McKiernan-Terry

DOUBLE-ACTING

PILE HAMMERS and EXTRACTORS

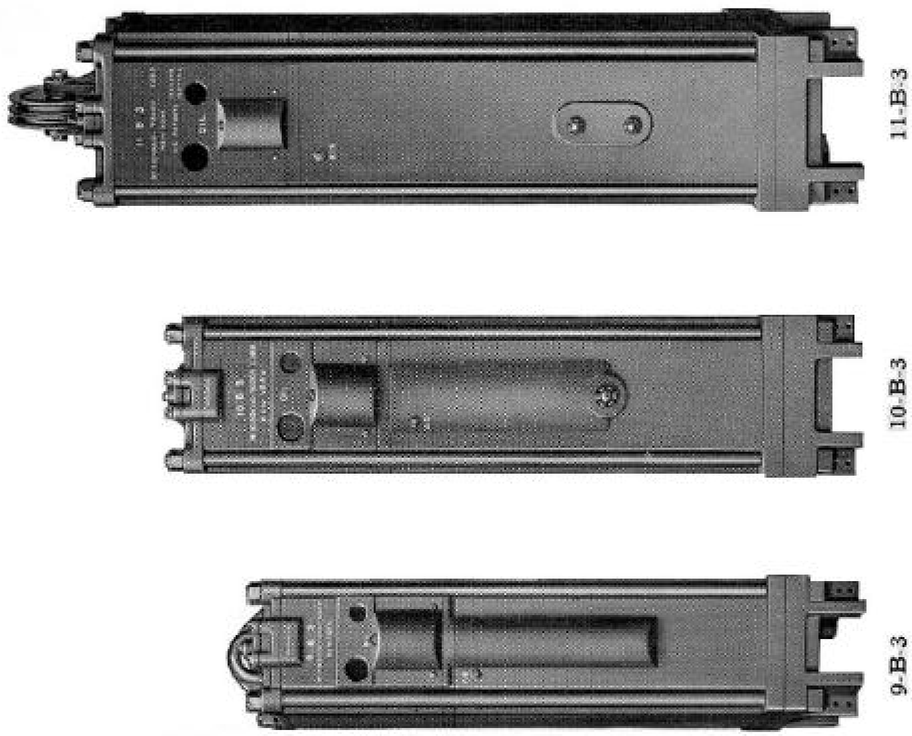
McKiernan-Terry Double-Acting Pile Hammers hit powerful blows at high frequency. For years, on land, and above or under water they have proved to be fast and economical pile hammers for driving all but the largest and heaviest piles.

The high frequency of blows of the Double-Acting Pile Hammer keeps the pile in motion, resulting in faster driving at low cost.

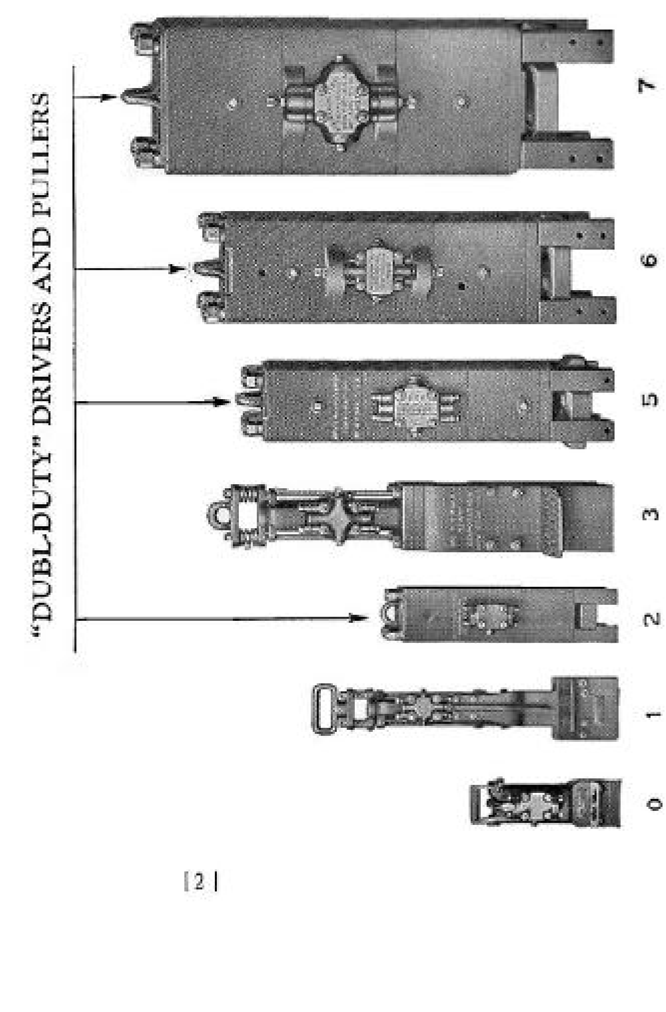
Our Double-Acting Pile Hammers cover the widest range of pile driving conditions.

Our Single-Acting Pile Hammers, described in our Bulletin 59, have relatively heavier mass rams hitting at lower striking velocities and fewer blows per minute. They are designed for economical driving of the heaviest precast concrete and other heavy mass piles.

McKiernan-Terry Corporation
Manufacturing Engineers
15 Park Row, New York 7, N. Y.
Distributors in Principal Cities



McKiernan-Terry Double-Acting Pile Hammers



Specifications of McKiernan-Terry Double-Acting Hammers

HAMMER SIZE — No.	0	1	2	3	5	6	7	9-B-3	10-B-3	11-B-3
Net weight with flat or bell (cup) anvil, hammer only, pounds	105	145	343	675	1500	2900	5000	7000	10,850	14,000
Shipping weight, hammer and fittings, pounds	135	185	380	735	1560	2970	5075	7100	11,000	14,200
Cubic measurements, inches	8x12x25	9x11x47	11x10x37	14x13x62	19x14x57	24x19x63	27x21x73	98x20x24	112x24x26½	133½x26x28
Weight of ram, pounds	5	21	48	68	200	400	800	1600	3000	5000
Bore, inches	2¼	2¼	4⅛	3¼	7	9¾	12½	8½	10	11
Stroke, inches	4½	3¼	5¼	5¾	7	8¾	9½	17	19	19
Blows per minute, normal	1000	500	500	400	300	275	225	145	105	95
Energy per blow, foot-pounds	....	....	....	....	1000	2500	4150	8750	13,100	19,150
Equivalent free fall of ram, feet	....	....	....	....	....	....	....	5.46	4.36	3.82
Size boiler required (boiler h.p. at 12 sq. ft. heating surface per boiler h.p.)	5	10	10	15	20	25	35	45	50	60
Compressed air required, actual cubic feet	60	70	70	110	250	400	450	600	750	900
Steam or air pressure required at hammer, pounds per sq. in. (See Note E)	100	100	100	100	100	100	100	100	100	100
Recommended steam pressure at boiler, or air pressure at compressor, pounds per sq. in. (See Note E)	125	125	125	125	125	125	125	125	125	125
Minimum size hose openings and connections from boiler/compressor to hammer, inches	¾	¾	¾	1	1¼	1¼	1½	2	2½	2½
Size of exhaust opening in hammer, inches	....	....	....	....	....	....	....	3½	4	4
Size wood sheeting or round timber piles, inches, approximate (See Note D)	2x10 or 3x8	2x10 or 3x10	3x8	3x12	4x12	6x12	10x14	17	20	21
Penetration in average material, feet, approximate	3–4	4–6	6–10	6–10	10–15	15–20	20–30	30–40	50–70	60–80
Size steel sheet piling, inches, approximate	9	9	9	12	12	12	Largest	Largest	Largest	Largest
Penetration in average material, feet, approximate	5–6	6–10	10–15	10–15	15–20	20–30	30–40	50–60	60–80	70–100
Code word for hammer	ORFOR	OPLAS	OPLET	OPLIX	OPLUZ	OPMAT	OPMEX	OPNOD	OPNIZ	OPNEY

N.B. A—When ordering, be sure to specify whether hammer is to be operated with AIR or STEAM, so that lubricator of proper type may be furnished.

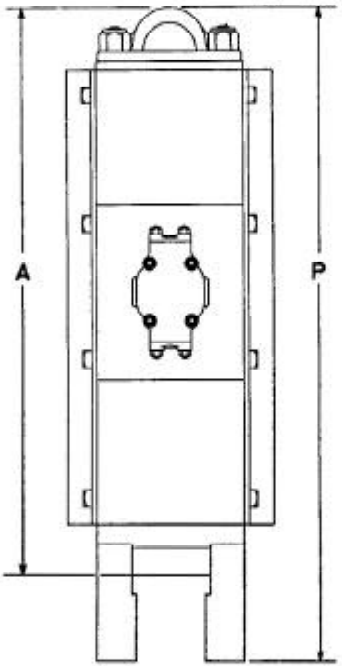
B—When ordering size 7, 9-B-3, 10-B-3 or 11-B-3 hammer, specify whether a standard flat or bell (cup) anvil is wanted. Other sizes furnished with flat anvils only. See pages 16, 17, 18 and 19. If other types of anvil or drive cap are required, they will be furnished at additional cost, after receipt of complete specifications of piling to be driven.

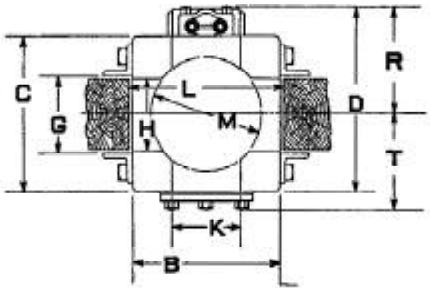
C—If angle iron guides are to be attached, give lead measurements A and B, as indicated on page 9.

D—If ordering size 0 or 1 hammer, specify size of sheeting to be driven.

E—Figures for steam pressure at hammer and at boiler are approximate, given as a guide. Actual pressures required will vary with the weather, and with the installation of the boiler, length of steam line from boiler to throttle valve, and length of hose used. The speed of the hammer must be regulated by means of the throttle valve and by varying the steam pressure at the boiler so that hammer will run at speed indicated in table. *Hammers must not be run faster than the rated speed.*

Dimensions of Pile Hammers





Size No.	A Inches	B Inches	C Inches	D Inches	G	H Inches	K Inches	L Inches	M Inches	P Inches	R Inches	T Inches
0	20	6	4	6½	.....	2¼—3¼	.....	.....	.....	25	4½	2
1	39	8	6	10½	.....	2¼—3¼	.....	.....	.....	43	4¼	1⅝
2	29	7½	6⅝	9	.....	3⅛	3⅛	.....	4⅜	33	5 11/16	3 9/16
3	53	9	9½	16½	.....	3⅝	.....	.....	.....	58	5⅜	2¾
5	51	11	11	14¾	.....	4¼	4¼	12	6	57	9¼	5½
6	55	15	15	18	.....	7	7	16	11¼	63	10½	7½
7	63	21	16	22⅝	As Required	7	11	22	16	73	14⅝	8¾
9-B-3	89¼	20	20	23½		9	9	21	15	98	13½	12
10-B-3	102¾	24	24	26½		11	11	25	19	112	14½	12
11-B-3	124½	26	26	27¾		13½	13½	27	22	133½	14¾	13

Formula for Bearing Power of Piles

THE "Engineering News" formula which is given below is generally used by engineers to determine the bearing power of piles driven with McKiernan-Terry Pile Hammers. An example of its use is given in the following table.

$$L = \frac{2E}{S + .1} \qquad L = \frac{2 \times 8750}{S + .1}$$

In the above formula L equals the bearing capacity of piles in pounds. E equals energy or foot pounds per blow. S equals average penetration in inches per blow for the last few blows.

The foregoing illustration is based on the No. 9-B-3 Pile Hammer running 145 strokes per minute and developing an 8750-foot-pound blow.

Attention is called to the fact that the energies herewith published are not so-called "Rated Energies" but are the *Actual foot pound blows* at the various speeds listed. These data are obtained by very careful calibration of our hammers, having been determined by exhaustive tests with the use of indicator diagrams and high speed moving picture apparatus, which actually determines the velocity of the ram at the point of impact.

Calculations based on steam pressures are misleading because no two set-ups are identical and it is impossible to determine the Mean Effective Pressure in the working cylinder from the boiler pressure as shown by the gauge.

Size of Hammer No.	Weight of Ram Pounds	Lifting Area of Piston Square Inches	Striking Area of Piston Square Inches	Length of Stroke Inches	FOOT POUNDS BLOW AT GIVEN STROKES PER MINUTE	
					Strokes per Minute	Foot Pounds per Blow
6	400	36.18	36.18	8¾	275	2,500
					230	2,160
					200	1,680
7	800	55.6	55.6	9½	225	4,150
					195	3,720
					170	3,280
9-B-3	1,600	40.85	56.75	17	145	8,750
					140	8,100
					135	7,500
					130	6,800
10-B-3	3,000	58.91	78.54	19	105	13,100
					100	12,000
					95	10,900
					90	9,550
11-B-3	5,000	75.40	95.03	19	95	19,150
					90	18,300
					85	17,500
					80	16.700

Bearing Power of Piles Driven with McKiernan-Terry Pile Hammers

Using "Engineering News" formula $L = \frac{2E}{S + .1}$ The assumed safety factor of this formula is 6.

