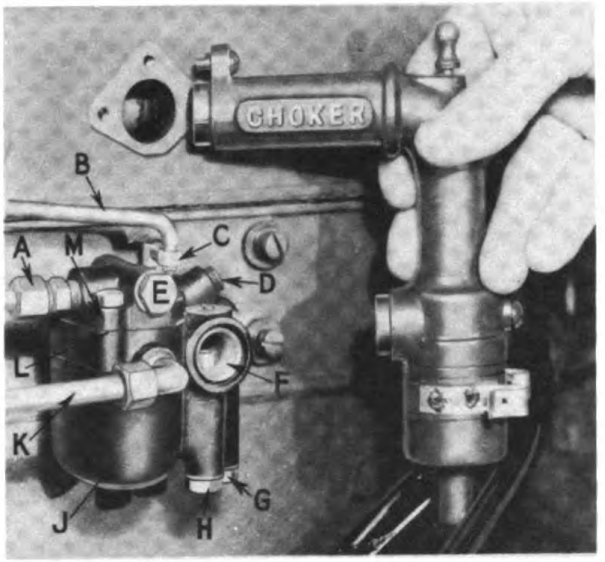
The fuel system consists of fuel pump, carburetor, choker and connecting tubing.

CARBURETOR: The carburetor is not adjustable, except that the mixture can be changed by changing the jets. The jets used are correct for sea level installations and should not be changed unless the plant is installed at a high altitude.

DIRT OR WATER IN THE CARBURETOR: When gasoline is dirty, a tiny speck of dirt may clog the aperture of a jet, and though the engine may continue to work, it does so imperfectly, giving indications of defective carburization. The jets can be quickly cleaned out by holding the hand over the air intake for a few seconds when running the motor fast, or the jets can be taken out by removing the brass hexagon nuts under the carburetor. If the engine speed and voltage are unsteady, particularly on light loads the jets need cleaning. The carburetor should be washed in gasoline and the jets should be blown clean with compressed air, if available. Water may be removed from the carburetor jets in the same manner, namely, removing the brass hexagon nuts.

FIGURE 9

Carburetor



A--Supply Line
B--Governor Operating Lever
C--Butterfly Valve Lever
D--Air Line Opening for Vacuum Tank (not used)
E--Screen in Supply
F--Venturi
G--Compensating Jet
H--Main Jet
J--Bowl
K--Overflow Line
L--Gasket
M--Cover

FUEL PUMP: The fuel pump requires very little attention and under ordinary operating conditions, will give many hours of service without the replacement of any of the parts. With the average fuel lift, it is not necessary to prime the fuel pump and it will pick up the gasoline at cranking speed. However, if the pump does not pick up the fuel, it is necessary to prime it. This can be done by operating the priming lever.

If the fuel pump fails to operate after the plant has been in service, it should be disassembled and the worn parts replaced. These are illustrated in the parts section and it is not difficult to repair the fuel pump. If it is not convenient to order the parts or repair the fuel pump, the entire assembly may be replaced as the cost of the unit is not excessive.

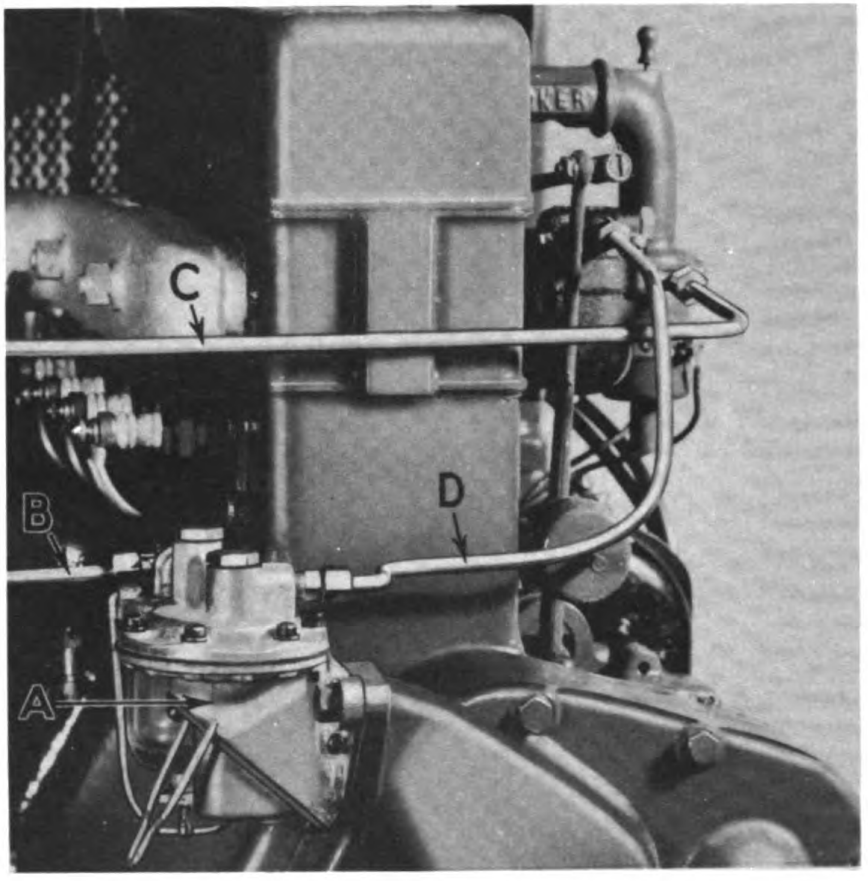


FIGURE 10 FUEL PUMP

A Fuel Pump
B Supply Line from Tank to Pump
C Overflow Line to Tank from Carburetor
D Supply Line to Carburetor from Pump

STARTING SYSTEM

MANUAL PLANTS: A manual plant must be started with the hand crank and the choker must be operated manually.

The ground button on the magneto is used for stopping the plant.

FAILURE TO GENERATE: When first starting a plant, if it fails to generate current at a normal speed (about 1000 R.P.M.), the cause will most likely be due to loss of residual magnetism, due to shock and jars sustained during shipment. To restore the residual magnetism, it is only necessary to form a momentary short circuit between one of the positive and one of the negative brushes on the machine. This can be done by holding a piece of wire so the ends of same will each touch a positive and negative brush, when the plant is operating. The wire must be instantly removed as soon as current is generated.

The residual magnetism can also be restored by connecting the terminals of any low voltage battery between the positive and negative terminals. The battery connection must be removed immediately as soon as the plant generates.

OPERATION UNDER ABNORMAL CONDITIONS

Successful operation depends upon satisfactory operating conditions.

If the plant is exposed to an unusual amount of dust, dirt, or grit, the air cleaner must be given more frequent attention and the plant should be protected insofar as possible.

An effort should be made to keep dust and dirt off of the commutator as this will cause undue wear of commutator and brushes.

If the plant is exposed to low temperatures, the cooling system must be protected against freezing by the addition of an anti-freeze solution.

A good grade of fuel should be used, and ignition system and valves should be checked regularly to facilitate starting.

If the plant is exposed to unusually high temperatures, ventilation should be provided and it may be necessary to install auxiliary fans or air ducts. The coolant should be checked in the cooling system at regular intervals.

If the plant is exposed to excess moisture, an effort should be made to keep the electrical parts as dry as possible by providing ventilation, or operating the plant sufficiently to prevent moisture from accumulating on brush holders, commutator, etc. Moisture is a conductor of electricity and harmful to insulation. Excessive moisture may cause a short circuit or ground.

PREPARATION OF A PLANT FOR STORAGE

If the plant is placed in storage, cylinders should be treated with a non-rusting and non-corrosive lubricant to prevent rusting of cylinder walls, pistons and rings.

Magneto and electrical parts should be protected from oil and moisture.

The cooling system should be protected against freezing by draining and adding a small amount of anti-freeze solution so as to prevent water in the cooling system from freezing.

Exposed machine parts which may become corroded or rusted if exposed to moisture should be protected with a non-rusting solution.

Spark plugs should be removed from engine and a small amount of non-rust non-corrosive lubricant may be placed in the combustion chamber after which the engine can be turned over two or three times with the hand crank so as to properly coat cylinder walls, pistons and rings.

If the plant is exposed to excessive moisture, it may be advisable to remove the magneto and store it in a dry place.

INDEX MAINTENANCE SECTION

ILLUSTRATIONS

SPECIFICATIONS, TOLERANCES, AND CLEARANCES

1.	Intake valve seat	1/32" x 45° Chamfer x 25/32" Dia.
2.	Exhaust valve seat	1/32" x 45° Chamfer x 25/32" Dia.
3.	Intake valve guide side clearance	.002"
4.	Exhaust valve guide side clearance	.002"
5.	Intake valve tappet clearance	.006" Hot
6.	Exhaust valve tappet clearance	.006" Hot
7.	Valve timing	40° Before low dead center
8.	Main bearing diameters	Front brg. 1.3125", Rear brg. 1.251"
9.	Main bearing diametral clearance	Front brg. .00125", Rear brg. .00125"
10.	Main bearing thrust clearance	.004"
11.	Connecting rod bearing diameter	1.249"
12.	Connecting rod bearing diametral clearance	.00075"
13.	Connecting rod bearing side clearance	.0035"
14.	Camshaft bearing diameters	Front 1.500", Rear 1.4375"
15.	Camshaft bearing clearances	Front.00195, Rear .00145"
16.	Cylinder bore	2.000"
17.	Piston clearance	.00175"
18.	Number and type of piston rings per piston	4 Rings (3 plain - 1 oil ring)
19.	Piston ring side and bottom clearance	Side .00125", Bottom .007"
20.	Piston pin diametral clearance	.001"
21.	Ignition timing-maximum degrees advance	Approx. 30°
22.	Recommended types of spark plugs	Champion spark plug No. 7 18 mm or the equivalent

REPAIRS AND ADJUSTMENTS

CAUTION: If the plant does not operate properly and the operator feels that the plant is at fault, he can test it by opening the main line knife switch and operating the plant to determine if the fault lies outside of the machine. However, if the plant does not function as it should, repairs or adjustments are necessary.

OVERLOADING: If properly installed and cared for, the plant can be depended upon to furnish 110 volt current up to its rated capacity. There is a tendency on the part of some operators to put a far greater load on the plant than it was ever designed to carry. This should not be done. While the Kohler Plant is a very rugged and substantially built machine, continued overloading is certain to cause trouble and expense.

SHORT CIRCUITS OR GROUNDS: Short circuits or grounds in the external wiring system will cause trouble. If the plant begins to act erratically and the voltage fluctuates, causing the lights to dim and brighten alternately, either the plant is overloaded or there is something wrong with the wiring, or with some of the power appliances in use.

STOP THE PLANT IMMEDIATELY AND MAKE AN INVESTIGATION: The trouble should be remedied before the plant is again operated.

OPEN CIRCUIT: The plant will not generate if there is an open circuit in the line between the engine and the light or appliance that is turned on. An open circuit in the external wiring will not affect the operation of the plant except that no light will be obtained beyond the point where the circuit is broken.

GROUNDED CIRCUIT: The plant described in this manual is parallel wound, and therefore a ground will not affect the operation, unless there should be a ground on both the positive and negative sides, which would then form a short.

SHORT CIRCUIT: A short circuit is a condition where a large part or the whole of the current generated passes directly from the positive to the negative wire.

TRACING DEFECTS IN WIRING SYSTEM: If the defect is due to an open circuit, the location of the trouble is usually easily found by tracing the various circuits, turning on different lights, until by a process of elimination the place where the circuit is broken can be located. This will usually be a broken wire or a loose connection easily repaired. If the trouble is due to a short circuit, it is not so easily detected.

If there are several circuits, try them separately and watch the performance of the engine, which will usually indicate on which circuit the defect is located. After determining in which circuit the trouble occurs, carefully examine the wiring at all points to find where the wires touch each other, the ground, or some substance which is a conductor of electricity. The trouble will usually be located at some point where the insulation is worn off by chafing against some other substance. If the wires run through metal or a wooden conduit, or should there be junction boxes on the line where moisture is liable to collect, the difficulty will usually be found at one of these places.

The procedure to be followed in all cases will depend on how the system is wired. Defects of this nature can only be discovered by careful examination of the different points where trouble is likely to occur.

REPAIRS TO GASOLINE ENGINE

Repairs or adjustments which may become necessary after a period of operation are included in the following instructions in the approximate order in which these repairs or adjustments may normally occur.

If the plant will not carry its rated capacity load of approximately 15 amperes at 110 volts or 1500 watts, the gasoline engine may lack sufficient power. This trouble may be due to several conditions, and perhaps the one condition which will occur before any other is that of a lack of compression due to leaky valves.

COMPRESSION: To test the engine for compression use the hand crank and turn the engine over very slowly. If the compression is good, there will be a noticeable resistance in rotating the engine as each of the pistons reach the top of the stroke, and the crankshaft will have a tendency to kick backward. When there is a lack of compression in one or more cylinders, the ease of cranking will indicate it. If the exhaust pipe is removed and the ear placed close to the exhaust opening while the motor is revolved by the hand crank, it is possible to judge the compression in this manner. If any of the valves or the piston rings are leaking, the escape of the confined vapor will make a hissing noise as it passes through the leaky valve or by the piston rings.

Following are the causes of poor compression:

1. Leaky valves, particularly exhaust valves.

2. Improper valve clearance. A clearance of .006" to .008" should be maintained.

3. Leaky spark plug - cracked porcelain or leaky gasket.

4. Loose cylinder head - leaky gasket - cylinder head not pulled down evenly.

5. Valves not seating properly, due to excessive carbon deposits or sticky valve stems.

6. Worn or sticking piston rings.

7. Scored cylinders or worn pistons.

The engine will not function properly or deliver its full power if the compression is not good, and in case it is found to be at fault, the valves should be reground, pistons rings replaced, joints made tight, or spark plugs renewed as the case may require.

REMOVING CYLINDER HEAD: Drain all water from cooling system, after which remove all water and gasoline connections. The nuts holding rocker arm brackets to head should then be removed and the entire assembly lifted off. Remove the eight push rods and lay them out carefully, so they can be replaced in their original position. Unscrew the nine nuts holding cylinder head and lift head and carburetor assembly off the engine. Be sure not to injure the copper asbestos cylinder head gasket. Do not pry the head up with a screwdriver. Use a block of wood, tapping gently until the head is loosened. (See Fig. 11.)

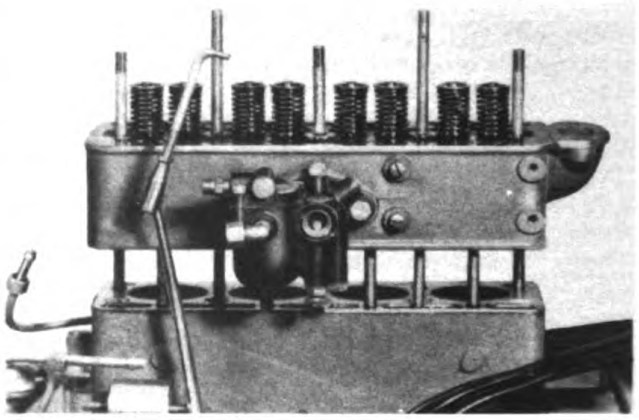


FIGURE 11

Removing Cylinder Head

GRINDING VALVES: Remove valves by depressing the valve spring and pulling keeper out of slot on the end of the valve stem. Observe the marks punched on the cylinder head and valves. Always replace the valves in their respective places.

If, after washing in gasoline, the valves or valve seats are pitted (show black specks) or are not seating properly, they should be "ground-in".

Apply the compound sparingly around the entire valve seat, put a light lifting spring over the stem, lubricate the stem and drop the valve back into its place in the cylinder head. The spring should just barely hold the valve off its seat. A two pronged tool that will fit the valves and a hand brace or a screw driver can be used to grind the valves.

Place the tool in the valve head to be ground. Press down until the valve is seated. Turn the valve a quarter turn, first in one direction, then in the other. Do this three or four times. Release the pressure on the valve and the little spring will lift it off its seat. Now turn the valve about 10 or 15 degrees to another position, and repeat the grinding. Do this until all the compound is rubbed off the valve seat. Withdraw the valve and put on some fresh compound. Repeat the grinding operations.

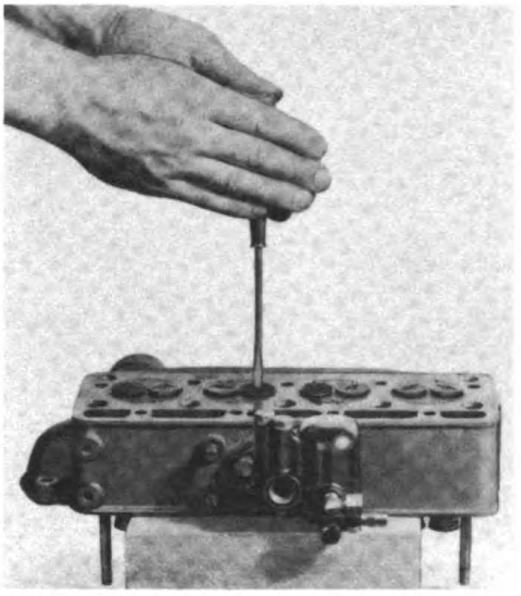


FIGURE 12

Grinding Valves

Clean the valve seat in the cylinder head and the face of the valve with gasoline occasionally to see how the grinding is progressing. To have a good seat it is necessary for both to be free of all pits and grooves and for both seat and valve to show a uniform light gray band all the way around. It is not necessary to have the valve seating across its entire width. If the band is 1/32" wide it will make a good seat. When finally replacing the valve, oil the valve stem and clean out all of the grinding compound from the valve chamber.

REPLACING THE CYLINDER HEAD: To replace the cylinder head, reverse the method given for removing. Carefully clean the joint surfaces and the gasket. Replace the push rods in their original positions, being certain they center in the sockets in tappets. When replacing the nuts holding head to cylinder, tighten down evenly, as there is a danger of wrinkling the gasket, causing a water leak. Replace all water and gasoline connections. Coat gaskets with grease, and be careful to get connections water and air tight.

It is highly important that the proper clearance of .006 to .008" be maintained between the top of valve stem and face of rocker arm. If this distance is too great, the valves will open late and close early; while if it is too small, they will not close at all, thereby causing a great loss of power.

Before proceeding to adjust the valve clearance, tighten down the cylinder head and rocker arm bolts securely. The valve adjustments should be made only when the engine is hot; if made when cold, they will not be accurate, due to the change in temperatures when the engine warms up to a running heat. A .006" gauge is furnished with all plants to be used in adjusting the valve clearance.

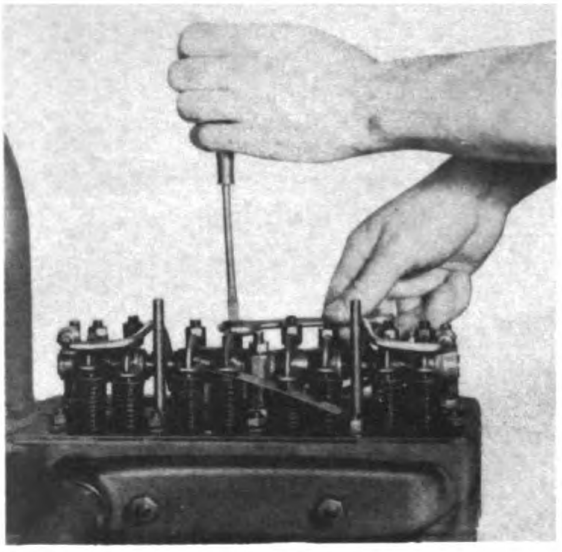


FIGURE 13

Adjusting Valve Clearance

To adjust clearance, proceed as follows: Turn the crank until the cylinder you are working on is on the firing center and both valves are completely closed. Also make sure that valves are not being held open by carbon deposits or a sticky or dirty stem. Then insert a gauge measuring .006" to .008" between the face of the rocker arm and top of the valve stem. The clearance is correct when this gauge or its equivalent can just be moved. If a gauge is not available, send for one.

In making the adjustment necessary to secure the proper clearance, first loosen the upper lock nut on the rocker arm. Then by turning the adjusting screw to the right or left, the clearance can be decreased or increased. Be sure to lock the adjustment securely with the lock nut after adjustment is made. To do this, hold the screw tight with a screw driver while the top nut is tightened. (See Fig. 13.) Valve clearance adjustment should be made while the engine is warm.

INSTALLING ENDLESS FAN BELTS: All new plants are fitted with endless type belts and if practicable to do so, we recommend that the endless belt be used. When the endless belt is to be installed, observe the following instructions: (See Fig. 14.)

1. Remove generator brushes from brush holders.
2. Remove eight cap screws from generator housing.
3. Lift off switch and generator assembly as illustrated.
4. Lower fan and remove old belt.
5. Place endless belt over armature, then on flywheel pulley.
6. Lower fan and slip belt on fan pulley.
7. Tighten fan in position with proper tension on belt.
8. Replace generator and switch assembly, being careful that the outer race of the generator bearing enters squarely into the hole in the armature support bracket.
9. Replace the eight generator cap screws but before tightening them, take a small block of wood and hammer and tap lightly against the armature support bracket above and below the generator ball bearing hole. This together with tightening the cap screws, will force the generator frame

tightly against the engine bell housing, close up the joint and align the generator ball bearing in armature support bracket.

10. Replace generator brushes.

11. After generator is completely assembled start the plant and listen closely to the generator ball bearing. If it is quiet the bearing is in alignment. If it is noisy the bearing is out of alignment. Use a block of wood and hammer and tap lightly above and below the bearing until it runs quietly. If the support bracket is driven in too far the bearing will be out of alignment the other way. The remedy is to insert a screw driver between the end of armature and pry the bracket out slightly.

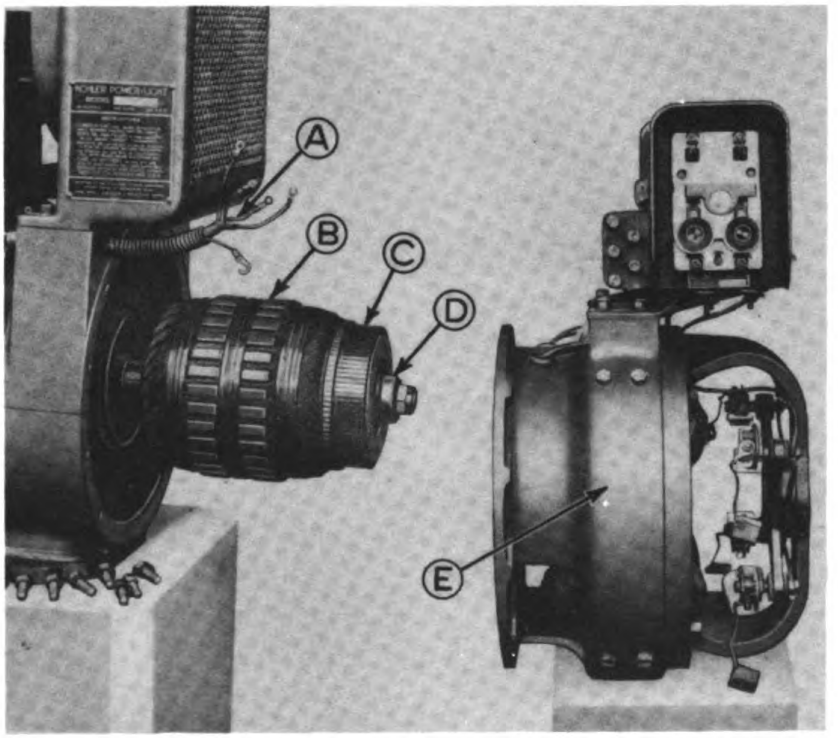


FIGURE 14

Generator and Switch Removed

A	Wire Accessory	D	Generator Ball Bearing
B	Armature		
C	Commutator	E	Generator

Note: - Although the appearance of your plant may differ slightly from the above the instructions can be followed.

Jointed fan belts can be supplied for replacement on plants in the field which have flat belts. It must be remembered that a jointed belt will not give the service that an endless belt will. The life of a jointed belt is approximately only half that of an endless belt. To install jointed belt, lower the fan, pass belt around pulley and join ends with fastener. Then adjust fan to secure proper belt tension. Jointed fan belts are supplied only for the convenience of those who desire them. They are not recommended for long life or continuous service.

MAJOR REPAIRS TO ENGINE

REMOVING CYLINDER BLOCK FROM OIL PAN OR SPLITTING THE PLANT

In case it becomes necessary to make adjustments to the internal parts of the engine such as the main bearings, connecting rod bearings, wrist pins, fit in new pistons or repair the oil pump, it will be necessary to take plant apart in order to obtain access to the parts requiring attention.

The generator and switch may be removed from the engine as previously described under instructions for installing the fan belt. Or, the generator can be left bolted to the upper part of the cylinder block and the engine split by observing the following instructions:

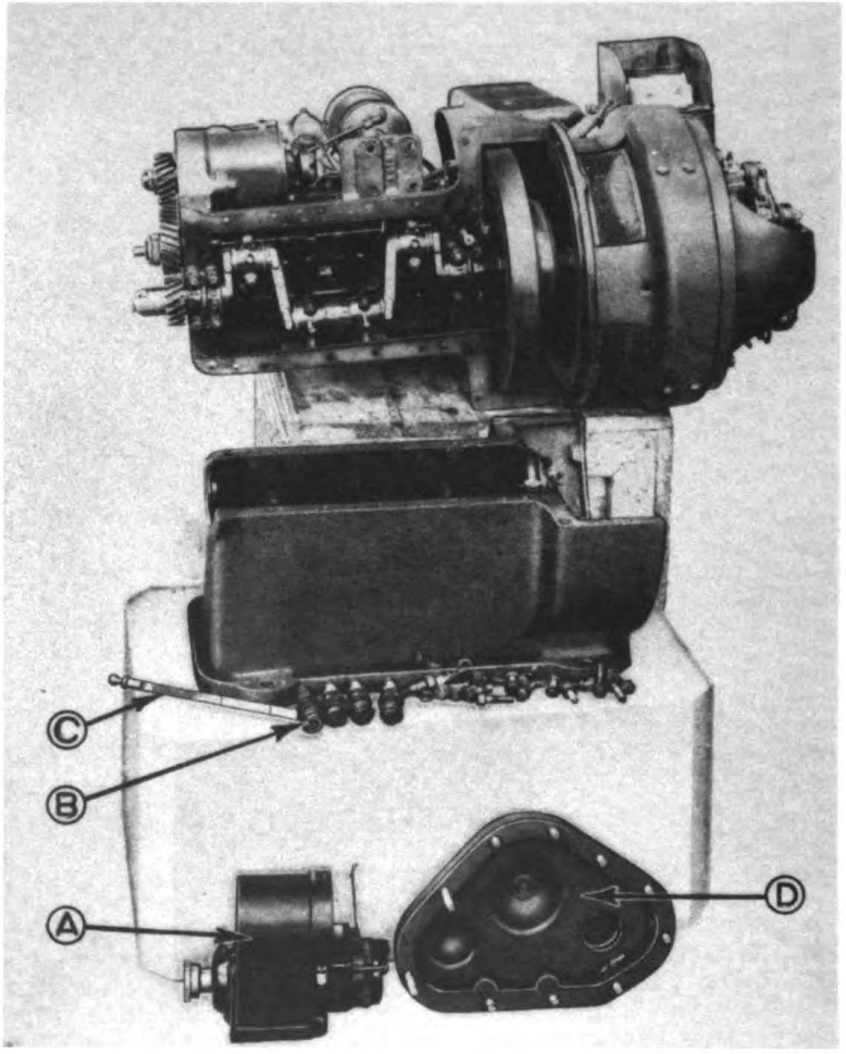


FIGURE 15

Splitting the Plant

A Magneto
B Spark Plugs
C Oil Gauge
D Gear Cover

1. Disconnect the gasoline supply and overflow lines, and wiring. Drain the oil from the crank case, the water from the cooling system, and the gasoline from the fuel pump and carburetor.