Penetration per blow Inches	BEARING POWER IN POUNDS			
	No. 7	No. 9-B-3	No. 10-B-3	No. 11-B-3
.1	41,500	87,500	131,000	191,500
.2	27,666	58,333	87,333	127,666
.3	20,750	43,750	65,500	95,750
.4	16,600	35,000	52,400	76,600
.5	13,833	29,166	43,666	63,833
.6	11,857	25,000	37,428	54,714
.7	10,375	21,875	32,750	47,875
.8	9,222	19,444	29,111	42,555
.9	8,300	17,500	26,200	38,300
1.	7,545	15,909	23,818	34,818

Operating Instructions

A—Leads Recommended

The use of leads to guide the hammer in driving is recommended. Driving without leads usually results in misalignment of the hammer with the pile, causing excessive wear or breakage of the striking end of the ram and the anvil block.

Angle iron guides are furnished with each hammer to guide the hammer in the leads. Guides should be spaced one half inch wider, back to back, than the width of the faces of the leads. The guides are furnished unattached, unless dimension for spacing of guides is specified when ordering hammer.

Leads should be spaced ½ to ¾ inch wider apart than width of hammer, so hammer will not bind in leads.

Guides are attached to hammer with cap screws, so that the rear guides may be removed to facilitate placing the hammer in the leads.

B—Hose Connections

The size hose specified for each hammer should always be used. Use of a smaller size than that specified may result in the hammer not running up to the rated number of blows per minute.

The hose should be connected to the steam inlet flange. Fittings, consisting of a nipple and an elbow, are furnished with each hammer. Universal joints for connecting hose to the hammer are recommended, but are not furnished as standard equipment.

Before connecting hose to steam inlet, the hose should be thoroughly blown out with steam or air.

The operation of the hammer will be improved if a drain cock or valve is installed in the steam line as near to the hammer as possible, so that condensed steam may be blown out before starting to drive each pile.

Do not use wornout hose. Pieces of rubber or lining may get blown into the hammer and clog ports or valve.

C—Precautions against Wear, Damage and Breakage

1—Use adequate lubrication with the right kind of oil.

2—Keep hammer in line with pile.

3—Keep full weight of hammer on pile while driving.

4—Do not use excessive steam or air pressure, as it will cause hammer to over-stroke and lift off pile on up-stroke.

5—Do not continue to drive on piles at refusal. Continued driving on piles which have stopped moving will damage piles and break hammer parts.

6—Do not use full power of hammer when starting piles or during very easy driving.

7—Keep tie rod nuts tight.

D—Starting Directions

A cold hammer should be warmed up slowly, by cracking the throttle valve and admitting steam or air to the cylinder, so that the hammer will run slowly and the ram make short strokes. In cold weather a large amount of steam will condense in the steam line and hose and inside the hammer. This condensate or water must be worked through the hammer before running hammer at full speed.

When starting a pile and during easy driving, the hammer should be run slowly with short strokes, so that the pile will not be driven out from under the hammer causing damage to the tie rods and drive cap.

The full weight of the hammer must rest on the pile while the pile is being driven. The hoisting line must be kept slack at all times while the pile is being driven, so that the ram will not strike the retainer and damage the hammer.

Continued operation of the hammer when the full weight of hammer is not resting on the pile will cause breakage of the tie rods and separation of the piston from the ram.

E—Disassembling Hammer

To take apart No. 9-B-3, 10-B-3 or 11-B-3 hammers, remove four tie rod nuts, and lift off top head and top cylinder in one piece. Remove valve from top cylinder. Lift out cam rod. Place eye bolt in top of piston. Lift piston, ram and intermediate head out of bottom cylinder in one piece. Do not remove piston or cam throw from ram unless necessary to make repairs. Reverse above operations to reassemble hammer.

Since No. 0, 1 and 3 Double-Acting Hammers are of a very open frame construction, their disassembly will be obvious.

To disassemble No. 2, 5, 6, 7 remove the four tie rod nuts on the top head, then lift off the top head next, then the top cylinder. Place eye bolt in top of ram. Lift out ram. Next lift out middle cylinder. Next bottom cylinder, leaving the bottom head and anvil block and four tie rods exposed. These parts can be taken apart by merely withdrawing the four tie rods.

F—Packing Piston

To pack the piston—square packing, Garlock #15 or # 777, is recommended.

No. 0 Hammer requires no packing.

For No. 1 Hammer, use four rings of 5/16-in. square packing.

For No. 3 Hammer, use four rings of 3/8-in. square packing.

For No. 9-B-3, 10-B-3 and 11-B-3 Hammers, use four rings of 5/8-in. square packing.

Do not use more than four rings.

On Nos. 1 and 3 Hammers, gland stud nuts should be made up evenly, so that gland will exert even pressure on the packing. Gland should compress packing very lightly. Packing will be kept tight by steam or air pressure. Severe compression will cause undue wear of packing and hinder free movement of the piston. Gland nuts must be made fast with wire to prevent working loose when hammer is driving.

The packing gland in the 9-B-3, 10-B-3 and 11-B-3 Hammers is of the self-aligning type and merely requires a complete assembly of the gland ring, gland

spring holder pins, gland springs, gland spring holder and the packing, so that, when assembling the hammer. the packing will be properly aligned. There are no stud or gland nuts to be adjusted.

G—Care of Hammer in Transit and When Not in Service

Plug inlet and exhaust to keep dirt out of hammer.

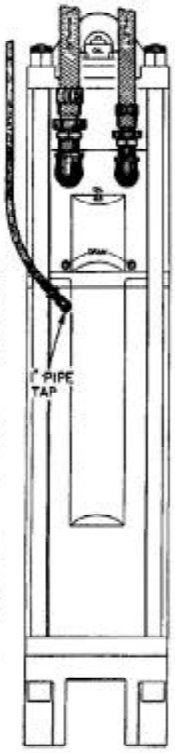
If hammer is to be out of service for a period under three months detach hose and pour one quart of oil down hose. Reattach hose and run hammer for several strokes to flush oil through hammer. Drain water which may have condensed in cylinder by removing drain plugs. Replace plugs to prevent entry of dirt.

If hammer is to be out of service for a period over three months take hammer apart, dry all parts, thoroughly coat them with oil and reassemble.

H—Cold Weather Precautions

When hammer is not being used during cold weather, all water should be drained out of the top cylinder by removing drain plugs. Failure to drain cylinder may result in cracking of the cylinder due to freezing.

I—Instructions for Under-water Driving



Cut at right shows how to attach the air inlet hose to bottom cylinder which is necessary for under-water driving with McKiernan-Terry Double-Acting Pile Hammers.

It is highly recommended that a lubricator be placed on the air line connected to the bottom cylinder and the same oil used as suggested for the steam line. (See section M.)

The exhaust line must be carried to the surface of the water. Use exhaust hose of the size recommended in specification table, page 3.

About 60 cubic feet of compressed air per minute is sufficient volume for any size hammer, and about ½-lb. pressure for every foot of submergence is required.

All hose should be kept out of water as much as possible, and free of kinks or bends.

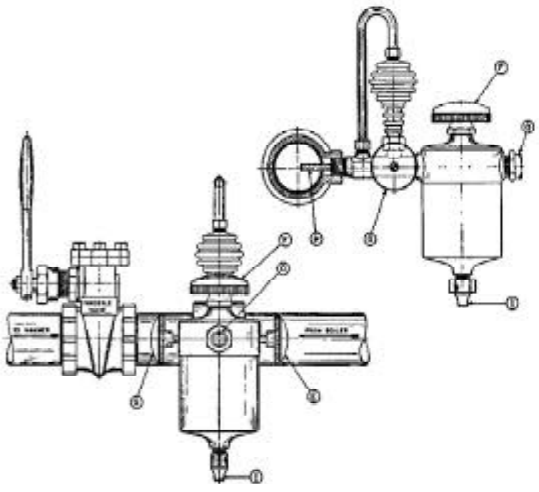
Lubrication—Please Read and Follow Carefully

Adequate lubrication is absolutely necessary for satisfactory pile hammer operation. Insufficient oil or use of the wrong kind of oil causes shut-downs, excessive wear and costly repairs.

All McKiernan-Terry Pile Hammers will operate on either steam or compressed air. No changes, except in lubrication, are necessary in changing from steam to air.

J—To Lubricate STEAM-OPERATED Hammers

A Swift Sight-Feed Lubricator for steam operation—see picture—is furnished with each No. 5 or larger McKiernan-Terry Double-Acting Pile Hammer, but any standard sight-feed lubricator, if properly installed and operated, will do.



The purpose of the lubricator is to supply oil to the steam so that it is carried inside the hammer to lubricate piston and steam cylinder. The lubricator should be carefully installed as per directions, and must be kept filled and in operation while the hammer is running.

K—How to Install Steam Lubricator

The lubricator should be placed on the steam line back of the throttle valve; that is, between throttle valve and boiler. The connection from lubricator to steam line should be made through a tee, with the oil outlet pipe P extending into the center of the steam line.

Be sure that the oil outlet pipe P extends all the way into the flow of steam and is at right angles to the flow.

This is necessary so that steam passing through the line will carry oil in the *center* of the hose and not along the sides.

Never mount lubricator at a bend in the steam line where the flow of steam will strike the oil outlet pipe P head-on, as this will cause lubricator to work intermittently.

L—How to Operate Steam Lubricator

Close valves E and G. Remove filler plug F and fill oil reservoir full to very top, and replace F. The bright nickel-silver plate showing the sight feed O will now be completely covered with oil.

Open valve E about one-half turn, then allow five or ten minutes, on a new installation, for steam to condense and form the water column. Then open valve G very carefully. Drops of water will commence to roll down over the bright plate. Each drop will cause a drop of oil to be forced into the steam line.

Valve G should be regulated to give at least one drop of oil to every ten blows of the hammer. Avoid opening valve G too wide. If water runs in a stream, instead of in drops, oil will be wasted.

When the oil in the reservoir is nearly exhausted water will commence to show at the bottom of sight-feed O, gradually rising and showing on the sight-feed plate. Although there will be still enough oil to run for some time, it is best to refill when the water shows.

To refill reservoir, close valves E and G to shut off lubricator from steam line, open I and remove plug F to drain off water. Then proceed to refill as above. When hammer is not operating, valve G should always be closed.

If the lubricator is connected in such a way as to cause variable pressure, better results can be obtained by closing valve E to about the same opening as valve G, making the adjustment after lubricator has commenced feeding.

M—Select the Right Oil for Use with Steam

Steam hammers are often required to run on wet steam, due to unavoidable operating conditions and the length of steam line and hose between boiler and hammer. Therefore we recommend high grade compounded steam cylinder oil containing 5% to 7% animal oil.

Oil of this type produces an emulsifying effect when in contact with moisture, and the resulting lather resists the tendency of wet steam to wash oil off the internal moving surfaces of the hammer. Oil meeting the following specifications has proved successful under average conditions:

Gravity—degrees API	22-25
Pour Point—degrees Fahrenheit	10-40
Flash Point—degrees Fahrenheit	525-590
Viscosity—Saybolt seconds at 210 degrees	120-140
Percentage of compounded oil—usually acidless tallow or lard	5%-7%

Typical oils meeting these specifications include Socony-Vacuum Gargoyle Cylinder Oil 600-W Regular; Standard Oil of New Jersey Cylesso T-140; Texas Company Honor Cylinder Oil; Gulf Oil Corporation Crystal Cylinder Oil B.

N—To Lubricate AIR-OPERATED Hammers

A Swift Sight Feed Lubricator to be used on the air line when hammer is operated on air, is furnished with each McKiernan-Terry Double-Acting Pile Hammer for sizes No. 5 and larger. For sizes No. 3 and smaller a regular line oiler is furnished. A Swift Sight Lubricator is also used on the air line of 9-B-3, 10-B-3 and 11-B-3 Hammers, connected to bottom cylinder when hammer is operated by steam or air for underwater driving. Note underwater instructions, section I.

O—How to Install Air Lubricator

The lubricator should be placed on the air line, back of the throttle valve; that is, between throttle valve and air receiver or compressor. The connection from lubricator to air line should be made through a tee, with the oil outlet pipe extending into the center of the air line.

Be sure that the oil outlet pipe extends all the way into the flow of air and is at right angles to the flow.

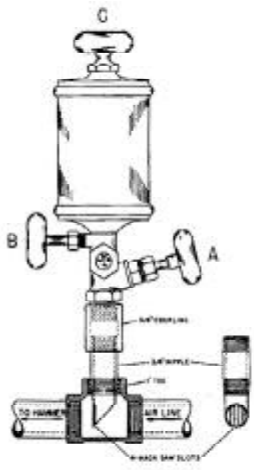


Illustration shows correct method of installing lubricator in air line so that air passing through the line will carry oil in the *CENTER* of the hole and not along the side.

Never mount lubricator at a bend in the air line where the flow of air will strike the air outlet pipe head-on, as this will cause lubricator to operate intermittently.

P—How to Operate Air Lubricator

Close valves A and B. Remove cover C and fill oil reservoir. Replace cover C and open valve B. Then open valve A very carefully and regulate it to give at least one drop of oil to every ten blows of the hammer. When lubricator needs refilling, close valves A and B, remove cover C and repeat above operation.

It is necessary that a steady supply of oil be fed into the air line whenever hammer is in operation. Operation without oil for even a brief period may cause serious damage to the hammer.

Q—Oils for Air Operation

The oils recommended for steam operation should not be used when the hammer is operated on air, because they are too heavy and sticky unless heated by steam. Oil of approximately the following specifications is recommended for air-driven hammers:

Gravity—degrees API	17-28
Pour Point—degrees Fahrenheit	0 to -10
Viscosity—Saybolt seconds at 210 degrees	48-60
Percentage of compounded oil	None to 3%

The following brands of oil have been used successfully in air-driven hammers: Socony-Vacuum Gargoyle D.T.E. Heavy Medium; Gulf Oil Corporation Harmony Oil D or Seneca Oil B; Texas Company Ursa Oil C; Standard Oil of New Jersey Teresso 52.