2. Remove the ten 5/16" cap screws which hold the cover in place. When the cover is removed the crank gear, cam gear, and magneto drive shaft gear are exposed. See Fig. 15.

Timing marks: All crank and camshaft gears are marked to insure correct valve timing. The system employed by the Kohler Co. is to have the gears so meshed that the single (O) mark on the crank gear will be located between the two teeth bearing the ("O") mark on the camshaft gear.

When removing gear cover careful check should be kept so that the fibre cam thrust plug is not forced out and lost.

3. Disconnect cables and remove spark plugs. Do this before splitting the plant, as it will be impossible to remove them afterward. Removing the spark plugs is very necessary to relieve the compression so the crankshaft can be turned and the pistons withdrawn from the cylinders.

4. Remove the two 3/8" cap screws from bottom of magneto bracket and remove magneto.

5. Remove the thirteen 5/16" cap screws around both sides of cylinder block, (cylinder block oil pan joint.)

6. Remove the four 3/8" cap screws from lower half of generator, (oil pan generator joints).

7. Be careful not to withdraw the camshaft when the plant is in an upright position, or the tappets will drop into the oil base and be difficult to recover.

8. Remove the oil gauge and lay to one side so as not to bend when block is lifted from oil pan.

Arrange a suitable platform about 12 inches high on the exhaust side of the plant; a strong heavy box will do. Then have someone help lift the engine from oil base and lay it on its side, the exhaust side down. Endeavor to place the engine in a position so that the crankshaft and its bearings are accessible, and that there will be room to work and good light. Tie a string or rubber band around the oil pump tappet to prevent it from falling into the case, while working on the engine. Fig. 15 clearly illustrates the various parts after the engine has been split.

CYLINDERS AND PISTONS

Disconnect the connecting rod bearings and withdraw the pistons from the cylinders. Examine the cylinder walls. If they are worn excessively or scored they will have to be reground and new pistons fitted. Clean the pistons and rings with gasoline and examine. If the rings are a good fit they will have a bright, highly polished surface all around each ring. If any ring has dark colored or rusty appearing spots or shows tool marks, it indicates that the ring does not fit the cylinder walls tightly.

An ill fitting ring may cause the engine to pump oil and if this condition is noticed new rings should be put in. The pistons should be fitted .002" smaller in diameter than the cylinder, and with rings removed should fit so they will just fall thru the cylinder of their own weight when engine is in a vertical position. A good way to test the tightness of the pistons, rings and valves is to push the piston, (with rings on) up to the top of its stroke allowing the air above the piston to escape, then with the spark plugs in place and the valves closed, pull the piston down to the bottom of its stroke. This will create a partial vacuum in cylinder and the piston will be hard to withdraw. Hold it in this position for a few seconds and release. If rings and valves are tight the difference in the atmospheric pressure on the two sides of the piston will return the piston back nearly to the top of the cylinder. If the piston does not move part way back toward the top of its stroke there is a leak past the rings, thru the valves, or spark plug hole. The sizes of cylinder bores are stamped on the bosses below the spark plug.

REGRINDING CYLINDERS

Cylinders which are badly seized or scored because of a lack of water or oil should be reground. Semi-finished pistons may be purchased from the Kohler Co. factory or branch offices for reground jobs. After the cylinders have been reground, the pistons should be ground to fit the cylinders.

FITTING PISTONS IN CYLINDER

The cylinders are numbered in consecutive order, No. 1 being next to crank end of plant, and No. 4 being next to radiator. The pistons must be replaced in the cylinders from which they were removed. The connecting rods are numbered 1, 2, 3, 4, to correspond to the cylinders to which they are fitted.

Fig. 16 illustrates the method of using a shim when fitting pistons to obtain the correct clearance of two thousandths inch. When fitting new pistons, the piston should not wedge with the shim, but a noticeable drag should be felt. Pistons can be furnished ground to various oversizes.

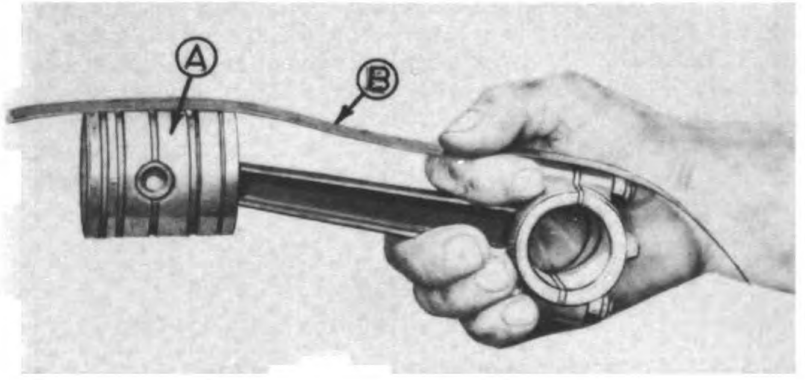


FIGURE 16

Fitting Piston with Shim

A Piston
B Shim (.002")

Semi-finished pistons are also available. These pistons are complete in every detail with the exception of the final grinding. This type of piston is most generally used when cylinder bores have been refinished oversize.

PISTON PINS

It is intended that the wrist pin shall fit more tightly in the piston than in the connecting rod bushing. If the old wrist pins are worn or loose in piston or bushing, new pins or new bushings must be put in. The wrist pin should be a tight hand press fit in the piston. This means it should fit snugly enough so that it can only be forced into the piston by the exertion of considerable strength, or with very light blows with a stick, such as a hammer handle. The wrist pin should be a snug hand press fit in the connecting rod bushing.

Piston pins used on all Kohler plants are so fitted to be full floating; the hardened ground steel pin is fitted to the bronze bushing in the upper end of connecting rod. Tension should be such, that when the pin is clamped in a vise with connecting rod attached, the weight of the rod should be sufficient to allow the rod to drop gradually. The same test is applied when fitting pin in piston as illustrated in Fig. 17.

Method employed to retain piston pin in piston is by spring steel retainers, which are locked in grooves located in the piston. See Fig. 17 (A). After pistons are assembled to connecting rods, they should be lined up with the rods, so they will be parallel with cylinder walls when connecting rod bearings are tightened.

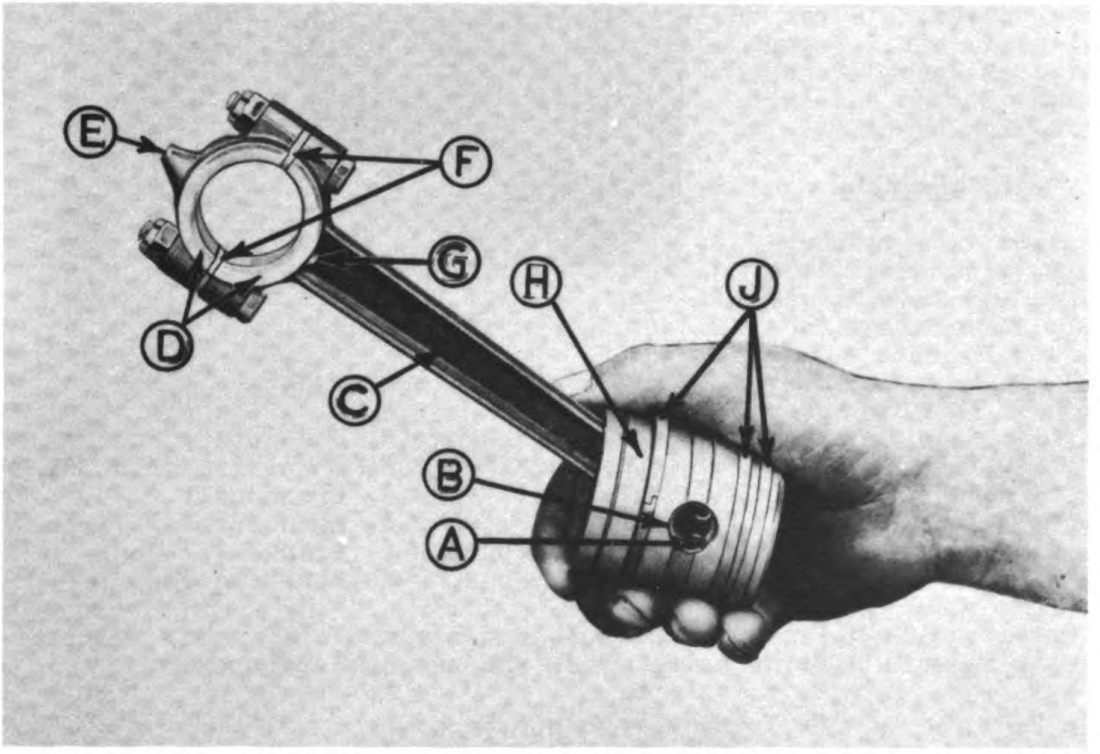


FIGURE 17

Fitting Piston Pin

A	Piston Pin Retainer	F	Bearing Shims
B	Piston Pin	G	Oil Hole
C	Connecting Rod	H	Piston
D	Bearings	J	Piston Rings
E	Oil Dip		

FITTING BEARINGS

When fitting new bearings or taking up worn bearing, DO NOT FIT TOO TIGHTLY. After connecting rod bolt nuts have been tightened, the tension of the bearing should be such as to allow the weight of piston and rod to carry the piston and rod downward gradually. See Fig. 18. Do not follow general automotive practice or bearings will be too tight and prevent engine from cranking.

If new main or connecting rod bearings are installed they must be first fitted to the main shaft or crank pin. Wipe the shaft and bearing clean; apply a very little Persian blue or red mixed in oil to the shaft; place the bearing half on the shaft, rock it back and forth, remove and note the impression. With a bearing scraper carefully cut down the high spots where the bearing touched the shaft. Repeat process until you have at least 80 per cent of the bearing touching the shaft.

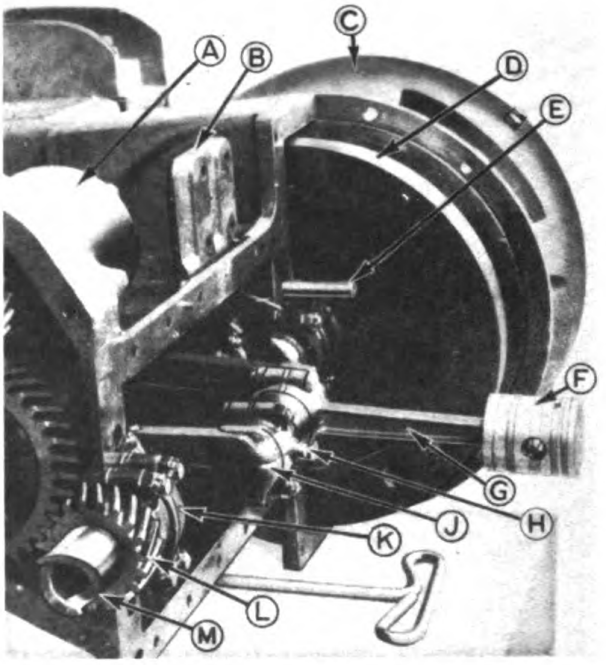


FIGURE 18

Fitting Bearings

A	Governor Housing	G	Connecting Rod
B	Magneto Bracket	H	Connecting Rod Dip
C	Generator	J	Crankshaft
D	Flywheel	K	Main Bearing (Front)
E	Oil Pump Tappet	L	Crankshaft Gear
F	Piston	M	Starting Jaw

MAIN BEARINGS

Remove the main bearing caps one at a time and examine. If cut or scored, scrape to fit if practicable, or replace with new; there should be a clearance of about .002". When adjusted properly there must be no lost motion, and the shaft will easily revolve by taking hold of the flywheel with the hand. Be sure and replace all split pins or wires in main bearing bolts after the nuts are tightened.

CONNECTING ROD BEARINGS

Each connecting rod bearing is numbered to correspond with the cylinder to which it belongs. If scored, scrape the old bearings to fit or put in new ones. When properly adjusted the bearing clearance will be about .002". To adjust, connect them up one at a time, leaving the rod outside the cylinder. Put in sufficient shims or liners, so that when the bolts are tightened the bearing will just move on the crank pin without binding. If, after tightening, the rod be placed in a horizontal position, and it drops to

a nearly vertical position by its own weight, the fit will be about right. See Fig. 18. After finding the correct adjustment remove bearing from shaft, attach the piston to the connecting rod, and insert it in the cylinder. When connected you should be able to just move the bearing from side to side on shaft. The shaft should turn easily without sticking or binding in any position, yet there must be no lost motion, or the bearing will be noisy when running. Be sure and replace all wires or split pins in bearing studs after nuts are tightened.

When replacing connecting rod bearing caps they should be so placed, that the oil hole in front of oil dip will face toward the exhaust side of engine. If the caps are not replaced in this position, the bearing will not receive sufficient lubrication.

CAM & GOVERNOR SHAFT BEARINGS

If replacement of cam and governor shaft bearings is necessary, the plant should be shipped to where facilities for renewal are available.

OIL DIP OF CONNECTING ROD

The height of the oil pan is 2-11/16", measured from the level of oil base joint to drain slot ground in ends of oil pan. When the cranks are in the bottom center, the top end of the oil dip must be exactly 2-23/32" below the level of cylinder block joint. This gives a dip of 1/32 when plant is assembled. If new connecting rods are put in, the length of dip must be carefully adjusted to this length. Gauges for this purpose are available. The hole in the oil dip must be to the LEFT looking from the crank end of the plant. If it is put in improperly, the bearing will not be LUBRICATED AND WILL BURN OUT. See Fig. 19.

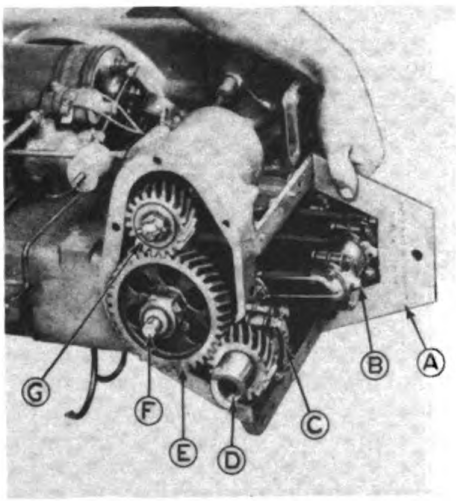


FIGURE 19

Measuring Oil Dip of Connecting Rod

A Connecting Rod Dip Gauge
B Connecting Rod Dip
C Main Bearing (Front)
D Starting Jaw
E Camshaft Gear
F Camshaft Thrust Plug
G Magneto Driveshaft Gear

Fig. 19 illustrates the method of using tool T-943 Connecting Rod Dip Gauge shown at A, for adjusting the Oil Dips to proper length of 2-23/32 inches from the Crank Case Joint.

MESHING OF GEARS

The crank and camshaft gears are marked SOS. They must be so meshed that the two O's will match together. NEVER withdraw the camshaft while the motor is assembled, or the valve tappets will drop down and the camshaft will not go back in place unless you split the plant.

TESTING OIL PUMP

While the motor is apart wash out the oil pump and oil base with kerosene. Operate the oil pump plunger by hand and see that its connections are tight. Examine all bolts and nuts to see that none are loose.

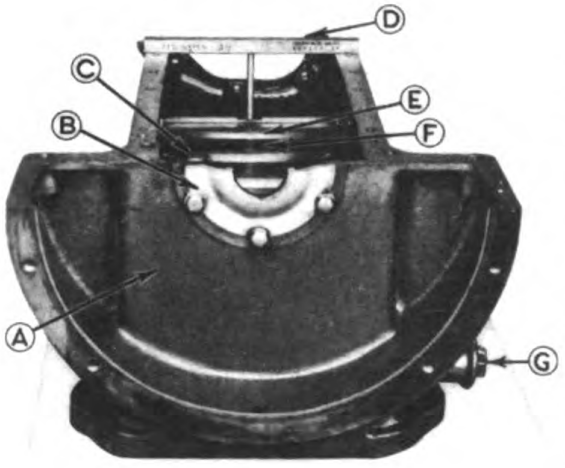


FIGURE 20

Checking Oil Level of Baffle Plate

A—Oil Base
B—Split Cover
C—Oil Pump Plunger
D—Gauge
E—Oil Grooves for Connecting Rod Dip
F—Baffle Plate
G—Oil Drain Plug

Fig. 20 illustrates the method of using tool No. SS-177 to check the height of the baffle plate, which will determine the oil level; this is very important. If the oil level is too high there will be a possibility that the engine will pump oil, due to too much oil being splashed on the cylinder walls. The exact height of the oil level in the baffle plate should be 2-11/16 inches from the top of the oil pan to the high level in baffle plate.

OIL BASE

Fig. 20 is an illustration of the oil base. Notice that the oil level in the baffle is checked with a gauge. The importance of checking this distance cannot be overestimated, because if the oil level is too high, the plant may pump oil, if it is too low, the connecting rod bearing will not receive enough oil and it may burn out. If the oil pump is removed from the base and disassembled, care should be taken to fasten all parts securely. The screen should be cleaned each time the oil is drained. It can be removed from base by removing the oil drain assembly.

REASSEMBLING PLANT

After all internal adjustments are made, clean off both joints of oil pan and cylinder block and examine the gaskets. If any gasket is damaged it must be renewed. If you have none on hand one may be cut from heavy smooth wrapping paper. Scrape the joints clean, coat the face of cylinder block joint with shellac and press the gasket firmly in place, being sure not to blind any of the holes. Pay particular attention to have a good fit at the joint between the halves of the oil retainer ring next to the flywheel. After the gasket has stuck fast apply a little oil to it, remove the string or rubber band from the oil pump tappet and the top part of the engine and set it squarely in place. Great care must be taken not to displace the gasket or an oil leak will result.

Tighten all flange bolts and replace the gear cover, being sure the spring and fibre plug in camshaft are in place.

OIL LEAKS

Should an oil leak develop in the joint between the cylinder block and the oil base, the cap screws in the joint must be tightened. If this does not stop the leak the Plant will have to be split, and a new gasket put on.

Should the leak appear to come from behind the magneto, it may come thru the cap screw holes where the magneto bracket is fastened to the oil base. If this is the case, remove the magneto from the bracket, take out the screws one at a time, apply some shellac or thick paint to the treads and replace the screws.

If the oil drips from the drain hole under the flywheel housing, there is an oil leak between the halves of the splitcover, or past the cap screws that hold the split-cover to the cylinder block or oil base. To gain access to the split-cover and cap screws, it is necessary to remove the generator cover, generator frame, generator ball bearing, armature, spacer, and flywheel. With these parts removed, operate the engine and note the location of the oil leak.

If the leak is in the joint, remove the upper half of the split-cover and put in a new paper gasket. If the leak is thru the cap screw holes remove the screws one at a time, apply shellac or thick paint to the threads, and replace. The clearance between shaft and split-cover must be .004" to .006".

Do not attempt to repair an oil leak in the split-cover by splitting the plant. For should the oil leak be in the cap screw holes of upper half of split cover, access is only obtainable by removing flywheel from shaft.

TESTING AND REPAIRING GENERATOR

GENERATOR TROUBLES

Trouble seldom occurs within the generator and it is usually indicated by low or high voltage, fluctuation of lights, failure of plant to give light, etc. Since these troubles may occur because of a failure of another part of the plant, before proceeding to work on the generator the cause of the trouble should be located. The gas engine may be tested with the brushes removed, and if it operates normally the brushes may be replaced; a change in the plant's operation will indicate the generator is at fault.

TESTING GENERATOR IN GENERAL

The following order of procedure should be used to test the generator: - Remove the generator cover and disconnect the wires from the switch; which are three in number, (1) Generator lead--negative (2) Shunt Field lead, attached to field resistance back of switch (3) Generator lead--positive.

To test the generator with the switch disconnected, connect one side of a test lamp to the positieve brush, (upper left) and the other side to the negative brush (upper right) and the shunt field lead. If light is generated with these connections when the plant is in operation, the generator is not at fault. If no light is generated, the generator is not functioning and the next step is to determine the cause of the trouble.

TESTING GENERATOR FOR GROUNDS

This type of plant is parallel wound; neither side of the circuit is grounded to the frame and it is an easy matter to ascertain if a ground exists, by alternately short circuiting between the positive brush holder and the generator frame, or between the negative brush and the generator frame while the plant is in operation. If a ground exists it will be indicated by sparking; its location can be found by testing the field coils separately, and the brush rigging.

TESTING FIELD COILS

In order to test the field coils, current from some source must be available to secure a flow thru the windings. As the plant will not be running, storage battery or dry cell current must be used. If available, a test light of proper voltage or a bell may be used as an indicator. If a test light or a bell is not at hand, connect one end of the coil to the battery terminal (use 4 to 6 volts) and note if there is a spark. When flowing current thru the coils without some resistance in the line as a test light, the contact must be only momentary on account of the danger of overheating and damaging the coil.

TESTING FIELD COILS FOR GROUNDS

Remove all wiring from switch terminals; ground one end of the test wire on generator frame; apply other end to coil terminals if current flows, one or more of the coils are grounded. To determine which, raise each of the coils separately from the frame with a screw driver after loosening cap screws. If the ground is removed when one of the coils is raised in this manner, it will be an indication that it is grounded to the frame. Place insulating paper,

oiled muslin, or mica between the coil and frame, and after tightening cap screws test again. If it is impossible to correct the ground by this method, it will be necessary to remove the generator from the machine, disconnect the coils from each other, and try each coil separately.

REMOVING GENERATOR

Follow the procedure on installing fan belt Figure 14 for removing the generator.

HOW TO REPAIR GROUNDED FIELD COILS

Grounded field coils which cannot be repaired without being removed should be repaired by dissembling the generator and removing the grounded coil. Examination will usually show where the insulation is cut or worn thru. After testing the coil and finding the ground, insulate the bare spot and put the coil back in service.

TESTING BRUSH RIGGING FOR GROUNDS

To test the brush rigging for grounds, disconnect all wires from the brush terminals and remove the brushes from the commutator. The brush must not touch the rigging or armature support bracket while making the test. With one end of the test wire grounded to the generator, connect the other end to the brush holder; if the circuit is completed the brush holder is grounded. Test each brush holder in this manner.

TO REPAIR GROUNDED BRUSH HOLDER

To repair a brush holder that is grounded, it is necessary to remove it from the rigging and install a new fibre bushing and fibre washers.

TESTING FIELD COILS FOR OPEN CIRCUIT

Remove all wiring from the switch terminals. Attach test wire to terminal on coil 767, apply other end of test wire to terminal on coil 764. If current flows, the circuit is complete. If current does not flow there is an open circuit in one or more of the coils, to determine which, unsolder the pig tails and test out the winding of each separately. An open circuit is something that rarely occurs within the coil itself, unless the coil has been burned out as a result of a bad ground or a short circuit. They are more likely to occur where the pig tails are soldered together.

HOW TO REPAIR OPEN CIRCUIT IN FIELD COILS

If the open circuit is in the pig tail connections it can easily be repaired by resoldering the taping, but if the wire is broken inside the coil, the insulation will have to be removed, the coil opened up and the ends of the wires joined. In such cases it is better to put in a new coil, as it would be a difficult job to open up and rewind a coil in the field.

SHORT CIRCUIT IN COILS

A short circuit between the windings of the field coils will be indicated by overheating of the coil, and low voltage when the machine is operating at a normal R.P.M. If the place where the wires are fused together is near the surface, the insulation may

be removed, the wires separated and insulated from each other. A repair of this kind is difficult in the field and should only be attempted when new coils are not available.

GENERATOR FRAME ASSEMBLY

The mechanical construction of the generators used on Kohler 4-cylinder plants is such that all parts are interchangeable and can be replaced without any special fitting. This includes the generator frame, pole pieces, armature support bracket, brush holders, and brush holder rigging.

Re-assembly: After field coils have been replaced, assemble brush holder rigging to armature support bracket, with the filister head screw on the right side, head up.

REPLACING ARMATURE SUPPORT BRACKET

Armature support bracket is held in place by four 3/8 inch cap screws.

Wire connections: Single lead from coil 767 (upper left) is attached to the upper left and the lower right brush holders. Armature lead wire (return) or the wire on the right hand side of generator, is fastened to the two negative brushes (upper right and lower left.)

BRUSHES AND THEIR ADJUSTMENT

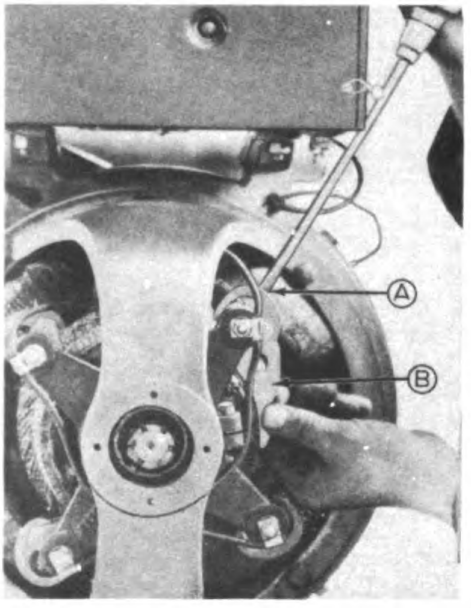


FIGURE 21
A-SCREWDRIVER
B-GAUGE

The brushes must fit their holders so they are free to move without sticking or binding, yet not so loose that they will chatter or get out of alignment.

The end of the brush must be sand papered till it fits the radius of the commutator on which it rests. After a period of use a gummy substance will collect on the brushes; this comes from the wearing of the brushes, also from dirt and dust drawn into the generator. The brushes may be withdrawn from their holders and cleaned with gasoline or alcohol.

The spring tension should be sufficient to press each brush against the commutator with a uniform tension. It is very important that each brush have an equal pressure. If one of the springs is too weak, the opposite brush will have to take more than its share of the load and sparking and damage to the commutator will result. The tension should not be too strong or it will cause rapid wear on both the brush and the commutator.