R—Oils for Underwater Driving

Hammers operate on very wet steam under water, due to the cold water in contact with the steam hose and outside surfaces of hammer. This causes steam to condense, with the result that a large amount of water is carried along with the steam.

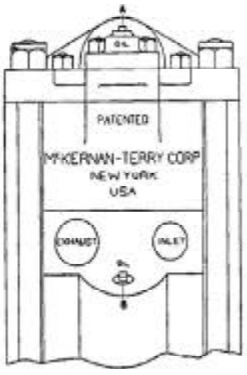
This excess water makes it necessary to use a cylinder oil containing 10% to 12% compound animal oil, in order to insure that oil will adhere to the moving parts.

Socony-Vacuum Gargoyle P. E. Cylinder Oil Dark and similar oils containing 11% compounded lard have proved successful and are recommended for underwater use.

S—Internal Lubrication

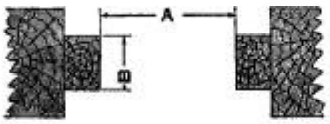
Oil reservoir A at top of valve and oil reservoir B in the face of the steam cylinder should be kept filled with the oil recommended above. Reservoir A oils the valve. Reservoir B oils the cam rod bearings, cam rod, and cam throw.

As the oil in these reservoirs drips out steadily, whether the hammer is in operation or not, the reservoirs should be completely filled at start of driving, and refilled at least every hour the hammer is in operation.



Remember—OIL is Cheaper than Breakdowns and Repairs

Attaching Angle-Iron Guides



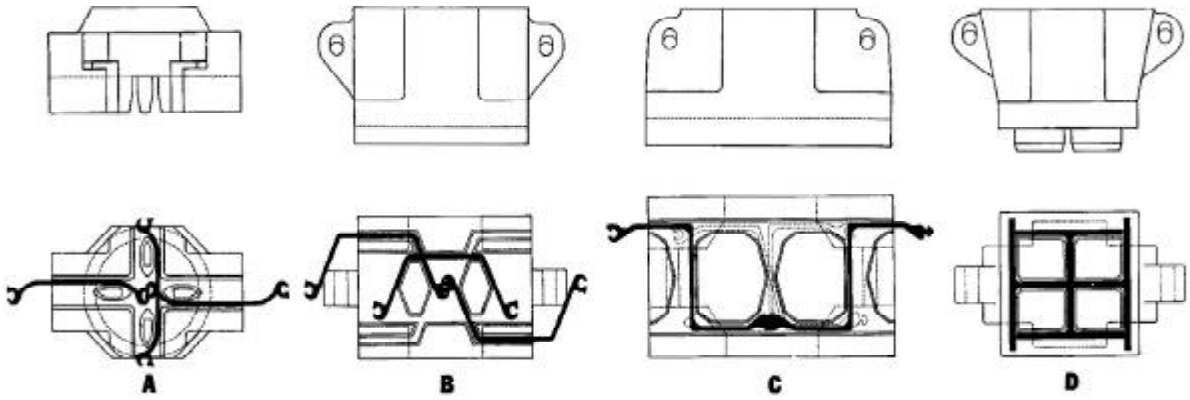
When ordering hammers with angle-iron guides attached, be sure to specify actual measurements of A and B indicated above.

For Drilling Angle-Iron Holes

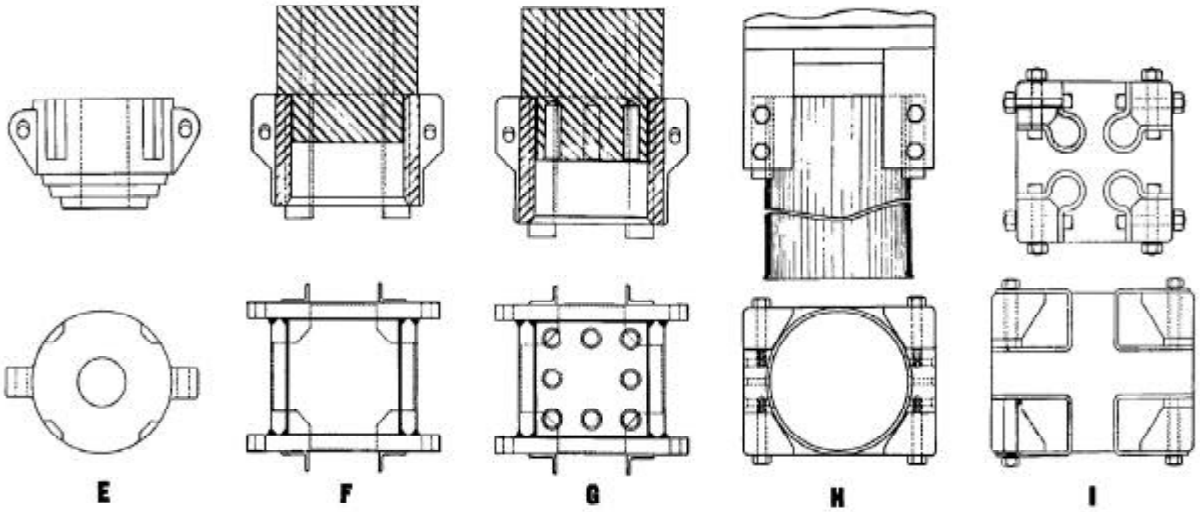
Hammer Number	Size Stud	Depth Tapping	Holes Required
5	¾″	1″	16
6	⅞″	1¼″	12
7	1″	1¼″	16
9-B-3	1″	1¼″	20
10-B-3	1″	1¼″	24
11-B-3	1″	1¼″	24

Angle-iron guides are furnished unattached, unless order specifies otherwise. They will be attached at factory without additional charge, provided dimensions A and B, shown above, are provided. If guides are not required to be attached at factory, we will provide—on application specifying hammer size—a detailed dimension print, showing exactly where and how to attach them. In drilling holes be sure that they are *not drilled deeper than shown in table above.* Guides come equipped with cap screws to enable removal of rear guides to facilitate placing hammer in leads.

Anvils and Base Attachments

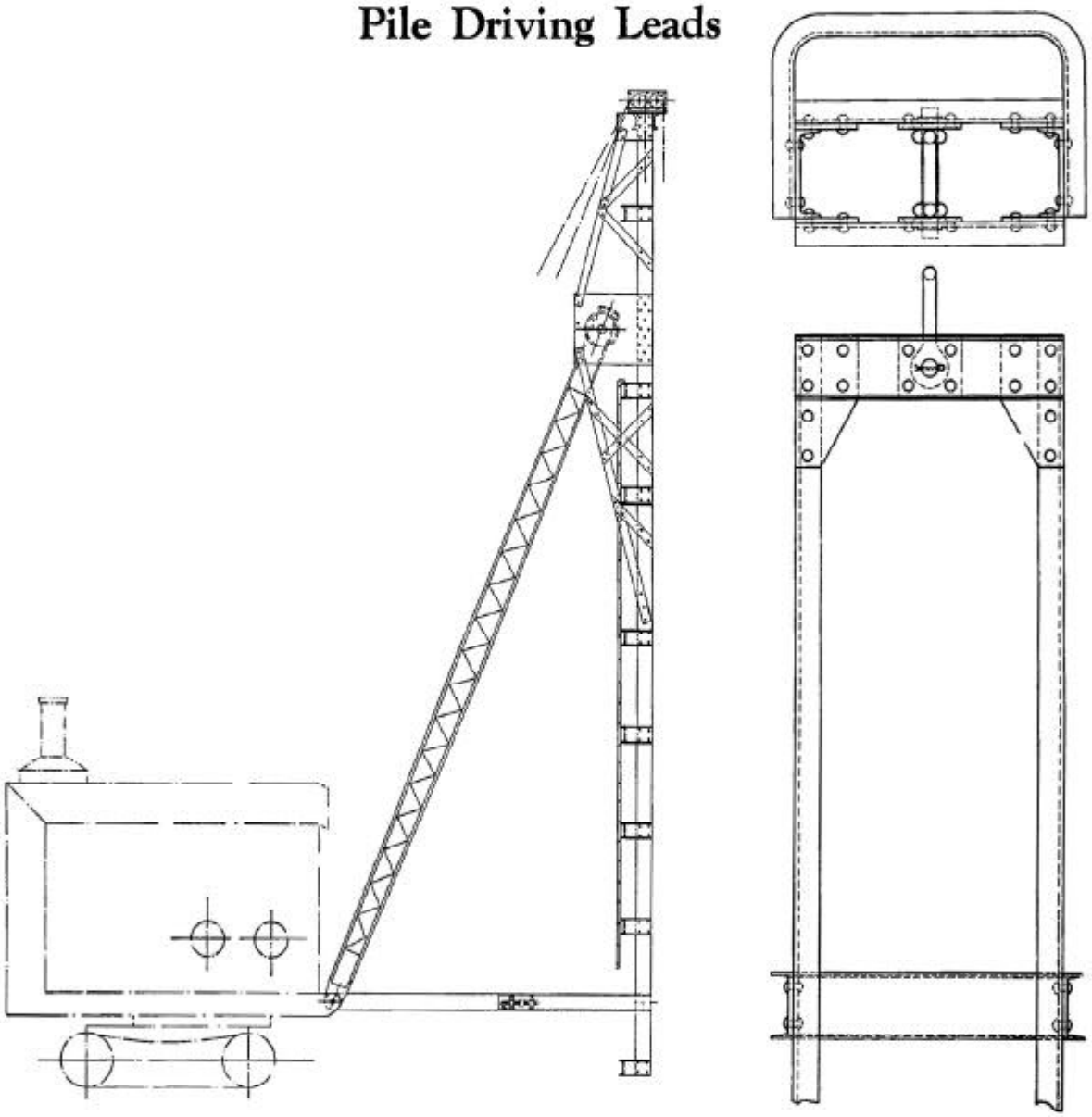


A—For driving one and/or two pieces of straight web steel sheet piling. B—For driving one and/or two pieces of deep arch steel sheet piling. C—For driving one and/or two pieces of Z-section steel piling. D—For driving steel H-beam piles.



E—For driving pipe piles of all sizes. F—For driving smooth butt concrete piles. G—For driving concrete piles with extended reinforcing rods. H—Pipe sleeve, diameter determined by dimension M on page 4. I—Filler pieces for various sizes and sections of steel sheet piling or Wakefield wood sheet piling.

Pile Driving Leads



The McKiernan-Terry Corporation has prepared an extensive set of designs for various types of structural steel pile driving leads. These were designed after careful study of the requirements and will appeal to anyone familiar with this kind of equipment.

We are prepared to quote on and furnish any of the following types of structural steel pile driver leads:

Standard Fixed Leads

Pendulum Pile Driver Leads

Portable Pile Driver with Overhanging Leads

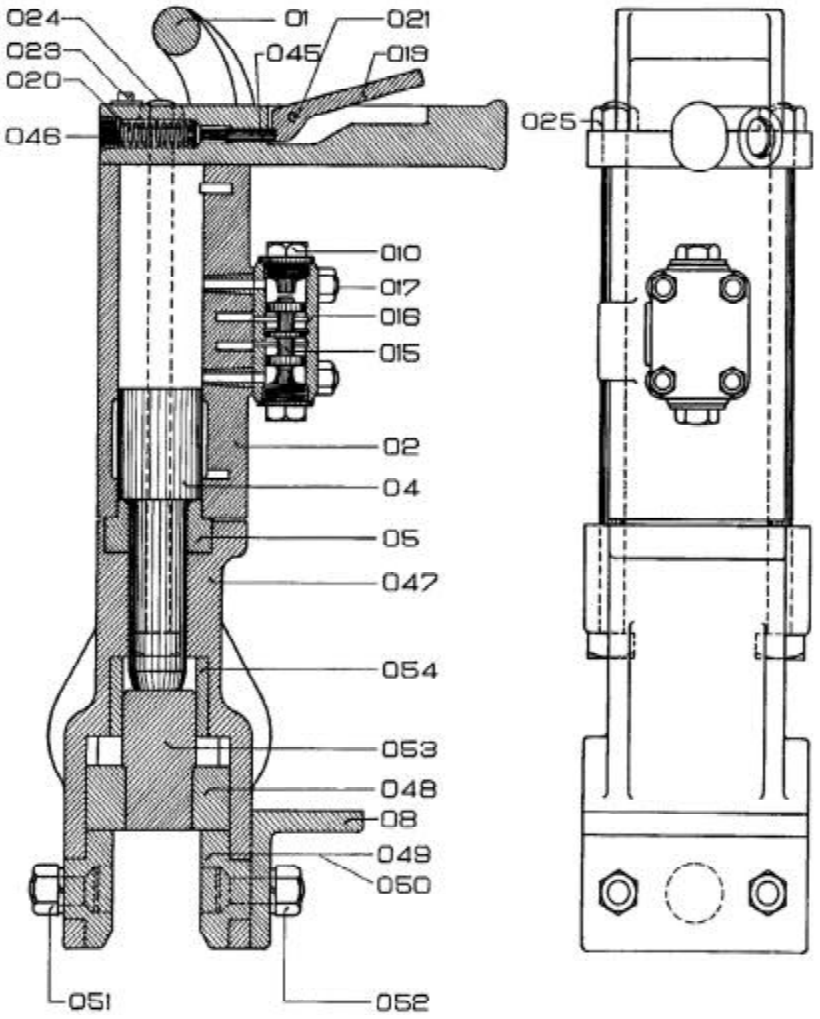
Fore and Aft Adjustable Batter Pile Driver Leads

Full Revolving Pile Driver Leads—fixed or pendulum

Hanging Pile Driver Leads for suspension from end of derrick, crane or shovel boom

Hanging Pile Driver Leads for fixed mounting on crane or shovel booms—suspended at boom point from top of leads or at quarter point on leads extending above boom point.