Brushes should be adjusted with tool No. SS-143, to insure proper angle with commutator.

ADJUSTMENT OF BRUSH RIGGING AND SPACING OF BRUSHES

The brush rigging is adjustable. Its position may be changed by loosening the holding screw, advancing or retarding the brushes to secure the most favorable cranking torque and generating effect. The position of the brush rigging is accurately located at the factory and marked, and should not be altered from this position. It is important that the brush holders be securely fastened in a position at which the brushes will be equally spaced around the circumference of the commutator surface. A discoloration of every third bar is an indication that the brushes are not equally spaced. A strip of paper, the exact length of the commutator circumference, divided into four equal parts, may be placed on the commutator for ascertaining if the brushes are equi-distantly spaced from each other.

The setting of the brush rigging should be such that the distance between the edge of the armature support bracket, to center of upper right hand brush holding screw, is never greater than 3/4 to one inch.

SPARKING AT BRUSHES

In case sparking occurs at the brushes, the cause may be determined by the nature of the spark.

A red spark is caused by dirty brushes or dirty commutator.

A blue spark indicates improper brush contact which may be due to insufficient spring tension, or a rough commutator surface. The latter may be caused by high mica, or low or high bars.

A green spark indicates a loose armature lead which will soon discolor the bar. As soon as this condition is noted the lead should be resoldered or the wings peened shut.

Rim fire is a continuous ring of fire that follows around the commutator, and it is caused by oil soaked mica which is allowing the bars to short circuit through the insulation.

If mica becomes oil soaked and it cannot be dried out, it will be necessary to send the armature to the factory.

In all cases where sparking at the brushes occurs, a remedy must be applied to correct the trouble or in time the commutator will be injured.

COMMUTATOR

While the commutator is part of the armature, it is necessary to consider it separately, for it is here that the current generated by the dynamo is collected by the brushes and forced out on the main line to be utilized for light or power. If, for any cause, the operating conditions are not correct the symptoms will be indicated at the commutator by the sparking at the brushes. (See "Sparking at Brushes" page 37.)

HIGH MICA

Mica is used for insulation between the commutator bars. When the armature is constructed the mica is cut away to a depth of about 1/32 inch below the surface of the bars. In time the surface of the bars will wear down to the level of the mica. As the mica is harder substance than copper, it forms ridges which cause the brushes to jump and prevents them from making good contact with the commutator. If the mica is even with or projects above the bars, it should be cut away to a depth of 1/32 inch. A hack saw blade is a good tool for this purpose.

CARE OF THE COMMUTATOR

The commutator and brushes are the only parts of the generator which are subject to wear, and they must be given the necessary attention to maintain them in their highest state of efficiency. Under proper conditions of cleanliness and adjustment, the commutator takes on a mahogany colored finish which is highly desirable for satisfactory operation.

As the generator is cooled by means of currents of air through the holes in the generator cover, it is very necessary that the plant be protected from flying dirt or dust which would be drawn into the machine, collect on the commutator and brushes and cause them to wear rapidly. Dirt, oil, and water are very injurious to any kind of electrical machinery.

The only care that the commutator should have is to keep it clean. Do not put oil or other lubricant on it. Wipe it off with a clean cloth occasionally. If the commutator gets gummy or sticky it may be cleaned with a cloth dipped in gasoline or alcohol. Do not operate after cleaning with gasoline or alcohol till dry, as a spark may ignite the volatile gases. Should the surface of the commutator bars become rough, or worn unevenly, it will cause the brushes to jump and the lights to flicker. If the condition is not too serious, it may be sandpapered until smooth; or it may be necessary to remove the armature, true it up in a lathe, and undercut the mica.

TESTING ARMATURE

If the field coils are not at fault, and the plant fails to generate, the armature should be tested.

A simple test to determine whether the armature is the cause of a plant failing to generate when the gasoline engine is functioning, is as follows:

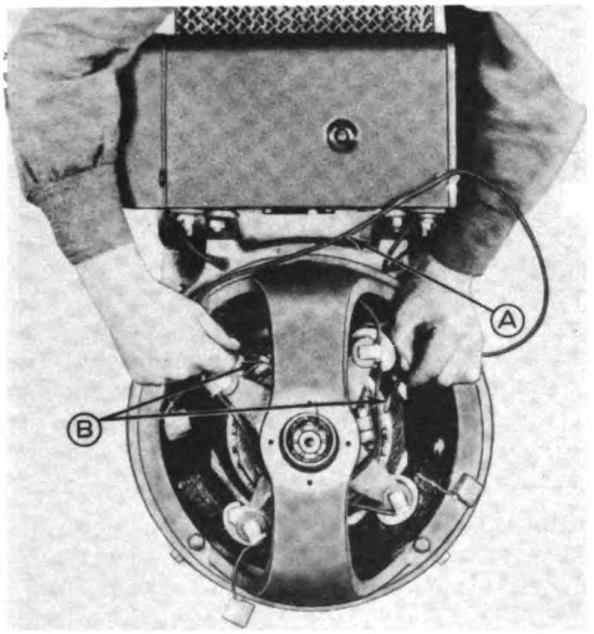


FIGURE 22

Testing the Armature

A Insulated Wire
B Bare Ends of Wire on Commutator

Remove the brushes. Take a piece of flexible insulated wire (#8 drop cord or heavier) about 24" long, and while engine is in operation, touch the bare ends of this wire on the commutator. The spacing of the wire should be 90 deg. or 1/4 distance on face of commutator as indicated in the picture. If an arc is produced it can be taken for granted that the armature is not at fault. See Fig. 22.

If the test shows the armature to be at fault it should be removed, tested, and repaired as instructed on the following pages.

REMOVING THE ARMATURE

Remove the cotter pin. Hold armature from turning with brake holder tool. Use socket wrench, to remove armature nut. DO NOT USE an open end or monkey wrench as this may spring the crankshaft and throw it out of line.

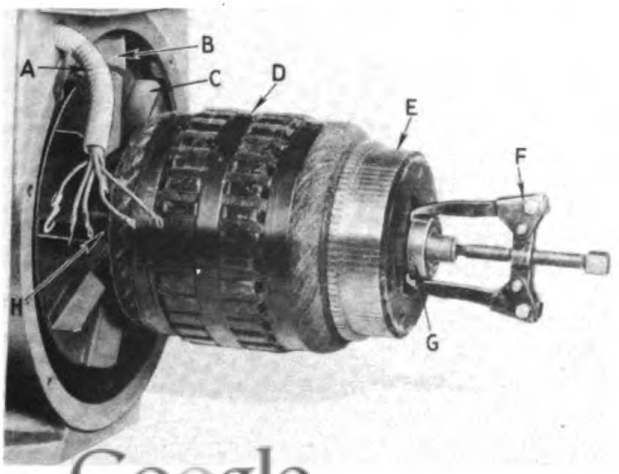


FIGURE 23

Removing Generator Ball Bearing

A Wire Accessory
B Fan Belt
C Generator Fan
D Armature
E Commutator
F Bearing Puller
G Generator Ball Bearing
H Armature Spacer

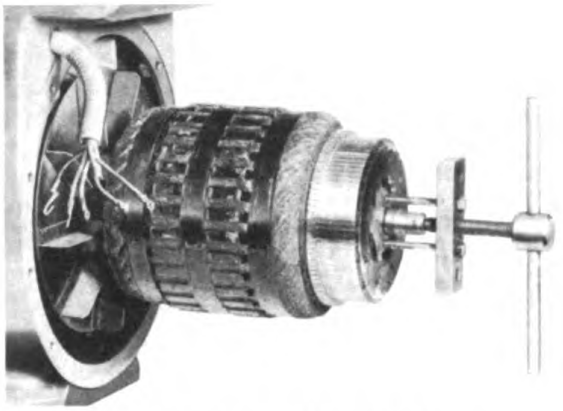


FIGURE 24 REMOVING ARMATURE

Note the special tool which is used. This can be furnished. If required, write for quotations.

REMOVING GENERATOR BALL BEARING FIGURE 23

Fig. 23 shows the method of removing the generator ball bearing with a bearing puller. After the bearing is removed it should be carefully washed and examined, if worn excessively it must be replaced. A worn race, cracked or nicked ball will cause the bearing to be noisy. Grease the bearing well with CG. before replacing. Grease bearing every 512 hours.

REMOVING THE ARMATURE FIGURE 24

The end of the armature is drilled and taped for two 5/16 x 18" cap screws; fasten the two long 5/16" cap screws through the armature puller. Turning in main drive screw will cause armature to be drawn from the shaft.

TESTING THE ARMATURE FOR GROUNDS

Grounds in the armature are generally at the top of the coils next to the core, or between the commutator and core. If a Centry Bar Tester, or similar instrument, which will locate the exact coil, is not available, the armature may be tested by the following method:-Use a test cord with a lamp, bell, or buzzer in series and connect from battery terminals so as to obtain from 4 to 6 volts. Hold one end of the test wire on the armature core and the other end on the commutator. If the armature is grounded the circuit will be closed. To locate the ground, remove one top lead from the copper segments, turn the armature half way around, and remove a top lead directly across from the one which has been removed; with the test cord test each half of the armature for the ground. If both halves of the commutator are still grounded, the ground may be between the copper bars and the lock ring. If only one half of the commutator is grounded, keep dividing the grounds until the grounded coil is found.

REPAIRING ARMATURE GROUNDS

If the ground is due to a break in the insulation, pry the coil away from the discs by means of a small thin gauged chisel, inserted between the old insulation and the disc. Remove the chisel and place a piece of mica or fish paper in the opening and test the coil again. If the ground is removed, insulate the repaired spot with air drying varnish or shellac.

The coil leads can easily be removed from the copper segments by using a blunt chisel or punch the width of the slot, and a hammer. Do not use a sharp chisel or punch to drive the leads out.

Grounds under the commutator bars and the core next to the lock ring usually cause burnt spots on the ends of the copper bars. They are due to moisture, minerals in the mica rings, and mineral particles which may have been in the air. They are easily repaired by removing the eight screws at the end of the armature and taking off the commutator lock ring.

After the lock ring has been removed, examine the mica rings. If a burnt spot is noticeable, it should be scraped off with a knife and replaced with a new piece of mica. If the ground is over the entire front of the armature, an entirely new mica ring should be installed. Replace the lock ring and tighten the screws securely. It may be advisable to have the commutator trued up after the lock ring has been replaced.

TESTING THE ARMATURE FOR SHORT CIRCUITS

The armature may become short circuited if it is water or oil soaked, damaged by rough handling, if there is broken insulation between coils, foreign substance between commutator bars, or if wings of commutator bars are crushed. A short circuit will tend to burn through and will be discovered by blackened commutator bars, or burnt insulation.

REPAIRING SHORT CIRCUITS IN ARMATURE

Coils which have burned through must be replaced, the burnt insulation removed and replaced with new. Armatures which are oil or water soaked must be dried out or replaced.

REPAIRING OPEN CIRCUIT IN ARMATURE

Remove a sufficient amount of insulation and wire to make a good soldering connection. Solder securely and test armature after it has been repaired.

REMOVING AND REPLACING FLYWHEEL, SPLIT COVERS, AND GENERATOR

REMOVING FLYWHEEL

After the armature has been removed as shown in Fig. 24 the flywheel may be removed as illustrated in Fig. 25.

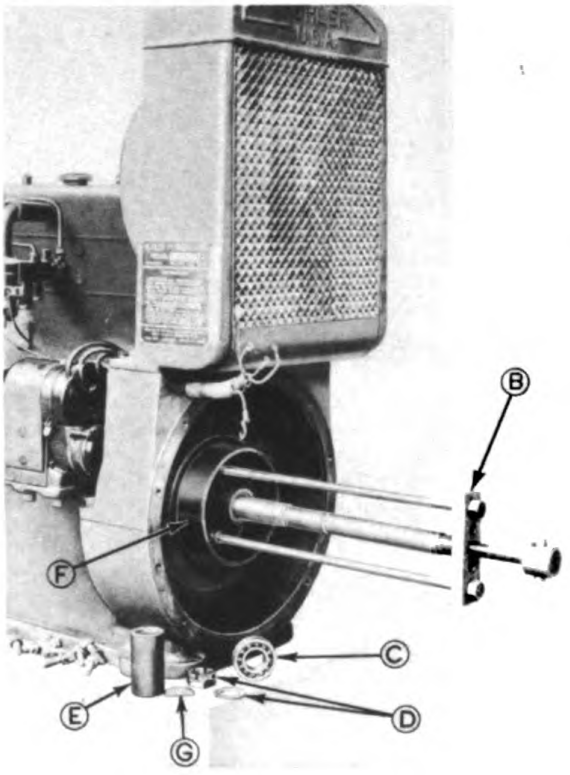


FIGURE 25

REMOVING THE FLYWHEEL

		D	Washer and Nut
B	Flywheel Puller	E	Armature Spacer
C	Generator Ball Bearing	F	Flywheel
		G	Woodruff Key

Before removing the flywheel, it is necessary to remove the woodruff key from the crankshaft, the armature spacer, and the fan belt. When removing the woodruff key, do not burr or cut the groove in which it fits. If the edges are burred, the burrs must be removed from both the grooves and the key before the key is replaced. The fan belt may be removed by loosening the fan holding nut and permitting the fan to drop lower in the radiator housing. This will decrease the tension on the belt to such an extent that the belt can be lifted over the fan blades and removed from the plant.

The flywheel has two holes drilled and tapped for the special long bolts furnished with the puller, tool No. SS-170. These holes should be cleaned of all foreign particles before the bolts are turned in. Turn the bolts in as far as possible, because if they are held with only one or two threads, they may break loose before the flywheel is moved.

Note the armature spacer, generator ball bearing, armature nut and washer lying on the block at the engine base. Fig. 25.

SPLIT COVERS (OIL RETAINERS)

After the flywheel has been removed the split covers will be exposed as illustrated in Fig. 26.

The split covers or oil retainers, are die cast metal so designed and fitted as to prevent oil from leaving the oil base. They are held in place by six 1/4" cap screws and copper asbestos packing washers. Packing washers are used to prevent oil from leaking out the threads of the cap screws. The split joint, (D Fig. 26) is kept oil proof by gaskets. The clearance between the crankshaft and the oil retainers, ("A" Fig. 26) should be between four and six thousandths inches. If these covers are not fitted correctly there will be an oil leak at this point, and oil will run from the base, at the flywheel housing.

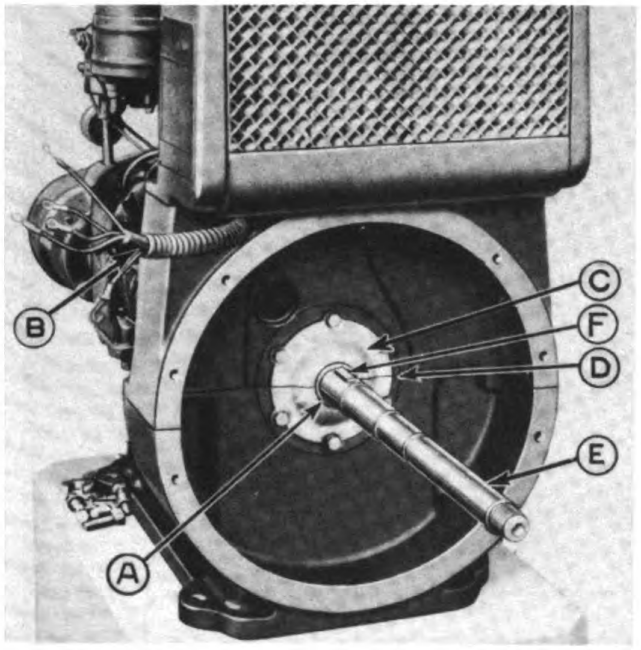


FIGURE 26

SPLIT COVERS (FLYWHEEL REMOVED)

A	Opening between Split Cover and Crankshaft	D	Joint between Upper & Lower Split Cover
B	Wire Accessory	E	Crankshaft
C	Split Cover	F	Woodruff Key

The covers are fitted in pairs, the lower half having an oil return notch or drain. To test for oil leak at this point, remove the generator, armature, and flywheel and operate the gasoline engine.

When starting with hand crank be careful when cranking. Regulate the engine speed by hand to about 1000 R.P.M. If there is an oil leak at split cover joint, or at cap screws, it will soon be noticeable and the gasket can be renewed or covers adjusted to overcome it.

REPLACING THE FLYWHEEL

When replacing the flywheel on crankshaft, be careful to have flywheel keyway line up true with key in shaft. Tool No. SS-131 steel tubing and armature driver, tool No. SS-207 should be used to drive flywheel in position.

After flywheel has been replaced, replace the fan belt.

REPLACING THE ARMATURE FIG. 27

After flywheel and fan belts are in place, replace armature spacer, and insert armature key; next placing driving screw of armature driver on end of shaft. The armature can now be slipped on shaft. Carefully check that key way in armature lines up with key in shaft, armature can then be forced in place with armature driver. Use brake (leather belt on bar) for holding armature and prevent it from turning. Be sure armature is forced on shaft until it is tight against armature spacer. If this is not done the brushes will not ride in their proper path on the commutator.

After armature has been driven in place, replace generator ball bearing and fasten with washer and nut. Use special armature nut socket wrench for tightening nut. Lock nut with cotter pin.

Face of commutator must run true. Factory limit on this variance is .007 inch.

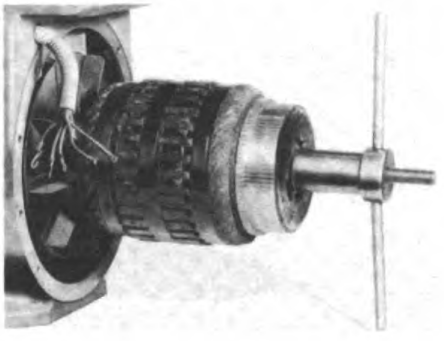


FIGURE 27
REPLACING ARMATURE

REPLACING GENERATOR FRAME ASSEMBLY

After armature has been securely fastened and checked for trueness, the generator frame can be replaced.

When mounting generator frame all the generator brushes must be removed from brush holders. Particular attention should be paid that commutator is not damaged when replacing generator frame.

Generator ball bearing must be entered true, generator frame should just fit, and it should not be necessary to draw or force generator frame into position. When generator frame is seated fasten in place with eight 3/8" cap screws. Always replace generator screens (held in place by the lower cap screws on each side). Brush holders and brushes should be checked for alignment and setting.

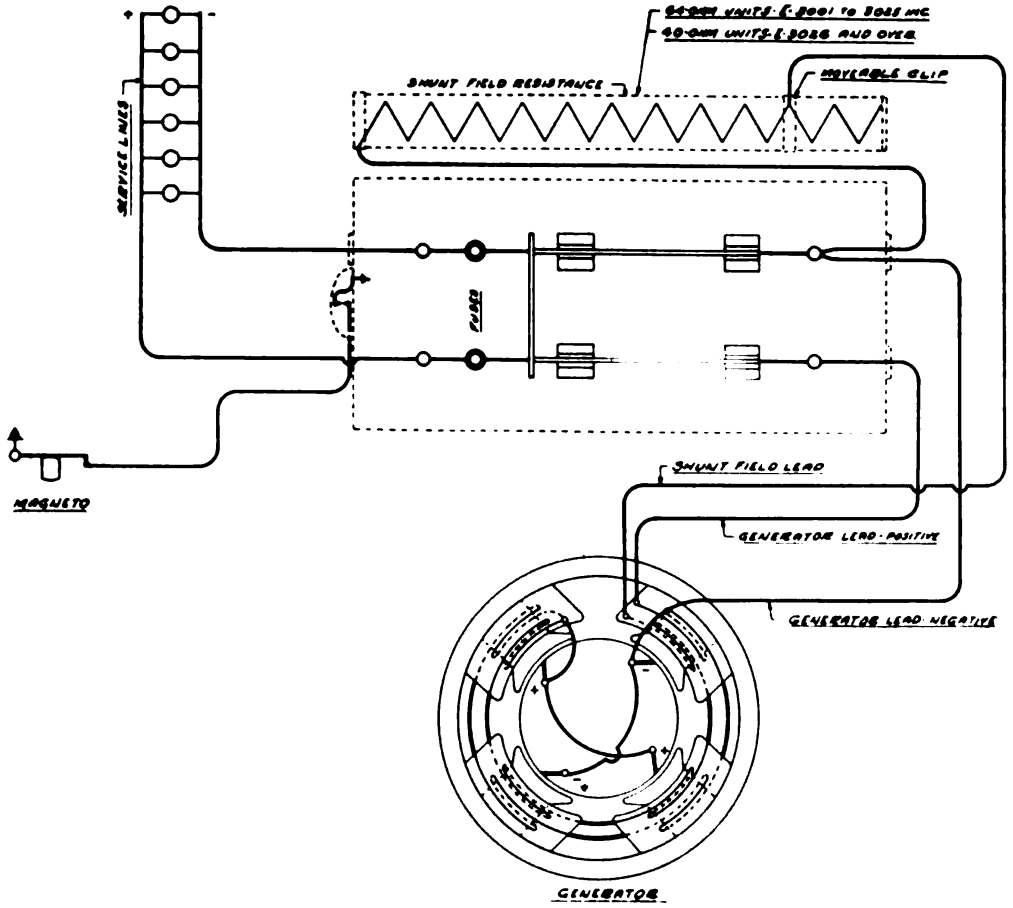


FIGURE 28

WIRING DIAGRAM MANUAL PLANTS

DIAGNOSES OF TROUBLES AND THEIR REMEDIES

Kohler Electric Plants are correctly designed and constructed of the best material by skilled mechanics under the supervision of engineers who have had years of experience in the construction of gasoline engines and electrical equipment. Each plant is thoroughly tested before shipment is made from factory.

If installed under proper operating conditions and given the care which all machinery of this kind must have, they will give long, dependable, and economical service.

If, however, the plant is not properly installed under conditions that are reasonably favorable for its operation, or does not receive proper care, satisfactory results cannot be expected and sooner or later trouble will be experienced.

If conditions are not right and the plant is not functioning properly, certain symptoms will appear. In the following pages are given various symptoms and the causes that are responsible for them and the remedy to apply.

Do not proceed blindly. If the plant does not operate as it should, note carefully how it acts. Turn to the symptom exhibited, find the cause and apply the correct remedy. Remember that cold weather, dirt in the supply line strainers or carburetor jets, water in the gasoline, fouled spark plugs or choked exhaust pipe or muffler, are responsible for most of the difficulties experienced with gasoline engines. Do not take the machine apart until you have located the trouble.

Remember that a low or inferior grade of gasoline will not permit the plant to start promptly during cold weather.

I. ENGINE FAILS TO CRANK

Engine does not turn freely, due to: (1) pistons corroded and seized; (2) water in cylinder; (3) crankshaft out of alignment; (4) foreign matter between armature and generator; (5) tight bearings; (6) congealed lubricating oil.

II. ENGINE FAILS TO START FIRING

1. Lack of fuel. Failure of plant to receive a supply of fuel may result from the following causes: (1) cold weather, particularly if low test gasoline is used; (2) water in gasoline; (3) no gasoline in the supply tank; (4) leaky or punctured supply tank; (5) clogged supply line, due to dirty strainers in the supply tank or carburetor; (6) air leaks in supply line connections. If main fuel tank is not properly vented, fuel will not be drawn freely.

2. Clogged carburetor. (1) sticking of needle valve in the carburetor; (2) excessive choking, due to sticking, rusted or bent valve or stem; (3) clogged main or compensating jet, due to foreign substances in fuel. Avoid use of varnish or paint cans as fuel containers.

3. Fuel pump at fault.

4. Defective magneto due to: (1) over-oiling, which causes dirty distributor brushes; (2) dirty rotating disc; (3) dirty collector ring; (4) worn or improperly adjusted breaker points; (5) loose or defective cables; (6) short circuit between brushes, caused by crack in distributor plate; (7) burnt out armature or condenser.

5. Defective, cracked or fouled spark plugs. Points not adjusted to 1/32" gap.

6. Excessive choking due to: (1) bent or unadjusted choker valve stem; (2) body of choker out of alignment; (3) screw in hot air manifold not removed in hot weather; (4) choker manifold out of alignment.

7. Improper timing. Instructions for timing are given on page 12. Check engine in accordance with directions given.

8. Improper valve adjustment due to: (1) worn or bent push rods; (2) worn or broken rocker arm adjusting screws: (3) broken rocker arm support bracket; (4) sticky rocker arms; (5) loose cylinder head. Check valve clearance in accordance with instructions given on page 24.

9. Engine too cold, combined with use of low grade of fuel.

10. Water in cylinders, due to: (1) leaky cylinder head gasket; (2) cracked cylinder block or head; (3) condensation from a long exhaust not fitted with a water drain.

III. ENGINE STARTS BUT MISFIRES

Caused by the following: (1) dirty, defective, or unadjusted spark plugs; (2) defective or crossed magneto cables (firing order is 1-3-4-2); (3) defective magneto: (4) improper timing (check timing in accordance with instructions); (5) poor compression, caused by scored cylinders, leaky valves, worn or defective piston rings, leaky spark plug gaskets, defective cylinder head. (6) tappets out of adjustment, giving too much or too little clearance for the valves; (7) weak or broken valve springs; (8) bent, worn, or sticking valve stems: (9) air leak between intake manifold and carburetor; (10) water in gasoline; (11) excessive lubrication; (12) mixture too lean (main compensating jet or spray nozzle should

be set in center of venturi tube;)(13) choker valve caught up, causing too rich mixture; (14) water in cylinder.

IV. ENGINE BACKFIRES THROUGH CARBURETOR

The following are some causes for backfiring; (1) cold motor; (2) mixture too lean, due to clogging or improper setting of main compensating jet; (3) poor grade of gasoline; (4) air leak between the carburetor and cylinder head; (5) dirty gasoline; (6) leaky or improperly adjusted intake valves, due to bent or worn push rods, broken rocker arm adjusting screws, bent or defective valve stems, excessive carbon deposit on valve seat or stem; (7) improper timing (See article on timing); (8) water in gasoline; (9) choker not functioning properly; (10) obstruction in exhaust line due to collection of carbon or foreign matter, frozen or condensed water, or exhausting of gas into closed area; (11) spray nozzle not in center of venturi tube or carburetor; (12) air leak from push rod clearance passage into intake manifold, due to crack or sand hole in casting.

V. ENGINE KICKS BACK WHEN BEING CRANKED

This condition may be caused by the following: (1) magneto advanced too far; (2) improper meshing of crankshaft gears and marking within the letters "O" and "S", which should coincide with the crank and cam gears; (3) water in cylinder.

VI. ENGINE KNOCKS

Knocking in engine may be due to the following causes: (1) excessive carbon in cylinders from using poor grade of fuel, obstruction in exhaust line, leaky piston rings or defective spark plugs; (2) magneto incorrectly timed; (3) connecting rod or main bearing burned out; (4) loose piston pin or bushing; (5) loose piston; (6) loose generator ball bearings, due to lack of lubrication, wear or improper alignment; (7) loose gears on crankshaft, camshaft or magneto drive shaft; (8) loose magneto coupling, (9) heavy overload; (10) weak spring in oil pump; (11) weak valve springs.

VII. ENGINE LACKS POWER

The following may cause this condition: (1) mixture too rich, due to obstructions of needle valve, leaky float or bent or worn needle valve or axle; (2) mixture too lean, due to partial obstruction in gas supply; (3) low grade or dirty fuel; (4) cold motor; (5) poor compression; (6) excessive carbon; (7) improper valve adjustment; (8) choked exhaust pipe or muffler; (9) defective or broken spark plugs; (10) defective magneto; (11) weak or broken valve springs; (12) bent or sticking valve stem or rocker arm; (13) lack of lubrication because of no oil, oil lines

clogged or pump not operating; (14) tight bearings; (15) carburetor lever adjusted so as to run plant slowly.

VIII. GOVERNOR SURGES

This may be due to the following causes; (1) partial obstruction in the gas supply; (2) cold motor; (3) leak between carburetor and cylinder head; (4) governor mechanism sticking or out of line.

IX. UNIT RUNS BUT FAILS TO GENERATE

Test for the following: (1) poor brush contacts on the commutator, due to dirty commutator, sticking or worn brushes or high mica between bars; (2) open circuit in the internal wiring system; (3) open circuit in field coils.

X. LIGHTS FLICKER AT NORMAL SPEED

The following are causes for this condition: (1) dirty or rough commutator; (2) sticking or tight brushes; (3) high mica; (4) faulty ignition due to defective spark plugs or defective magneto; (5) high or low commutator bars; (6) clogged muffler; (7) valves out of adjustment; (8) not enough ventilation; (9) irregular load.

XI. LOW VOLTAGE

(1) Cold motor; (2) speed too low, due to carburetor operating lever not being adjusted properly; (3) excessive back pressure in exhaust line, due to muffler being clogged with carbon; (4) binding or sticking condition in governor mechanism preventing throttle valve from moving freely; (5) overload, short circuit or ground.

XII. ENGINE RUNS TOO FAST

(1) A sticky or binding condition of throttle valve mechanism preventing the governor from giving accurate control; (2) carburetor throttle lever not adjusted properly.

XIII. ENGINE OVERHEATS

This may be caused by the following: (1) lack of water in radiator; (2) poor circulation in radiator due to deposit of mineral scale (this scale may be removed from radiator by use of a solution of sal soda and water and flushing); (3) fan belt slipping or fan blades bent; (4) excessive carbon, causing pre-ignition; (5) improper timing; (6) lack of lubrication.

XIV. PISTONS PUMPING OIL

This may be due to: (1) leaky valves; (2) oil level too high; (3) piston rings sticky, broken or ineffective, due to loss of tension; (4) cylinder walls scored or worn; (5) rings fit too loosely in pistons; (6) oil dip of connecting rods too great; (7) poor quality of oil or dilution of oil by fuel; (8) defective ignition, either spark plug or magneto; (9) oil soaked magneto cables causing defective insulation and ignition leaks; (10) air or oil leak from push rod clearance passage into intake manifold; (11) oil leak around intake valve guides.

XV. ENGINE RUNS TOO SLOW

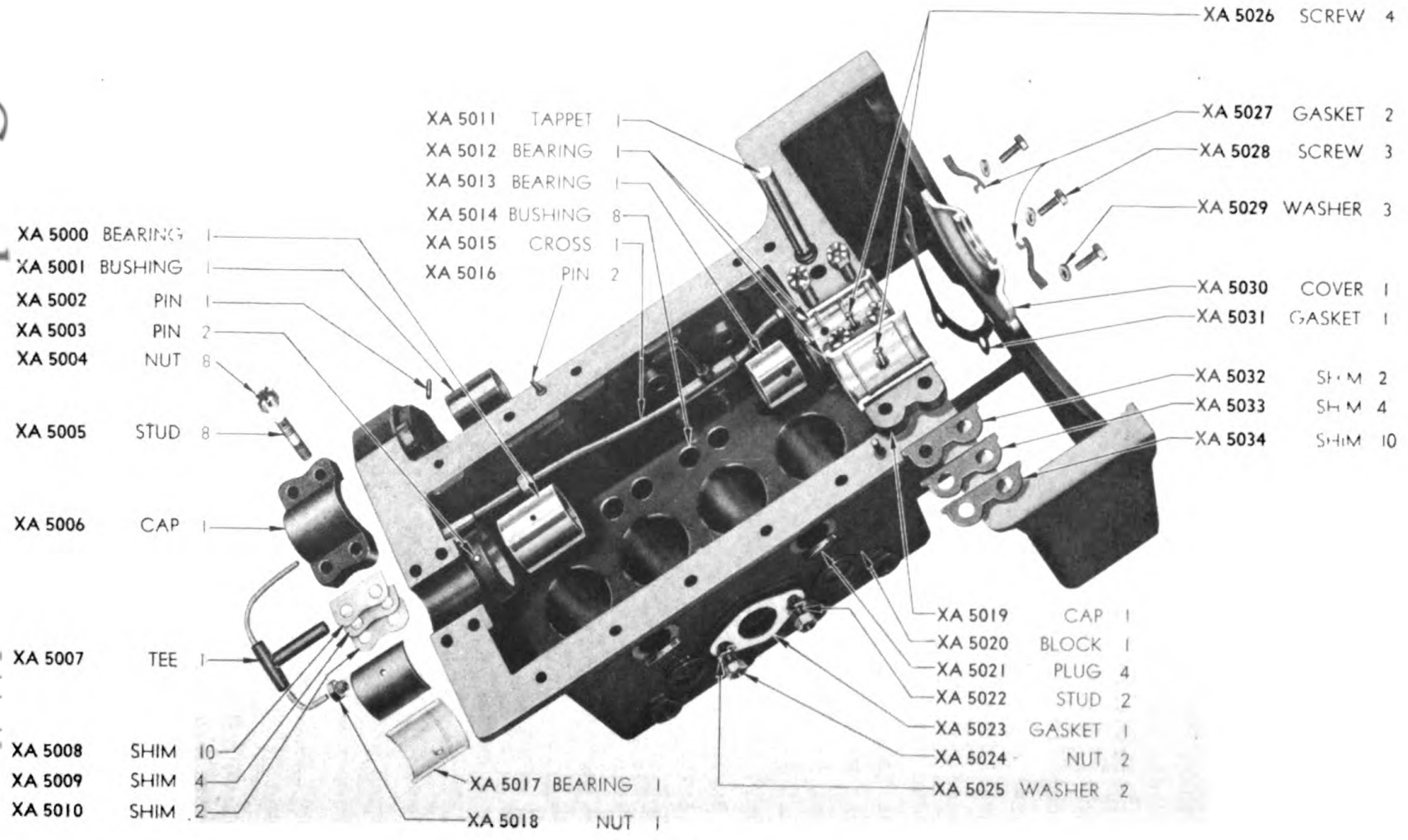
This condition may be due to: (1) misadjustment of throttle arm to carburetor feeding insufficient gas; (2) poor compression; (3) retarded spark; (4) defective ignition; (5) obstruction in gas supply.

XVI. LACK OF FUEL

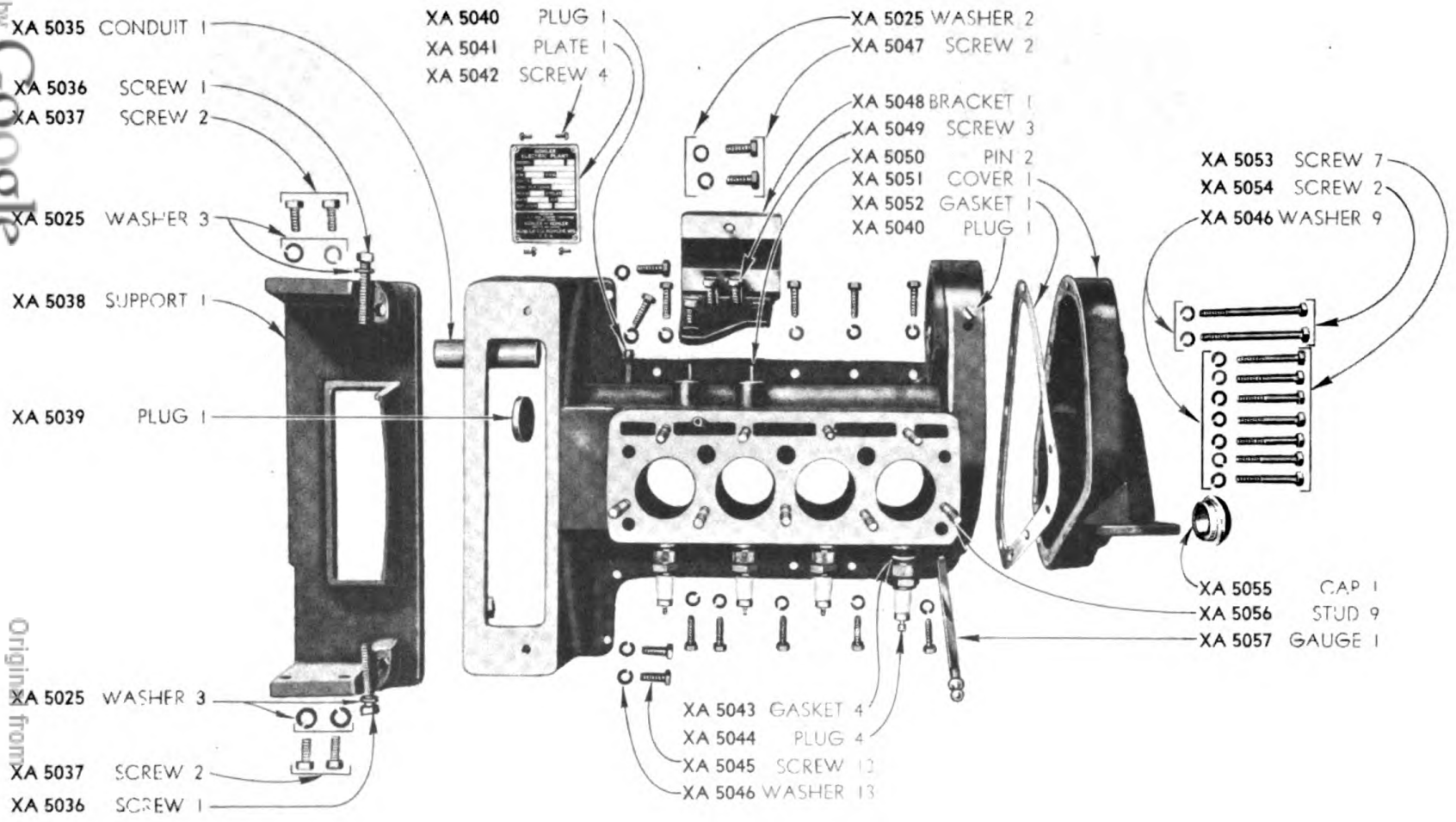
This may be due to: (1) storage tank empty; (2) air leak in supply pipe or connection; (3) too great a gasoline lift; (4) fuel pump defective.