Any of the above pile driver leads are built for land driving mounted on skids or rollers or rail mounting—or for barge mounting for water driving. They can also be furnished with telescopic extension for underwater driving. We also have designs for wooden leads for which we are prepared to quote on and furnish the necessary fittings.

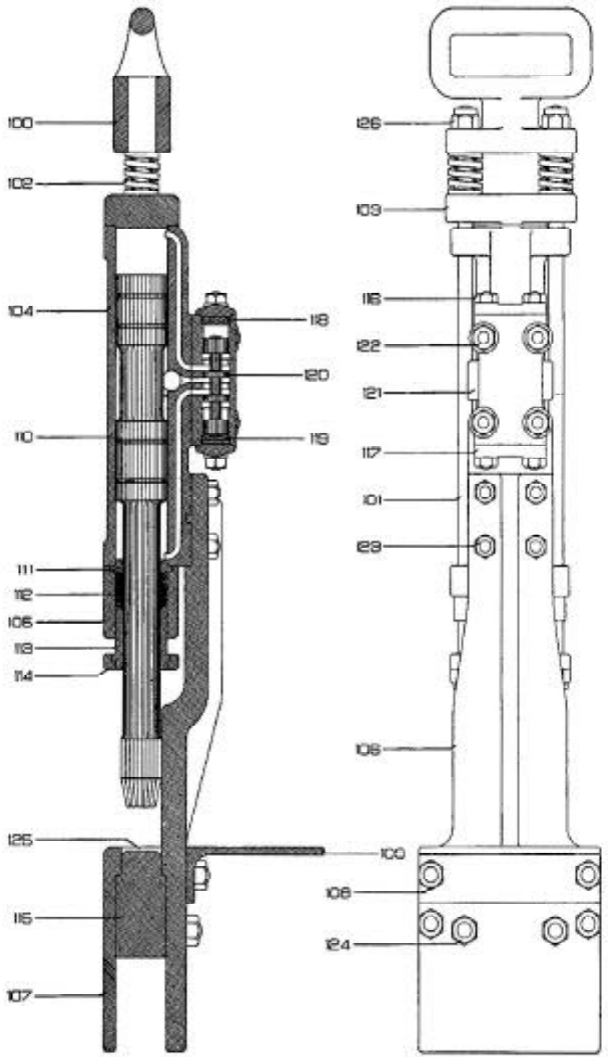


Duplicate Parts for No. 0 Pile Hammer

No. 0 Pile Hammer, Code Word ORFOR

No.	Name	No. Req.	Code Word	No.	Name	No. Req.	Code Word
01	Top Head	1	AHAHT	025	Side Rod Nut	2	AHCET
02	Cylinder	1	AHALF	045	Inlet Valve	1	AHCIX
04	Piston	1	AHAMA	046	Spring Stop	1	AHCOY
05	Piston Bearing	1	AHANE	047	Front Head	1	AHCUZ
08	Step	1	AHAPI	048	Anvil Block	1	AHDAT
010	Chest Cover	2	AHARO	049	Front Head Cap, for 2-in. sheeting	2	AHDEX
015	Valve	1	AHASU	050	Front Head Cap, for 3-in. sheeting	2	AHDIH
016	Valve Chest	1	AHATY	051	Front Head Cap Bolt	2	AHDOZ
017	Chest Stud and Nut	4	AHBAR	052	Front Head Cap and Step Bolt	2	AHDUL
019	Inlet Valve Handle	1	AHBES	053	Dolly	1	AHEBP
020	Inlet Valve Spring	1	AHBIT	054	Front Head Bushing	1	AHECH
021	Inlet Valve Handle Pin	1	AHBOX				
023	Oil Plug	1	AHBUY				
024	Side Rod	2	AHCAS				

Hammer can be supplied for either 2-inch or 3-inch Wood Sheeting.

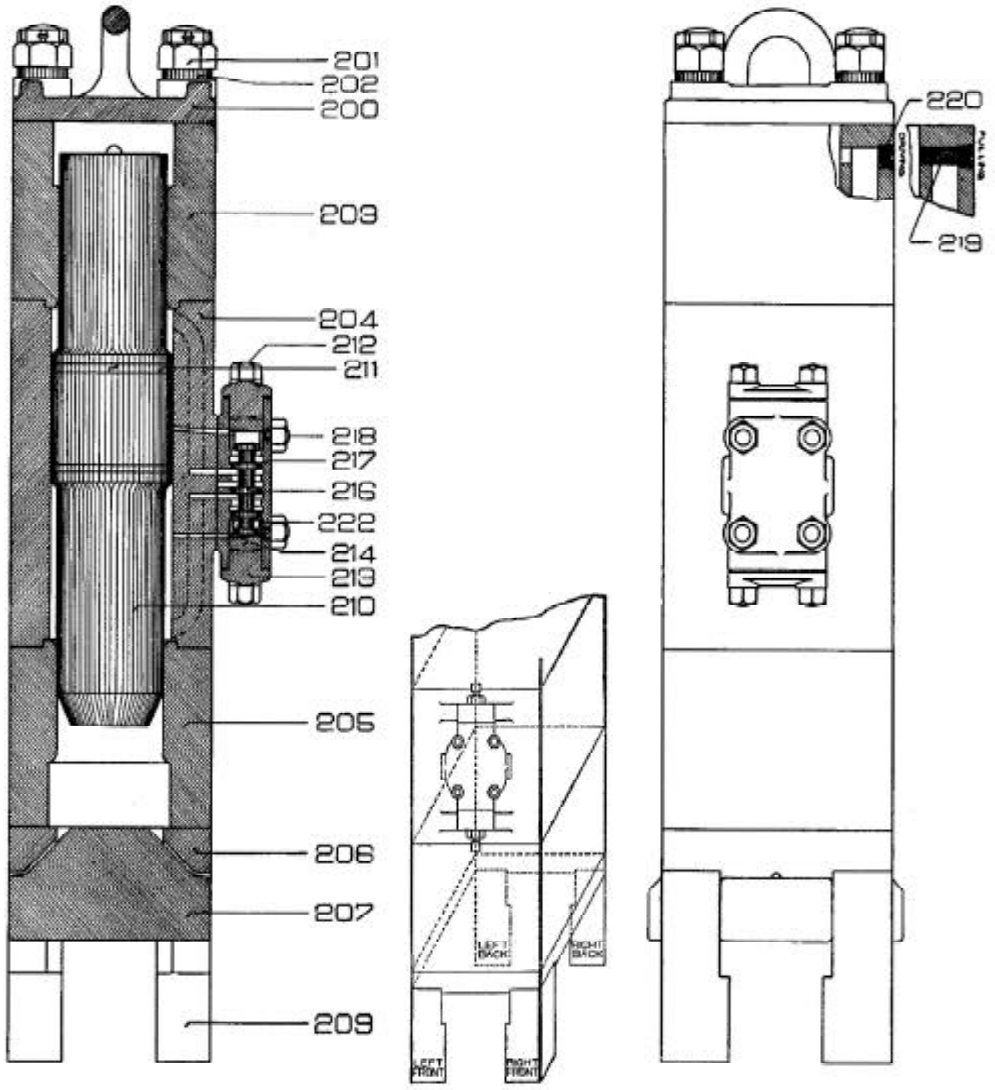


Duplicate Parts for No. 1 Pile Hammer

No. 1 Pile Hammer, Code Word, OPLAS

No.	Name	No. Req.	Code Word	No.	Name	No. Req.	Code Word
100	Bail	1	ABFAF	113	Packing Sleeve—2 Pieces	1	ABHOX
101	Side Rod	2	ABFEP	114	Packing Sleeve Gland	1	ABHUY
102	Top Head Spring	2	ABFIR	115	Anvil Block	1	ABIGT
103	Top Head	1	ABFOS	116	Chest Cover Stud and Nut	4	ABIHZ
104	Cylinder	1	ABFUT	117	Chest Cover	2	ABILS
105	Bottom Head	1	ABGAP	118	Valve Buffer	2	ABINA
106	Base Block	1	ABGER	119	Valve Washer	2	ABIPE
107	Base Block Cap*	1	ABGIS	120	Valve	1	ABIRI
108	Base Block and Nut	4	ABGOT	121	Valve Chest	1	ABISO
109	Step	1	ABGUX	122	Chest Stud and Nut	4	ABITU
110	Ram	1	ABHAR	123	Cylinder Stud and Nut	4	ABIVY
111	Bottom Head Split Ring—2 pieces	1	ABHES	124	Anvil Block Guide Bolt and Nut	2	ABJAS
112	Piston Rod Packing 5/16 sq.—4 Rings		ABHIT	125	Base Block Distance Piece	2	ABJET
				126	Side Rod Nut	4	ABJIX

*Can be supplied for either 2-inch or 3-inch Wood Sheeting.

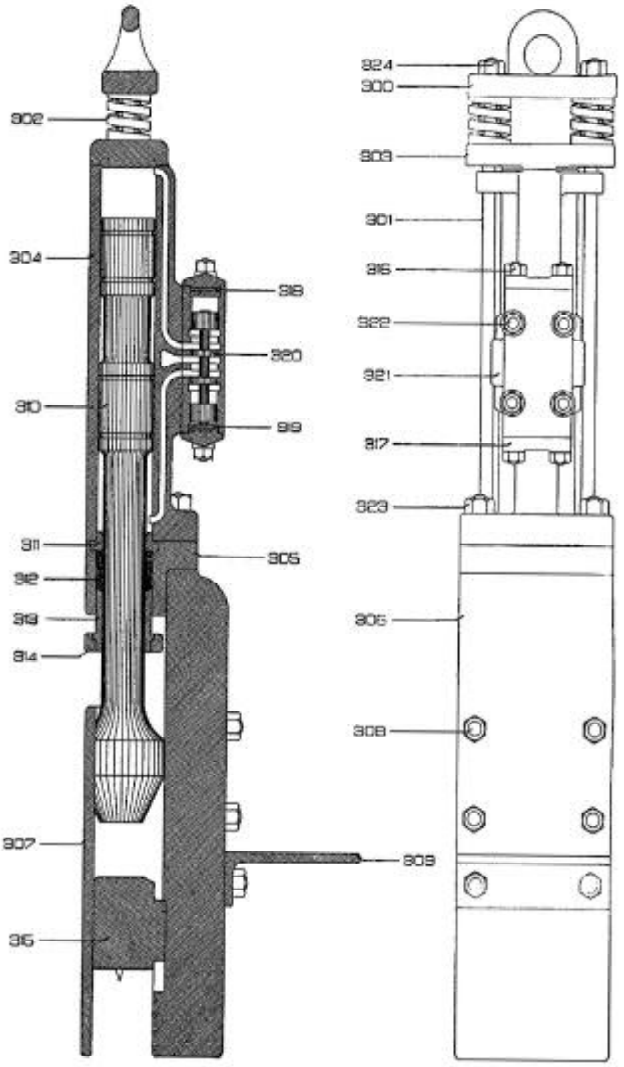


Duplicate Parts for No. 2 Pile Hammer

No. 2 Pile Hammer, Code Word, OPLET

No.	Name	No. Req.	Code Word	No.	Name	No. Req.	Code Word
200	Top Head	1	ABMAY	212	Chest Cover Stud and Nut	4	ABOCY
201	Tie Rod Nut	4	ABMEZ	213	Chest Cover	2	ABOGN
202	Tie Rod Washer	4	ABMIA	214	Valve Washer	2	ABOHF
203	Top Cylinder	1	ABMOB	216	Valve	1	ABOXP
204	Middle Cylinder	1	ABMUC	217	Valve Chest	1	ABOTZ
205	Bottom Cylinder	1	ABNAZ	218	Chest Stud and Nut	4	ABOVA
206	Bottom Head	1	ABNEG	219	Pulling Plug	1	ABOWE
207	Anvil Block	1	ABNIB	220	Driving Plug	1	ABOXI
209	Tie Rod (2 right and 2 left)	4	ABNOC	222	Valve Bushing—2 pieces	1	ABPAB
210	Ram	1	ABNUD	223	Lifting Handles	2	ABPEC
211	Piston Ring	2	ABOBU				