NOTES

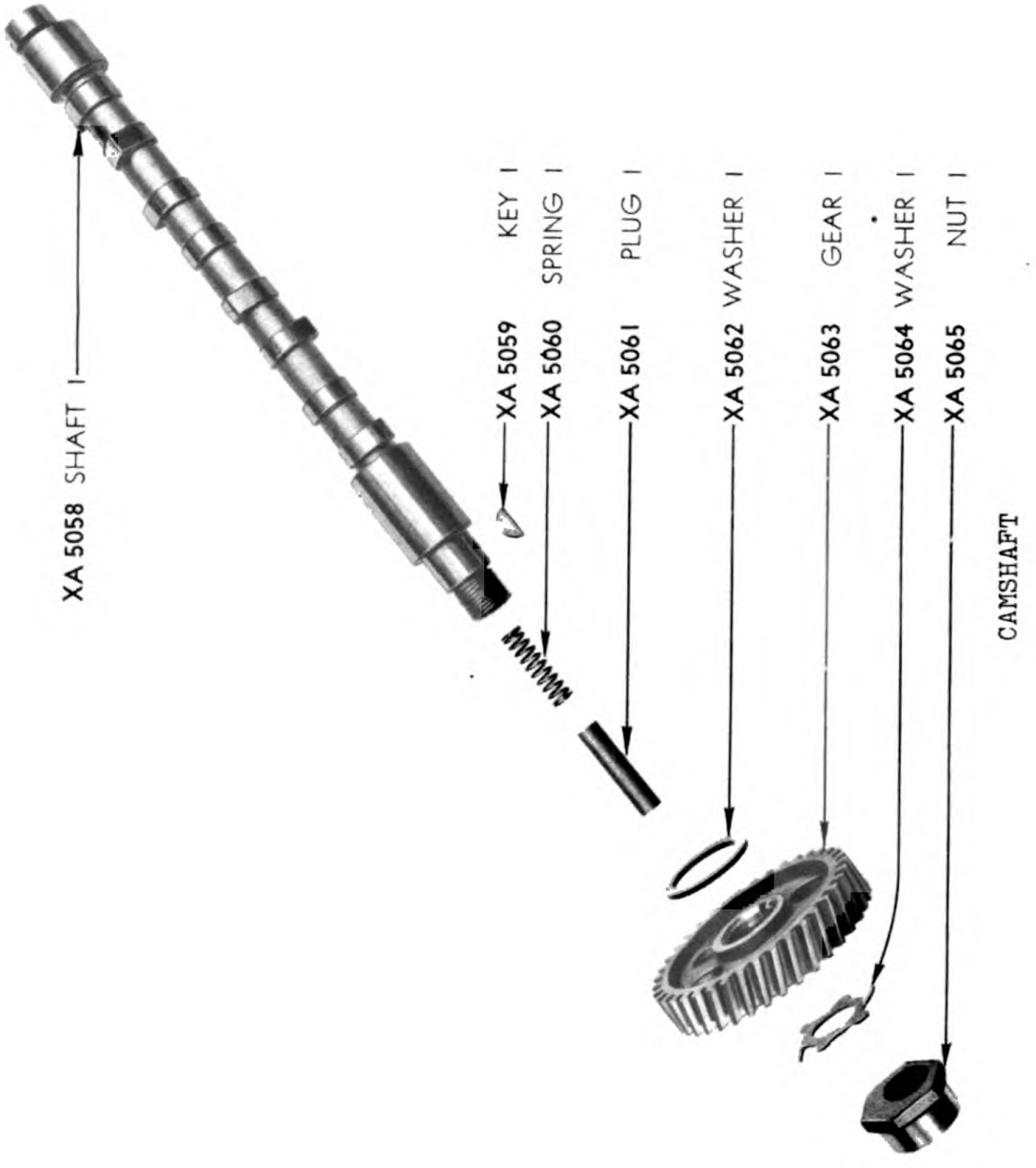
INDEX PARTS SECTION



CYLINDER BLOCK - BOTTOM VIEW

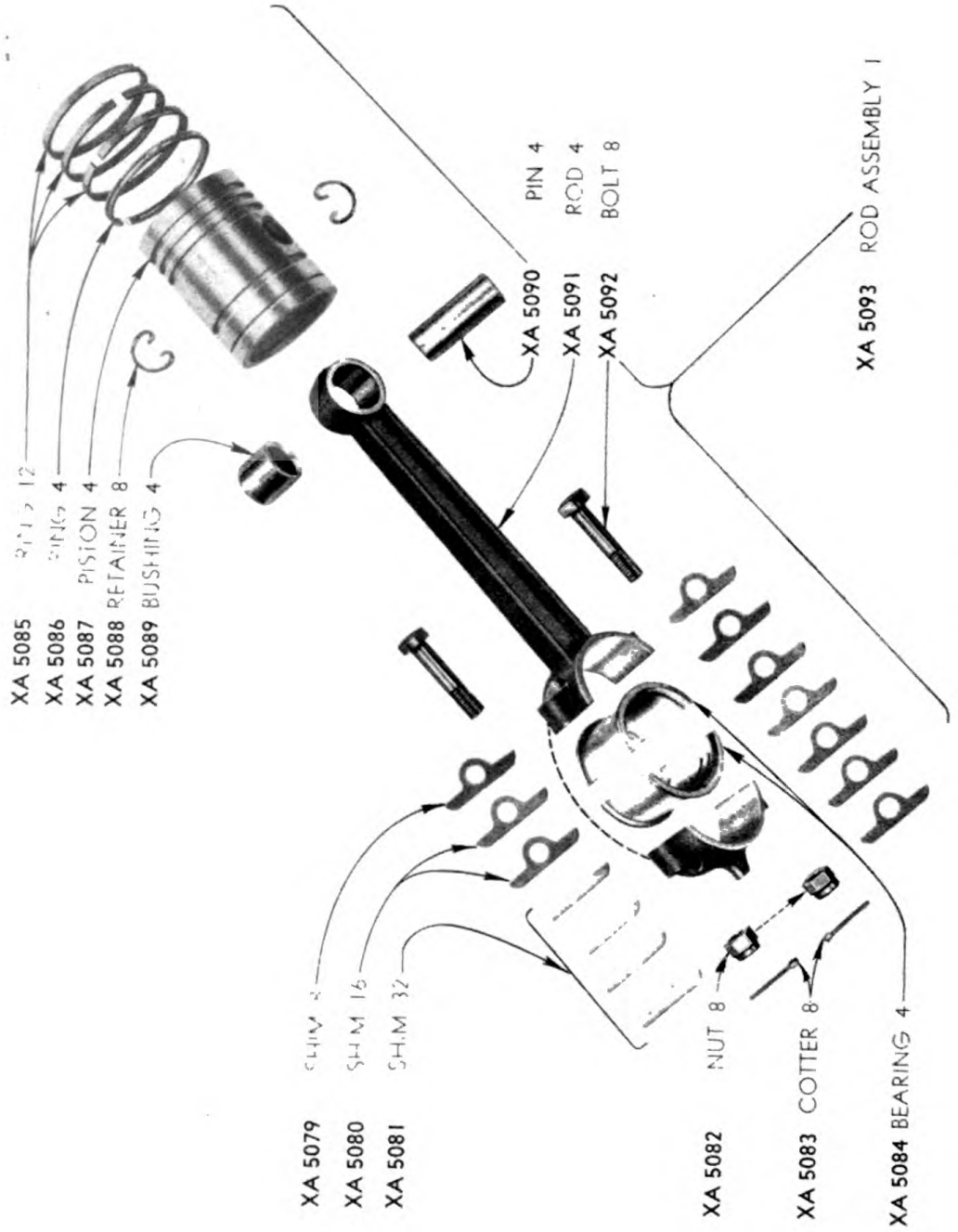


CYLINDER BLOCK - TOP VIEW

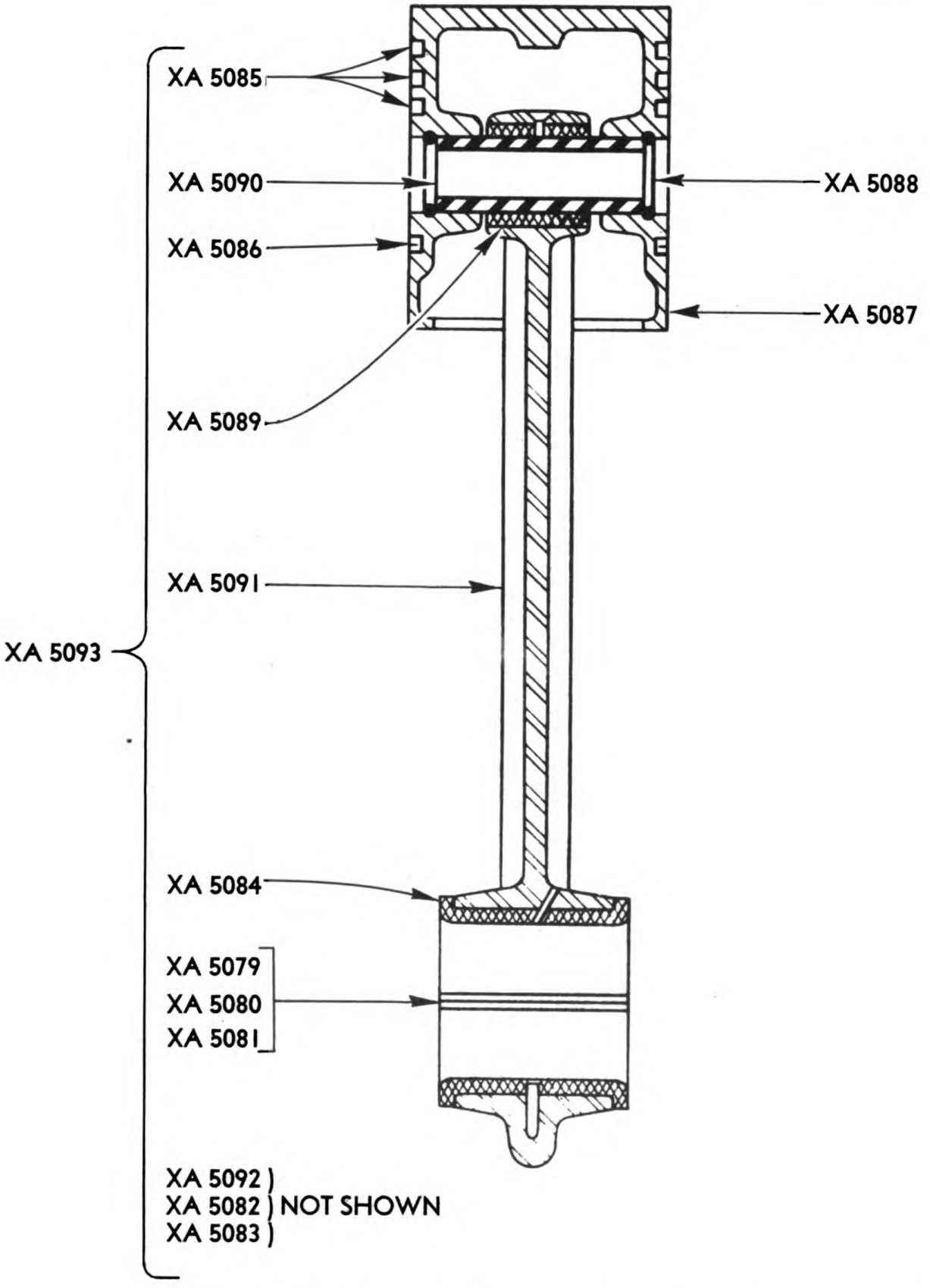


CAMSHAFT

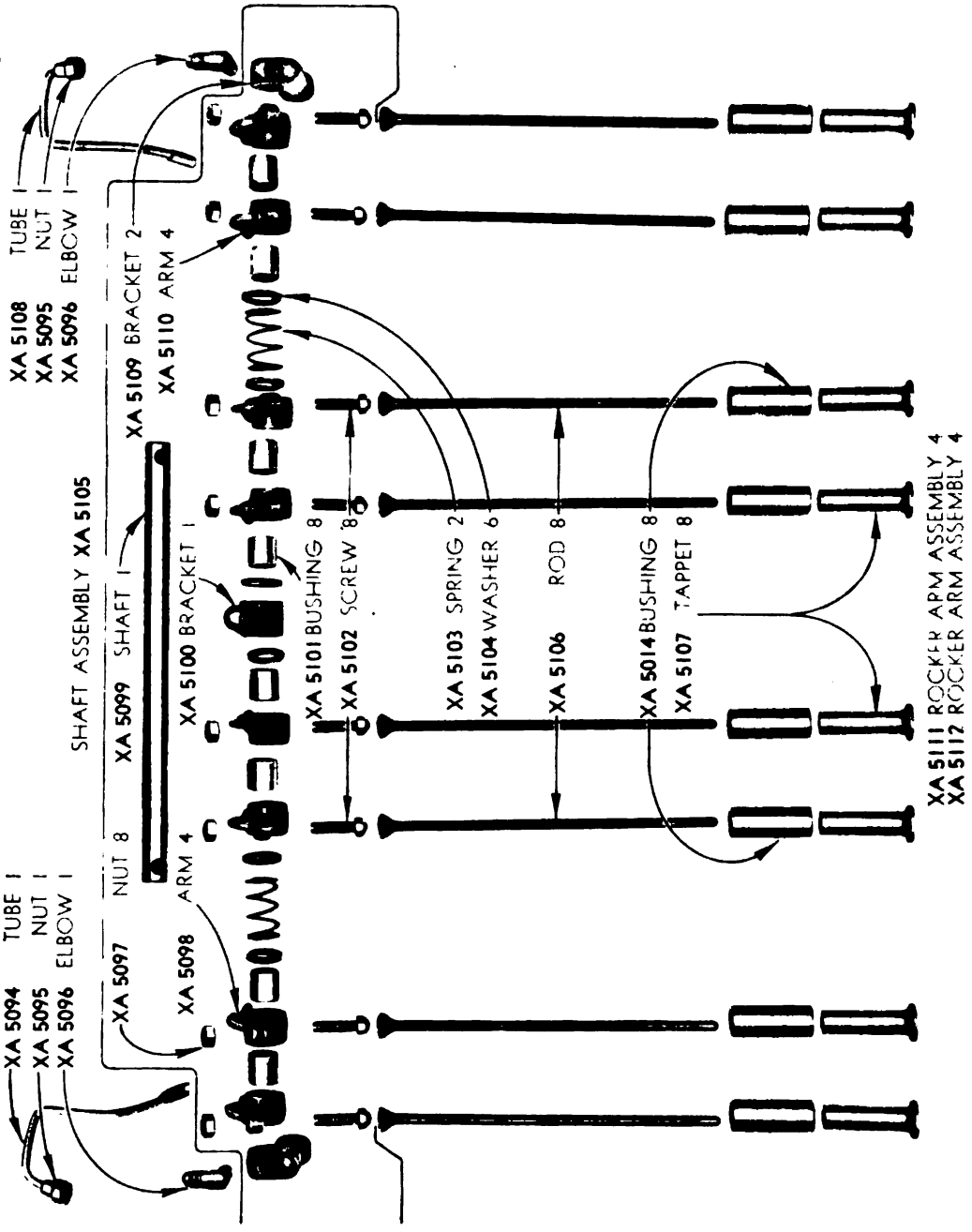
CRANKSHAFT AND FLYWHEEL



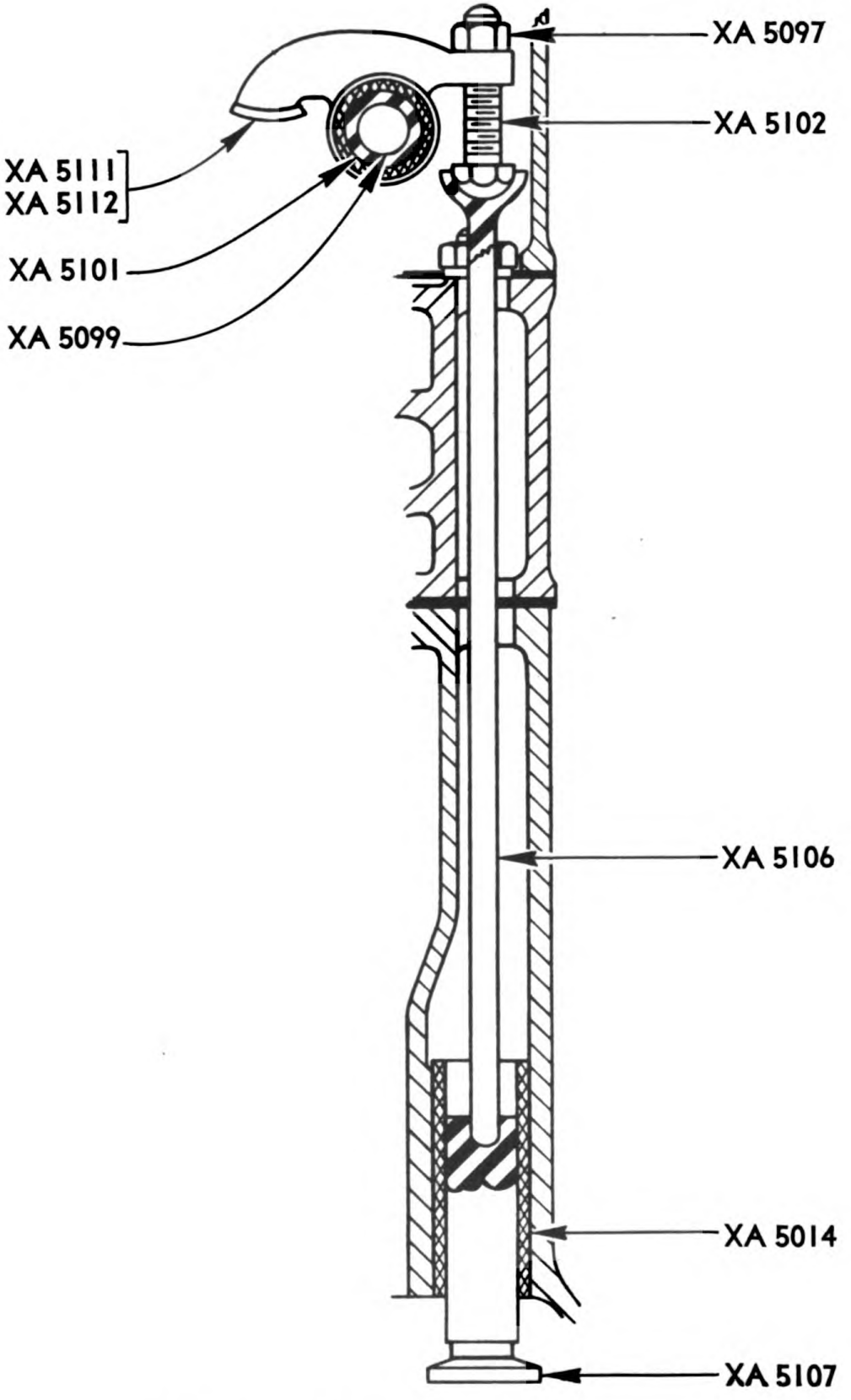
CONNECTING ROD AND PISTON ASSEMBLY



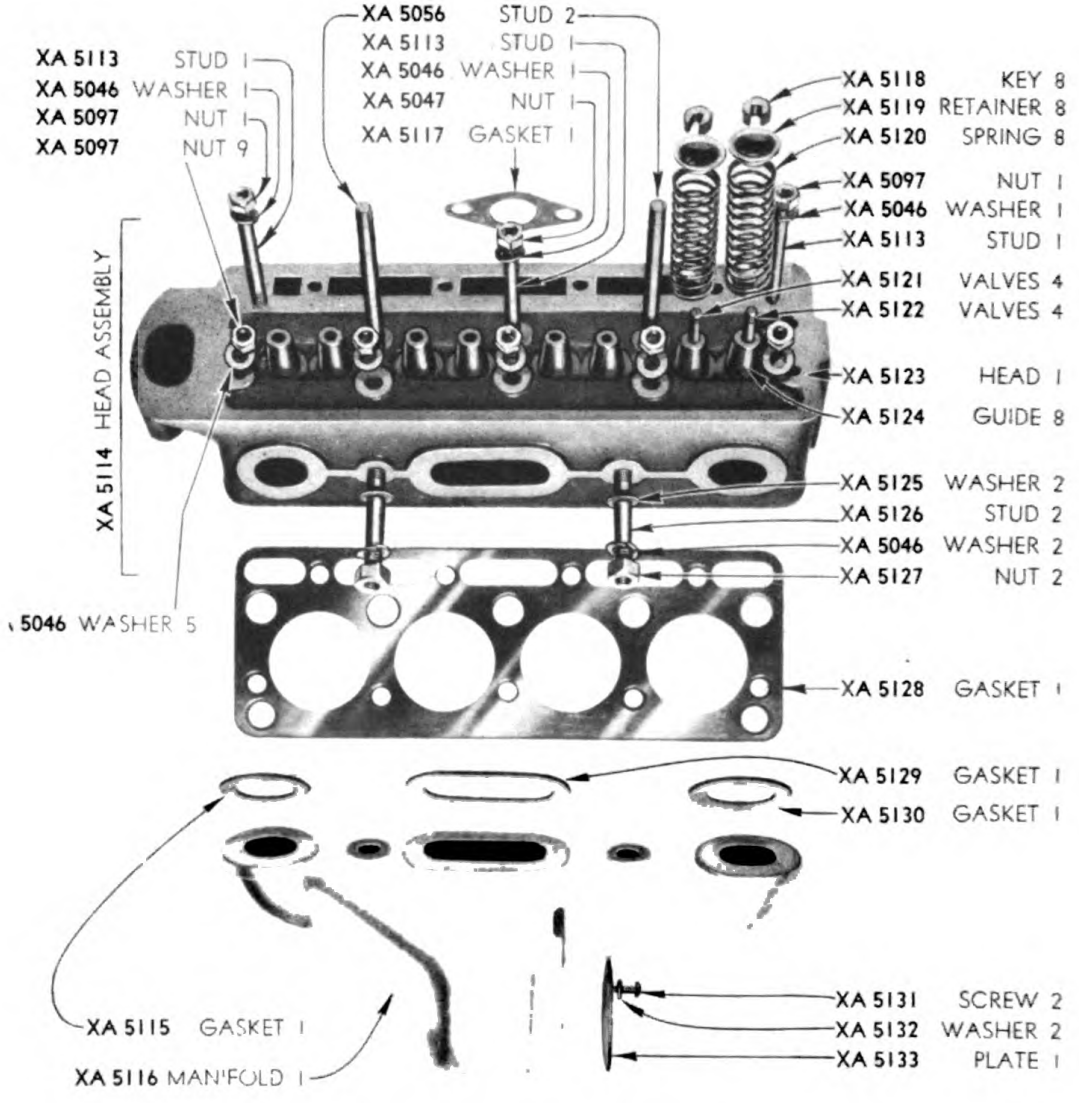
CONNECTING ROD AND PISTON - CROSS SECTION



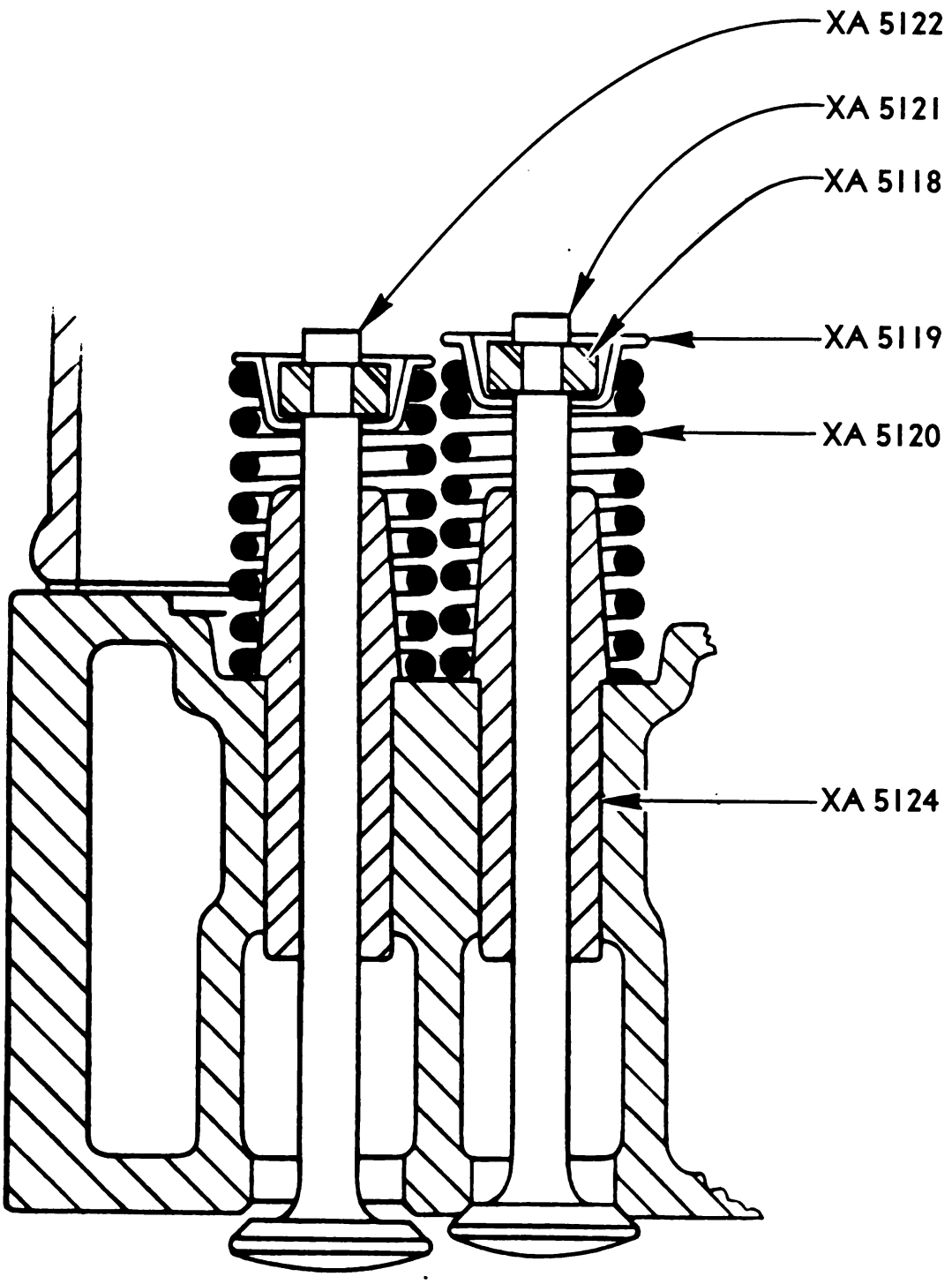
PUSH RODS AND ROCKER ARMS



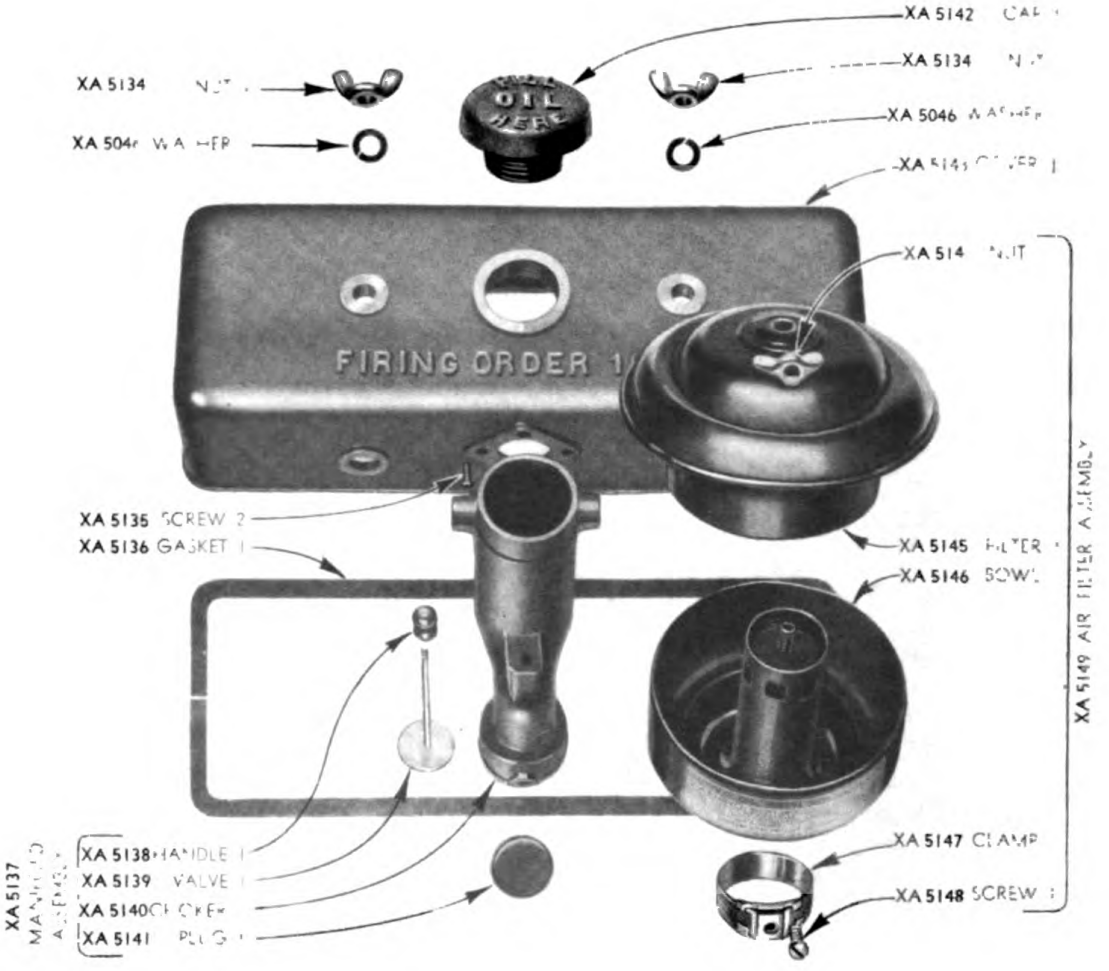
PUSH RODS AND ROCKER ARMS - CROSS SECTION



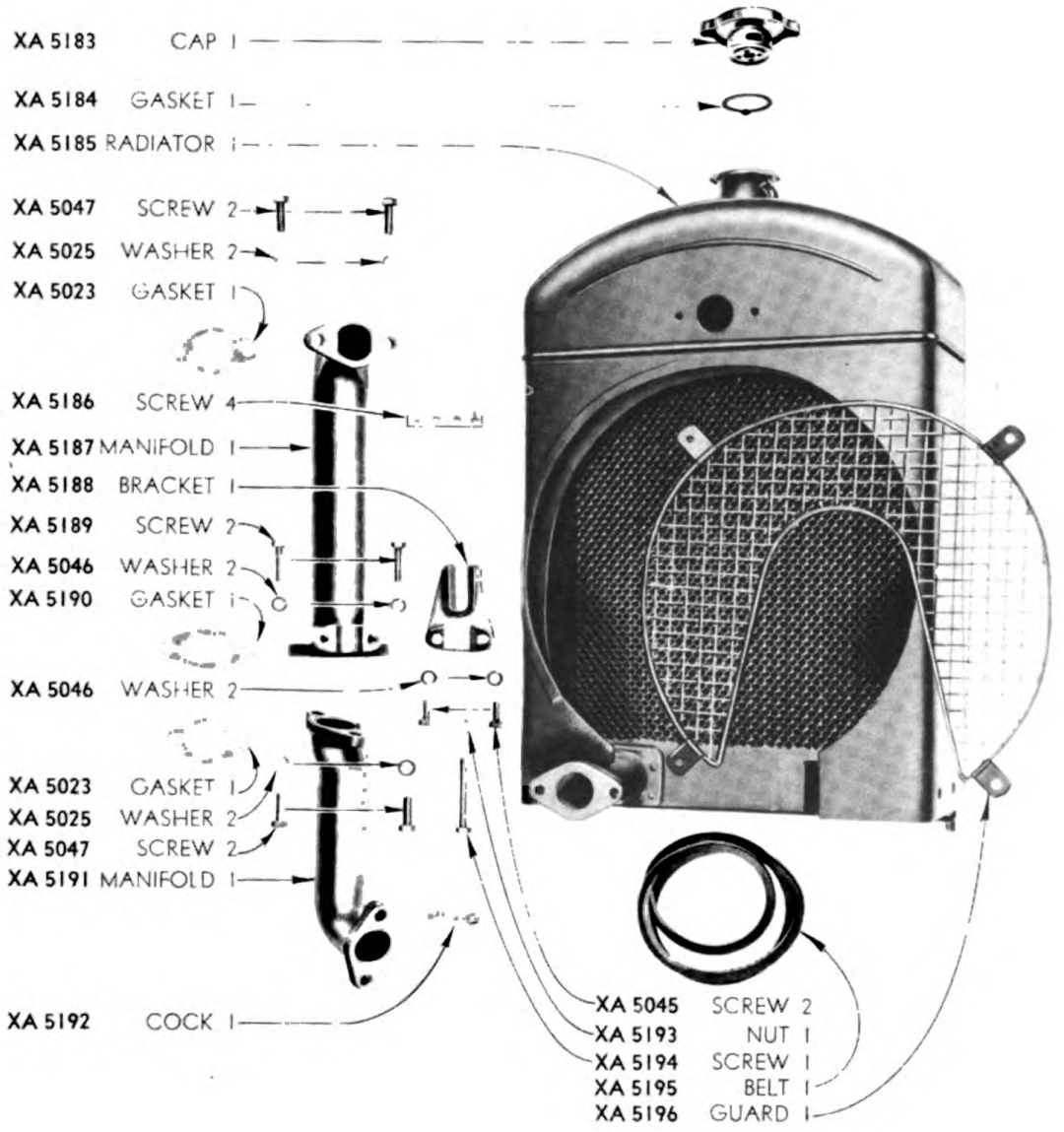
CYLINDER HEAD - VALVES AND EXHAUST MANIFOLD



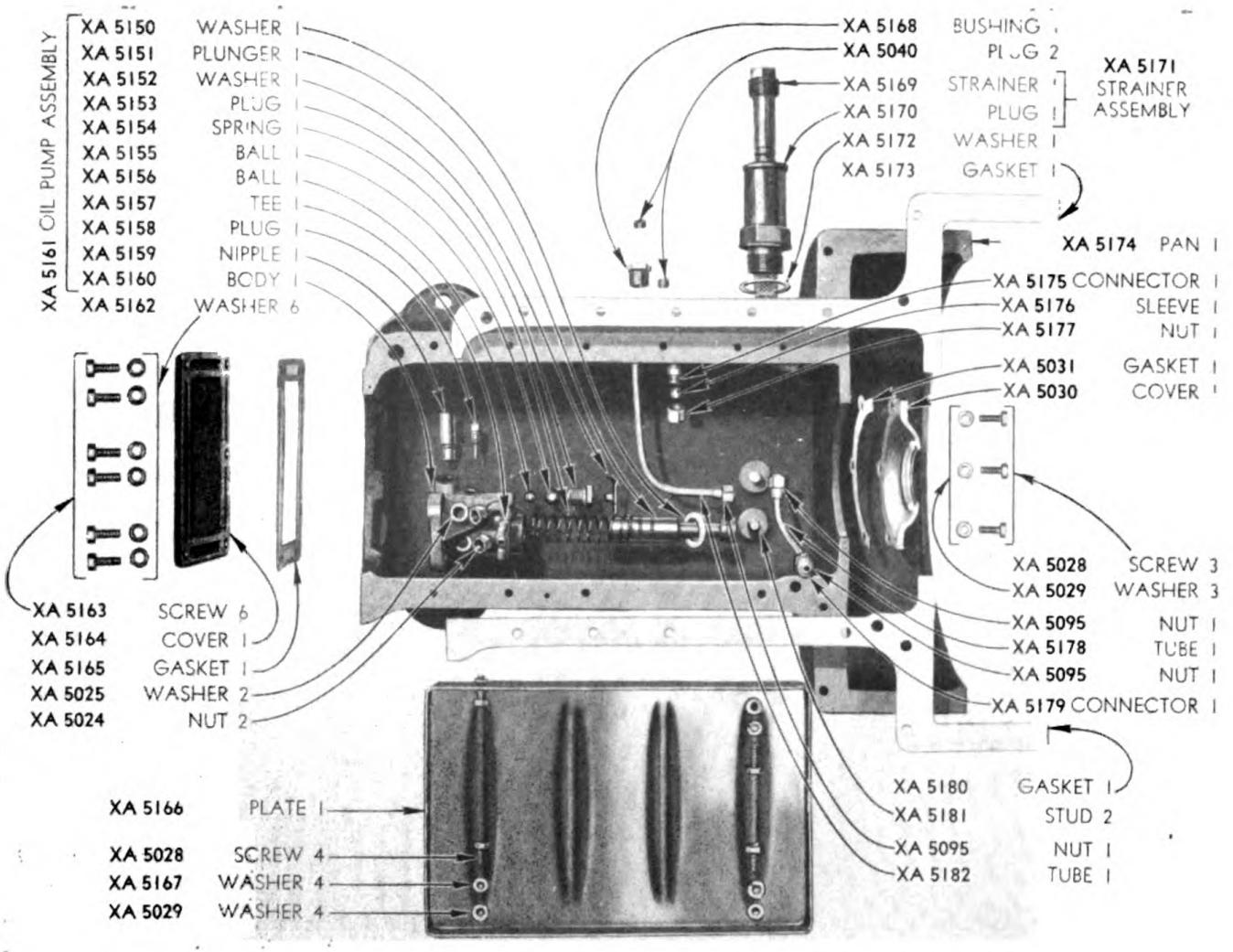
CYLINDER HEAD AND VALVES - CROSS SECTION