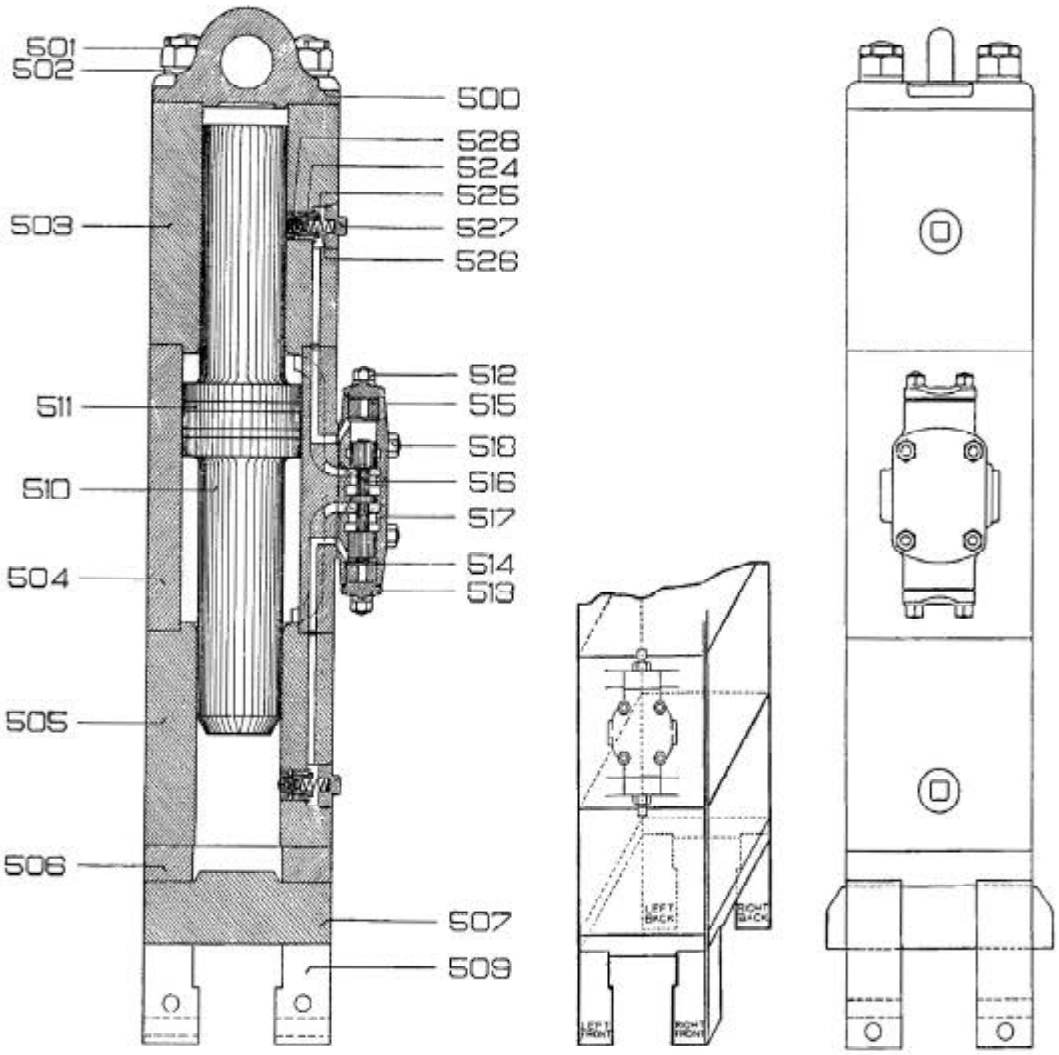
NOTE: When ordering Tie Rods (Part No. 209) be sure to specify whether right or left side, front or back, (looking toward valve chest). See diagram above.



Duplicate Parts for No. 3 Pile Hammer

No. 3 Pile Hammer, Code Word, OPLIX

No.	Name	No. Req.	Code Word	No.	Name	No. Req.	Code Word
300	Bail	1	ABTAE	312	Piston Rod Packing, ⅜ sq. —4 rings		ABUSK
301	Side Rod	2	ABTEF	313	Packing Sleeve—2 pieces	1	ABUZN
302	Top Head Spring	2	ABTIG	314	Packing Sleeve Gland	1	ABVAH
303	Top Head	1	ABTOH	315	Anvil Block	1	ABVEI
304	Cylinder	1	ABUBA	316	Chest Cover Stud and Nut	4	ABVIK
305	Bottom Head	1	ABUCE	317	Chest Cover	2	ABVOL
306	Base Block	1	ABUDI	318	Valve Buffer	2	ABWAG
307	Base Block Cap	1	ABUFO	319	Valve Washer	2	ABWEK
308	Base Block Bolt and Nut	6	ABUGU	320	Valve	1	ABWIL
309	Step	1	ABUHY	321	Valve Chest	1	ABXAK
310	Ram	1	ABULT	322	Chest Stud and Nut	4	ABXEL
311	Bottom Head Split Ring—2 pieces	1	ABUMP	323	Cylinder Stud and Nut	4	ABXIM
				324	Side Rod Nut	4	ABXON

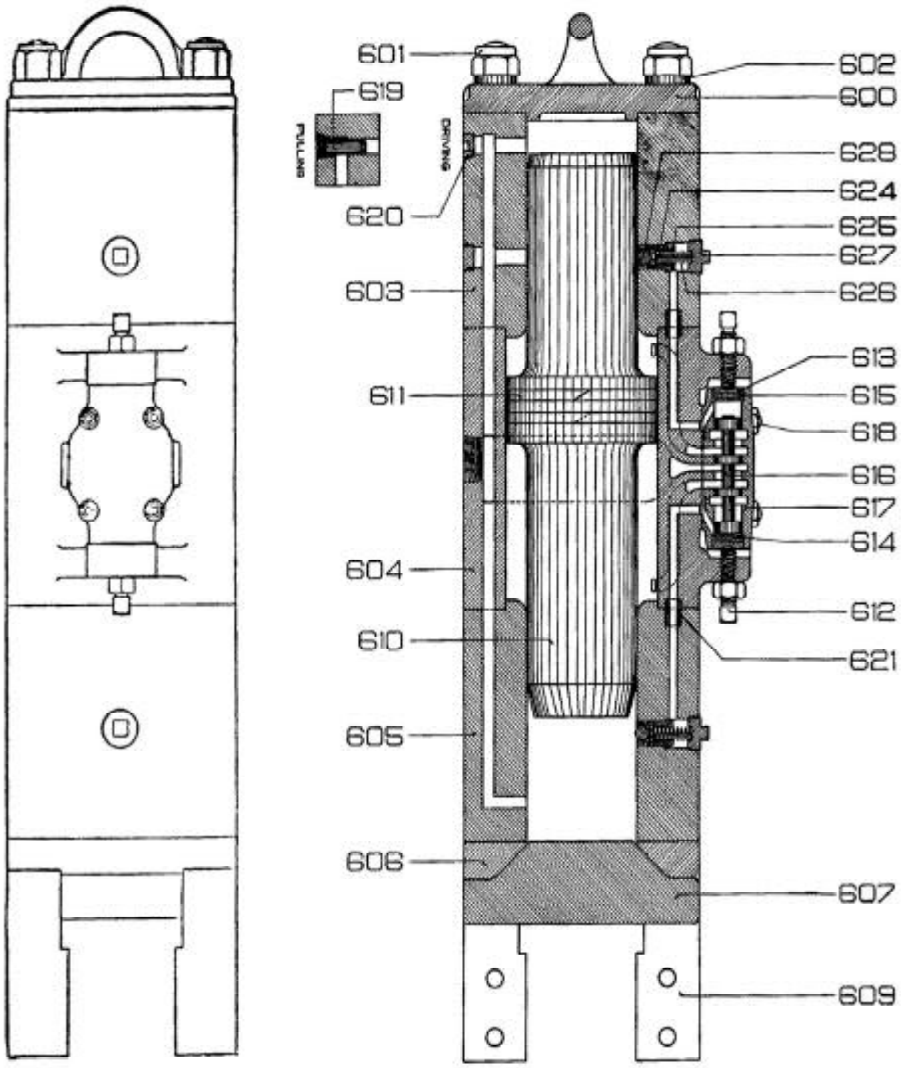


Duplicate Parts for No. 5 Pile Hammer

No. 5 Pile Hammer, Code Word, OPLUZ

No.	Name	No. Req.	Code Word	No.	Name	No. Req.	Code Word
500	Top Head	1	ACABT	513	Chest Cover	2	ACBUK
501	Tie Rod Nut	4	ACACS	514	Valve Washer	2	ACCAN
502	Tie Rod Washer	4	ACAFZ	515	Valve Buffer	2	ACCEO
503	Top Cylinder	1	ACAGA	516	Valve	1	ACCIP
504	Middle Cylinder	1	ACAKI	517	Valve Chest	1	ACCOR
505	Bottom Cylinder	1	ACALO	518	Chest Stud and Nut	4	ACCUS
506	Bottom Head	1	ACANY	524	Valve Cage	2	ACDAF
507	Anvil Block	1	ACARB	525	Movable Valve Seat	2	ACDEP
509	Tie Rod (2 right and 2 left)	4	ACBAM	526	Spring	2	ACDIR
510	Ram	1	ACBEN	527	Spring Stop	2	ACDOS
511	Piston Ring	2	ACBIC	528	Steel Ball	2	ACDUT
512	Chest Cover Stud and Nut	4	ACBOP				

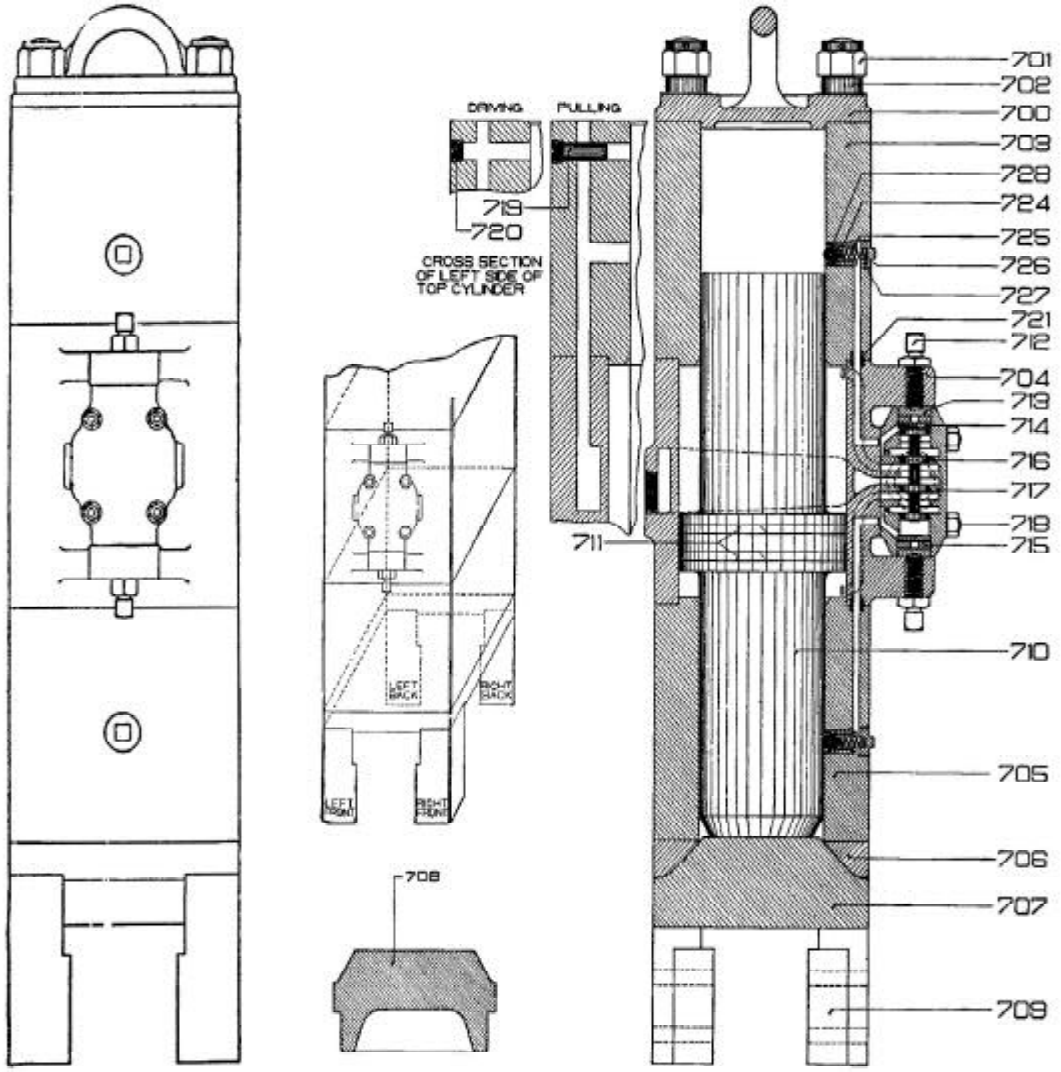
NOTE: When ordering Tie Rods (Part No. 509) be sure to specify whether right or left side, front or back, (looking toward valve chest). See diagram above.



Duplicate Parts for No. 6 Pile Hammer

No. 6 Pile Hammer, Code Word, OPMAT

No.	Name	No. Req.	Code Word	No.	Name	No. Req.	Code Word
600	Top Head	1	ACFAP	614	Valve Washer	2	ACHUZ
601	Tie Rod Nut	4	ACFER	615	Valve Buffer	2	ACICK
602	Tie Rod Washer	4	ACFIS	616	Valve	1	ACIDZ
603	Top Cylinder	1	ACFOT	617	Valve Chest	1	ACIFT
604	Middle Cylinder	1	ACFUX	618	Chest Stud and Nut	4	ACIPA
605	Bottom Cylinder	1	ACGAR	619	Pulling Plug	1	ACIRE
606	Bottom Head	1	ACGES	620	Driving Plug	1	ACISI
607	Anvil Block	1	ACGIT	621	Dowel	2	ACITO
609	Tie Rod (interchangeable)	4	ACGOX	624	Valve Cage	2	ACIWY
610	Ram	1	ACHAS	625	Movable Valve Seat	2	ACIXS
611	Piston Ring	2	ACHET	626	Spring	2	ACJAT
612	Chest Cover Set Screw and Nut	2	ACHIX	627	Spring Stop	2	ACJEX
613	Chest Cover	2	ACHOY	628	Steel Ball	2	ACJIH

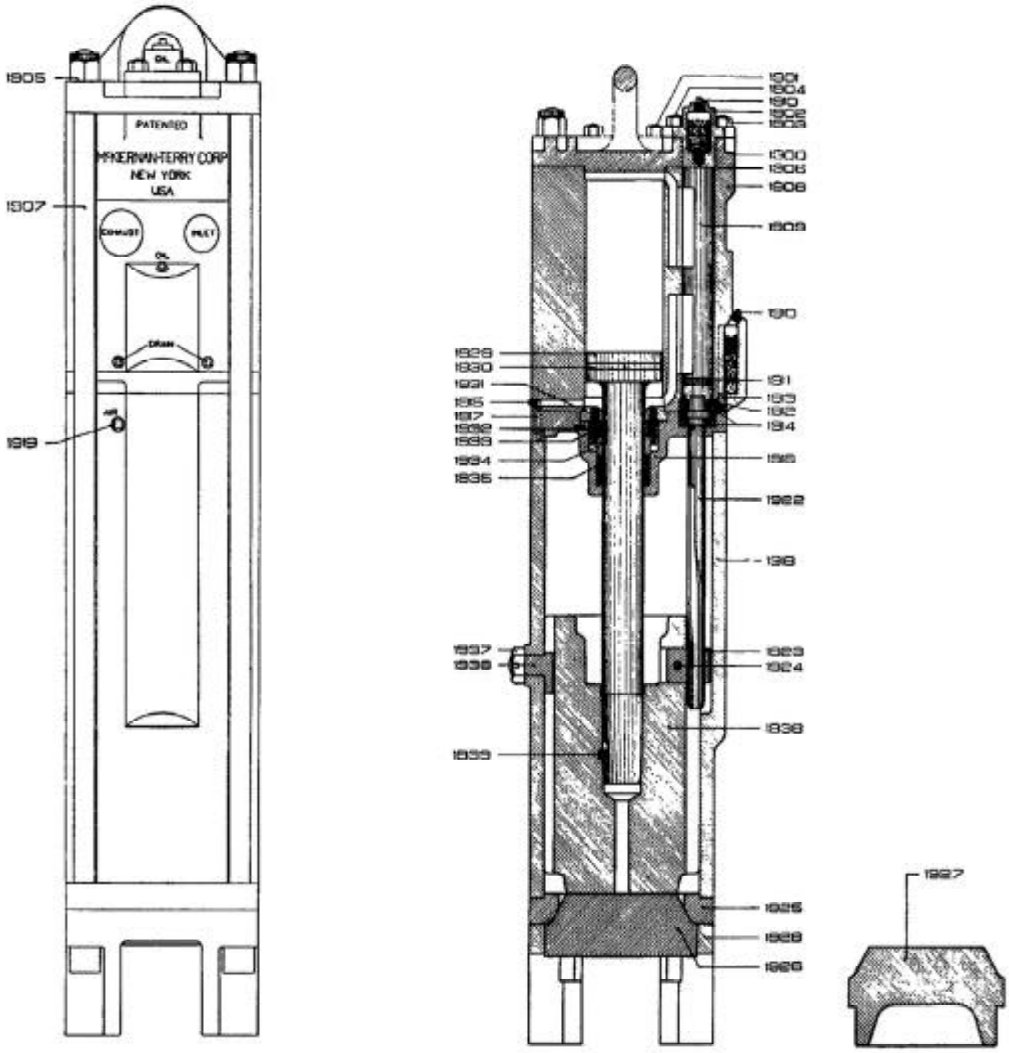


Duplicate Parts for No. 7 Pile Hammer

No. 7 Pile Hammer, Code Word, OPMEX

No.	Name	No. Req.	Code Word	No.	Name	No. Req.	Code Word
700	Top Head	1	ACLEZ	713	Chest Cover	2	ACNUF
701	Tie Rod Nut	4	ACLIA	714	Valve Washer	2	ACOBO
702	Tie Rod Washer	4	ACLOB	715	Valve Buffer	2	ACOCU
703	Top Cylinder	1	ACLUC	716	Valve	1	ACODY
704	Middle Cylinder	1	ACMAZ	717	Valve Chest	1	ACOKS
705	Bottom Cylinder	1	ACMEG	718	Chest Stud and Nut	4	ACOLM
706	Bottom Head	1	ACMIB	719	Pulling Plug	1	ACOPH
707	Anvil Block (Flat)	1	ACMOC	720	Driving Plug	1	ACORF
708	Anvil Block (Bell Bottom)	1	ACMUD	721	Dowel	2	ACOST
709	Tie Rod (2 right and 2 left)	4	ACNAB	724	Valve Cage	2	ACOWA
710	Ram	1	ACNEC	725	Movable Valve Seat	2	ACOXE
711	Piston Ring	2	ACNID	726	Spring	2	ACOZI
712	Chest Cover Set Screw and Nut	2	ACNOE	727	Spring Stop	2	ACPED
				728	Steel Ball	2	ACPIE

NOTE: When ordering Tie Rods (Part No. 709) be sure to specify whether right or left side, front or back, (looking toward valve chest). See diagram above.

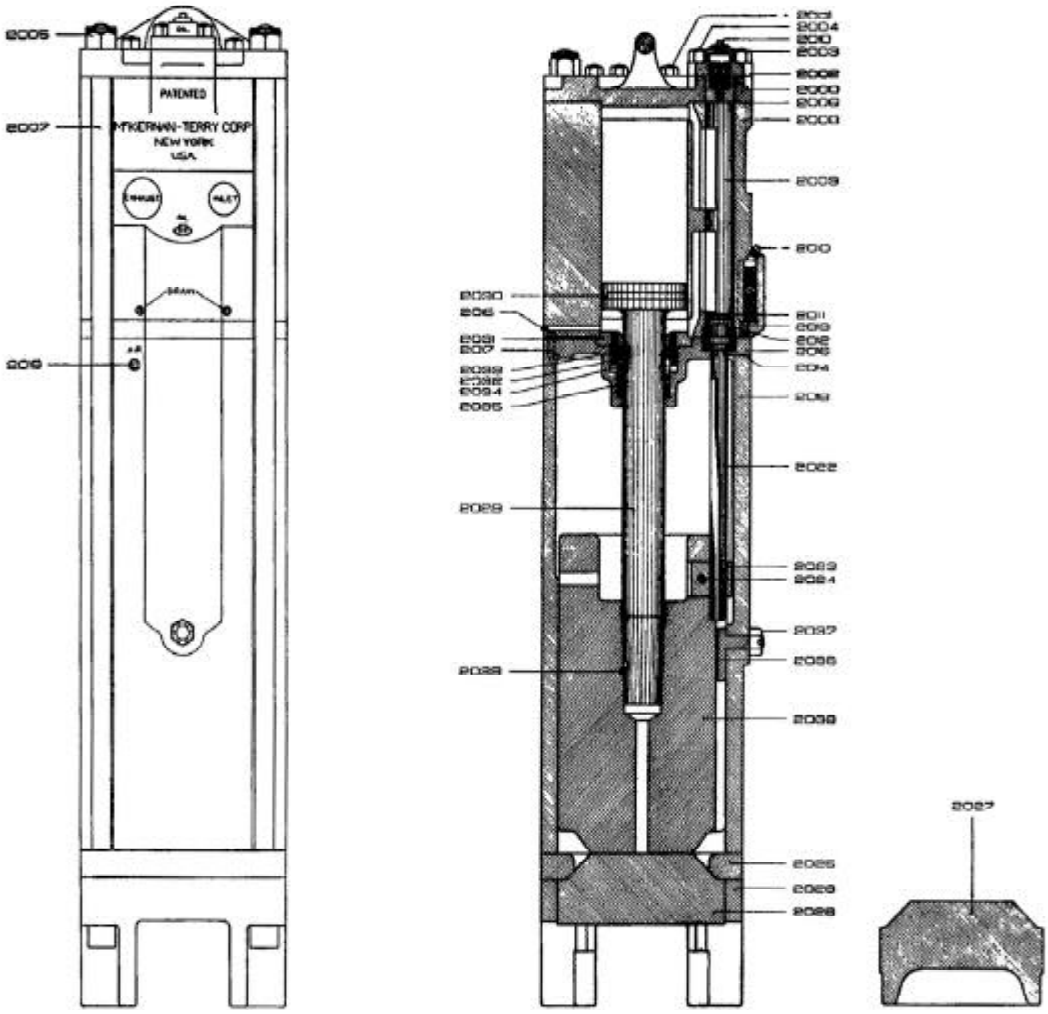


Duplicate Parts for No. 9-B-3 Pile Hammer

No. 9-B-3 Pile Hammer, Code Word, OPNOD

Part No.	Name of Part	No. Req.	Code Word	Part No.	Name of Part	No. Req.	Code Word
1900	Top Head	1	AFJIA	1919	Air Inlet Plug	1	AFNEB
1901	Top Head Stud and Nut	6	AFJOB	1922	Cam Rod	1	AFNUH
1902	Valve Cover	1	AFJUC	1923	Cam Throw	1	AFOBE
1903	Valve Cover Stud and Nut (Front)	2	AFKAZ	1924	Cam Throw Taper Pin	1	AFOCI
1904	Valve Cover Stud and Nut (Rear)	2	AFKEG	1925	Bottom Head	1	AFODO
1905	Tie Rod Nut	4	AFKIB	1926	Anvil Block (Flat)	1	AFOFU
1906	Top Head Gasket	1	AFKOC	1927	Anvil Block (Bell Bottom)	1	AFOGY
1907	Tie Rod	4	AFKUD	1928	Anvil Block Retainer—2 pieces	1	AFOLK
1908	Top Cylinder	1	AFLAB	1929	Piston	1	AFONS
1909	Valve	1	AFLEC	1930	Piston Ring	1	AFORL
1910	Oil Plug	2	AFLID	1931	Gland Ring—2 pieces	1	AFOZA
1911	Valve Ring	2	AFLOE	1932	Gland Spring Holder Pin	6	AFPAE
1912	Cam Rod Bearing Thrust Washer	1	AFLUF	1933	Gland Spring	6	AFPEF
1913	Oil Pocket Cap	2	AFMAC	1934	Gland Spring Holder—2 pieces	1	AFPIG
1914	Cam Rod Bearing	2	AFMED	1935	Packing	.....	AFPOH
1915	Drain Plug	3	AFMIE	1936	Ram Guide	1	AFRAJ
1916	Intermediate Head	1	AFMOF	1937	Ram Guide Nut	1	AFREI
1917	Dowel Pin	2	AFMUG	1938	Ram	1	AFRIK
1918	Bottom Cylinder	1	AFNAD	1939	Ram Taper Pin	1	AFROL

NOTE: Do not use more than 4 rings of 5/8" square packing.