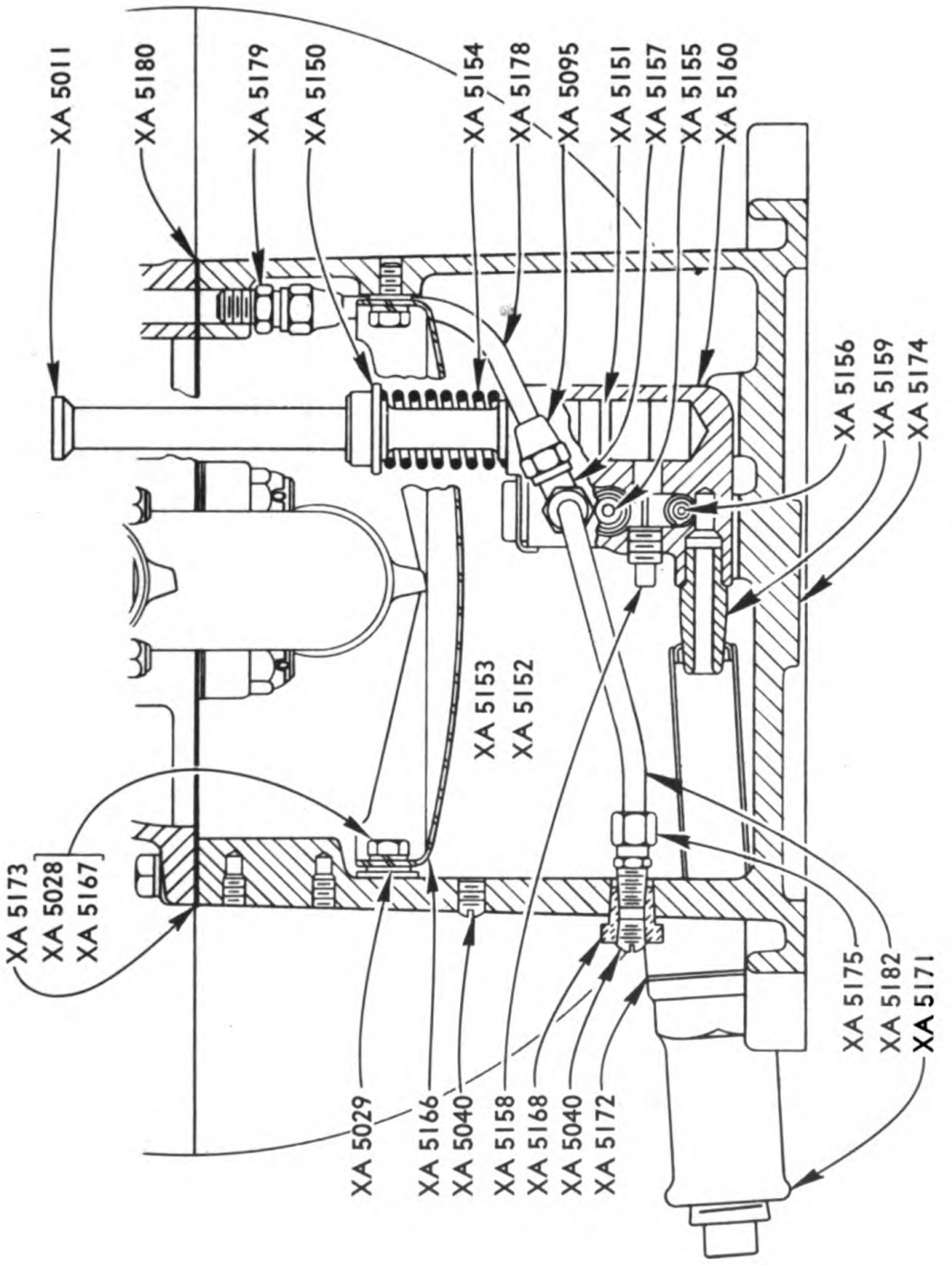
CYLINDER HEAD COVER AND AIR CLEANER



RADIATOR AND FAN BELT

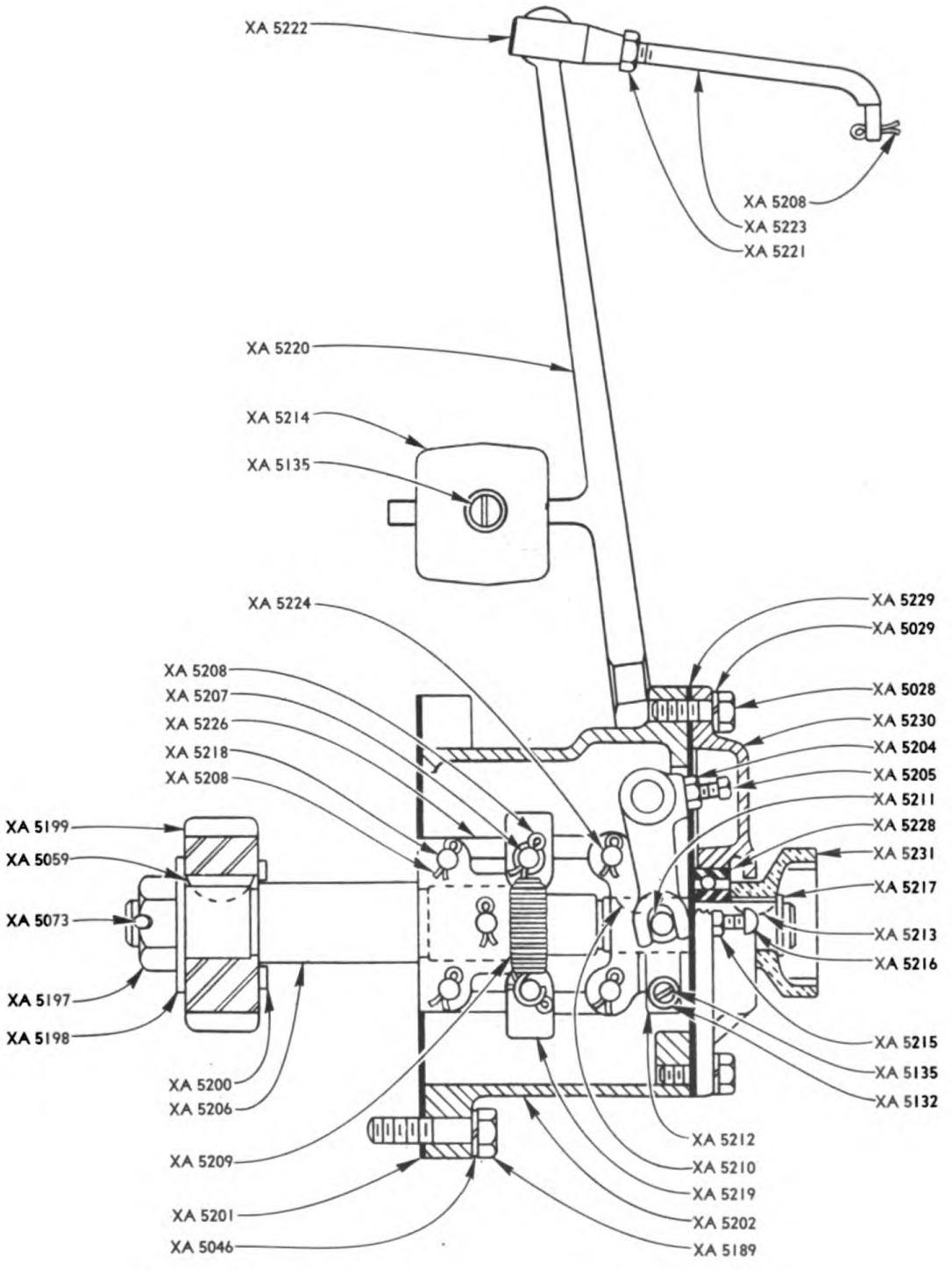


PAN AND OIL PUMP



PAN AND OIL PUMP - CROSS SECTION

GOVERNOR



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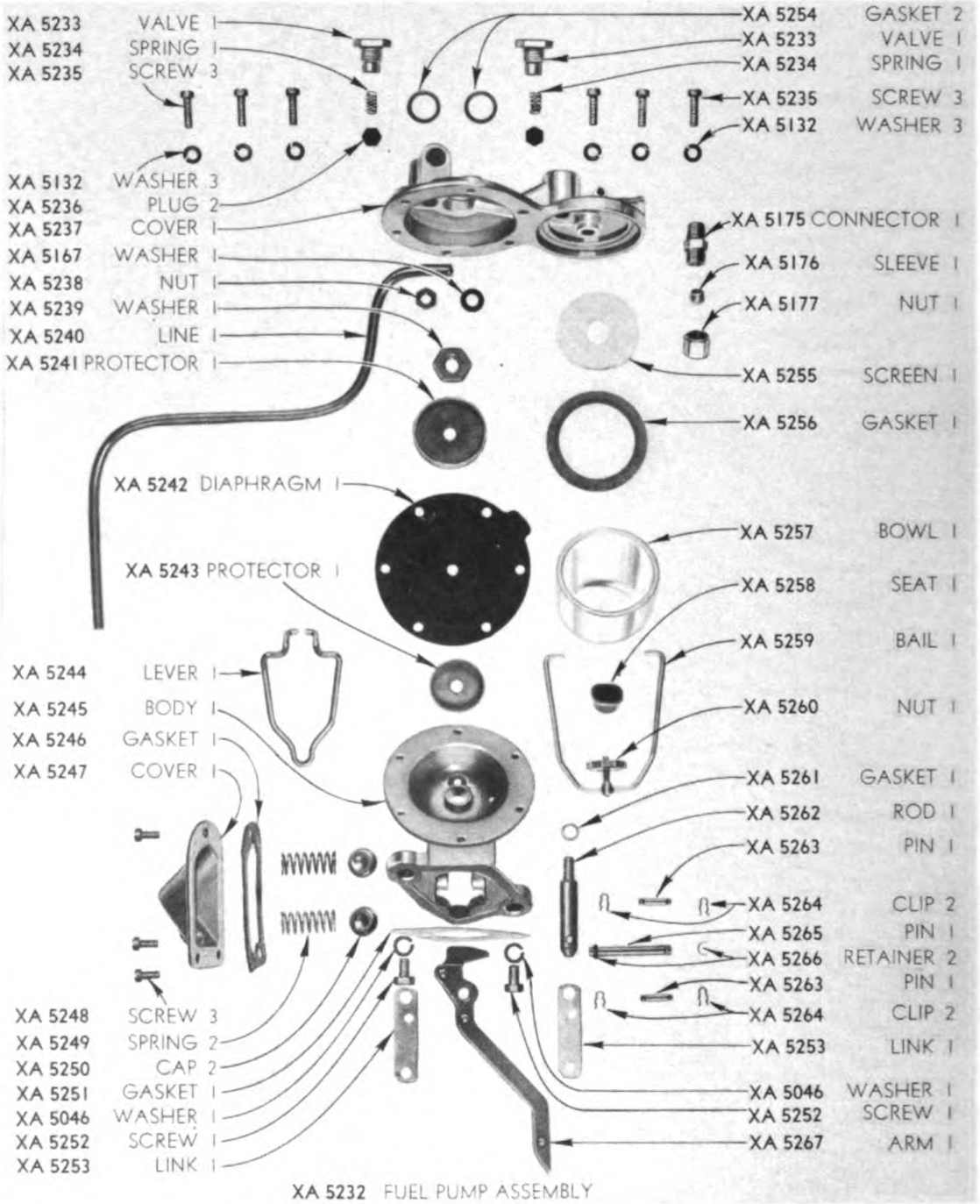
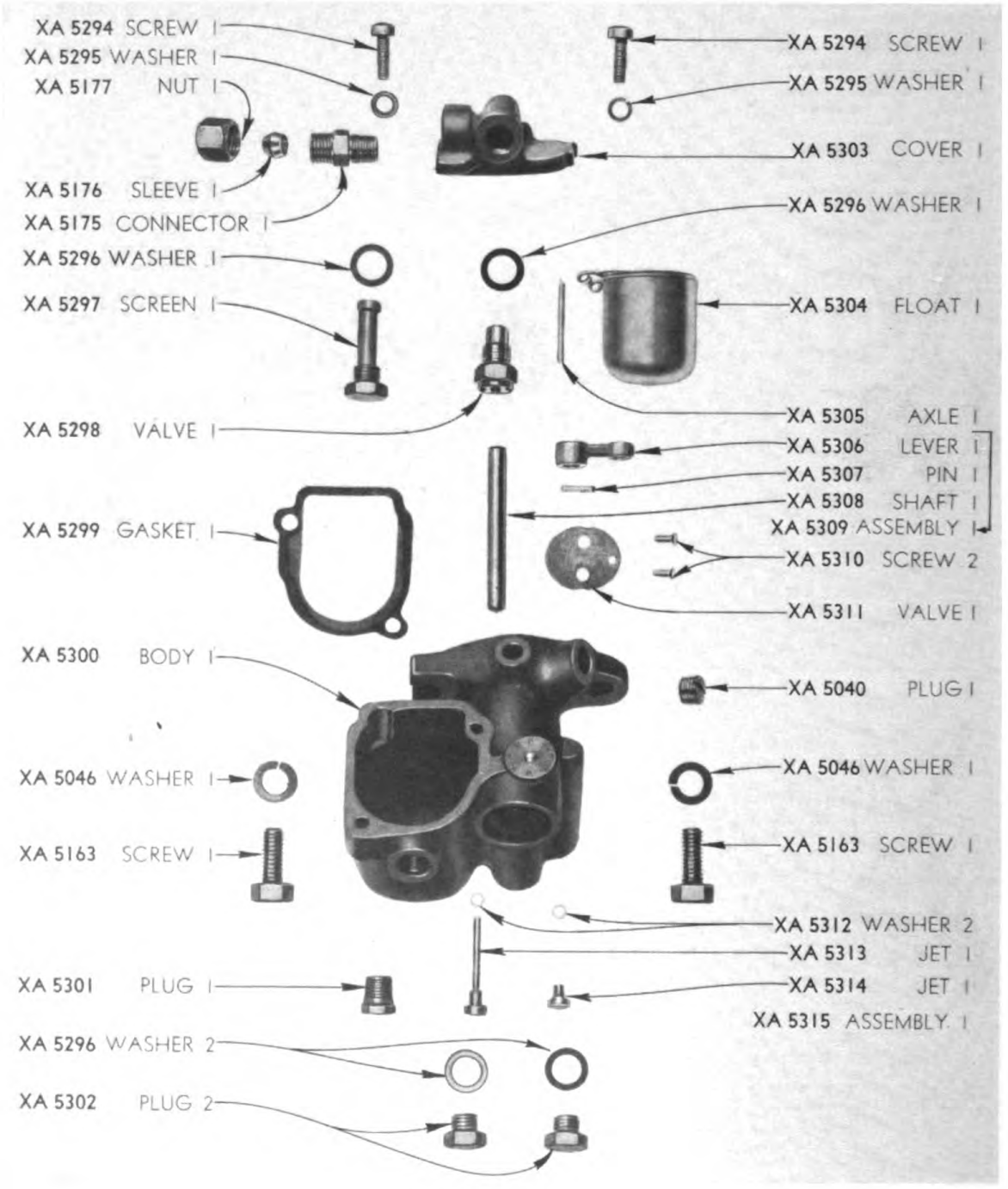


XA 5232 FUEL PUMP ASSEMBLY

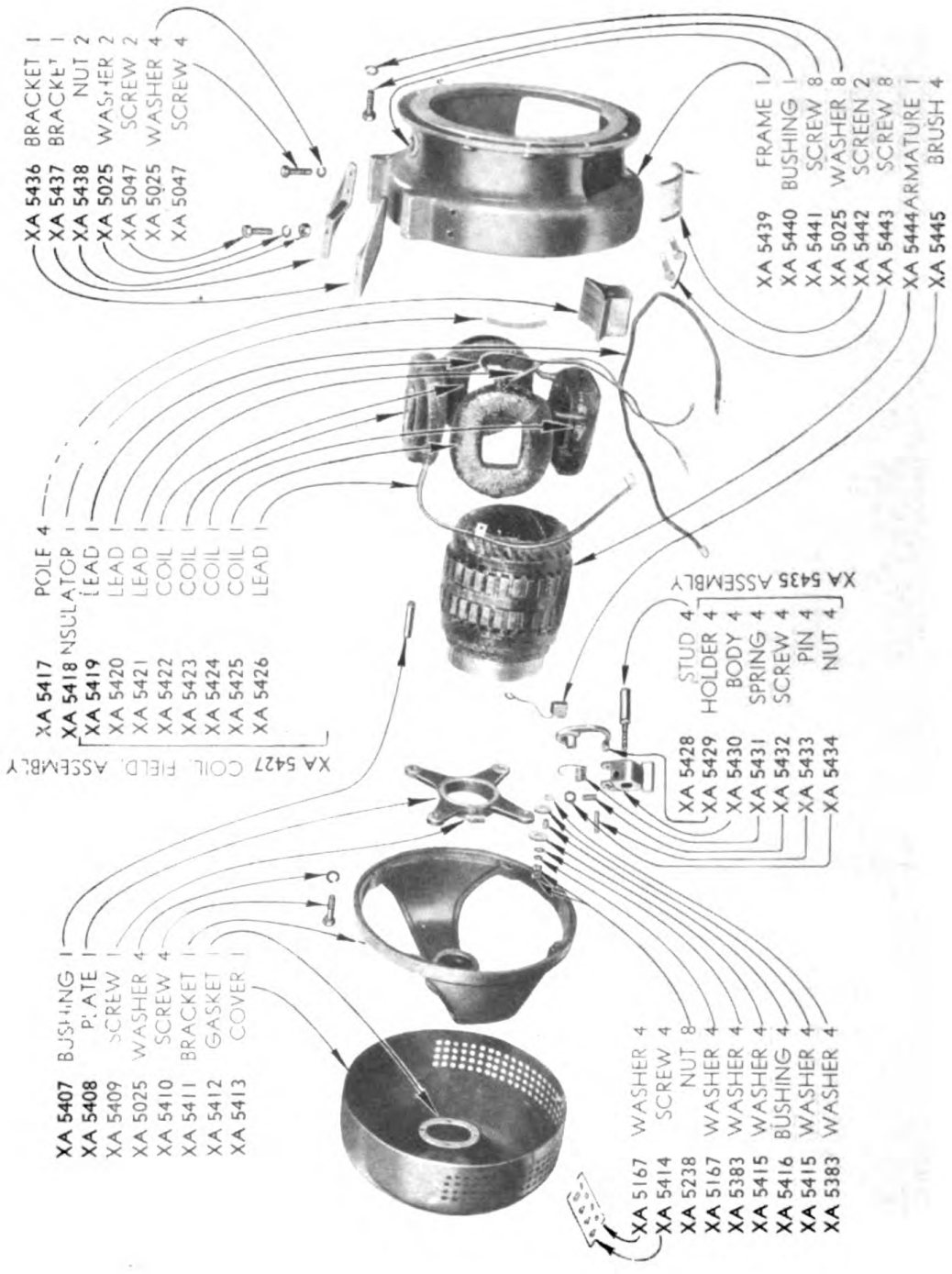
FUEL PUMP

ENGINE FAN

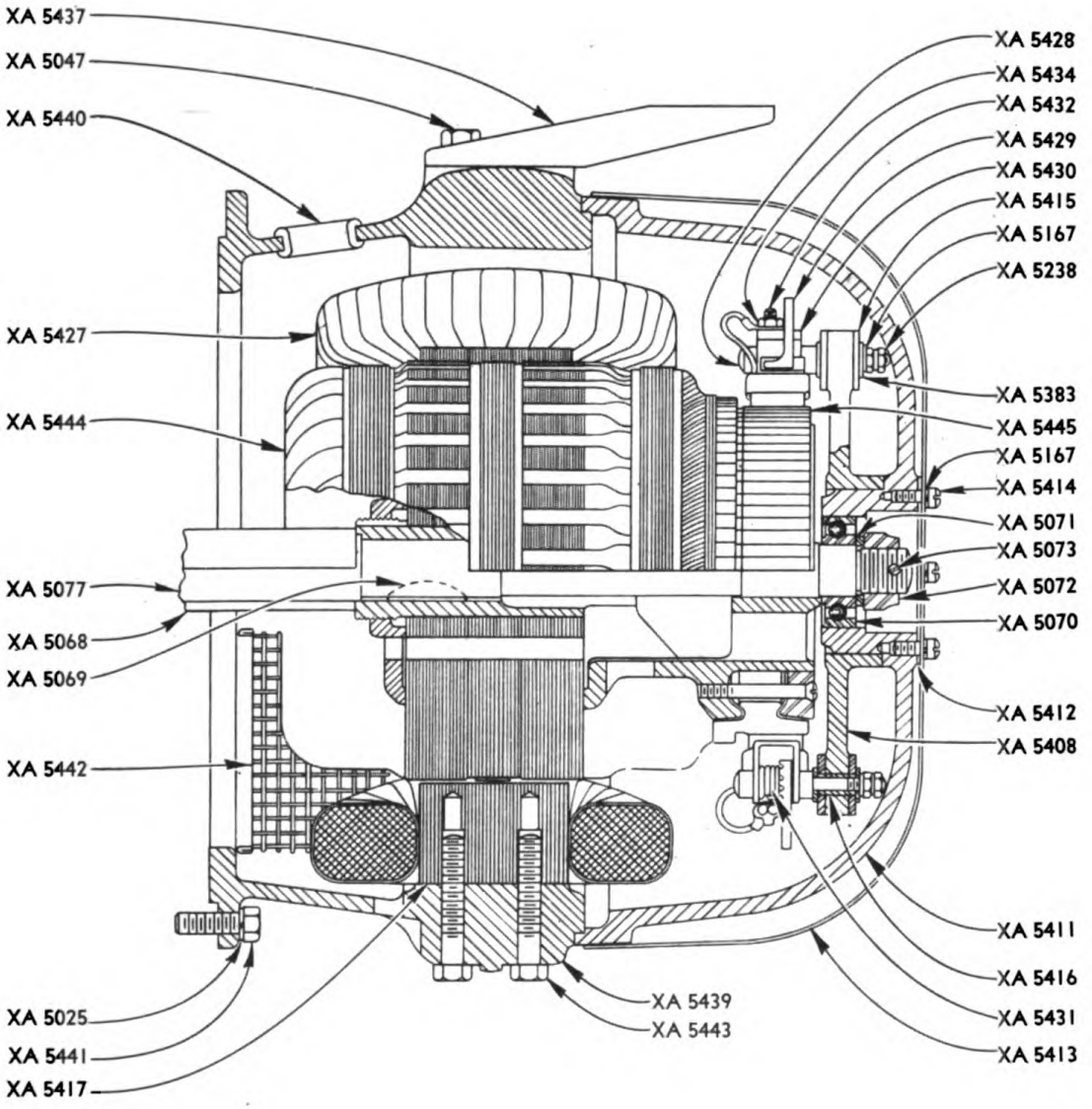


CARBURETOR

MAGNETO



GENERATOR



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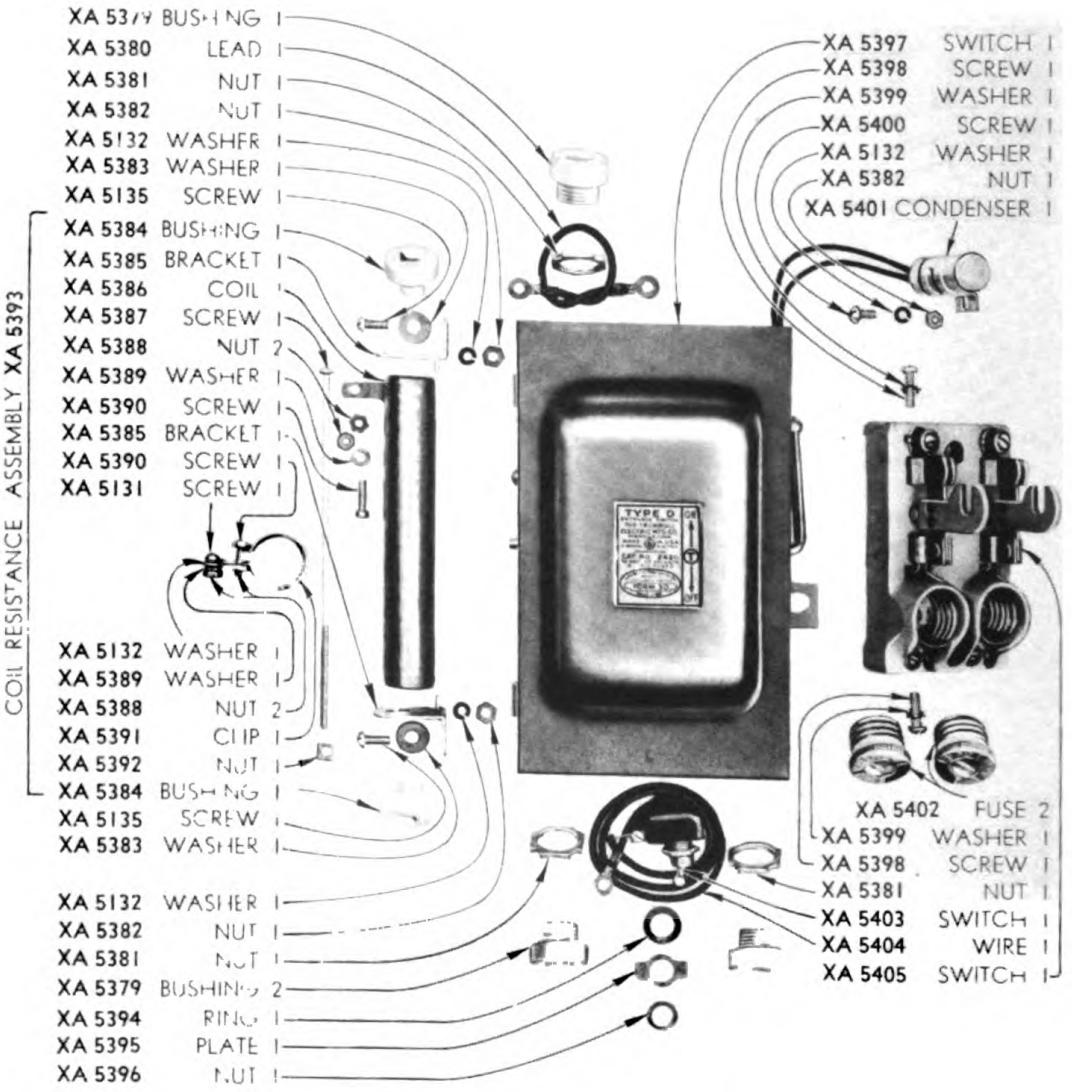
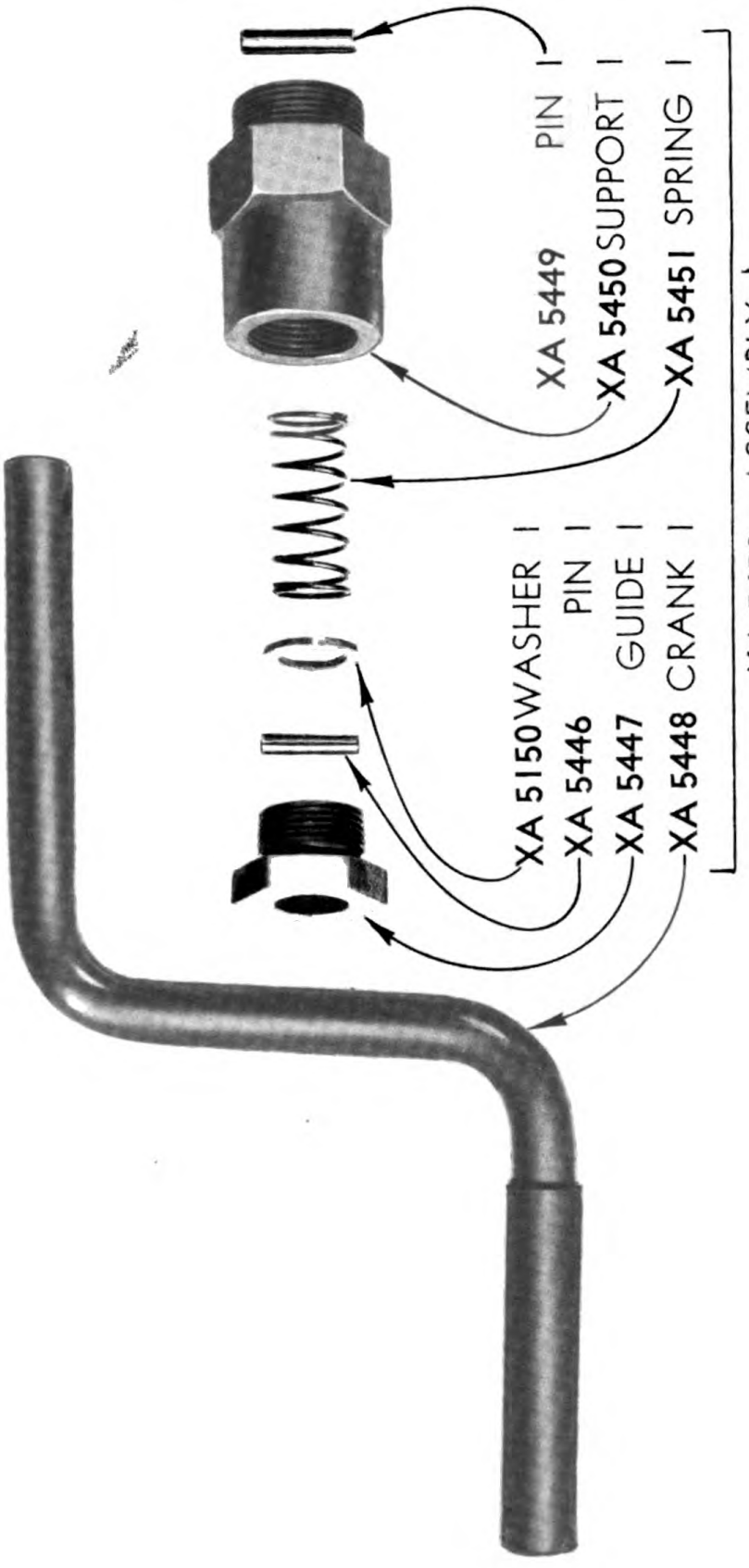
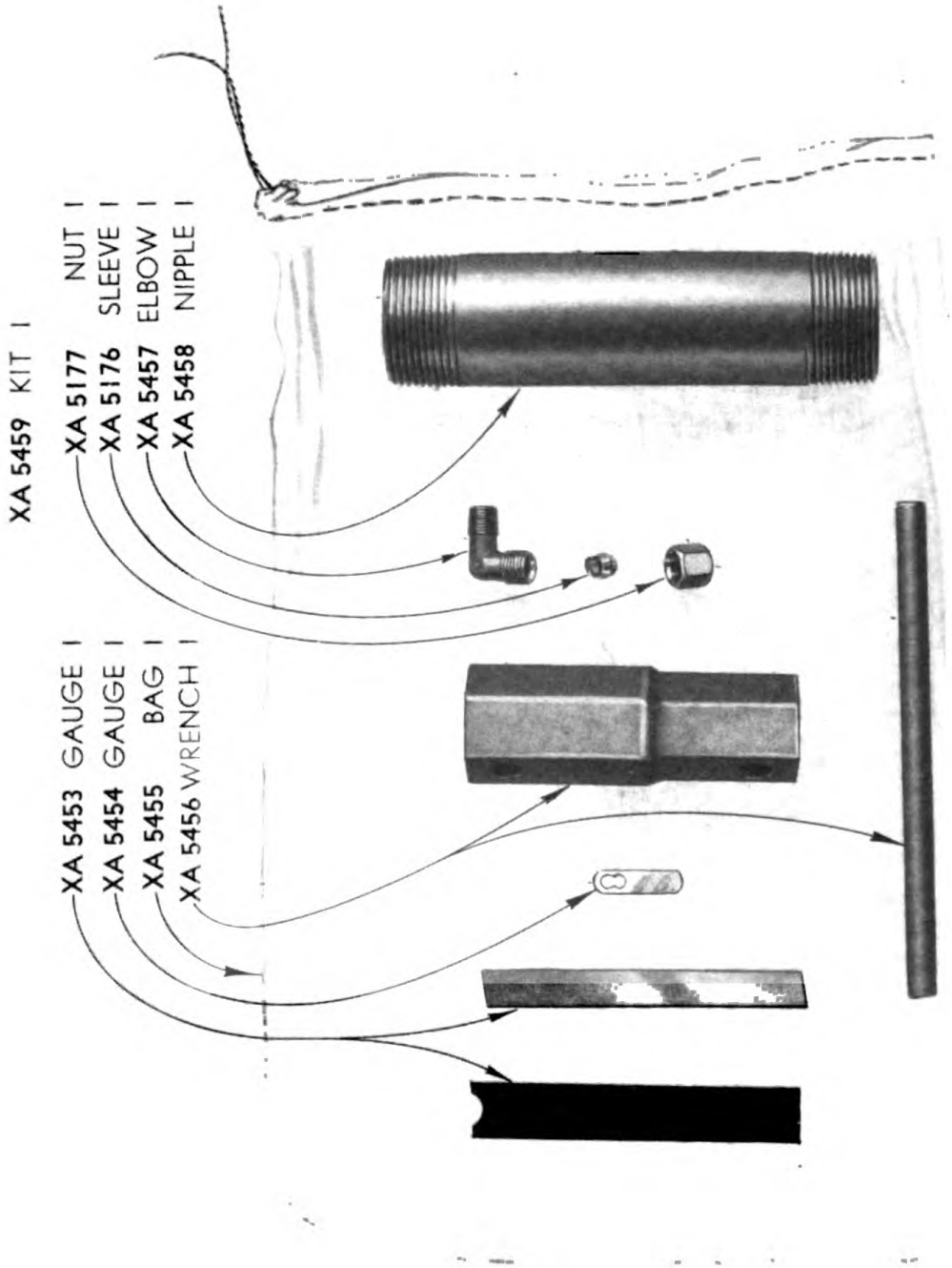