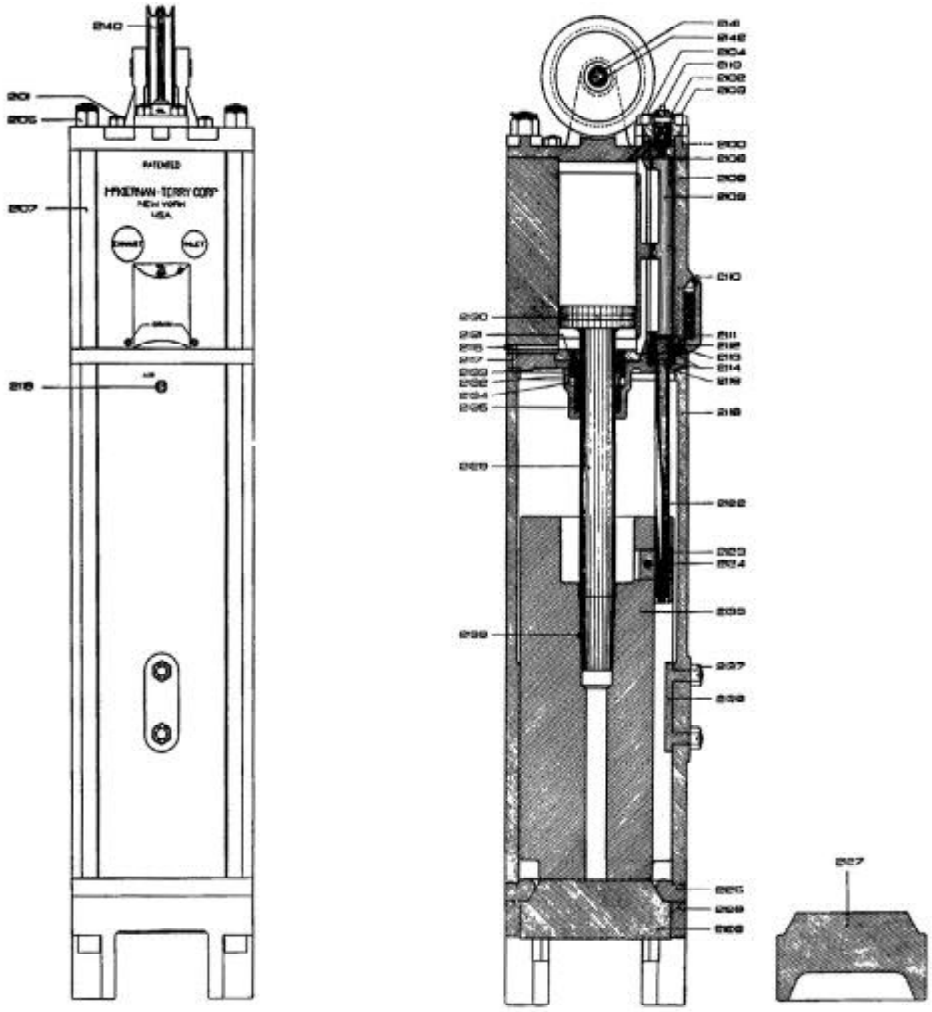


Duplicate Parts for No. 10-B-3 Pile Hammer

No. 10-B-3 Pile Hammer, Code Word, OPNIZ

Part No.	Name of Part	No. Req.	Code Word	Part No.	Name of Part	No. Req.	Code Word
2000	Top Head	1	AFTAK	2019	Air Inlet Plug	1	AFVUP
2001	Top Head Stud and Nut	6	AFTEL	2022	Cam Rod	1	AFWIC
2002	Valve Cover	1	AFTIM	2023	Cam Throw	1	AFWOP
2003	Valve Cover Stud and Nut (Front)	2	AFTON	2024	Cam Throw Taper Pin	1	AFWUK
2004	Valve Cover Stud and Nut (Rear)	2	AFTUR	2025	Bottom Head	1	AFXAN
2005	Tie Rod Nut	4	AFUBZ	2026	Anvil Block (Flat)	1	AFXEO
2006	Top Head Gasket	1	AFUFA	2027	Anvil Block (Bell Bottom)	1	AFXIP
2007	Tie Rod	4	AFUGE	2028	Anvil Block Retainer	1	AFXOR
2008	Top Cylinder	1	AFUHI	2029	Piston	1	AFXUS
2009	Valve	1	AFUKO	2030	Piston Ring	1	AFZAG
2010	Oil Plug	2	AFULU	2031	Gland Ring—2 pieces	1	AFZEK
2011	Valve Ring	2	AFUMY	2032	Gland Spring Holder Pin	6	AFZIL
2012	Cam Rod Bearing Thrust Washer	1	AFUNK	2033	Gland Spring	6	AFZOM
2013	Oil Pocket Cap	2	AFURD	2034	Gland Spring Holder—2 pieces	1	AFZUN
2014	Cam Rod Bearing	2	AFUSH	2035	Packing	.....	AGAHK
2015	Drain Plug	3	AFVAL	2036	Ram Guide	1	AGALA
2016	Intermediate Head	1	AFVEM	2037	Ram Guide Nut	1	AGAME
2017	Dowel Pin	2	AFVIN	2038	Ram	1	AGANI
2018	Bottom Cylinder	1	AFVOK	2039	Ram Taper Pin	1	AGAPO

NOTE: Do not use more than 4 rings of $\frac{5}{8}$" square packing.



Duplicate Parts for No. 11-B-3 Pile Hammer

No. 11-B-3 Pile Hammer, Code Word, OPNEY

Part No.	Name of Part	No. Req.	Code Word	Part No.	Name of Part	No. Req.	Code Word
2100	Top Head	1	AFAMI	2122	Cam Rod	1	AFDIT
2101	Top Head Stud and Nut	6	AFANO	2123	Cam Throw	1	AFDUT
2102	Valve Cover	1	AFARY	2124	Cam Throw Taper Pin	1	AFFUZ
2103	Valve Cover Stud and Nut (Front)	2	AFASB	2125	Bottom Head	1	AFBIR
2104	Valve Cover Stud and Nut (Rear)	2	AFHIZ	2126	Anvil Block (Flat)	1	AFBOS
2105	Tie Rod Nut	4	AFAPU	2127	Anvil Block (Bell Bottom)	1	AFBUT
2106	Top Head Gasket	1	AFHOD	2128	Anvil Block Retainer	1	AFHAX
2107	Tie Rod	4	AFCAP	2129	Piston	1	AFCER
2108	Top Cylinder	1	AFAZT	2130	Piston Ring	1	AFCIS
2109	Valve	1	AFDAR	2131	Gland Ring—2 pieces	1	AFGIH
2110	Oil Plug	2	AFEGT	2132	Gland Spring Holder Pin	6	AFGOZ
2111	Valve Ring	2	AFDES	2133	Gland Spring	6	AFGEX
2112	Cam Rod Bearing Thrust Washer	1	AFDOX	2134	Gland Spring Holder—2 pieces	1	AFGAT
2113	Oil Pocket Cap	2	AFEHZ	2135	Packing	.....	AFCOT
2114	Cam Rod Bearing	2	AFHUB	2136	Ram Guide	1	AFETU
2115	Drain Plug	3	AFELS	2137	Ram Guide Nut	2	AFEVY
2116	Intermediate Head	1	AFBAF	2138	Ram	1	AFCUX
2117	Dowel Pin	2	AFESO	2139	Ram Taper Pin	1	AFIBK
2118	Bottom Cylinder	1	AFBEP	2140	Sheave	2	AFFAS
2119	Air Inlet Plug	1	AFENA	2141	Sheave Bushing	2	AFICF
				2142	Sheave Shaft	1	AFIDS

NOTE: Do not use more than 4 rings of $\frac{5}{8}$" square packing.

Pile Pulling

MANY years ago McKiernan-Terry pioneered the use of an inverted pile hammer fitted with suitable rigging for interposition between crane or derrick hook and piling to be pulled, thereby delivering powerful, rapid upward blows to assist in extracting stubbornly set piling.

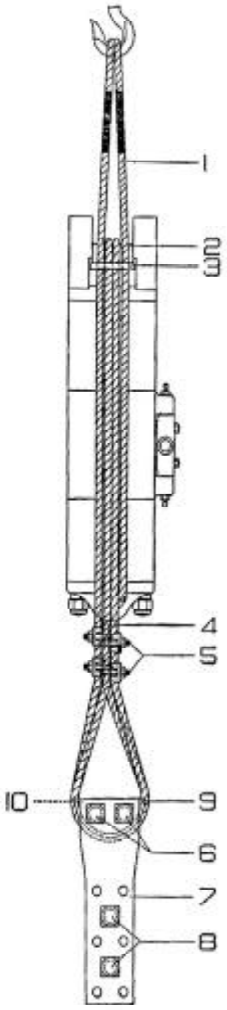
The use of our hammers in this manner has been standard practice throughout the world for many years.

The method of rigging our hammers with a cable pulling rig for pile pulling is illustrated herewith and parts lists are also appended.

However, about 20 years ago we designed a double-acting pile extractor built for the exclusive purpose of pile pulling and further information, details, data, specifications and illustrations of the two sizes of extractors built by McKiernan-Terry are shown on the succeeding pages

Pulling Rig

This cable pulling rig is still in common use, and can be furnished for Nos. 5, 6, or 7 McKiernan-Terry Pile Hammers.



Parts for Cable Pulling Rig
Nos. 5, 6, and 7 Pile Hammers.

Part No.	Name	No. Req.	Code Word
1	Crane Sling	1	ADPAD
2	Grooved Saddle Block	1	ADPEB
3	Retaining Ring	1	ADPIF
4	Pile Sling	1	ADPOG
5	Clips	8	ADPUH
6	Pile Sling Bolt and Nut	2	ADRAE
7	Pile Clamp	2	ADRIG
8	Pile Bolt and Nut	2	ADROH
9	Half Sheave (single)	2	ADSAH
10	Half Sheave (double)	1	ADSEI

Note: When ordering parts be sure to specify whether for No. 5, 6, or 7 pile hammer.
Part Nos. 5, 9 and 10 not used on No. 5 pile hammer.
Pulling Rig, complete, for No. 5 Pile Hammer.....ORNOB
Pulling Rig, complete, for No. 6 Pile Hammer.....OROZU
Pulling Rig, complete, for No. 7 Pile Hammer.....ORRUF

McKIERNAN-TERRY Double-acting PILE EXTRACTORS

"We have known for a long time that a McKiernan-Terry Hammer will drive any piles that can be driven. We have learned that a McKiernan-Terry Extractor will pull them out." This is an unsolicited statement of a well-known pile-driving contractor.

Forty years ago, a progressive contractor discovered that a McKiernan-Terry Double-acting Hammer could be operated in an inverted position and would then extract steel sheet piling more rapidly and with less expense for rigging than by any other means then available. This method of extracting piles is still in common use, but as much more piling is being extracted today than ever before, a distinct need has developed for a self-contained extractor which could be put immediately into use without any special rigging.

To meet this need, the McKiernan-Terry Corporation designed their double-acting pile extractors years ago. This extractor followed the same mechanical principles that are used in McKiernan-Terry Pile-driving Hammers, and after thorough tests on various kinds of pulling work, it was offered to the trade and quickly won the enthusiastic approval of its users.

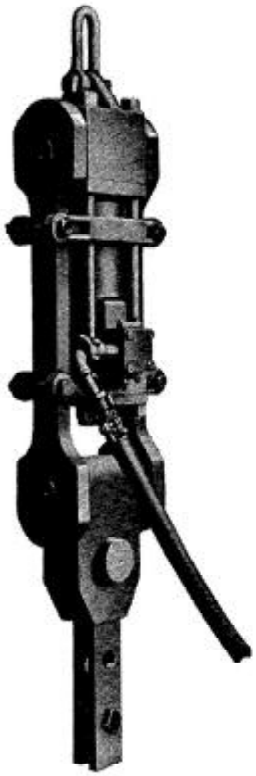
Both the E2 and E4 Pile Extractors are built ruggedly to stand up under the severe service imposed by this kind of work. In addition to exceptional power and sturdiness, their design includes the means necessary for quickly connecting up to the pile, placing it where desired after extraction, and disconnecting the pile without loss of time.

The high frequency and energy of the sharp *uncushioned* blows of a McKiernan-Terry Pile Extractor vibrates and loosens the most stubbornly set piling.

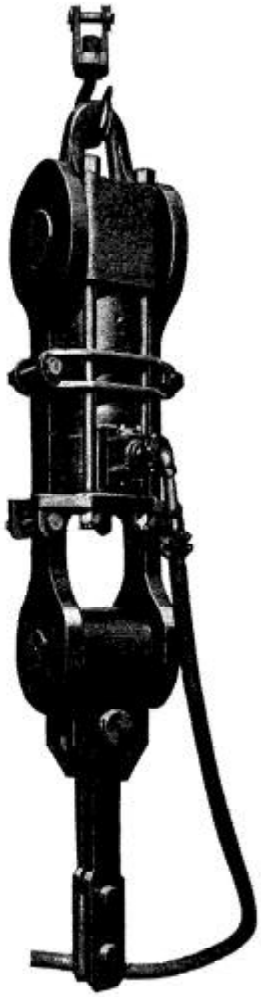
Economical extraction of piling is dependent upon the combination of vibration, caused by a heavy upward blow and a continuous pull on the member to be removed. For the average light extracting job the E2 Extractor is recommended; but for longer, heavier and more stubbornly set piling, the E4 Extractor should be used. The E2 Extractor is designed to withstand a crane pull up to 50 tons and the E4 Extractor up to 100 tons.

As an illustration of McKiernan-Terry Extractor efficiency, reports have been submitted by users to the effect that these Extractors have pulled successfully, piling that could not be removed with other and much larger types of pile extractors.

Tables listing the principal characteristics of both Extractors will be found on Page 23.



No. E2

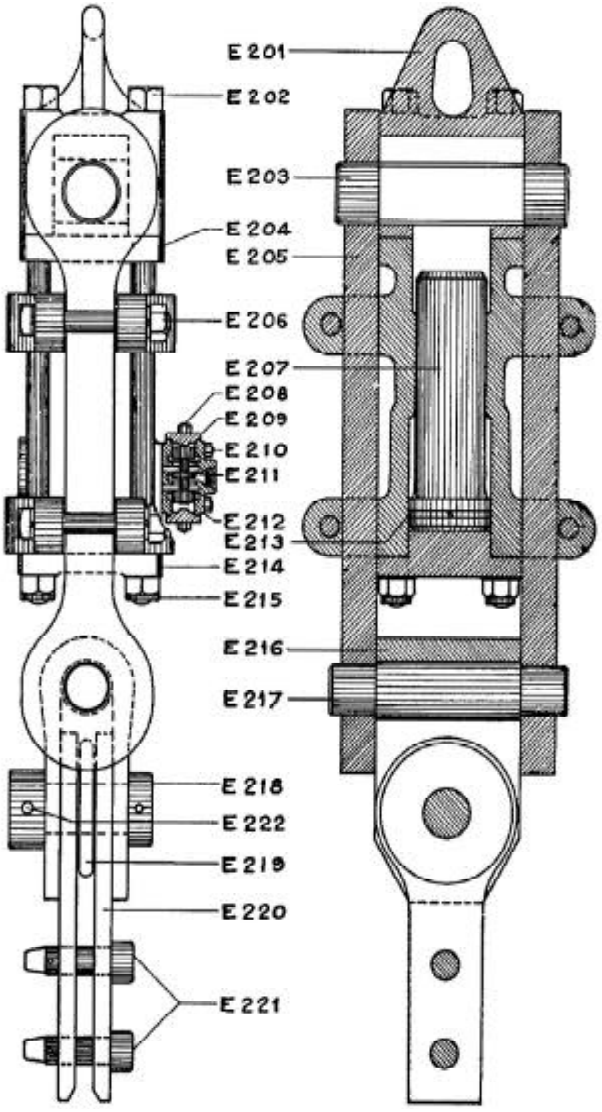


No. E4

Specifications of McKiernan-Terry Extractors

SIZE NUMBER	E2	E4
Net weight of extractor and attachment, lbs.	2600	4400
Weight of ram, lbs.	200	400
Bore, inches	7	9
Stroke, inches	3	3
Energy of blow, foot pounds	700	1000
Strokes per minute	450	400
Width overall, inches	25	26
Depth overall, inches	19	22
Length overall, inches	100	125
Diameter of pile clamp bolt, inches	2⅜	2⅜
Width of standard pile clamp, inches	6	6
Air consumption, cubic feet per minute, actual	400	550
Boiler Horsepower	30	35
Hose connection, inches	1½	1½
Maximum crane pull, tons	50	100
Code word for Extractor	PULAT	RABAL

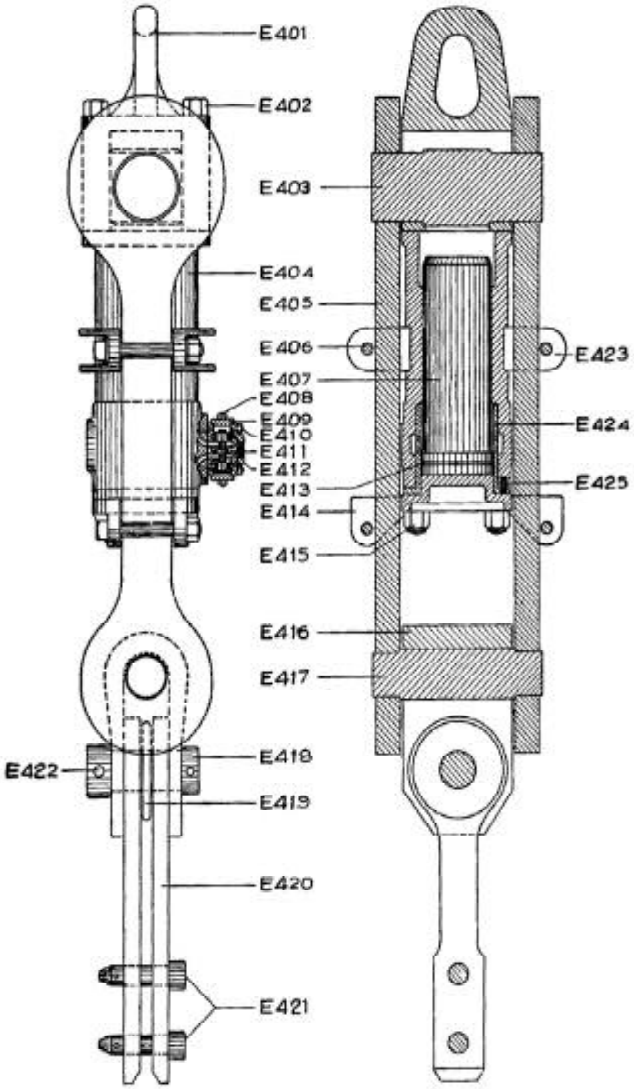
Steam or air pressure should not exceed 125 lbs. gauge pressure.



Part List No. E2 Pile Extractor

Code Word for Pile Extractor—**PULAT**

Part No.	Name	No. Req.	Code Word	Part No.	Name	No. Req.	Code Word
E-201	Top Head	1	PULOX	E-212	Valve Chest	1	PUPEZ
E-202	Tie Rod	4	PULSA	E-213	Piston Ring	1	PUPIB
E-203	Anvil Block	1	PULTE	E-214	Bottom Head	1	PUPOC
E-204	Cylinder	1	PULUZ	E-215	Tie Rod Nut	4	PUPUD
E-205	Side Strap	2	PULVI	E-216	Yoke	1	PUPWA
E-206	Side Strap Guide Bolt and Nut	4	PULWO	E-217	Yoke Pin	1	PUPXE
E-207	Ram	1	PULZY	E-218	Pile Clamp Pin	1	PUPZI
E-208	Chest Cover Stud and Nut	4	PUPAX	E-219	Spacer	1	PURAZ
E-209	Chest Cover	2	PUPBO	E-220	Pile Clamp	2	PURBI
E-210	Chest Stud and Nut	4	PUPCU	E-221	Pile Clamp Bolt	2	PURCO
E-211	Valve	1	PUPDY	E-222	Taper Pin	1	PURDU



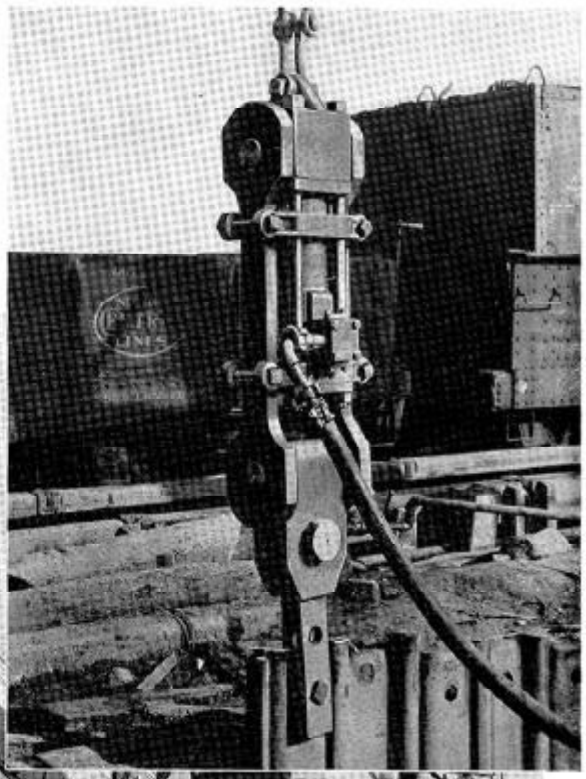
Part List No. E4 Pile Extractor

Code Word for Pile Extractor—**RABAL**

Part No.	Name	No. Req.	Code Word	Part No.	Name	No. Req.	Code Word
E-401	Top Head	1	RABEM	E-414	Bottom Head	1	RACLA
E-402	Tie Rod	4	RABIN	E-415	Tie Rod Nut	4	RACME
E-403	Anvil Block	1	RABKA	E-416	Yoke	1	RACNI
E-404	Cylinder	1	RABLE	E-417	Yoke Pin	1	RACOR
E-405	Side Strap	2	RABMI	E-418	Pile Clamp Pin	1	RACPO
E-406	Side Strap Guide Bolt and Nut	4	RABNO	E-419	Spacer	1	RACRU
E-407	Ram	1	RABOP	E-420	Pile Clamp	2	RACSY
E-408	Chest Cover Stud and Nut	4	RABPU	E-421	Pile Clamp Bolt	2	RACUS
E-409	Chest Cover	2	RABRY	E-422	Taper Pin	1	RADNE
E-410	Chest Stud and Nut	4	RABUR	E-423	Side Strap Clamp	2	RADEP
E-411	Valve	1	RACAN	E-424	Cylinder Liner	1	RADAN
E-412	Valve Chest	1	RACEN	E-425	Liner Dowel	1	RADIR
E-413	Piston Ring	1	RACIP				

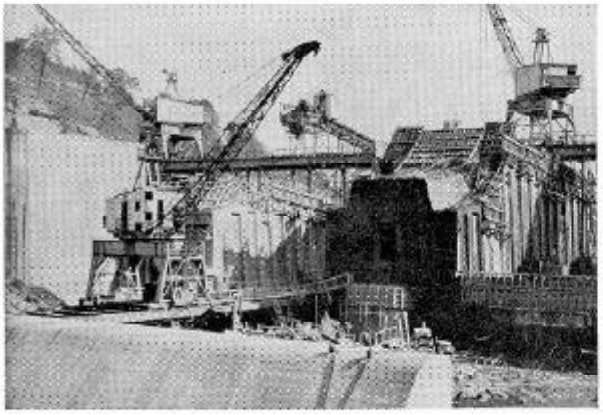
The steel sheeting being withdrawn by this McKiernan-Terry Pile Extractor had been driven through 40 ft. of hard clay and a 5-ft. bottom layer of wet sand containing numerous boulders, and as hard as possible against solid rock in order to obtain a water seal. The bottom ends of the piles were split, bent and crimped in many instances, and considerable difficulty was anticipated in attempting to extract the piles. The contractor, who had tried out other extracting devices, doubted that the McKiernan-Terry Extractor could do the work. He later wrote us: *"I was pleasantly surprised with its performance. Pulling only with a 'Caterpillar' crane, the majority of the piles simply walked out of the holes, and even badly bent and crimped pieces came out with surprising ease."*

Illustration at right is a close-up of the operation shown in larger picture. Only one pile bolt is shown used to connect extractor to sheeting. For more difficult pulling we recommend making two holes in the piling and using both holes in the clamps of the extractor to secure greater firmness.



McKiernan-Terry No. E-2 Pile Extractor withdrawing heavy steel sheet piling which had been driven to a penetration of 75 feet and was bonded to concrete 35 feet on one side. The extractor, operated from the boom of a crane, completed the job without difficulty.

McKIERNAN-TERRY PRODUCTS



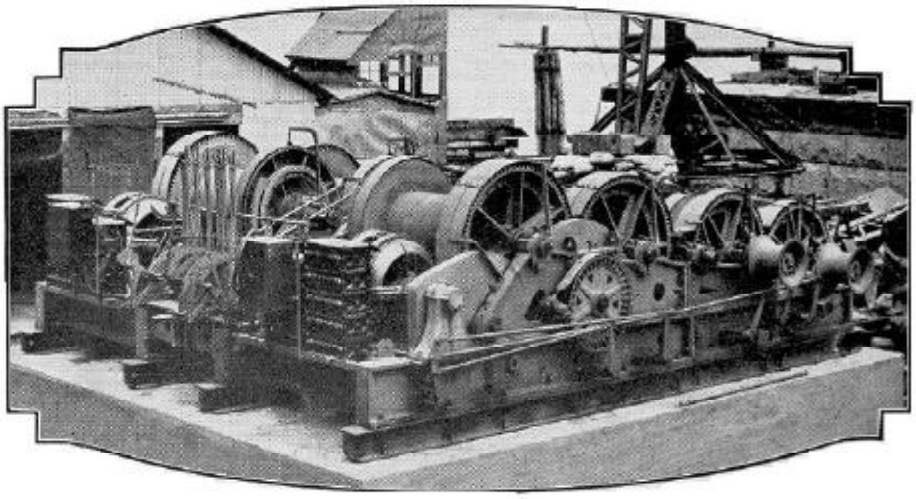
Double-Acting Pile Hammers
Double-Acting Pile Extractors
Single-Acting Pile Hammers • Pile Driving Leads
Complete Pile Driving Units • Mine—Quarry Hoists
Heavy Hoisting and Special Crane Equipment
Ship Auxiliary Equipment—Steering Gears—Capstans—Winches
Cableways • Steel Derricks and Fittings
Lighter Derricks • Car Pullers • Dredge Engines
Bridge Operating Machinery
Blocker Power Blacksmith Hammers
Special Machinery Completely Designed, Engineered and Manufactured
Special Machinery Manufactured from your Design

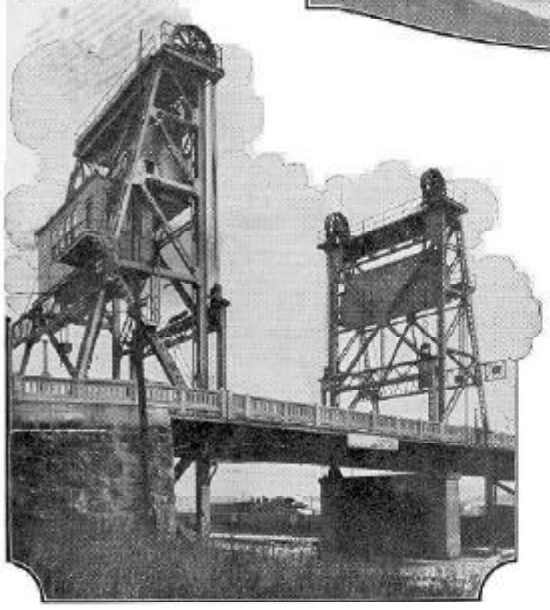
Above—3 Lambert-National Whirlers equipped with 95 ft. booms, capacity 8 tons at 95 ft. radius, gantry mounted, self-propelled and electric driven with 150 HP main hoist and 50 HP swingers used in construction of the Tygart Dam at Grafton, W. Va.

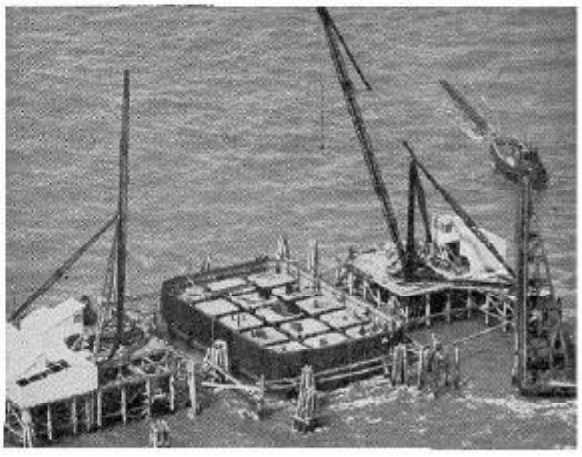
Center 1 of several Lambert National 7 drum hoists used for erecting steel on the George Washington Bridge, New York and Golden Gate Bridge, San Francisco.

Bottom, left—Steele & Conduit Highway Bridge at Trenton, N. J.

Bottom, right—Lambert-National stiffleg derricks on contract for San Francisco Oakland Bay Bridge. This is a caisson with cutting edge on rock 250 ft. below the surface of the water. Derricks were used to muck out caisson with 2 yd. clam-shells and for placing concrete with two yd. bottom dump buckets.







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