XA 5406 SWITCH ASSEMBLY 1

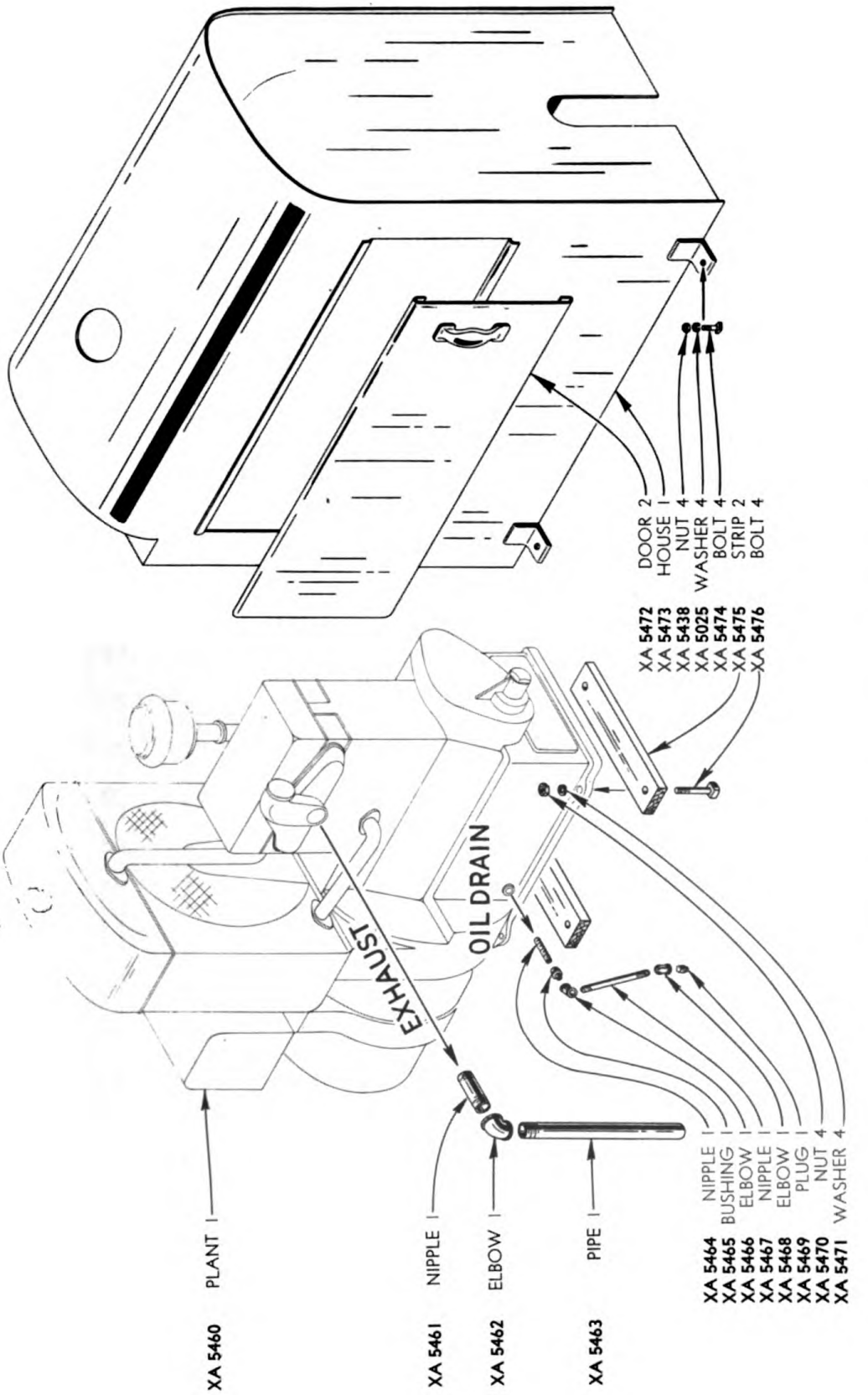
MANUAL SWITCH



ENGINE CRANK



TOOL KIT



HOUSE - EXHAUST PIPE AND DRAIN PIPE

PARTS LIST
FOR
STANDARD MODEL E KOHLER LIGHT PLANT ASSEMBLY

SYMBOL IDENTIFICATION

CH - Champion Spark Plugs
AC - Spark Plugs and Fuel Pump
AB - American Bosch Magneto Corp.
ND - New Departure - Bearings
SC - Switzer-Cummins Co. - Fans
UA - United Air Cleaner Co.
Z - Zenith Carburetor Co.
K - Kohler Co.

Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 5000	Bearing, front camshaft K-A-519	1	1/2#	$ 1.10	52
XA 5001	Bushing, magneto drive shaft - K-A-631	1	4 pcs.1#	.70	52
XA 5002	Pin, magneto shaft bearing K-A-798	1	200 pcs.1#	.03	52
XA 5003	Pin, camshaft bearing K-A-797	2	xx	.03	52
XA 5004	Nut, castle 3/8" NF	9	64 pcs. 1#	.03	
XA 5005	Stud, crankshaft bearing K-A-527	8	20 pcs. 1#	.05	52
XA 5006	Cap, crankshaft bearing front - K-A-525	1	1/2#	.30	52
XA 5007	Tee, oil line dash assembly - K-D-2516	1	5 pcs. 1#	.60	52
XA 5008	Shims, crankshaft front bearing .002 - K-A-549	10	xx	.03	52
XA 5009	Shims, crankshaft front bearing .008 - K-A-548	4	xx	.03	52
XA 5010	Shims, crankshaft front bearing .094 - K-A-547	2	43 pcs.1#	.03	52
XA 5011	Tappet, oil pump - K-A-573	1	5 pcs. 1#	.35	52
XA 5012	Bearing, crankshaft rear - K-A-515	1	3 pcs. 1#	.80	52
XA 5013	Bearing, camshaft rear K-A-520	1	5 pcs. 1#	.80	52
XA 5014	Bushing, valve tappet K-A-545	8	7 pcs. 1#	.15	
XA 5015	Cross, oil line - assembly - K-D-2517	1	3 pcs. 1#	.70	52
XA 5016	Pins, dowel 3/16"x5/8" K-A-761	2	xx	.03	52
XA 5017	Bearing, crankshaft front - K-A-1-513	1	3 pcs.1#	.72	52
XA 5018	Nut, oil line split K-A-610	1	50 pcs. 1#	.10	52
XA 5019	Cap, crankshaft bearing rear - K-A-526	1	3/4#	.25	52
XA 5020	Block, cylinder - assembly - K-A-1-501	1	62½#	52.00	52
XA 5021	Plug, casting vsdyinh - 1" - K-A-806	4	60 pcs.1#	.03	52

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Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 5022	Stud, 3/8" - 16 and 24x1-3/16" NC NF K-A-583	2	26 pcs.1#	$ .03	52
XA 5023	Gasket, water manifold K-A-656	3	xx	.05	
XA 5024	Nut, hex. 3/8" NF K-X-83-1	9	70 pcs.1#	.03	
XA 5025	Washer, Lock 3/8" - K-X-22-1	37	xx	.03	
XA 5026	Screw, flat hd. #8x3/8" NC - K-X-31-1	4	xx	.03	52
XA 5027	Gasket, split cover joint K-A-579	2	xx set	.03	52
XA 5028	Screw, hex. cap 1/4"x 5/8" NC - K-X-5-1	14	69 pcs. 1#	.03	
XA 5029	Washer, packing 1/4" K-A-536	14	xx	.03	
XA 5030	Cover, rear split - upper and lower - K-A-556	2	5/8#	.85	
XA 5031	Gasket, rear split cover K-A-555	2	xx	.05	
XA 5032	Shims, crankshaft rear bearing .094 - K-A-550	2	30 pcs.1#	.03	52
XA 5033	Shims, crankshaft rear bearing .008 - K-A-551	4	xx	.03	52
XA 5034	Shims, crankshaft rear bearing .002 - K-A-552	10	xx	.03	52
XA 5035	Conduit, wire accessory K-B-694	1	30 pcs. 1#	.15	53
XA 5036	Screw, hex. cap 3/8x2" NC - K-X-7-3	2	13 pcs.1#	.03	53
XA 5037	Screw, hex. cap 3/8"x3/4" NC - K-X-7-8	4	26 pcs.1#	.03	53
XA 5038	Support, radiator K-K-576	1	6-3/8#	3.10	53
XA 5039	Plug, cylinder casting - large - K-A-681	1	200 pcs.1#	.05	53
XA 5040	Plug, pipe - headless K-X-75-17	5	142 pcs. 1#	.03	
XA 5041	Plate, name - K-151482	1	18 pcs. 1#	.30	53
XA 5042	Screw, drive #4 - K-X-67-2	4	xx	.03	53
XA 5043	Gasket, spark plug - K-A-675	4	xx	.03	53
XA 5044	Plugs, spark AC-87S or CH-7	4	5 pcs. 1#	.65	53
XA 5045	Screw, hex. cap 5/16" x 1" N.C. - K-X-6-7	15	33 pcs. 1#	.03	
XA 5046	Washer, lock 5/16" - K-X-21-1	49	xx	.03	
XA 5047	Screw, hex. cap 3/8"x1" N.C. - K-X-7-1	12	22 pcs. 1#	.03	
XA 5048	Bracket, magneto support K-A-676	1	2#	.55	53
XA 5049	Screw, fill.hd. - K-A-759	3	29 pcs. 1#	.05	53
XA 5050	Pins, dowel 1/4"x5/8" - K-X-56-1	2	122 pcs. 1#	.03	53

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Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 5051	Cover, gear - K-D-521	1	8-1/2#	$4.20	53
XA 5052	Gasket, gear cover K-A-650	1	192 pcs. 1#	.05	53
XA 5053	Screw, hex. cap 5/16" x 2-1/4" NC - K-X-6-3	7	18 pcs. 1#	.03	53
XA 5054	Screw, hex. cap 5/16" x 3-3/4" NC - K-X-6-4	2	11 pcs. 1#	.05	53
XA 5055	Cap, starting crank hole K-A-598	1	4 pcs. 1#	.20	53
XA 5056	Studs, cylinder head 5/16" x 3-7/8" NC NF K-A-557	11	12 pcs. 1#	.03	
XA 5057	Gauge, oil - K-A-594	1	19 pcs. 1#	.10	53
XA 5058	Shaft, cam - K-A-506	1	4-1/4#	6.25	54
XA 5059	Key, Woodruff #9 - K-A-45-1	3	110 pcs.1#	.03	
XA 5060	Spring, camshaft thrust plug - K-A-592	1	80 pcs.1#	.03	54
XA 5061	Plug, camshaft thrust K-A-591	1	58 pcs. 1#	.10	54
XA 5062	Washer, camshaft thrust K-A-590	1	22 pcs.1#	.15	54
XA 5063	Gear, camshaft - K-A-523	1	2#	2.20	54
XA 5064	Washer, camshaft lock K-A-633	1	42 pcs.1#	.03	54
XA 5065	Nut, cam - K-D-3576	1	1/2#	.60	54
XA 5066	Flywheel - K-5272	1	31#	5.10	55
XA 5067	Key, Woodruff #128 - K-X-47-1	1	25 pcs. 1#	.05	55
XA 5068	Spacer, generator K-A-661	1	5/8#	.30	55
XA 5069	Key, Woodruff #127 K-X-46-1	1	32 pcs. 1#	.05	55
XA 5070	Bearing, ball - ND-7505	1	3 pcs. 1#	2.05	55
XA 5071	Washer, lock nut - K-A-663	1	54 pcs. 1#	.05	55
XA 5072	Nut, Castle 7/8" NF K-A-662	1	9 pcs. 1#	.15	55
XA 5073	Pin, cotter 1/8" x 1¼" K-X-37-1	2	xx	.03	
XA 5074	Jaw, starting crank K-D-597	1	1/2#	.80	55
XA 5075	Slinger, oil - K-D-3583	1	10 pcs.1#	.05	55
XA 5076	Gear, crankshaft - K-A-522	1	3/4#	1.15	55
XA 5077	Shaft, crank - K-A-505	1	12½#	17.30	55
XA 5078	Fan, generator - K-K-833	1	2#	.95	55
XA 5079	Shims, connecting rod .063 - K-A-617	8	148 pcs. 1#	.03	56
XA 5080	Shims, connecting rod .008 - K-A-618	16	xx	.03	56
XA 5081	Shims, connecting rod .002 - K-A-619	32	xx	.03	56
XA 5082	Nut, Castle 5/16" NF K-X-86-1	8	86 pcs. 1#	.03	56
XA 5083	Pin, cotter 1/16"x¾" K-X-36-2	9	xx	.03	
XA 5084	Bearing, connecting rod - K-A-1-517	4	3 pcs. 1#	.90	56

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Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 5085	Ring, comp. - Std. (For oversize see 5482, 5483, 5484 and 5485) - K-A-826	12	xx	$ .15	56
XA 5086	Ring, oil - standard (For oversize see 5486, 5487, 5488 and 5489) - K-D-2448	4	xx	.20	56
XA 5087	Piston, specify size (See 5478) - K-D-508	4	3/4#	1.25	56
XA 5088	Retainer, piston pin K-D-966	8	xx	.03	56
XA 5089	Bushing, connecting rod K-A-512	4	19 pcs. 1#	.15	56
XA 5090	Pin, piston - standard (For oversize see 5479, 5480 & 5481) K-A-510	4	11 pcs. 1#	.15	56
XA 5091	Rod, connecting - K-A-507	4	3/4#	1.65	56
XA 5092	Bolts, connecting rod K-A-601	8	30 pcs. 1#	.05	56
XA 5093	Rod, connecting assembly K-A-1-507	4	1-1/4#	2.40	56
XA 5094	Tube, oil return assembly K-A-1-606	1	12 pcs. 1#	.15	58
XA 5095	Nut, oil line - K-A-616	5	35 pcs.1#	.05	
XA 5096	Elbow, oil line - K-A-607	2	20 pcs. 1#	.10	58
XA 5097	Nut, hex. 5/16" NF K-X-82-1	20	118 pcs. 1#	.03	
XA 5098	Arm, rocker - R.H. K-A-533	4	5 pcs. 1#	.45	58
XA 5099	Shaft, rocker arm - K-A-1-537	1	2 pcs. 1#	1.45	58
XA 5100	Bracket, rocker arm shaft center - K-A-539	1	4 pcs. 1#	.85	58
XA 5101	Bushing, rocker arm - K-A-542	8	32 pcs. 1#	.05	58
XA 5102	Screw, rocker arm - K-D-535	8	34 pcs. 1#	.10	58
XA 5103	Spring, rocker arm - K-A-540	2	106 pcs. 1#	.03	58
XA 5104	Washer, rocker arm spacing K-A-541	6	78 pcs. 1#	.03	58
XA 5105	Shaft, rocker arm assembly - K-A-2-537	1	2 pcs. 1#	1.45	58
XA 5106	Rods, push - K-D-600	8	8 pcs. 1#	.20	58
XA 5107	Tappet, valve - K-A-543	8	5 pcs. 1#	.30	58
XA 5108	Tube, oil pump - K-A-1-611	1	10 pcs. 1#	.30	58
XA 5109	Bracket, rocker arm shaft - end - K-A-538	2	5 pcs. 1#	.80	58
XA 5110	Arm, rocker - L.H. K-A-534	4	6 pcs.1#	.40	58
XA 5111	Arm, rocker assembly (with bushing) R.H. K-A-1-533	4	5 pcs. 1#	.45	58
XA 5112	Arm, rocker assembly (with bushing) L.H. K-A-1-534	4	5 pcs. 1#	.45	58

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Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 5113	Stud, 5/16" x 2-5/8" NC & NF - K-B-897	3	18 pcs. 1#	$ .05	60
XA 5114	Head, cylinder -assembly complete - K-K-2-502	1	20-1/4#	17.25	60
XA 5115	Gasket, exhaust manifold front - K-A-695	1	100 pcs. 1#	.05	60
XA 5116	Manifold, exhaust- K-5451	1	4-7/8#	1.40	60
XA 5117	Gasket, carburetor flange K-A-657	1	xx	.05	60
XA 5118	Key, valve spring K-A-532	8	107 pcs. 1#	.03	60
XA 5119	Retainer, valve spring K-A-531	8	100 pcs. 1#	.03	60
XA 5120	Springs, valve - K-A-530	8	22 pcs. 1#	.05	60
XA 5121	Valves, intake - K-D-529	4	10 pcs. 1#	.30	60
XA 5122	Valves, exhaust - K-S-120	4	10 pcs. 1#	.60	60
XA 5123	Head, cylinder (with valve guides)K-A-1-502	1	18¼#	13.65	60
XA 5124	Guides, valve stem K-A-528	8	5 pcs. 1#	.15	60
XA 5125	Washer, copper 3/8" K-D-972	2	xx	.05	60
XA 5126	Studs, exhaust man.3/8"x 2-5/8" NC - K-A-558	2	13 pcs. 1#	.03	60
XA 5127	Nut, exhaust man. stud 3/8" N.C. brass K-A-559	2	41 pcs. 1#	.05	60
XA 5128	Gasket, cylinder head K-A-649	1	5 pcs. 1#	.40	60
XA 5129	Gasket, exhaust manifold center - K-A-696	1	63 pcs. 1#	.05	60
XA 5130	Gasket, exhaust manifold - rear - K-A-697	1	82 pcs. 1#	.05	60
XA 5131	Screw, Rd.Hd. Mach. #8x 3/8" NF - K-X-51-12	3	xx	.03	
XA 5132	Washer, Lock 3/16" - K-X-19-1	14	xx	.03	
XA 5133	Plate, exhaust manifold K-5452	1	11 pcs. 1#	.05	60
XA 5134	Nut, wing 5/16" NF - K-A-589	2	51 pcs. 1#	.03	62
XA 5135	Screw, Rd.Hd. Mach. #10 x 1/2" NF - K-X-50-1	7	xx	.03	
XA 5136	Gasket, cylinder head cover - K-A-653	1	72 pcs. 1#	.05	62
XA 5137	Manifold - assembly K-5519-M	1	2#	3.40	62
XA 5138	Handle, choker valve K-B-920	1	82 pcs. 1#	.05	62
XA 5139	Valve, choker assembly K-5525	1	31 pcs. 1#	.25	62
XA 5140	Manifold - choker K-5521-1	1	1-3/4#	2.45	62
XA 5141	Plug, cylinder casting 1-1/8" - K-A-806-A	1	50 pcs. 1#	.05	62
XA 5142	Cap, oil filler K-A-621	1	4 pcs. 1#	.15	62
XA 5143	Cover, cylinder head K-A-511	1	5-1/2#	1.50	62

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Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 5144	Nut, wing 1/4" NC UA-AC-1782	1	89 pcs. 1#	$ .05	62
XA 5145	Filter and cover UA-AC-1779	1	5/8#	6.50	62
XA 5146	Bowl, air cleaner UA-AC-1778	1	5/8#	3.50	62
XA 5147	Clamp, air filter UA-AC-1789	1	20 pcs. 1#	.35	62
XA 5148	Screw, fill. hd. #12 x 5/8" NC - K-X-52-25	1	119 pcs. 1#	.03	62
XA 5149	Filter, air - assembly (H40-12145) UA-AC-1788	1	1-1/4#	10.00	62
XA 5150	Washer, oil pump spring K-D-566	2	61 pcs. 1#	.03	64
XA 5151	Plunger, oil pump K-D-564	1	3/8#	.40	64
XA 5152	Washer, ball retainer K-D-996	1	188 pcs. 1#	.03	64
XA 5153	Plug, oil pump passage K-D-995	1	16 pcs. 1#	.10	64
XA 5154	Spring, oil pump plug K-D-565	1	22 pcs. 1#	.05	64
XA 5155	Ball, oil pump outlet 1/2" - K-D-624	1	54 pcs. 1#	.03	64
XA 5156	Ball, oil pump inlet 3/8" - K-D-623	1	137 pcs. 1#	.03	64
XA 5157	Tee, compression - K-D-227	1	21 pcs. 1#	.20	64
XA 5158	Plug, oil pump lead K-D-588	1	49 pcs. 1#	.15	64
XA 5159	Nipple, oil pump K-D-571	1	6 pcs. 1#	.10	64
XA 5160	Body, oil pump - K-D-561	1	1-1/2#	1.15	64
XA 5161	Pump, oil - assembly K-D-560	1	2#	2.30	64
XA 5162	Washer, copper 5/16" K-D-997	6	xx	.03	64
XA 5163	Screw, hex. cap 5/16"x 3/4" N.C. - K-X-6-11	10	38 pcs. 1#	.03	
XA 5164	Cover, oil base end K-D-973	1	1-5/8#	.25	64
XA 5165	Gasket, end cover K-D-974	1	30 pcs. 1#	.05	64
XA 5166	Plate, oil pan baffle K-D-504	1	1-1/2#	.25	64
XA 5167	Washer, lock 1/4" K-X-20-1	14	xx	.03	
XA 5168	Bushing, reducer - K-D-228	1	14 pcs. 1#	.15	64
XA 5169	Strainer, oil assembly K-D-1012	1	3 pcs. 1#	.50	64
XA 5170	Plug, oil strainer K-D-568	1	7/8#	.20	64
XA 5171	Strainer, oil assembly K-D-1-567	1	1-1/4#	.60	64

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Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 5172	Washer, oil drain plug K-A-569	1	130 pcs. 1#	$ .03	64
XA 5173	Gasket, oil base right K-A-651	1	180 pcs. 1#	.05	64
XA 5174	Pan, oil - K-A-503	1	50#	11.40	64
XA 5175	Conn. comp. (1/8" I.P. 1/4" tubing) - K-A-823	3	25 pcs. 1#	.10	
XA 5176	Sleeve, comp. (1/4" tubing) - K-A-825	4	xx	.03	
XA 5177	Nut, comp. (1/4" tubing) K-A-824	4	xx	.05	
XA 5178	Tube, oil pump assembly K-A-1-615	1	11 pcs. 1#	.15	64
XA 5179	Connector, oil line 7/16" NF - K-A-605	1	27 pcs. 1#	.10	64
XA 5180	Gasket, oil base left K-A-652	1	188 pcs. 1#	.05	64
XA 5181	Stud, oil pump 3/8" x 1-5/16" NC NF - K-A-574	2	26 pcs. 1#	.03	64
XA 5182	Tube, pump to block K-D-224	1	13 pcs. 1#	.30	64
XA 5183	Cap, radiator - K-K-580-2	1	4 pcs. 1#	1.50	63
XA 5184	Gasket, radiator cap K-A-843-3	1	xx	.10	63
XA 5185	Radiator (includes cap and gasket) - K-K-577-3	1	17#	21.70	63
XA 5186	Screw, sheet metal #10 K-X-67-3	4	xx	.03	63
XA 5187	Manifold, water outlet K-K-582	1	3-3/8#	1.50	63
XA 5188	Bracket, fan support K-5424	1	1/2#	1.50	63
XA 5189	Screw, hex. cap 5/16" x 1¼" N.C. - K-X-6-2	3	28 pcs. 1#	.03	
XA 5190	Gasket, water manifold K-A-655	1	188 pcs. 1#	.05	63
XA 5191	Manifold, water inlet K-K-581	1	2-5/8#	1.05	63
XA 5192	Cock, drain 1/8" - K-A-599	1	18 pcs. 1#	.20	63
XA 5193	Nut, hex. 5/16" N.C. K-X-82-2	1	51 pcs. 1#	.03	63
XA 5194	Screw, fan adjusting K-5423	1	18 pcs. 1#	.10	63
XA 5195	Belt, fan - K-5446	1	4 pcs. 1#	.85	63
XA 5196	Guard, fan - K-5422	1	1/2#	1.50	63
XA 5197	Nut, drive shaft - K-A-627	1	22 pcs. 1#	.10	66
XA 5198	Washer, magneto drive shaft - K-A-628	1	22 pcs. 1#	.03	66
XA 5199	Gear, magneto drive K-A-524	1	3/4#	1.15	66
XA 5200	Washer, thrust - K-A-629-1	1	24 pcs. 1#	.20	66
XA 5201	Gasket, governor housing K-A-659	1	xx	.05	66
XA 5202	Housing, governor K-D-1301	1	2#	1.50	66

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Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 5203	Plug, governor housing K-D-1307	1	xx	$ .03	66
XA 5204	Nut, hex. - galv. 1/4" NC - K-B-936	1	161 pcs. 1#	.03	66
XA 5205	Screw, set 1/4"x3/4" sq. hd. - K-X-60-10	1	99 pcs. 1#	.05	66
XA 5206	Shaft, magneto drive (includes hub & pin) K-A-1-630	1	1-1/4#	3.05	66
XA 5207	Pin, fly weight - K-A-639	2	40 pcs. 1#	.03	66
XA 5208	Pin, cotter 1/16"x½" K-X-36-1	14	xx	.03	66
XA 5209	Spring, governor - K-A-646	2	57 pcs. 1#	.10	66
XA 5210	Key, Woodruff #6 - K-X-44-1	1	xx	.03	66
XA 5211	Stud, sliding sleeve K-A-638	2	119 pcs. 1#	.03	66
XA 5212	Bearing, sliding sleeve-assembly - K-A-1-642	1	8 pcs. 1#	1.05	66
XA 5213	Key, Woodruff #3 - K-X-43-1.	2	xx	.03	
XA 5214	Weight, governor lever K-A-837	1	3/4#	.25	66
XA 5215	Nut, hex. - brass #8 NC K-X-72-2	1	xx	.03	66
XA 5216	Screw, rd. hd. #8 x 1" NC - K-X-51-3	1	40 pcs. 1#	.03	66
XA 5217	Ring, lock - K-A-654	1	xx	.05	66
XA 5218	Pin, link - K-A-851	2	69 pcs. 1#	.03	66
XA 5219	Weight, governor fly K-A-635	2	6 pcs. 1#	.25	66
XA 5220	Fork, governor with lever assembly K-D-1312-1	1	5/8#	2.00	66
XA 5221	Nut - K-A-861	2	xx	.03	66
XA 5222	Joint, ball - K-A-774	1	18 pcs. 1#	.20	66
XA 5223	Rod, ball joint - K-D-1308	1	20 pcs. 1#	.15	66
XA 5224	Pin, governor link K-A-640	2	64 pcs. 1#	.03	66
XA 5225	Washer, link plate K-A-645	4	xx	.03	66
XA 5226	Plate, link - K-A-664	8	105 pcs. 1#	.03	66
XA 5227	Sleave, sliding - K-A-641	1	5 pcs. 1#	.70	66
XA 5228	Bearing, ball - ND-3202	1	10 pcs. 1#	1.15	66
XA 5229	Gasket, governor housing cover - K-D-1306	1	xx	.03	66
XA 5230	Cover, governor housing K-D-1302	1	1-1/8#	1.00	66
XA 5231	Coupling, magneto - female - K-A-669	1	5 pcs. 1#	.75	66
XA 5232	Pump, fuel assembly AC-1521799	1	2-1/8#	2.95	68
XA 5233	Valve - AC-855003	2	27 pcs. 1#	.03	68
XA 5234	Spring, valve- AC-856270	2	xx	.03	68

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Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 5235	Screw, fill. hd. #10 x 5/8" NF - K-X-15-1	6	180 pcs. 1#	$ .03	68
XA 5236	Plug, valve - AC-855135	2	xx	.20	68
XA 5237	Cover, valve seat - assembly - AC-1523358	1	5/8#	1.30	68
XA 5238	Nut, hex. - brass 1/4" NF - K-X-76-1	9	188 pcs. 1#	.03	
XA 5239	Washer, diaphragm alignment - AC-855029	1	151 pcs. 1#	.05	68
XA 5240	Line, fuel - K-D-3710	1	7 pcs. 1#	.20	68
XA 5241	Protector, diaph.-upper AC-1521194	1	32 pcs. 1#	.25	68
XA 5242	Diaphragm - AC-855035	1	65 pcs. 1#	.25	68
XA 5243	Protector, diaph.-lower - AC-855078	1	46 pcs. 1#	.25	68
XA 5244	Lever, priming - AC-1522280	1	27 pcs. 1#	.35	68
XA 5245	Body, fuel pump AC-856122	1	5/8#	2.50	68
XA 5246	Gasket, bottom cover AC-855229	1	xx	.03	68
XA 5247	Cover, bottom -AC-855228	1	8 pcs. 1#	1.50	68
XA 5248	Screw, fill. hd. #10 x 3/8" NF - K-X-15-3	3	xx	.03	68
XA 5249	Spring, rocker arm AC-855253	2	130 pcs. 1#	.05	68
XA 5250	Cap, spring - AC-855532	2	xx	.10	68
XA 5251	Gasket, fuel pump - K-D-3713	1	xx	.05	68
XA 5252	Screw, hex. cap 5/16" x 1/2" NC - K-X-6-1	6	47 pcs. 1#	.03	
XA 5253	Link - AC-855374	2	44 pcs. 1#	.25	68
XA 5254	Gasket, valve plug - AC-855136	2	xx	.03	68
XA 5255	Screen - AC-854009	1	xx	.10	68
XA 5256	Gasket, bowl - AC-854003	1	xx	.03	68
XA 5257	Bowl, glass - AC-1522092	1	6 pcs. 1#	.15	68
XA 5258	Seat, bowl - AC-854005	1	140 pcs. 1#	.10	68
XA 5259	Bail, with screw AC-1522090	1	15 pcs. 1#	.20	68
XA 5260	Nut, bail - thumb AC-855763	1	49 pcs. 1#	.10	68
XA 5261	Gasket, pull rod AC-855012	1	xx	.03	68
XA 5262	Rod, pull - AC-855250	1	21 pcs. 1#	.25	68
XA 5263	Pin, link - AC-855016	2	xx	.05	68
XA 5264	Clip, link pin - AC-855017	4	xx	.05	68
XA 5265	Pin, rocker arm - AC-1521289	1	45 pcs. 1#	.05	68
XA 5266	Washer, rocker arm AC-1521269	2	xx	.03	68
XA 5267	Arm, rocker - AC-1521986	1	6 pcs. 1#	1.85	68
XA 5268	Blade, fan - SC-B-1954	1	1#	1.15	69
XA 5269	Gasket, fan hub - K-D-783	1	xx	.10	69
XA 5270	Washer, lock 3/8" shake-proof - K-X-22-8	2	xx	.03	69

xx Over 200 Pcs. per Lb. +As required *Price per 100 Pcs

Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 5271	Retainer, shaft spring SC-C-2495	1	76 pcs. 1#	$ .30	69
XA 5272	Spring, shaft cone adj. SC-C-2498	1	38 pcs. 1#	.15	69
XA 5273	Washer, shaft cone clamp SC-C-2496	1	121 pcs. 1#	.15	69
XA 5274	Bearing, fan shaft SC-C-2814	1	16 pcs. 1#	2.65	69
XA 5275	Hub, fan - SC-C-19147	1	4 pcs. 1#	2.50	69
XA 5276	Bearing, fan shaft SC-C-2815	1	7 pcs. 1#	2.65	69
XA 5277	Washer, felt retainer SC-C-2493	1	44 pcs. 1#	.15	69
XA 5278	Gasket, felt retainer SC-C-3837	1	xx	.10	69
XA 5279	Washer, felt - SC-C-2494	1	xx	.15	69
XA 5280	Retainer, fan hub felt SC-C-2492	1	26 pcs. 1#	.40	69
XA 5281	Spindle, fan - SC-C-19148	1	xx	2.40	69
XA 5282	Washer, fan shaft SC-C-3793	1	12 pcs. 1#	.20	69
XA 5283	Washer, fan shaft nut SC-C-1263	1	48 pcs. 1#	.05	69
XA 5284	Nut, hex. 5/8" N.F. K-X-85-2	1	21 pcs. 1#	.03	69
XA 5285	Oiler, fan - SC-C-8650	1	24 pcs. 1#	.15	69
XA 5286	Fan, assembly (Old Style) K-5425	1	4 lbs.	7.15	69
XA 5287	Fan, assembly - K-7004	1	4-3/8 lbs.	7.15	69
XA 5288	Blade, fan - SC-F-4801	1	1-1/8 lbs.	2.40	69
XA 5289	Ring, fan bearing snap SC-C-114071	2	40 pcs. 1#	.10	69
XA 5290	Bearing, fan - SC-C-1140692	2	9 pcs. 1#	2.65	69
XA 5291	Hub, fan - SC-B-114067	1	2-1/4#	1.45	69
XA 5292	Spacer, fan bearing SC-C-114070	1	19 pcs. 1#	.25	69
XA 5293	Shaft, fan - SC-C-114068	1	3 pcs. 1#	1.65	69
XA 5294	Screw, assembly - Z-T-1-S10-7	2	181 pcs. 1#	.05	70
XA 5295	Washer, screw assem. lock - Z-T-11-10	2	xx	.03	70
XA 5296	Washer, lower plug Z-T-56-23	4	xx	.05	70
XA 5297	Screen, filter - assembly Z-C-140-24	1	62 pcs. 1#	.30	70
XA 5298	Seat, fuel valve, assembly Z-C-81-26	1	29 pcs. 1#	.75	70
XA 5299	Gasket, cover- Z-C-144-10	1	xx	.05	70
XA 5300	Body, carburetor assembly Z-B-21A	1	1-1/4#	7.50	70
XA 5301	Plug, overflow - K-D-3654	1	73 pcs. 1#	.25	70
XA 5302	Plug, lower - Z-C-138-23	2	xx	.35	70
XA 5303	Cover, carburetor - assembly - Z-C-6-14	1	5 pcs. 1#	3.15	70

xxOver 200 Pcs. per Lb. †As required *Price per 100 Pcs.

Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 5304	Float - assembly Z-C-85-8	1	44 pcs. 1#	$ .65	70
XA 5305	Axle, float - Z-C-120-4	1	xx	.10	70
XA 5306	Lever, throttle - K-A-832	1	56 pcs. 1#	.78	70
XA 5307	Pin, throttle lever K-A-1573	1	xx	.10	70
XA 5308	Shaft, throttle - K-A-1566	1	41 pcs. 1#	.55	70
XA 5309	Shaft, butterfly arm Z-C-29-494	1	22 pcs. 1#	1.40	70
XA 5310	Screw, butterfly retainer Z-C-136-1	2	xx	.05	70
XA 5311	Valve, butterfly Z-C-21-8	1	68 pcs. 1#	1.20	70
XA 5312	Washer, carburetor jet Z-T-56-24	2	xx	.05	70
XA 5313	Jet, compensating #11 Z-C-52-3	1	xx	.55	70
XA 5314	Jet, main #8 - Z-C-52-24	1	200 pcs. 1#	.60	70
XA 5315	Carburetor - complete Z-0-10042	1	1-5/8#	12.50	70
XA 5316	Washer, rotor felt ret. AB-WA-5245	1	175 pcs. 1#	.05	70
XA 5317	Plate, name - type AB-NP-521	1	105 pcs. 1#	.10	71
XA 5318	Coil, high tension AB-CL-5238	1	1#	5.15	71
XA 5319	Clip, coil cable term. AB-EC-5224	1	xx	.05	71
XA 5320	Housing, magneto AB-HG-5216	1	4-1/2#	8.29	71
XA 5321	Washer, ventilator cover AB-WA-5281	1	140 pcs. 1#	.05	71
XA 5322	Gasket, ventilator cover AB-GA-5215	1	xx	.05	71
XA 532?	Cover, ventilator - AB-CV-52126	1	25 pcs. 1#	.15	71
XA 5324	Plate, name - ventilator cover - AB-NP-5222	1	123 pcs. 1#	.10	71
XA 5325	Coupling, magneto male K-A-670	1	5 pcs. 1#	.75	71
XA 5326	Washer, lock - AB-WA-6-3-CA	2	xx	.05	71
XA 5327	Screw, vent cover AB-SC-37-8-CA	2	xx	.05	71
XA 5328	Screw, magneto coil lock AB-SC-1060	2	100 pcs. 1#	.05	71
XA 5329	Cable, coil - specify length - AB-KL-100657	1	151 pcs. 1#	.05	71
XA 5330	Clip, terminal - AB-EC-1012	1	xx	.05	71
XA 5331	Bearing, ball - AB-BB-60226	2	13 pcs. 1#	1.55	71
XA 5332	Washer, bearing spacing AB-WA-1034	2	130 pcs. 1#	.05	71
XA 5333	Shim, bearing .0126 AB-WA-61	+	xx	.05	71

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Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 5334	Shim, bearing .0071 AB-WA-106	+	xx	$ .05	71
XA 5335	Shim, bearing .0040 AB-WA-107	+	xx	.05	71
XA 5336	Shim, bearing .0197 AB-WA-1009	+	xx	.05	71
XA 5337	Washer, rotor felt AB-WA-81751	3	xx	.05	71
XA 5338	Bracket, interrupter assembly - AB-BK-5259	1	3 pcs. 1#	1.30	71
XA 5339	Strip, packing ball bearing - AB-IS-504	2	xx	.05	71
XA 5340	Plate, locking - AB-PL-52125	2	xx	.05	71
XA 5341	Washer, interrupter lever stud - AB-WA-1012	1	xx	.05	71
XA 5342	Washer, interrupter brkt. lock - AB-WA-21-5	2	xx	.05	71
XA 5343	Pin, interrupter lever stud - AB-PN-1007	1	xx	.05	71
XA 5344	Screw, interrupter bracket - AB-SC-41-8-CA	2	xx	.05	71
XA 5345	Bracket, contact - with point - AB-BK-566	1	52 pcs. 1#	.85	71
XA 5346	Washer, contact brkt. lock - AB-WA-21-4	2	xx	.05	71
XA 5347	Screw, contact brkt. AB-SC-39-5-CA	3	xx	.05	71
XA 5348	Bushing, cable - K-150595	1	72 pcs. 1#	.10	71
XA 5349	Wick, cam oiler AB-WK-5231	1	xx	.05	71
XA 5350	Screw, name plate AB-SC-121-4CA	2	xx	.05	71
XA 5351	Rotor, magneto AB-RT-52105	1	1-3/8#	11.75	71
XA 5352	Plate, distributor AB-DP-52254	1	5/8#	3.50	71
XA 5353	Washer, distr. gear spacing AB-WA-528	1	xx	.05	71
XA5354	Washer, lock - AB-WA-288	5	xx	.05	71
XA 5355	Gear, distributor AB-GE-5282	1	9 pcs. 1#	2.40	71
XA 5356	Screw, magneto grd. AB-SC-24-4CA	1	xx	.05	71
XA 5357	Brush, carbon & spring AB-BR-529	1	xx	.20	71
XA 5358	Gear, rotor AB-GE-5238	1	6 pcs. 1#	.85	71
XA 5359	Ring, shaft spring AB-SP-1021	1	xx	.05	71
XA 5360	Gasket, distributor plate - AB-GA-524	1	137 pcs. 1#	.10	71
XA 5361	Screw, distr. plate AB-SC-1037-CA	4	84 pcs. 1#	.05	71
XA 5362	Washer, fastening screw AB-WA-98922	4	xx	.05	71
XA 5363	Washer, sealing AB-WA-5280	4	xx	.05	71
XA 5364	Nipple, rubber insul. AB-IS-82927	4	126 pcs. 1#	.05	71

xxOver 200 Pcs. per Lb. +As required *Price per 100 Pcs.

Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 5365	Cable, magneto #1 K-D-3011-1	1	13 pcs. 1#	$ .20	71
XA 5366	Cable, magneto #2 K-D-3011-2	1	13 pcs. 1#	.20	71
XA 5367	Cable, magneto #3 K-D-3011-3	1	16 pcs. 1#	.20	71
XA 5368	Cable, magneto #4 K-D-3011-4	1	13 pcs. 1#	.20	71
XA 5369	Washer, rotor gear spacing - AB-WA-1070	1	xx	.05	71
XA 5370	Shaft, rotor gear AB-SD-5249	1	48 pcs. 1#	.10	71
XA 5371	Ring, shaft spring AB-SP-5254	1	xx	.05	71
XA 5372	Condenser - AB-CW-5232	1	23 pcs. 1#	.70	71
XA 5373	Bracket, wick ret. AB-BK-5283	1	xx	.10	71
XA 5374	Washer, lock - AB-WA-5-4	1	xx	.05	71
XA 5375	Washer, fastening screw lock - AB-WA-6-3-CA	1	xx	.05	71
XA 5376	Screw, conducting lead AB-SC-37-5-CA	1	xx	.05	71
(A 5377	Lever, interrupter AB-LE-5236	1	86 pcs. 1#	.60	71
(A 5378	Magneto - assembly (less XA-5325) K-D-3001	1	8-1/4#	35.00	71
XA 5379	Bushing, conduit K-C-1217	3	32 pcs. 1#	.03	74
XA 5380	Lead - K-5959	1	74 pcs. 1#	.10	74
XA 5381	Nut, bushing lock K-C-1218	3	114 pcs. 1#	.03	74
XA 5382	Nut, hex. #10 NF K-X-70-3	3	xx	.03	74
XA 5383	Washer, flat 1/4"K-D-1509	10	xx	.03	
XA 5384	Bushing, insulating K-E-1237	2	33 pcs. 1#	.15	74
XA 5385	Bracket, coil support K-E-1236	2	42 pcs. 1#	.25	74
XA 5386	Coil, resistance K-E-1234	1	3 pcs. 1#	.15	74
XA 5387	Screws, rd. hd. mach. #6x7 NC - K-X-4916	1	46 pcs. 1#	.03	74
XA 5388	Nut, hex. #8 NC K-X-72-4	4	xx	.03	74
XA 5389	Washer, flat 3/8" O.D. 5/32" I.D. - K-X-25-9	3	xx	.03	74
XA 5390	Screw, rd.hd. mach. #8 x 5/8" NC - K-X-51-9	2	xx	.03	74
XA 5391	Clip, adjustable - K-E-1235	1	80 pcs. 1#	.20	74
XA 5392	Nut, hex. #6 NC K-X-71-2	1	xx	.03	74
XA 5393	Coil, resis. assembly K-E-1233	1	4 pcs. 1#	1.75	74
XA 5394	Ring, lock - K-1515-11	1	xx	.05	74
XA 5395	Plate, instruction K-151508	1	xx	.30	74
XA 5396	Nut, lock - K-151523	1	xx	.10	74
XA 5397	Switch, manual (includes XA-5405) E1206 K-C-1200-1	1	4#	5.90	74

xxOver 200 Pcs per Lb. +As required *Price per 100 Pcs.

Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 5398	Screw, rd.hd.mach. #10x 11/16" NC K-X-50-31	2	164 pcs. 1#	$ .03	74
XA 5399	Washer, lock shakeproof K-X-22-9	2	xx	.03	74
XA 5400	Screw, rd. hd. mach. #10x3/8" NF K-X-50-2	1	xx	.03	74
XA 5401	Condenser - K-AC-1539	1	12 pcs. 1#	.50	74
XA 5402	Fuse - 25 ampere K-A-804	2	17 pcs. 1#	.10	74
XA 5403	Switch, snap - K-151510-2	1	20 pcs. 1#	1.00	74
XA 5404	Wire, magneto ground K-E-816	1	36 pcs. 1#	.10	74
XA 5405	Switch, knife - complete K-E-1206	1	1-1/8#	2.25	74
XA 5406	Switch, manual - assembly K-E-1200	1	6-1/8 lbs.	7.75	74
XA 5407	Bushing, insulating K-D-1511	1	60 pcs. 1#	.10	72
XA 5408	Plate, brush support K-D-1502	1	2#	1.10	72
XA 5409	Screw, fill. hd. 5/16" x 1" NC - K-X-53-3	1	40 pcs. 1#	.03	72
XA 5410	Screw, hex. cap 3/8" x 1-5/8" NC - K-X-7-4	4	16 pcs. 1#	.03	72
XA 5411	Bracket, armature support K-D-716	1	14#	6.30	72
XA 5412	Gasket, generator ball bearing - K-B-903	1	xx	.03	72
XA 5413	Cover, generator - K-D-730	1	2-1/2#	1.60	72
XA 5414	Screws, fill.hd. 1/4" x 1/2" NC K-X-52-1	4	96 pcs. 1#	.05	72
XA 5415	Washer, insulating - K-D-1508	8	188 pcs. 1#	.05	72
XA 5416	Bushing, insulating K-D-1507	4	xx	.05	72
XA 5417	Pole, Field - assembly K-D-1-722	4	3-1/4#	1.35	72
XA 5418	Insulator, lead - K-D-234	1	xx	.02	72
XA 5419	Lead, negative - K-D-975	1	6 pcs. 1#	.25	72
XA 5420	Lead, shunt field - K-D-960	1	39 pcs. 1#	.03	72
XA 5421	Lead, series field - K-E-958	1	19 pcs. 1#	.30	72
XA 5422	Coil, field - lower left K-E-766	1	4-1/4#	4.55	72
XA 5423	Coil, field - upper left K-E-767-1	1	4-1/4#	4.55	72
XA 5424	Coil, field - lower right K-E-765	1	4-1/4#	4.55	72
XA 5425	Coil, field - upper right K-E-764-1	1	4-1/4#	4.55	72
XA 5426	Lead, brush - K-D-1130	1	20 pcs. 1#	.05	72
XA 5427	Coil, field assembly K-E-1-723	1	17-1/8#	18.20	72
XA 5428	Studs, brush holder K-D-1505	4	11 pcs. 1#	.10	72

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Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 5429	Arm, brush holder K-D-947-2	4	18 pcs. 1#	$ .20	72
XA 5430	Body, brush holder K-D-946-3	4	6 pcs. 1#	.30	72
XA 5431	Spring, brush holder K-D-948	4	100 pcs. 1#	.05	72
XA 5432	Screw, set - brass 5/16"x 5/8" NC - K-D-950	4	92 pcs. 1#	.03	72
XA 5433	Pin, brush holder - K-D-949	4	105 pcs. 1#	.03	72
XA 5434	Nut, hex. brass 5/16" NC - K-D-951	4	xx	.03	72
XA 5435	Holder, generator brush K-D-741-2	4	8 pcs. 1#	.55	72
XA 5436	Bracket, switch support L.H. - K-D-980	1	7/8#	.30	72
XA 5437	Bracket, switch support R.H. - K-D-979	1	7/8#	.30	72
XA 5438	Nut, hex. 3/8" NC K-X-83-2	2	34 pcs. 1#	.03	
XA 5439	Frame, generator - K-D-714	1	68#	10.05	72
XA 5440	Bushing, rubber K-D-229	1	63 pcs. 1#	.10	72
XA 5441	Screw, hex. cap 3/8"x 1-1/4" NC - K-X-7-2	8	19 pcs. 1#	.03	72
XA 5442	Screen, generator frame K-D-860	2	10 pcs. 1#	.15	72
XA 5443	Screw, hex. cap 3/8" x 2-1/2" NC - K-X-7-5	8	11 pcs. 1#	.03	72
XA 5444	Armature - K-D-768	1	56#	30.00	72
XA 5445	Brush,generator - K-D-742	4	29 pcs. 1#	.35	72
XA 5446	Pin,starting crank spring K-C-1204	1	64 pcs. 1#	.03	75
XA 5447	Guide, starting crank K-C-1202	1	4 pcs. 1#	.10	75
XA 5448	Crank, starting K-C-593	1	2 lbs.	.90	75
XA 5449	Pin, starting crank K-A-596	1	35 pcs. 1#	.03	75
XA 5450	Support, starting crank K-C-1201	1	7/8#	.35	75
XA 5451	Spring, starting crank K-C-1209	1	42 pcs. 1#	.03	75
XA 5452	Crank, starting - assembly - K-C-1-593	1	3-5/8#	1.55	75
XA 5453	Gauge, valve feeler .006 K-B-1-913	1	133 pcs. 1#	.03	76
XA 5454	Gauge, point setting AB-GG-552	1	xx	.05	76
XA 5455	Bag, tool - K-B-915	1	xx	.10	76
XA 5456	Wrench, spark plug (1 x 1-1/8" hex.) K-D-831	1	5/8#	.30	76
XA 5457	Elbow, compression - comp. (1/8" I. P. 1/4" tubing) K-A-822	1	20 pcs. 1#	.15	76
XA 5458	Nipple, pipe 1-1/4" x 4" I.P. - K-A-48	1	2-3/4#	.25	76

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Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 5459	Kit, tool - K-D-965	1	5-1/4#	$ .90	76
XA 5460	Plant, light - Type E 110 volts, 1500 Watts	1	475#	421.00	77
XA 5461	Nipple, 1¼" x 3"	1	2 pcs. 1#	.13	77
XA 5462	Elbow, 1¼" x 90°	1	1#	.40	77
XA 5463	Pipe, 1¼"x26"-thread one end	1	5#	1.15	77
XA 5464	Nipple, 3/8" x 2"	1	10 pcs.1#	.05	77
XA 5465	Bushing, reducer - 3/4" x 3/8" W. I.	1	10 pcs. 1#	.07	77
XA 5466	Elbow, 3/8" x 45° - W.I.	1	7 pcs. 1#	.14	77
XA 5467	Nipple, 3/8" x 7"	1	3 pcs. 1#	.11	77
XA 5468	Elbow, 3/8" x 90° - W.I.	1	6 pcs. 1#	.14	77
XA 5469	Plug, pipe - 3/8"	1	20 pcs. 1#	.04	77
XA 5470	Nut, hexagon - 1/2" N.C.	4	14 pcs. 1#	.02	77
XA 5471	Washer, lock - 1/2"	4	80 pcs. 1#	.60*	77
XA 5472	Door, house - 22SM162	2	10#	3.25	77
XA 5473	House, light plant 211UA16	1	103#	45.00	77
XA 5474	Bolt, machine - 3/8" x 1" N.C.	4	19 pcs. 1#	.03	77
XA 5475	Strip, mounting - 4225A739	2	2 pcs. 1#	.55	77
XA 5476	Bolt, machine - 1/2" x 3¾" N.C.	4	4 pcs. 1#	.05	77
XA 5477	Pan, oil assembly less XA5173 & XA5180 K-A-2-503	1	54#	17.75	

OVERSIZE ENGINE PARTS

Part No.	Name and Description of Part	Qty.	Approx. Weight	Price Each	Page No.
XA 5478	Piston, semi-finished K-D-508-1	-	3/4#	$1.05	
XA 5479	Pin, piston - .003 oversize - K-A-510-3	-	11 pcs.1#	.15	
XA 5480	Pin, piston-.005 oversize - K-A-510-5	-	11 pcs.1#	.15	
XA 5481	Pin, piston-.010 oversize - K-A-510-10	-	11 pcs.1#	.15	
XA 5482	Ring, comp. - .005 oversize - K-A-826-5	-	xx	.15	
XA 5483	Ring, comp. - .010 oversize - K-A-826-10	-	xx	.15	
XA 5484	Ring, comp. - .020 oversize - K-A-826-20	-	xx	.15	
XA 5485	Ring, comp. - .030 oversize - K-A-826-30	-	xx	.15	
XA 5486	Ring, oil - .005 oversize - K-D-2448-5	-	xx	.20	
XA 5487	Ring, oil - .010 oversize - K-D-2448-10	-	xx	.20	
XA 5488	Ring, oil - .020 oversize - K-D-2448-20	-	xx	$ .20	
XA 5489	Ring, oil - .030 oversize - K-D-2448-30	-	xx	.20	

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